Vertical Distribution of Trace Elements in Coal Seams from the San Juan and Raton Basins, New Mexico

By

Lorie A. Baker

Submitted in Partial Fufillment
of the Requirements for the Degree of
Master of Science in Geochemistry

New Mexico Institute of Mining and Technology
Socorro, New Mexico
March, 1989

ACKNOWLEDGMENTS

During the course of this investigation, several people provided support and assistance. I would like to take this opportunity to offer my gratitude to these individuals.

Mr. Alvin Smith, President of the Santa Fe Mining Company allowed us to collect samples from the Lee Ranch Mine Area. Mr. Brian Easterday, geologist of the Lee Ranch Mine, provided direction, supervision and guidance in obtaining drill core samples from the mine. Mr. Bret Harvey, General Manager of the York Canyon Mine of the Kaiser Coal Company extended permission to collect samples from the mining property. Mr. Roy Pillmore, geologist at the York Canyon Mine provided assistance and direction in obtaining our samples from the York Canyon Mine.

My special thanks to Dr. Frederick J. Kuellmer who provided support and guidance during this investigation. Dr. Philip Kyle gave assistance during the Neutron Activation Analysis. New Mexico Bureau of Mines and Mineral Resources allowed use of their lab facilities. I am especially grateful for the assistance of the following two individuals without whom this project would not have been completed. Mr. D. T. Kendrick offered his advice and made invaluable contributions in every area of this project and Ms. Patricia Stoll generously shared her time and computer expertise.

ABSTRACT

Six drill cores penetrating three different seams from the Cleary Coal Member of the Menefee in the Lee Ranch Mine Area, and channel samples from the West Ridge Coal Deposit of the Raton Fm provided the sample base for this study. Each sample represents .16 to .2 vertical feet of both coal and non-coal lithologies.

Analyses of whole coal samples were accomplished for all seams. In addition two of the seams underwent a float-clay-sink separation. Abundances of 27 trace elements were determined for both whole coal and separate samples. Proximate, ultimate, forms of sulfur, petrographic maceral identification, vitrinite reflectance, and XRD analyses of selected samples were also made.

Detailed correlation analyses show that many elements exhibit positive correlations with ash when all samples are considered (both coal and associated non coal samples). When only coal samples are considered the number of elements with positive correlations with ash is drastically reduced on a basin-wide scale. On a seam-by-seam coal-only basis many elements have positive correlations with ash. The difference in the number of elements that show positive correlations with ash between the seams may be due to some geochemical conditions such as pH which govern the ability of trace elements. Elements which consistently show strong correlations with ash remain stable in mineral structures under varying geochemical conditions and can be expected to be associated with the ash fraction.

The distribution profiles are generally U-shaped with maximums just inside the upper and lower boundaries. The trace element profiles deviate from the ash profiles in a systematic way, based on ionic potential. The elements were plotted on an ionic potential diagram and divided into groups. Distribution profiles for Group 2 elements, the soluble cations, are flatter than ash, or very similar to ash, indicating variable leaching from their parent minerals. Secondary redistribution in the coal is very minor, which is expected since these elements do not readily form organic complexes and are highly soluble. Group 3 elements, the hydrolysate elements, have distribution profiles similar to ash or more defined than ash, indicating that leaching and subsequent redistribution is most likely a product of organic complexation. Group 4 elements, the REE, straddle the boundary between Groups 2 and 3

and exhibit the continuum of curve shapes, from flatter than ash to redistributed from the ash, between these two groups. Group 1 elements do not fit any particular category on the ionic potential diagrams and were considered separately.

The distribution profiles of the elements vary in a fairly predictable way based on their ionic potential. Factors which cause elements to deviate from their expected distribution are the formation of stable phases (by elements concentrated enough to make their own phase) lithotype variations in the coal, and secondary mineralization as fracture filling.

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INTRODUCTION

A great deal of literature exists on the distribution of trace elements in coal. The majority of the research has utilized float-sink separations to examine the organic vs. inorganic affinity of trace elements in coal. But, as Balkissoon (1981) pointed out in her literature review, inorganic/organic associations in coal can be contradictory. Finkelman (1980) suggested that rafting of minute authigenetic minerals in the organic fraction during float-sink separations yields erroneous affinities for most trace elements.

These studies, and several others, have used bulk samples representing the entire seam. Some studies (Zubovic, 1966; Kaplan et al., 1983), have examined lateral variations in trace elements but it was not until recently that vertical variations were studied (Kendrick, 1985). Vertical distribution profiles can reveal a great deal about the geochemical and geological parameters (such as ion exchange and diagenetic re-distribution) that determine the ultimate mode of occurrence for trace elements in coal.

The purpose of this study was to determine the vertical distribution of trace elements in coal seams from the San Juan and Raton Basins, New Mexico. Samples were taken from several seams in each basin allowing for comparisons within each basin as well as between the basins. Selected samples underwent a float-sink separation. These data were used to examine the relative distribution and movement of an element between phases in the vertical column. It is the goal of this study to develop a model explaining how a given element is expected to be distributed in a coal seam.

BACKGROUND

Coal is the most abundant and economic fossil fuel in the United States. The amount of energy extracted from coal is dependent on its caloric content. Several factors can reduce the caloric content, one being the amount of impurities in the coal seam. These impurities can also cause furnace corrosion, increased acid rain production, and release of toxic elements to the atmosphere during combustion. Also, the disposal of coal ash, estimated at $70x10^6$ tons annually (Adriano, 1986), presents a continual problem.

Inorganic constituents in coal are generally classified in three groups:

1. Inorganic matter from the original plants,

2a. Inorganic–organic complexes and minerals which formed during the first stage of the coalification process or

b. were introduced by water, wind, and clastic material into the coal deposits as they were forming, and

3. Minerals deposited during the second phase of the coalification process, after consolidation of coal, by ascending or descending solutions in cracks, fissures or cavities, or by alteration of primary clastic minerals (Stach, 1982).

The material deposited as a consequence of 2b above usually forms an ashy layer in the coal seam, and is commonly laterally continuous. It is assumed that these layers are a large source for trace elements. Washing and gravity separation techniques have been successful in removing a great many of the impurities deposited in the coal by this process along with the minerals deposited as described under 3 above. However, studies have indicated that finely distributed trace elements (those deposited as described in 1 and 2a above) are not effectively removed from the coal by these techniques. This has led to the concept of organically and inorganically bound trace elements. Further studies using this approach have met with several difficulties. Elements show different affinities for coals of different rank (Gluskoter et al, 1977), and age (Nicholls, 1968).

In order to understand how these elements are distributed in a coal seam the complex interactions between sediment, plant, and water throughout the coalification process must be examined.

The present distribution of trace elements in a coal seam may have been rearranged from their original positions by geologic and geochemical processes. It is important to consider how these elements first arrived in the coal forming environment, and how in their journey to the swamp processes acting upon them will affect their subsequent redistribution during coalification. A brief overview of the source of sediment, plant and water is presented below.

During the plant growth and peatification the swamp is an open basin. Sediment is brought in by water during short periods of deposition and by air-fall material from volcanic eruptions or other sources. The source rock for the fluvial deposits will determine the types and quantity of trace elements brought into the basin. Physical and chemical weathering processes on the source rocks also play an important role. The degree of chemical weathering determines the amount and type of clay. The clay minerals and their capacity for cation exchange will govern the mobility of the trace elements. Physical weathering may cause heavy mineral fractionation by separation based on grain size (Taylor and McLennan, 1985). Pyroclastic sediment brings native material into the swamp and may be a more abundant source for elements such as the alkaline earths which are readily mobilized and removed during the early stages of weathering.

Trace elements are assimilated into plants through the root system to form organic complexes in the plant tissue. The degree to which plants are capable of incorporating trace elements depends on the plant species itself and the soil-water properties surrounding the root system. There are several forms in which a trace element may be held in the soil, but only those elements dissolved in soil solution and those held onto exchange sites of organic solids and inorganic constituents are photoavailable (i.e. available to be incorporated into the plant structure). Other factors which influence the photoavailability in soils are the soil pH, the cation exchange capacity (CEC) of clays, the CEC and chelating ability of organic matter, and the amount of iron, manganese and aluminum oxides (Adriano, 1986). Many authors have published lists of elements believed to be associated with a particular plant species. However, these lists apply to modern day plants and may not be related to the coal forming plants. Several elements are considered necessary for the development of all plants. The major elements carbon, oxygen, phosporous, hydrogen, nitrogen, potassium, calcium, magnesium, sulfur, and iron are considered essential, as are the trace elements boron, copper, manganese, molybdemum, cobalt, and zinc (Adriano, 1986). Many elements that are concentrated in plants are less concentrated in the organic portion of coal (Kuhn et al, 1980). This may be attributed to increased microbial action (occurring when water levels drop) releasing metals formed in the living plant (Stach, 1982). Plants may also preferentially exclude certain ions such as the anions, because of their large size.

Waters entering the swamp also provide a source of trace elements. Meteoric, oceanic and groundwater carry soluble ions which may precipitate to form authigenetic minerals, be assimilated by living plants or participate in cation exchange with clays. Different depositional paleoenvironments will receive different source waters. Bailey (1981) found that coals formed under the influence of marine water show higher concentrations of zinc, iron, and sulfur, while fluvial coals were higher in copper, chromium, titanium, potassium, silicon, and aluminum. Also, water provides a medium through which the re-distribution of elements operates throughout the coalification process. The Eh and pH of the water acting on the detritus and changes in these parameters during coalification determine the mobility of these elements and their relative distribution.

Trace metals must be in a stable form to avoid de-sorption and subsequent expulsion from the coal forming environment during peatification and mineralization of the coal. Authigenic minerals offer a stable structure as long as equilibrium between the mineral and surrounding water is maintained.

Metals may also hold three positions in complex compounds formed from plant decay:

1. Substitute for the hydrogen of a carboxyl group forming a salt,
2. Bond directly to the carbon atom of an organic radical forming a metallo–organic compound, and
3. Form the center of a ring structure, bonded to nitrogen, oxygen or sulfur atoms, forming a chelate (Krauskopf, 1979).

Of these three, chelates are the most stable. The ability of metals to form these complexes is determined by the structure of the electronic shells of the atoms, the size of their ionic radius, their valence and polarization; increase in valence and decrease in ionic radius favor complex formation (Sherbina, 1956). The relationships between valence, ionic radius and complex formation were shown by Sherbina (Figure 1). Formation of complexes results in increased solubility of the cations, changes in their redox potential, and in some cases permits migration for ions that would have otherwise formed insoluble precipitates.

Further, Zubovic (1968b), found that elements of high ionic potential (charge/radius) had high organic associations in coal and related this to the ability of these metals to form chelates. Arranging the elements in order of highest to lowest organic affinity yields the sequence Be>Ni>Co>Zn>Fe which is equivalent to chelate stability for bivalent metals. The same is true for

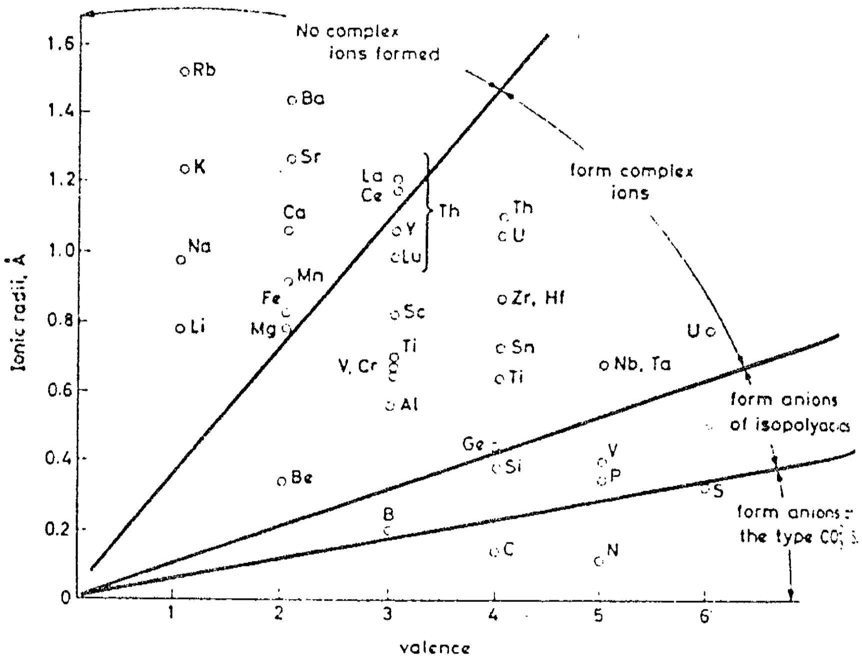

Figure 1. Position of elements forming complex compounds on an ionic potential diagram (From Sherbina, 1956).

trivalent metals. However, a metal will form a chelate only if the relation between stability constants of chelates and solubility products of minerals forming in the environment favor chelation. Copper is an example of a bivalent mineral with a relatively high chelate stability, but it tends to be deposited in sulfate minerals because their solubility products are so low. Therefore, the amount of an element complexed depends on the chemical conditions, its availability with respect to the amount of organic matter available, and its position in a complex stability series of competing elements (Zubovic, 1968b).

Trace elements that form complexes should remain in the coal-forming environment throughout coalification. A loss of oxygen, a result of an increase in rank, can result in a decrease in trace element abundance. The oxygen is lost from functional groups which are involved in ion exchange and chelation of metals. Loss of the oxygen results in mobilization and possible expulsion of trace metals. Lower rank coals will hold more trace elements in organic associations (Finkelman, 1982). As rank increases, other factors (such as decrease in porosity) make it more difficult for metals to concentrate in the coal seam except in fractures.

GEOLOGIC SETTING

San Juan Basin

The San Juan Basin is a Laramide (Late Cretaceous to Eocene) structural depression that comprises the south–eastern part of the Colorado Plateau (Figure 2). The basin is nearly circular in shape and is strongly asymeteric, with its axis trending northwest to southeast (Fassett, 1977). Several structural features bound the basin (Figure 3). The Puerco fault zone, a group of structures formed partially by the Rio Grande Rift, created the southeastern boundary, while the Nacimento uplift is the boundary to the east. The remaining boundaries are formed by uplifts of the Colorado Plateau. These include the Hogback Monocline to the north and the Defiance Monocline in the southwest. The southern boundary runs into the gently dipping Chaco Slope which grades into the Zuni uplift further south (Woodward and Callender, 1977).

The sediments in the basin range in age from Cambrian to Quaternary. The Cretaceous rocks, including the coal–bearing Cleary Member of the Menefee, crop out along the rim and throughout the southern and western parts of the basin. During the Late Cretaceous, the North American continent was bisected by a shallow sea that repeatedly underwent a series of transgressive and regressive episodes. This resulted in a sequence of

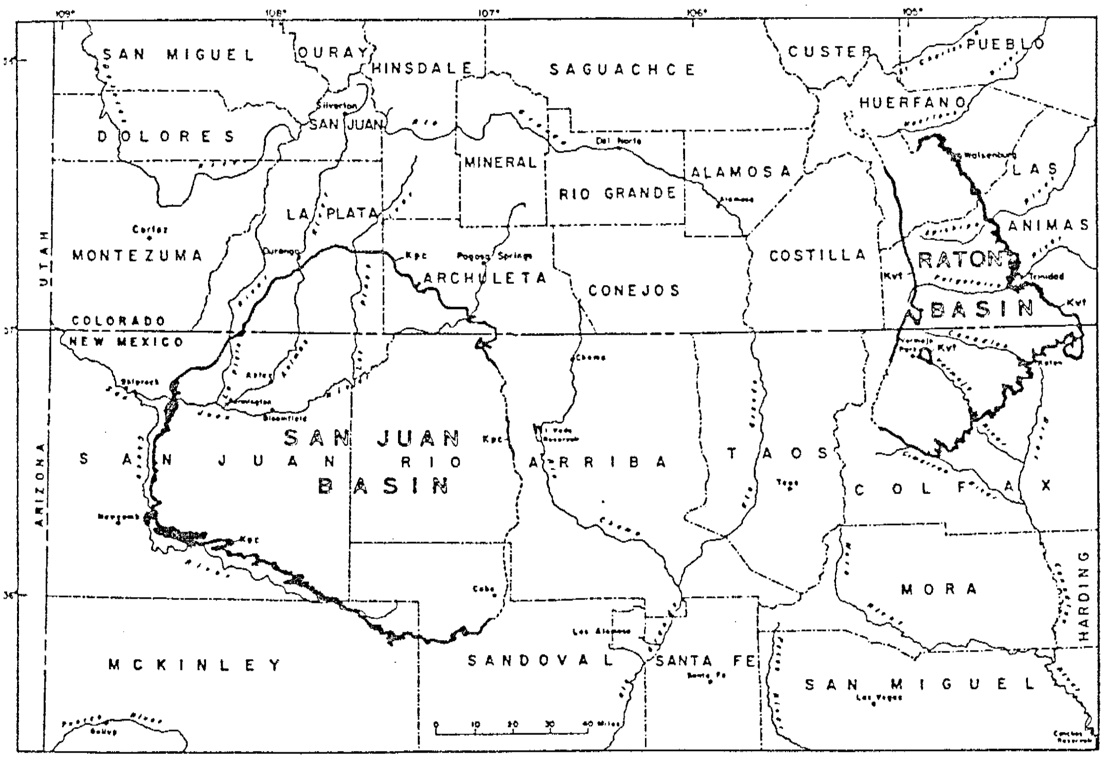

Figure 2. Map showing the locations of the San Juan and Raton Basins (From Fassett, 1977).

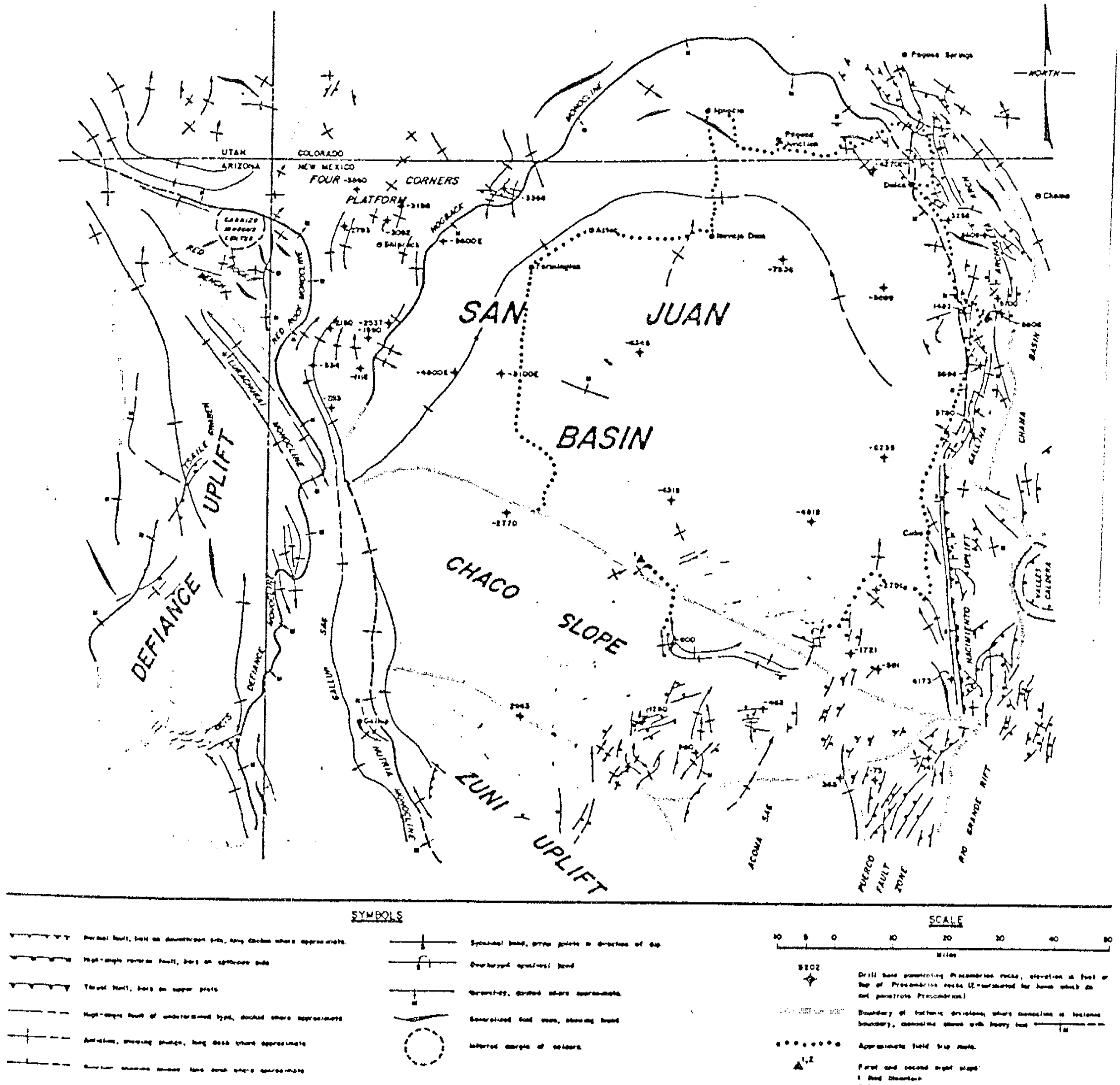

Figure 3. Geological structure map of the San Juan Basin and surrounding areas (From Woodward and Callendar, 1977).

intertounging marine shales and littoral sandstones with associated fluvial deposits. The fourth regressive phase, of interest in this study, is represented by the upper part of the Satan Tongue of the Mancos Shale, the upper part of the Mancos Shale, the Point Lookout Sandstone and the lower part of the non-marine Menefee Formation (Molenaar, 1983, Figure 4).

The Point Lookout Sandstone is the most extensive regressive coastal barrier sandstone in the San Juan Basin, representing a regional regression throughout the western interior (Molenaar, 1977). The overlying Menefee Formation represents non-marine palludal to alluvial plain deposits landward of the Point Lookout and overlying Cliff House Sandstones. The Menefee is divided into two members, the Cleary Coal Member and the Allison Member. Further to the south, the Cleary Coal Member directly overlies, and is undifferientated from, the Gibson Coal Member of the Crevasse Canyon Formation (third regressive sequence deposit) (Campbell and Roybal, 1987). The Menefee is overlain by the Cliff House Sandstone, representative of the fifth transgressive phase.

The Cleary Coal Member consists of sandstone, siltstone, mudstone, shale and coal with bands of concretionary siderite (Beaumont, 1987). All lithologies are considered non-marine.

Raton Basin

The Raton Basin is a north trending structural basin that extends from northeastern New Mexico into southeastern Colorado (Figure 1). It consists

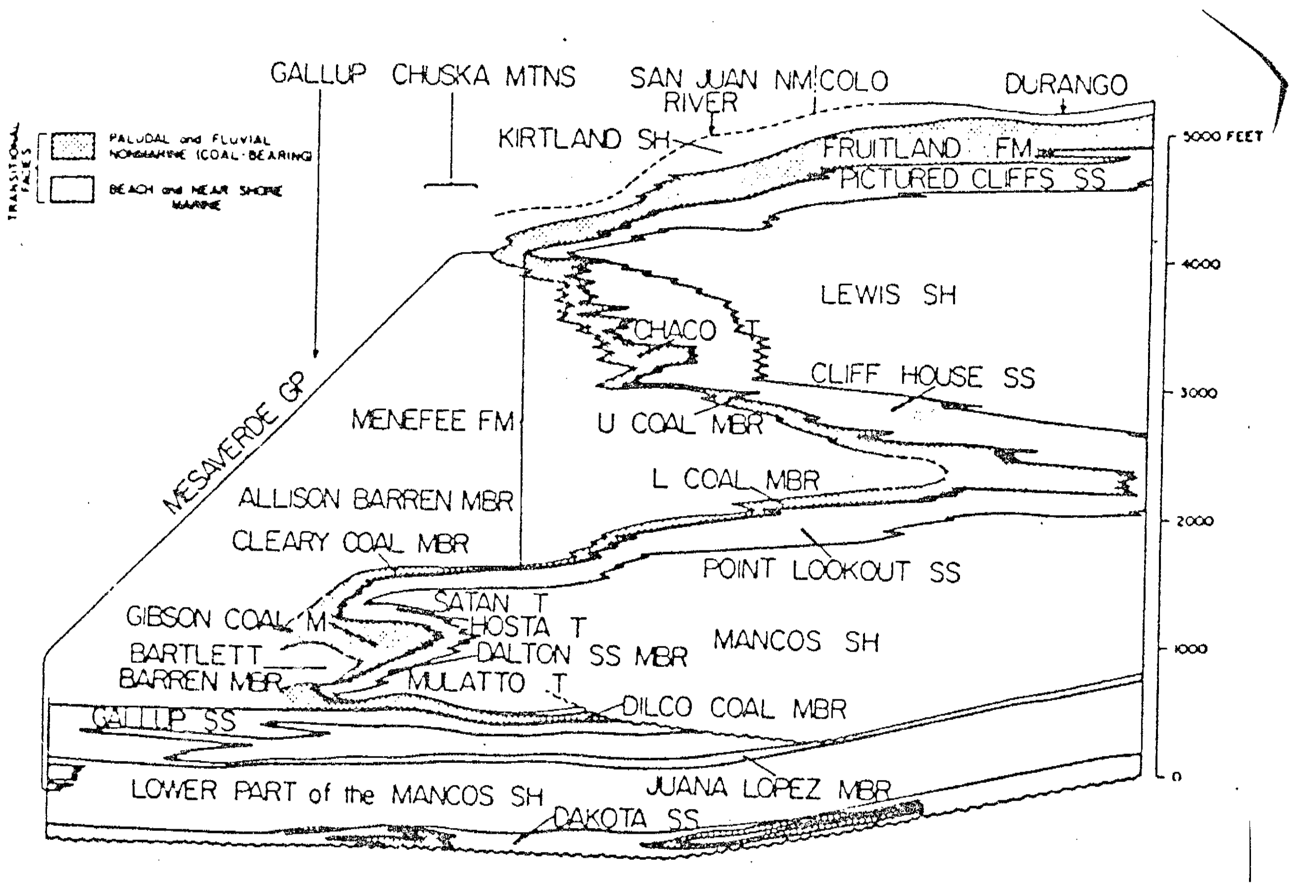

Figure 4. Stratigraphic diagram showing sequence and thickness of Cretaceous rocks in the San Juan Basin (From Beaumont, 1986).

of two parts, the Las Vegas sub-basin, and the main part of the basin extending from Cimmaron, New Mexico to Huerfano Park, Colorado.

Figure 5 shows the structural features associated with the Raton Basin. The Sangre de Cristo Mountains form the western boundary of the basin. The sedimentary rocks along this margin dip steeply to the west, are locally overturned and are highly faulted. The eastern portion of the basin is bounded by the Sierra Grande Arch. One of the most prominent features in the basin is the Vermejo Park anticline. This gently folded structure was formed by a buried intrusive. The West Ridge coal deposit of the Raton Formation lies on the south-east flank of this feature (Pillmore, 1976).

Pre-orogenic rocks in the basin range from Precambrian to Late Cretaceous (Woodward and Snyder, 1976). The synorogenic sedimentary rocks (Vermejo and Raton Formations) are Late Cretaceous to Paleocene. Figure 6 gives a generalized stratigraphic column of the Mesozoic and Cenozoic rocks in the Raton Basin. The Pierre Shale represents the beginning of the fifth and final regression of the interior seaway. The Pierre Shale intertounges with the Trinidad Sandstone, a slightly younger representative of the regressive sequence that deposited the Pictured Cliffs Sandstone in the San Juan Basin (Jurich and Adams, 1984). The overlying Vermejo Formation was deposited in swamps and on the floodplains near the coast of the retreating sea. The Vermejo consists of shale, carbonaceous shale, coal and arkosic sandstones, and is younger but lithologically equivalent to the Fruitland Formation of the San Juan Basin (Jurich and Adams, 1984).

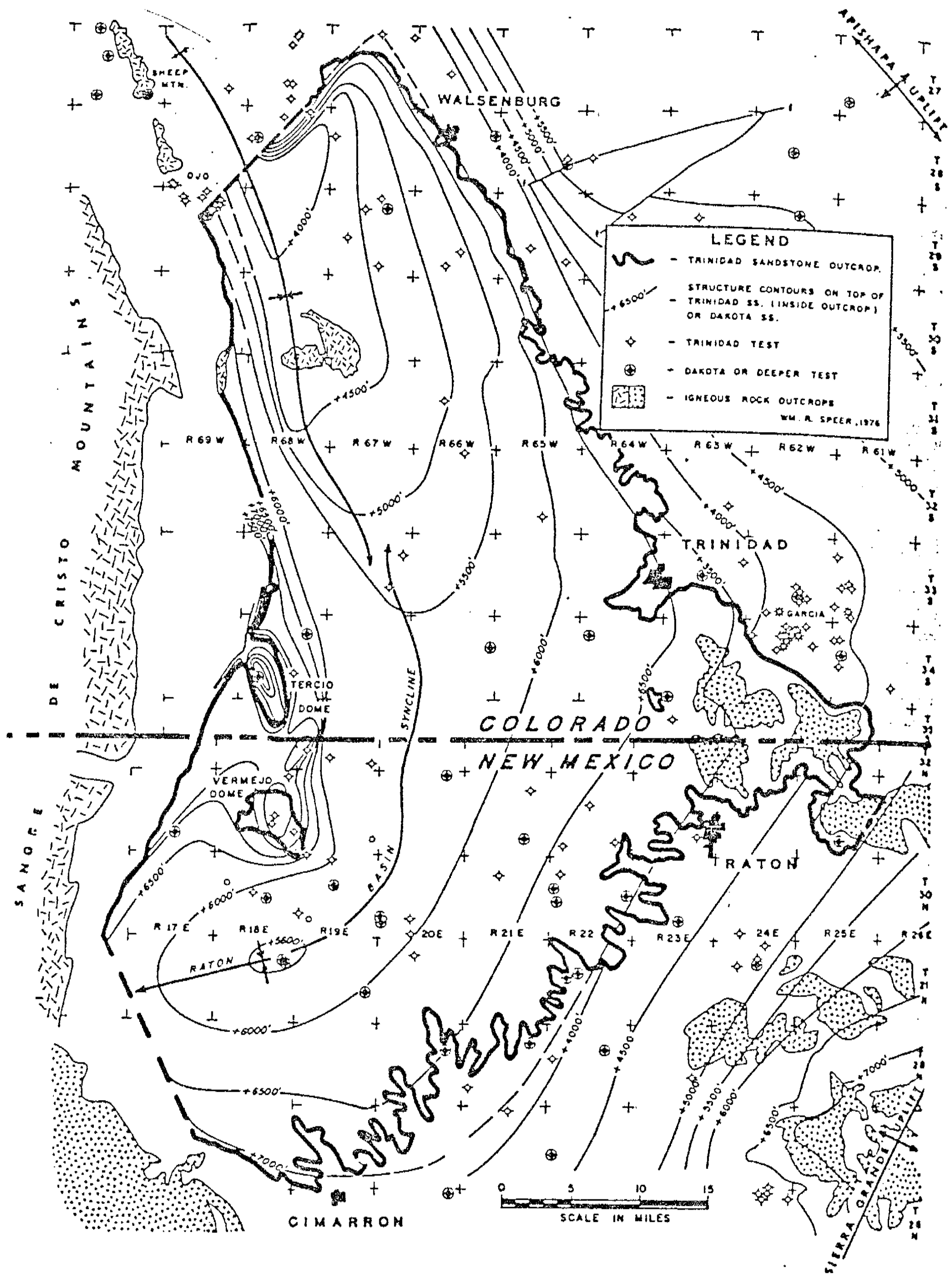

Figure 5. Geological structural map of the Raton Basin (From Speer, 1976).

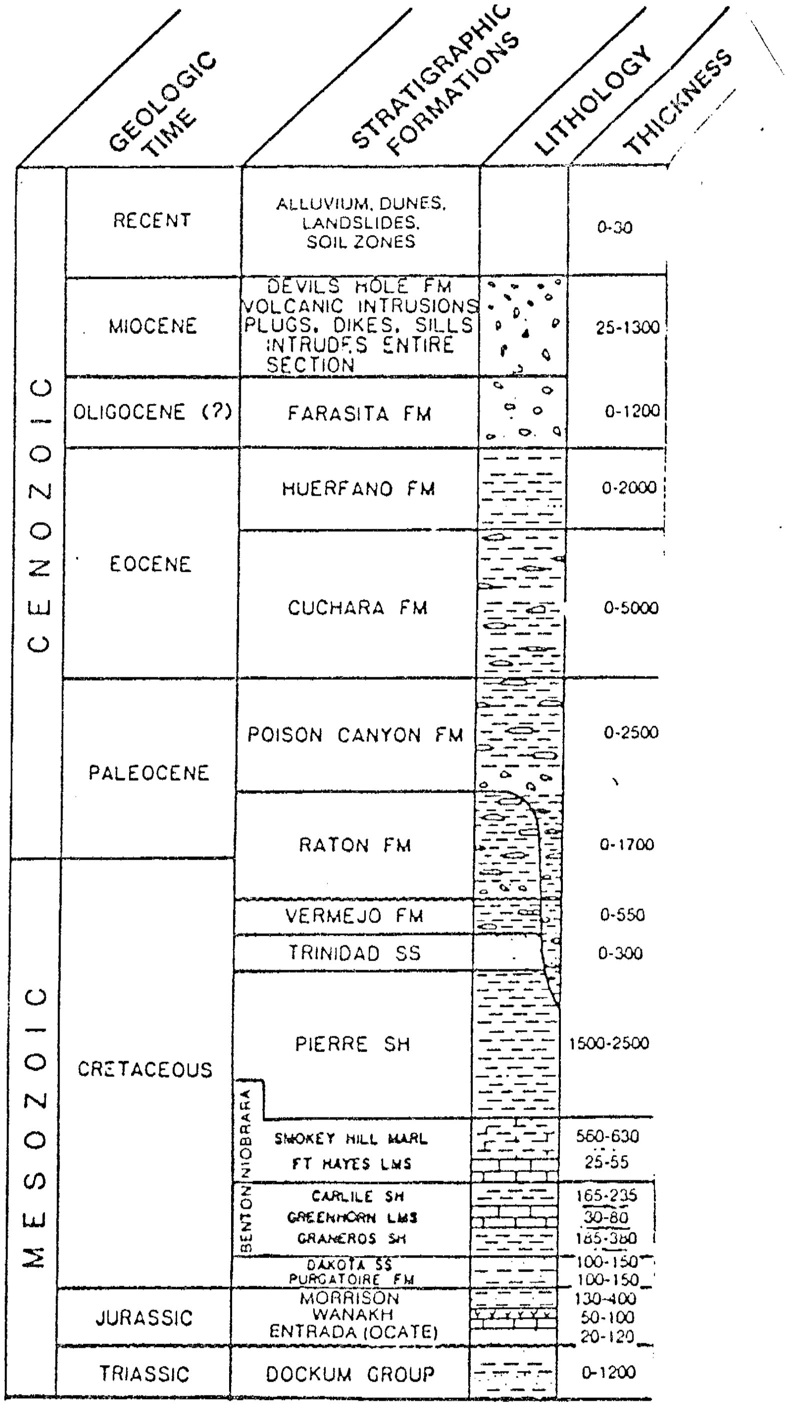

Figure 6. Generalized stratigraphic column of Mesozoic and Cenozoic rocks in the Raton Basin (From Jurich and Adams, 1984).

The Raton Formation, overlying the Vermejo, contains the thickest coal deposits in the basin. The unit consists of three parts, 1) a basal conglomerate unconformably overlying the Vermejo Fm., 2) the lower zone, predominantly sandstone and siltstone, and 3) the upper coal-bearing zone which grades into the Posion Canyon Fm. The West Ridge Coal Deposit is contained in the upper coal-bearing zone, and consists of continental upper alluvial plain deposits of Early Paleocene age deposited in floodplain and backswamp environments associated with meander belt channels and crevasse splays (Pillmore, 1986).

LOCATION AND SAMPLING

Lee Ranch Mine

Location

The Lee Ranch Mine is located approximately 30 miles northeast of Grants, New Mexico (Figure 7). The mine recovers coal from the Cleary Coal Member of the Menefee Formation, ranging in thickness from 45 to 250 feet over the lease area. Coal was being mined from three seams, the "P" seam, the "BA" seam, and the "BB" seam.

Detailed measured stratigraphic descriptions for each drill core are given in Appendix A. Figures 8, 9 and 10 show coal lithotype and sediment lithology for each drill core of the P, BA, and BB seams respectively. The dominant lithotypes are clarain and durain. Sparse to moderate, thin to medium (Schopf, 1960) bands of vitrain are found throughout the clarain, and occasionally in the durain. Blebs of resin are often visible (up to 10%), usually in sections exhibiting moderate cleat fractures. The cleats are filled with calcite and pyrite.

The distance represented by the boundary rocks on the top of the BA seams and the bottom of the BA and BB seams do not represent the entire interval between the P, BA and BB seams. While the boundary lithology at the top and bottom of each seam is the same for the paired holes, it differs

Figure 7. Location of Lee Ranch Mine.

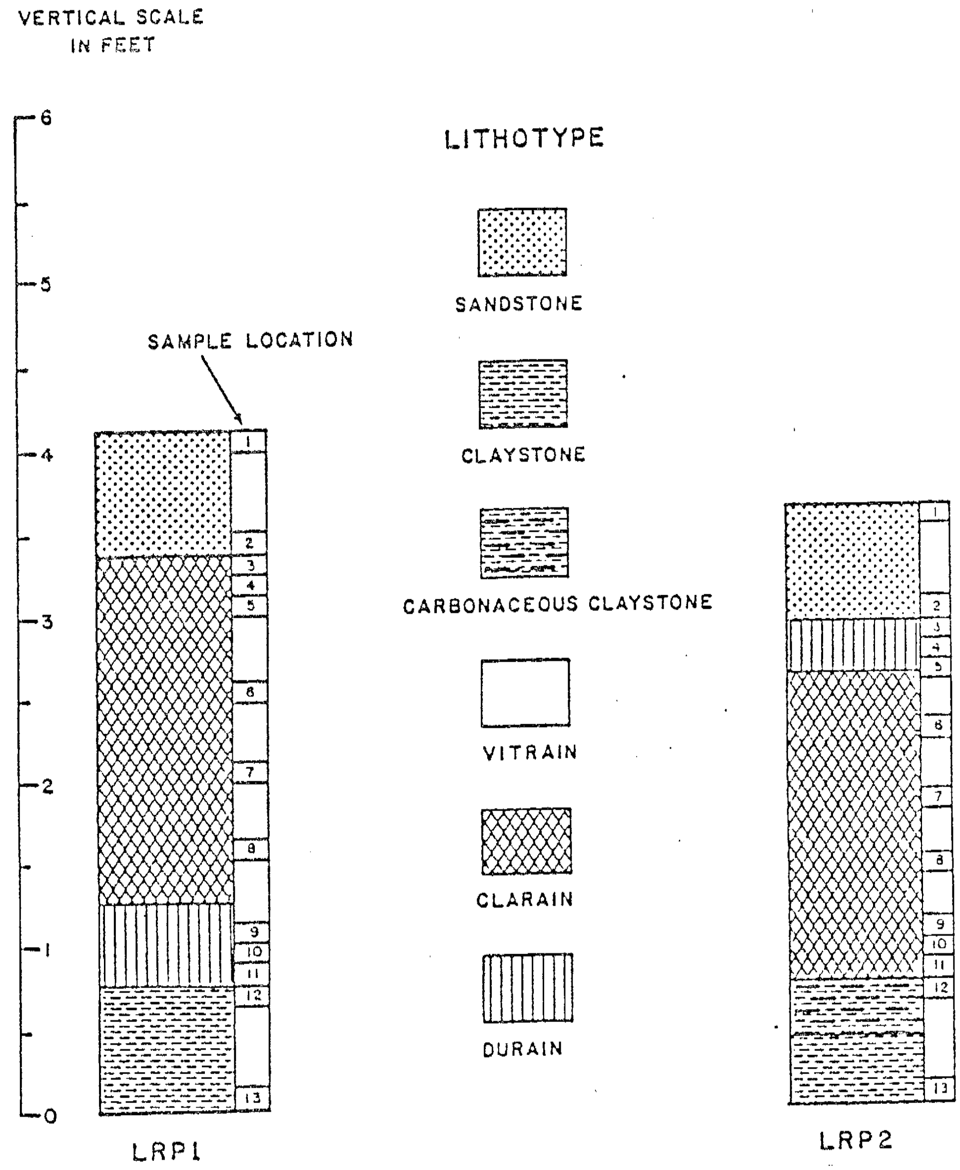

Figure 8. Coal lithotype columns for the Lee Ranch P Seam drill cores.

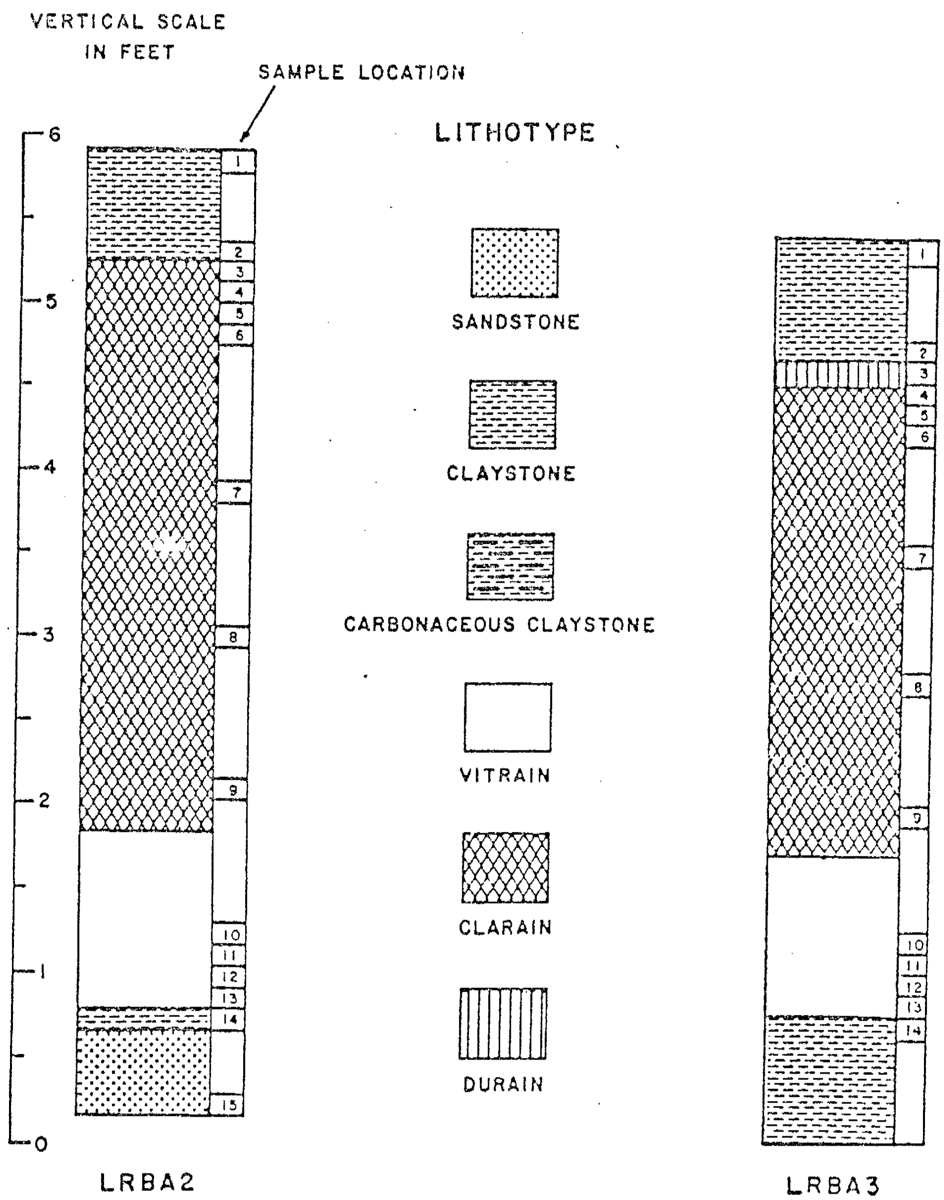

Figure 9. Coal lithotype columns for Lee Ranch BA Seam drill cores.

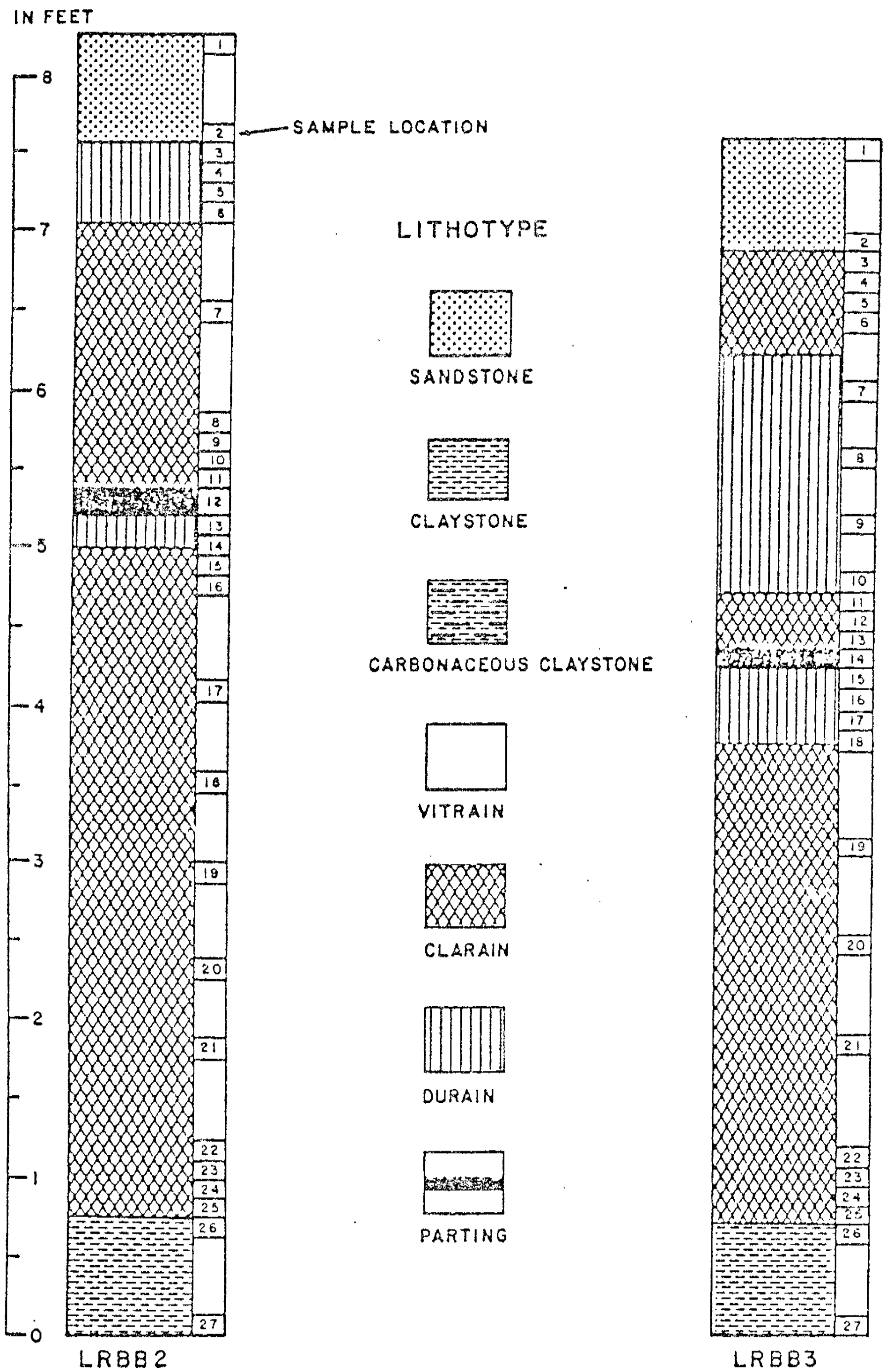

Figure 10. Coal lithotype columns for Lee Ranch BB Seam drill cores.

from seam to seam (i.e., both A seam drill cores have an upper boundary lithology of sandstone, but the Lower boundary of the P seams are claystone). This may be important in explaining concentration variability between the seams. Only the BB seams have a well defined parting. The simplicity of these seams allows for better interpretation of trace element distribution patterns and how partings affect the movement of elements.

Sampling

Samples were collected from the Lee Ranch mine using a truck-mounted rotary rig. Water was used as the drilling fluid. Two and one half inch diameter drill cores were recovered from each of the three seams (P, BA, BB) at two separate locations. Samples were collected on May 26, 1986. The first location sampled was from the northeastern end of pit number 1, NE 1/4, NE 1/4,SE 1/4 of Section 27, T15N, R8W, and is represented by drill cores LRP1, LRA3, and LRB3. The second location sampled was from the northwestern end of pit number 1, NW 1/4, NE 1/4, SE 1/4 of Section 27 T15N, R8W of an irregular section. This location is represented by drill cores LRP2, LRA2, and LRB2. The two sample locations are separated by 1500 feet. The cores were placed in plastic tubing and sealed until they were logged and sampled for analysis.

Previously, Kendrick, 1985 showed that the greatest variation in trace element concentration occurs near the seam boundaries and partings. The sampling scheme therefore provided for a maximum sample density in these areas.

Uranium

Uranium is capable of existing in two oxidation states; the 4+ is the most prevalent in coal-forming environments. The reduced compounds are only slightly soluble. Uranium may form complexes with carbonates and sulfates. Unlike thorium, uranium usually shows organic associations, and is most likely associated with authigenetic minerals.

Previous distribution studies have shown much the same tendencies as thorium, and uranium is leached from tonsteins in the same manner as thorium. The average in western coals is 1.2 ppm which is twice the average in the coals of this study.

Distribution Profiles (Refer to Figures D-173 to D-179).

The distribution profiles are very similar to those for thorium. The coal samples adjacent to the boundaries show enrichment. The distribution patterns for uranium are more U-shaped than those for ash indicating uranium is mobilized from the boundary rocks and trapped in the adjacent coal. The mobility of uranium around the parting is different than thorium, the upward adjacent coal sample is more highly enriched and the enrichment zone is much wider. The anomalies due to durain zones are more defined. The York Canyon profiles are the same except that the enrichment around the parting is greater in the lower adjacent sample.

Correlations (Refer to Appendix E).

Uranium shows the same correlations as thorium.

Separates (Refer to Figures D-180 and D-181).

The graphs are basically the same as those for thorium. The total concentration of uranium is notably higher in the samples adjacent to the parting. The contribution from the float is much higher than in any other coal samples, indicating secondary enrichment in the coals from the parting rock.

Summary of Actinides

The actinides show varying properties. Thorium is more like the transition metals, in that it is relatively immobile from boundary rocks and somewhat mobile in the partings. Uranium shows increased leachability and mobility in coals adjacent to the boundaries, enriched more than anticipated from the ash content. Both uranium and thorium show the same correlations, indicating that their modes of occurrence are probably the same, uranium is more mobile as evidenced by the data from the separates.

Summary of Group 3 Elements

The hydrolysate elements generally have U-shaped distribution profiles. See Table 5 (page 92) for general curve characteristics. The extent to which the U is narrower than those of the ash curves (approximating more of a V shape) varies and depends on the form in which an elements arrives at the coal swamp. If an element is contained in a very stable phase it will not be available for secondary redistribution into a chelate or authigenic phase.

The formation of stable phases (i.e., pyrite, carbonates) by abundant elements is also a controlling factor in the distribution of trace elements. If a trace element easily substitutes into the structure of these mineral phases then the curve shapes of the trace element will reflect areas of formation of the stable phase.

GROUP 4 THE RARE EARTH ELEMENTS

The rare earth elements (REE), also known as the Lanthanide series (including elements lanthanum through lutetium) offer a unique opportunity to study the effect of ionic potential on a group of elements known to have similar geochemical characteristics. Eight of the REE (La, Ce, Nd, Sm, Eu, Tb, Yb, and Lu) were analyzed in this study.

Previous studies of REE show contradictory results regarding their organic vs. inorganic affinity. A fairly complete synopsis is given in Finkelman (1980). In one recent study, Eskenazy (1978) found a relative increase in the HREE in low ash coals, an increase in the absolute REE concentration with increasing ash content, and a REE pattern that approached that for shales in high ash coals.

As Fleet (1984) states, the bulk of the REE transported in fluvial systems is in the detrital fraction; the amount dissolved in solution accounts for very little of the total REE. Therefore, as assumed for other trace elements, the bulk of the REE enters the swamp in allogenic material, and may be subsequently re–distributed during diagenesis. Fleet suggests that the bulk of the REE are held within the clay fraction or in accessory minerals such as zircon and apatite. Finkelman (1980) found the majority of the REE in authigenetic phosphate minerals such as monazite and xenotime. The presence of authigenetic minerals requires mobilization and localized concentration of the REE from allogenic materials, which may be accomplished by organic complexing.

Since the REE are so similar they will not be described on an element-by-element basis. Instead, they are grouped as follows: the light rare earths (LREE) include La, Ce, and Nd, the intermediate rare earths include Sm, and Eu, and the heavy rare earths (HREE) include Tb, Yb, and Lu.

The LREE

Distribution Profiles (Refer to Figures D-182 to D-202).

The concentrations in the boundary rocks are higher than any of the coal and parting samples. The upper boundaries tend to show higher concentrations than the lower boundaries. The coals adjacent to the boundaries show no or very slight enrichment relative to the interior coal samples. The parting samples are enriched compared to the interior coal samples, as are the samples directly adjacent to the partings.

The York Canyon curves show a more varied distribution profile. The concentrations in the coal samples adjacent to the upper boundary are enriched, but those adjacent to the lower boundaries are less so. The distribution profiles are jagged with most anomalies occurring in durain zones. Overall, the distribution profiles are very similar to those of ash, except for those of the York Canyon.

Correlations (Refer to appendix E).

The LREE show the highest correlations among themselves, all greater than .90. They also exhibit high correlation coefficients with the intermediate

REE and neodymium shows correlations with some of the HREE. In the Lee Ranch separately the LREE show correlations with more of the REE in addition to the actinides and selenium. In the York Canyon the REE show correlations only with other REE elements, reinforcing the idea that the REE originate as detrital grains.

Separates (Refer to Figures D-203 to D-208).

The graphs for the LREE separates are so similar that they are indistinguishable. The boundaries and partings are dominated by the sink and clay contribution. The float contribution is insignificant in the boundaries but comprises the majority of the total concentration in the coals. The concentration lines for the clay and the sink follow each other and with out exception are higher in the non-coal samples. The float concentration line is independent of the other two and except for the YA seam is fairly flat.

The Intermediate REE

Distribution Profiles (Refer to Figures D-209 to D-222).

Where the profiles for Sm and Eu do not exactly match, those for Sm show greater concentrations. The boundaries again are much higher than any coal samples with the upper boundaries having higher concentrations than the lower, regardless of lithology. The coals adjacent to the boundaries are enriched, and the enrichment zone extends further into the interior coals resulting in a very well defined and symmetric U-shaped distribution pattern. The seams with partings show that parting samples have much lower concentrations than the boundary samples The partings in the Lee Ranch B seams are depleted or equal to adjacent coals . Enrichment from the parting in the B2 is in the upper adjacent coals while the enrichment for the B3 seam is in the lower coals although the amount of enrichment is small. The partings in the York Canyon seams are enriched and enrichments are found in the upper part of the YA YUM and YM seams.

Correlations (Refer to Appendix E).

Aside from the correlations with the LREE, the intermediate REE show high correlations with each other and the HREE. Europium also shows a high correlation with scandium.

Separates (Refer to Figures D-223 to D-226).

The separate profiles are very similar to those for the LREE. The patterns for Eu and Sm are strikingly similar even though the concentration of Sm is four times greater. Within the coals, the concentration line for the clays is the greatest.

The HREE

Distribution Profiles (Refer to Figures D-227 to D-247).

The boundary samples are the most concentrated in the HREE but the difference in concentration between the boundary and adjacent coal is smaller than for any other group. Like the intermediate REE the enrichment zone extends further into the coal seam, but enrichments are greater than in the intermediate REE. This results in narrowing of the U pattern, especially in the thinnest seams. The partings in the Lee Ranch B seams are depleted, but the enrichments in the adjacent coals are not as great as the enrichments near the boundaries.. In the York Canyon seams the partings are less depleted. The upper part of the YUM and YM seams show considerable enrichment in HREE relative to ash.

Correlations (Refer to Appendix E).

The HREE show the highest correlations among themselves with lower but significant correlations with other REE. All three HREE elements show correlations with scandium. In the Lee Ranch samples the HREE also show a correlation with antimony and in the York Canyon all HREE show correlations with cobalt.

Separates (Refer to Figures).

The graphs are very similar to the other REE.

Summary of the REE

The distribution patterns of the REE exhibit the continuum from the soluble cations to the hydrolysate elements; from a flat U-shaped distribution pattern (of the LREE) similar to ash to the well-defined narrow U-shape of the HREE indicative of mobilization and secondary enrichment. See Table 5 (page 92) for generalized curve shapes and correlations. The same general observations were made by Kendrick (1985). In discussing the behavior of the REE adjacent to the partings he states "The LREE were preferentially accommodated in the clay minerals which were forming as weathering products. The HREE were preferentially hydrolyzed or bound with organic complexes and allowed to migrate away from the parting." This explanation fits well if only whole coal distributions are considered. However, this statement suggests that the clays are enriched in LREE relative to HREE. This should be reflected in the concentration lines for the float-clay-sink separation. Inspection of these diagrams shows the clay concentration lines have the same patterns, especially around the partings, for all the REE. Further, Kd calculations (Table C-10) show no consistent trends of clay enrichment in LREE over HREE. In fact, many samples show higher organic content of LREE relative to HREE.

While there is no doubt that the HREE are leached, mobilized, complexed and subsequently form authigenetic minerals, the fate of the LREE is questionable. While it is reasonable to assume that some amount of LREE is mobilized from the parent material and taken up by clays, the clay fraction can not account for all the LREE. Float-clay-sink distributions show that a significant portion of the LREE in non coal samples occurs in the sink. Perhaps the HREE, due to their size or change in oxidation state upon entering the coal environment are more easily removed from the parent material than the LREE. This could well account for the dramatic decrease in concentration from the LREE to the HREE.

CONCLUSIONS

Table 5, page 92, presents generallized curve shapes and correlations for all elements. The distribution profile of a trace element in coal is generally U-shaped, but depends on many factors. The first is the availability of the element itself. In order to be available the element must first be brought into the coal forming environment. There are three different sources to consider, the plants, water, and sediment. Sediment is most important whether it is fluvial or air borne. Elements brought in by sedimentation may not be movable after deposition if they are part of a stable mineral structure. These minerals are not dissolved or leached show the same distributions as ash. This is especially true for many elements in seams without partings. In seams with partings distribution patterns around the tonstein do not exhibit an increase in trace element concentration proportional to the increase in ash, indicating leaching from primary volcanic materials. However, enrichment zones in the adjacent coals are not always present. Elements in this category are Zn and the LREE.

The elements which are released from their parent minerals along with those brought in by sedimentation are available to participate in diagenetic reactions. The elements can now be divided into two categories, those that are concentrated enough to form their own stable phases (S, Fe, Ba, and Ca) and those that are governed by the laws of dilute solutions. The elements forming their own phases and their influence on other trace metals will be discussed later. The fate of the dilute elements depends on several factors, ionic potential being one of the most important. The larger, low charge cations are relatively unstable in their parent minerals, easily leached, and because they are incapable of adsorbing onto clays or forming complex compounds, are carried away in solution. This results in distributions that are flatter than ash profiles, as exhibited by the alkaline metals of Group 2 (Cs, Rb, and Na). An increase in charge allows for the next set of elements in Group 2 (Ca, Ba, and Sr) to be slightly more retained in their parent mineral or adsorbed, but chelates for the alkaline earth metals are rare (Martell and Calvin, 1952). Their distributions are still flatter than the ash profiles. Transition metals of the same charge, (Fe, Co, and Zn) are more likely to form complex compounds or to be adsorbed because they form covalent bonds, whereas the alkaline and alkaline earth metals do not.

The closer a Group 2 metal is to the boundary between Group 2 and Group 3, the more it appears to have the same distribution as ash (as evidenced by the LREE and Zn). Crossing over into the Group 3 elements, distribution patterns show narrower U-shape distribution indicating mobilization and secondary enrichment. The question now arises as to the extent of an element's mobility. The mobility is governed by the kind of complex ions an element forms in solution and how that affects adsorption. Elements such as arsenic which form complex ions in solution will not be adsorbed and are subsequently carried away in solution, yielding a flat distribution profile. Elements that do not form complex ions in solution will be adsorbed. There are basically two types of adsorption sites, those on clays and those associated with the decaying organic matter. A metal may bond at one of two sites in the organic material; with a carbon atom forming a metallo-organic complex, or with an O, S, or N, forming a chelate. Since there are many orders of magnitude more organic complexing sites than clay adsorption sites, it is reasonable to assume that most metals will bond at organic sites, if the bonding strength of each kind of site is approximately the same.

The coal will act as an ion exchange column for those elements adsorbed on clay and on organic sites. For chelates the relative stability of chelate structures of an element will depend on ionic forces (a function of ionic potential) and the ability of a metal to form homopolar bonds. Also the basicity of the metal appears to control chelate stability. The weakly basic metals form the strongest chelates and the most highly basic metals form the weakest. Therefore not only is the ability to form homopolar bonds important, but those that involve the d orbitals will be most stable (Martell and Calvin, 1952). In general, the elements in the periodic table most likely to form chelate structures are the transition metals.

Another important consideration are the components that make up the organic matter. Lithotype variations seem to be important in governing anomalies in curve shapes, as evidenced by several elemental distribution patterns showing high concentrations in durain zones. One may speculate that this may be due to an increased ash concentration (yet the durain zones do not always stand out in ash distribution profiles). A more likely explanation is the increased abundance of exinites in durains. The exinites are resins and other low order molecules with high adsorption capabilities.

The other important factor governing the trace element distributions is the formation of stable phases. Elements that form stable phases were listed previously. The formation of a stable phase affects not only the elements forming the mineral, but also trace metals capable of substituting into the mineral structure. Elements that form stable phases generally show higher concentrations in the coal than in the surrounding rocks and partings. Trace elements capable of substituting into the structure often show anomalies where concentrations of stable phases are highest. Trace elements which appear to be affected by the formation of stable phases are Sr, Cr, and Co.

Microscopic studies (Finkelman, 1980) have determined that several trace elements not associated directly with the ash occur as authigenic phases. However, float–clay–sink data indicate that the bulk of the trace element is in the float. Although the concentration lines for the clay and sink indicate that these two phases have greater concentrations than the float, the weight percent of these two phases is so low in the coals that they do not make a significant contribution to the bulk concentration. Therefore, the authigenic minerals must be so small and intimately mixed with the organic matter that they can not be removed by float–clay–sink separation. The only other explanation is that that adsorption and chelation form strong enough bonds that the elements remain on the hydrocarbons.

The major conclusions from this study are as follows:

1. The vertical distribution profiles for trace elements are generally U–shaped with maximums at or near the boundaries.

2. Elements can be categorized into the following groups based on comparison with ash profiles:

   a. Profiles flatter than ash suggest movement from the ash and removal from the coal forming environment.

b. Profiles the same as ash suggest that the elements are still associated with the clastic mineral matter.

c. Profiles more V–shaped than the ash profiles suggest redistribution from the ash into the coal.

d. Profiles showing no relation to ash profiles (erratic) are due to ele ments forming their own mineral phases, often as secondary filling of fractures.

3. A rough grouping of an element into one of the four above groups can be made based on that element's position in an ionic potential diagram.

4. The REE represént the continuum between groupings on the ionic potential diagram and exhibit the change in curve shapes from one group to another.

5. Pearson correlation coefficients between ash and an element are higher when boundary, parting and coal samples are considered, and lower when only coal samples are considered.

6. The slopes and intercepts of a best fit line through data plotted on an ash vs. trace element concentration line are significantly different. When coal, parting, and boundary rocks are considered the slopes are very high, when only coal samples are considered the slopes are lower.

7. Float–clay–sink diagrams support the above arguments but are not complete enough to support any conclusions on their own.

Table 5. Summary of Results

Element	Curve Shape: Comparison with Ash	Curve Shape: Behavior at Partings	Anomalies with Durain	Correlations: In all Seams	Correlations: LR	Correlations: YC
Group I						
Bromine	Inverted U	Some inflections	No	None		
Sulfur	Inverted U	Opposite of ash	No			
Selenium	M – shaped	Some inflections		Hf, Ta, U		
Group 2						
Alkali Metals						
Sodium	Bracket, flatter than ash	Depleted from partings, no inflections	No	None		
Rubidium	Bracket, flatter than ash	Depleted from partings, no inflections	Yes	Cr, Cs		Ash
Cesium	Bracket, flatter than ash	Depleted from partings, slight inflection	Yes	Rb, Ash	Cr	Ta, Th
Alkaine Earth						
Barium	Flatter than ash	No inflections	Yes	None	Sr	Sr
Calcium	Inverted U	Same as ash	No	None		
Strontium	Bracket, more erratic	Depleted from partings, no peaks	No	Ba		
Transition Metals						
Cobalt	More erratic than ash, U – shaped	Depleted from patings no peaks	Yes			REE, Zn
Iron	Erratic	Less than ash	Yes	None		S
Zinc	U – shaped, flatter than ash	Less than ash	Yes			Ash, Co

Group 3

Group VA Elements						
Arsenic	Flat, U – shaped	Flatter than ash, no peaks	Yes anomalies with iron			
Antimony	V – shaped, redist. from ash	Depleted from partings, enriched above	No	None	HREE, Lu, Tb, Yb	Cr, Sc, Se U
Transition Metals						
Chromium	Similar to ash, U – shaped	Depleted from partings	Yes	Cs, Rb, Sc Ta,	Sm, Ta	Variety
Scandium	Similar to ash, U – shaped	Depleted from partings	Yes	Cr, Eu, Th, HREE, ash	Sm,	Sb, Se, U
Hafnium	Similar to ash except at partings redistr.	Enriched, redist. in adjacent coals	No	Se, Ta, Th U	Ce, La	Ash, Cr
Tantalum	Similar to ash, U – shaped	Same as ash	Yes	Cr, Hf, Se, Th, U	Ce, La, Nd, Sm	Ash, Cs Rb
Actinides						
Thorium	Redistr. from ash, U – shaped	Depleted from partings, enriched above and below	Yes	Hf, Ta, U	LREE, Sc	Ta
Uranium	Redistr. from ash, V – shaped	Depleted from partings, enriched above and below	Yes	Hf, Ta, Th	LREE, Sc	Ta
LREE						
LREE	Same as ash, U – shaped	Moved from parting, enriched above and below	Yes	LREE, IREE	Th, U, Se	
IREE						
IREE	Redistr. from ash, U – shaped	Moved from parting, slightly enriched	No	LREE, IREE, HREE		
HREE						
HREE	Redistr. from ash, V – shaped	Moved from parting, enriched above and below	No	LREE, IREE, HREE	Sb	Co

SUGGESTIONS FOR FURTHER WORK

To better understand the distribution of trace elements in coal more attention should be paid to the source of trace metals. The starting composition and mineralogy of non–coal samples must be determined. A good way to accomplish this would be to sample the non–coal lithologies in the coal and adjacent facies. Analysis of these samples by INAA, SEM, and XRD would determine how the mineralogies of these two environments differ which would shed some light on the leachability of trace elements from their parent minerals in coal environments. SEM studies of the same coal would determine authigenetic vs. allogenic phases, and the distribution of trace elements in each.

The distribution of an element in the coal itself is at one time dependent on the organic complexing capability in the coal. In order to study this an ion exchange columns should be constructed so that the effect of changes in coal lithotype, pH, Eh, and concentration could be analyzed.

Another important factor governing the distribution of trace elements in coal is the formation of stable phases, both as secondary fracture filling and in the coal. Stable isotope studies may determine when different stable phases are formed and thus shed some light on differences in trace element substitution in these minerals.

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APPENDIX A

MEASURED STRATIGRAPHIC COLUMNS

Drill Core LRP1

Thickness Total	Unit	
9.4"	9.4"	Claystone black to grey fisslie sparse coal stringers resin blebs conc. near bottom
35.5"	25.9	Clarain vitrain bands, thin to med thick, moderate abundance resin blebs 5–10% pyrite 3–5%, mostly as fracture filling moderate cleat
41.3"	6"	Durain thin, sparse vitrain bands resin 3–4% more abundant at the top pyrite 5%, disseminated
50.7	9.4"+	Claystone dark brown to black fissile minor resin blebs scattered coal fragments
		Bottom of Section

Drill core LRP2

Thickness Total	Unit	
9.4"	9.4"	Sandstone

		light grey friable well sorted, subangular to subrounded 2.5 – 1 ϕ quartz 80% felds 15% other 5% calcite cement clayey zones near bottom
13.0"	3.6"	Durain thin, sparse vitrain bands resin, pyrite 2–3%, more concentrated near top moderate cleat
35.8"	22.8"	Clarain thin–med., sparse–moderate bands of vitrain resin 10–15% especially abundant near base and along fractures pyrite 6–10% same occurence as resin
40.1"	4.3"	Carbonaceous Claystone
44.2"	4.1"	Claystone dark grey–black fissile resin blebs throughout discontinuous coal blebs and stringers

Bottom of Section

Drill Core LRBA2

Thickness Total	Unit	Description
9.4"	9.4"	Claystone dark grey fissile broken coal blebs and stringers resinous, pyritic
51.2"	41.8"	Clarain vitrain bands thin–moderate thickness, sparse–moderate abundance, grades into vitrain near bottom resin, 5%, scattered pyrite up to 10% disseminated and scattered good cleat, white authigenetic mineral as fracture coating
62.0"	10.8	Vitrain very thick vitrain bands some clarain pyrite and resin <2%, scattered good cleat, white mineral as fracture coating
63.4"	1.4"	Claystone grey fissile some coal blebs
71.4"	8"	Sandstone light grey

medium induration
subrounded, moderately sorted
2–3 ϕ
discontinuous coal stringers

Bottom of Section

Drill Core LRBA3

Thickness Total	Unit	
9.4"	9.4"	Claystone light grey fissile broken coal blebs, more abundant near boundary
11.8"	2.4"	Durain no vitrain bands pyrite, resin <2%, scattered and disseminated poor cleat
45.5"	33.7"	Clarain thin, sparse–moderate vitrain bands resin and pyrite 3–5%, scattered and disseminated moderate cleat surfaces weathered
56.3"	10.8"	Vitrain very thick dominant vitrain bands and lenses

		some clarain pyrite and resin 4%, disseminated and on cleat surfaces good cleat weathered surfaces
65.7"	9.4"	Claystone brown–grey semi–fissile coal blebs

Bottom of Section

<u>Drill Core LRBB2</u>

Thickness		
Total	Unit	
9.4"	9.4"	Sandstone yellow–orange well indurated moderately sorted, subround, 2–1 ϕ calcite in fractures
15.7"	6.3"	Durain shaley very thin sparse vitrain bands pyrite 3%, scattered resin 7%, scattered poor cleat
35.9"	20.2"	Clarain thin, sparse vitrain bands and blebs pyrite 3%, scattered and on fractures

		resin 10%, disseminated moderate cleat
38.1"	2.2"	Parting white, clayey hard coal stringers
40.5"	2.4"	Durain thin, sparse vitrain bands resin and pyrite <2% poor cleat
91.7"	51.2"	Clarain thin–med., moderate vitrain bands thickening toward base some plant remains pyrite 3% on fractures and disseminated resin, 10% as blebs and disseminated moderate cleat white authigenetic clay mineral along fractures
101.1"	9.4"+	Claystone dark brown fissile resinous, coal blebs

Bottom of section

Drill Core LRBB3

Thickness: Total	Thickness: Unit	
9.4"	9.4"	Sandstone yellow–grey moderately indurated well sorted, subrounded to subangular 2–1 ϕ grades into claystone
16.6"	7.2"	Clarain thin, sparse vitrain bands pyrite and resin <2%, disseminated moderate cleat
35.3"	18.7"	Durain thin, sparse vitrain bands pyrite 6% on fracture surfaces and disseminated resin 3% and disseminated moderate cleat
38.9"	3.6"	Clarain thin, sparse vitrain bands pyrite and resin 5%, along fracture surfaces moderate cleat
40.2"	1.3"	Parting light grey clayey hard coal stringers
46"	5.8"	Durain thin, sparse vitrain bands

		pyrite and resin 3% disseminated and scattered poor cleat
82"	36"	Clarain thin–med., moderate vitrain bands pyrite 6% as vienlets and fracture filling resin 7%, disseminated calcite as vienlets abundance of pyrite, resin and calcite increase toward bottom moderate cleat
91.4"	9.4"	Claystone dark grey non fissile some coal stringers and pyrite blebs

Bottom of Section

York Canyon YA Seam

Thickness Total	Unit	
9"	9"	Carbonaceous Claystone black-brown-light grey thin vitrinitic lenses 1 cm thick
10.5"	1.5"	Vitrain crumbly with minor lenses of carbonaceous claystone
23.5"	13"	Clarain blocky, massive sparse, med. thick vitrain bands sparse cleats
24.5"	1"	Carbonaceous Claystone dark grey discontinuous coal blebs
26.5"	2"	Durain
36.5"	10"	Clarain moderate, thick vitrain bands similar to clarain above
58.5"	22"	Carbonaceous Claystone (Interburden between YA and YUM) black-brown sparse, common, med. thick vitrain layers limonite on fracture surfaces in layers

72.5"	14"	YUM Seam Clarain abundant med. vitrain bands crumbly fractures at high angle to face grey coating on slickensides
78.5"	6"	Claystone (Interburden between YUM and YM) brownish thin vitrinitic lenses .5 cm fresh pyrite lenses
84.5"	6"	YM Seam Interlayered durain and vitrinitic clarain vitrain layers medium thick conchoidal crumbles readily due to highly fractured clarain
95.0"	10.5"	Clarain abundant, med. thick vitrain bands closely spaced vertical fractures fractures at high angle to face subparallel, .5cm apart white mineral (gypsum, calcite) as coating on fracture surfaces
97.0"	2"	Durain thin, lenticular, sparse vitrain bands fractured

117.0"	20"	Clarain abundant med. thick vitrain bands white mineral coating cleats
120.0"	3"	Durain fractures further apart, less abundant, more massive
138.0"	18"	Clarain vitrinitic bands abundant, med. thick, highly fractured sparser mineral coating in cleats
142.5"	4.5"	Durain finely striated
		Claystone
		Bottom of Section

APPENDIX B

ANALYTICAL METHODS

Coal Parameters

Proximate Analysis

The proximate analyses moisture, ash, volatile matter and fixed carbon content (in percent) were performed by Commercial Testing Inc. in Denver, Colorado. The methods for analysis were in accordance with ASTM standard methods for coal analyses D-3173, D-3174, and D-3175.

Ultimate Analysis and Forms of Sulfur Analysis

Commercial Testing Inc. also performed the ultimate analyses consisting of carbon, hydrogen, oxygen and nitrogen (in percent) and the forms of sulfur analyses consisting of pyritic, organic and sulfate sulfur determinations. Methods of analyses are in accordance with ASTM standard methods D-3176 and D-2492.

Precision and Accuracy

Unmarked duplicate samples were sent along with each sample set. The precision and accuracy of the analysis were well within ASTM standards. Results are given in Tables C-1, C-2, and C-3 of Appendix C.

Scope Work

Sample Preparation

Approximately 10 grams of the –20 mesh split was wetted with epoxy (APCO resin 2410A and catalyst 2183B). The mixture was placed into one inch diameter circular molds and compressed to not more than 2000 lbs/in^2. The epoxy was allowed to set and the pellets were removed from the mold. They were then cut in half using a bladed rock saw. Each half was then polished using silica carbide, diamond polishing compound and aluminia compound. The polishing process was completed to meet the specifications of ASTM procedure D–2797.

Maceral Content

The methods for maceral content are given by ASTM procedure D–2799 and are briefly described below. The analysis for maceral content were counted under a 40x oil immersion objective and 10x occulars, one containing a cross–hair. A mechanical stage was used to move the sample by fixed increments. The spacings between points was chosen such that 500 points would cover a maximum surface area on each pellet. Two pellets were analyzed for each sample. The results are given in Table C–4, Appendix C.

Vitrinite Reflectance

Vitrinite reflectance analysis was performed on 100 randomly selected vitrinite grains for each sample. Measurements were made using a green light with a wavelength of 546 nm. An aperture was inserted in front of the photomultiplier tube so that the effective area of measurement was 12.5 microns in diameter. The instrument was calibrated against known glass standards. Again, a 40x oil immersion objective was used in conjunction with 10x occulars. The procedures used are in compliance with ASTM method D-2798.

The mean, standard deviation and variance were calculated for each sample. The data is given in Table C-5, Appendix C.

XRD

Samples for X-Ray diffraction analysis were treated by two different methods, low temperature ashing, and high temperature ashing. The purpose was to determine if a correlation could be made between primary mineral phases identified from low temperature ashing and secondary phases formed from the less time consuming high temperature ashing.

Sample Preparation

LTA

Approximately 10 grams of the -60 mesh sample stock was ground to -200 mesh. Three to five grams of the -200 mesh sample was weighed into a dried, previously weighed sample boat. The boat was placed in a drying oven and dried at 105° C for 2 hours, and weighed to determine the moisture loss.

The boat was placed in the ashing chamber of the low temperature asher. Four samples per run were ashed for five to seven days in a LFE Corp. model 504 Electronic Low Temperature Asher. The samples were removed and stirred approximately four times a day to allow complete oxidation of the organic material.

HTA

Approximately 20–25 grams of coal from the sample stock was weighed into a clean pre-weighed porcelain crucible. The samples were dried for one to two hours at 100 C to drive off moisture. The crucibles were then placed in a furnace and ashed at 350 C for 24 hours. If the ashing process was not complete then the samples were placed back in the furnace at the same temperature for another two hours. The residue (usually 1–2 grams) was weighed and subsequently ground in a ceramic mortar and pestle to -200 mesh.

Method and Results

The powder from each ashing process was mounted on a gelled oriented fluorite crystal by tapping it through a sieve. This allowed for uniform distribution of the powder. The crystal was mounted on a spinner and X-rayed on a Rigaku Geigerflex diffraction unit using Ni filtered CuK (≈1.5418 A) radiation. All samples were scanned at 2°/minute between 3° and 63° 2θ . The data are given in Table C-6, Appendix C.

INAA

Sample Preparation

The samples were prepared in accordance with Jacobs et. al. (1977), and the method is briefly described below. The samples were dried and approximately 100 mg was weighed to the nearest .01 mg into cleaned ultra pure fused silica vials. The vials were sealed, cleaned and re-weighed for identification purposes.

The vials were placed in aluminum foil which was formed into a tube and placed inside a 3.34 inch diameter irradiation cylinder. The samples were irradiated at the University of Missouri's 10 MW Research Reactor for approximately 48 hours with an average flux of 2.4×10^{-13} n cm^{-2} sec^{-1}. The cylinder was rotated during irradiation to allow equal exposure to the flux. The samples were returned to New Mexico Institute of Mining and Technology following a mandatory cooling period of approximately60 hours.

Three separate irradiations were necessary to treat all the whole coal samples. The first irradiation included all the samples from the York Canyon Mine while the second and third were comprised of samples from the Lee Ranch P1,A3,B3 and P2,A2,B2 seams respectively. The float - clay - sink separates from both the A2 and YA seams were treated in a fourth irradiation.

Instrumentation

The samples were counted on high purity germanium detectors using a Nuclear Data 6620 System. The signal was passed through a pre–amp, an amplifier, a shaping amplifier and then to an analog to digital converter. The spectra were stored on magnetic disks. The elemental abundances were determined using the TEABAGS computer program of Lundstrom and Korotev, (1982).

Procedures

The counting scheme varied between each irradiation due to the number of detectors available for each count. Two separate counts were made, a short count three to five days after irradiation, and a long count 30 to 40 days after irradiation following the guidelines of Jacobs et al (1977). The counting schedule is outlined in Table B–1.

Table B–1.

Counting Schedule For All INAA Runs

Irradiation	Duration of Count	Count Time
1. York Canyon		
Short	7 days	3 hours
Long	6 days	3 hours
2. Lee Ranch		

P2, A2, B2

Short	7 days	2 hours
Long	10 days	3 hours

3. Lee Ranch

P1, A3, B3

Short	7 days	2 hours
Long	9 days	3 hours

4. Separates

Short	7 days	2 hours
Long	10 days	3 hours

Two detectors were used for the first irradiation allowing for a longer count time in the short count. However, the extra hour for the short count did not influence the counting statistics significantly. The remainder of the samples, with the exception of the long count on the third irradiation and the short count on the fourth, used only one detector. The results are given in Tables C-7A to C-7I, Appendix C.

Precision and Accuracy

In order to determine the precision and accuracy of the INAA technique, two NBS standards (NBS 1635, and NBS 1632a) were analyzed in each of the three irradiation groups. The results are given in Tables B-2 and B-3. The coefficient of variation gives an estimate of the precision of the technique. Comparison of average values with NBS values and with an

Table B–2.

NBS 1635 Replicate Analysis Summary

Element	Mean	S.D.	C.V.	NBS	Unc.	Gladney	Uncr
As	0.379	0.013	9.12%	0.42	0.15	0.35	0.06
Ba	66.58	9.6	12.56%	–	–	73.	6.
Br	1.76	0.30	8.91%	–	–	1.9	0.8
Ca	0.827	0.09	4.95%	–	–	0.5500	0.020
Ce	3.13	0.04	3.37%	3.6	–	3.4	0.1
Co	.584	0.009	2.3%	0.65	–	0.64	0.06
Cr	2.30	0.04	1.97%	2.5	0.3	2.38	0.24
Cs	0.048	0.003	13.28%	–	–	0.050	–
Eu	0.0570	0.0019	3.68%	0.064	–	0.060	–
Fe							
Hf	0.272	0.026	4.86%	0.29	–	0.27	0.02
La	1.73	0.06	4.79%	–	–	1.8	0.4
Lu	0.0276	0.0026	8.23%	–	–	0.032	–
Na							
Nd	1.26	0.09	11.80%	–	–	1.4	–
Rb	0.406	0.082	50.74%	–	–	0.8	–
Sb	0.134	0.004	11.92%	0.14	–	0.14	–
Sc	0.570	0.009	1.97%	0.63	–	0.71	0.14
Se	0.85	0.093	5.82%	0.9	0.3	0.89	0.08
Sm	.272	0.01	5.39%	–	–	0.29	0.04
Sr	120.	8.	7.87%	–	–	128.	9.
Ta	0.047	0.007	16.50%	–	–	0.045	–
Tb	0.044	0.002	6.99%	–	–	0.035	–
Th	0.551	0.006	2.75%	0.62	0.04	0.62	0.03
U	0.249	0.032	14.11%	0.24	0.04	0.25	0.06
Yb	.164	0.005	4.48%	–	–	0.16	0.02
Zn	4.82	0.53	2.13%	–	–	–	–

S.D. = Standard Deviation
C.V. = Coefficient of Variation
Uncr. = Uncertainty
Gladney = Gladney et al., (1982)

Table B-3.

NBS 1632a Replicate Analysis Summary

Element	Mean	S.D.	C.V.	NBS	Uncr.	Gladney	Uncr
As	7.67	1.18	15.375	9.3	1.0	9.3	0.4
Ba	111.3	1.3	1.20%	–	–	124.	16.
Br	51.83	7.35	14.18	–	–	42.	2.
Ca							
Ce	28.94	0.60	2.07%	30.	–	29. 2.	
Co	6.25	0.14	2.165	6.8	–	6.4	0.3
Cr	33.83	0.06	4.175	34.4	1.5	35.	5.
Cs	2.20	0.07	3.15%	2.4	–	2.3	0.2
Eu	0.457	0.007	1.50%	0.540	–	0.527	0.023
Fe							
Hf	1.55	0.06	4.08%	1.6	–	1.68	0.19
La	13.56	0.70	5.14%	–	–	15.	3.
Lu	0.166	0.010	5.94%	–	–	0.176	0.003
Na							
Nd	14.11	1.67	11.80%	–	–	11.4	1.3
Rb	28.27	0.26	0.93%	31.	–	29.	0.5
Sb	0.51	0.02	3.50%	0.58	–	0.60	0.12
Sc	5.85	0.14	2.32%	6.3	–	6.4	0.3
Se	2.27	0.06	2.52%	2.6	0.7	2.6	0.2
Sm	2.54	0.09	3.39%	–	–	2.4	0.3
Sr	64.23	2.7	4.15%	–	–	89.	5.
Ta	0.393	0.012	3.00%	–	–	0.410	0.03
Tb	0.326	0.011	3.23%	–	–	0.310	0.02
Th	4.23	0.10	2.39%	4.5	0.1	4.5	0.3
U	1.17	0.34	29.17%	1.28	0.02	1.22	–
Yb	1.04	0.09	8.31%	–	–	1.03	0.12
Zn	27.55	1.06	3.83%	–	–	–	–

S.D. = Standard Deviation
C.V. = Coefficient of Variation
Uncr. = Uncertainty
Gladney = Gladney et al., (1982)

average of cited literature values collected by Gladney et al, (1982), gives an estimate of the accuracy.

NBS 1635 was analyzed in triplicate for the third irradiation, in duplicate for the second and in duplicate on each of the detectors used in the first irradiation. Only one sample of NBS 1632a was analyzed in the third irradiation, one sample was analyzed on each detector in the first irradiation and a duplicate was analyzed in the second irradiation.

In general the values obtained in this study correspond with the cited literature values. Only sodium and rubidium consistently fall below the accepted values. In addition Fe, Zn, Se, Sr, Ce, Nd, Eu, Lu, and Th are not within one standard deviation of the cited value for one, but not both of the NBS samples. Most of the elements above are from NBS 1635. This standard has low concentrations for many elements and may be near the working detection limit, causing values to be less accurate.

The precision between the three runs is good. Iron, Sc, Cr, Co, Sb, Sm, Eu, Tb, and Th show less than a 5% coefficient of variation between the means for each NBS standard. In addition Ca, Cs, and Ce may be added to this list if only the averages for detector 3 are considered. Since detector 2 was only used for part of the first irradiation, and detector 3 was used for all other samples, this gives a more realistic assessment of the actual precision. Elements which had less than a 5% coefficient of variation for one, but not both NBS standards are Na, Zn, As, Rb, Sr, Ba, La, Yb, Hf, and Ta. Again the difference in precision can mostly be attributed to the low concentrations of these elements in the standards. Arsenic however, has a very rapid decay time and shows good precision for NBS 1635, which was usually counted at the4 beginning of a run, but show poor precision for NBS 1632a which was always counted at the end of a run.

Two unknown triplicates, one coal and one clay were also analyzed. The results are given in Table B–4. The precision on these samples is very good. Scandium and Co have coefficients of variation of less than 1% for both samples. Iron, Cr, Sr, La, Ce, Yb, Lu, Ta, and Th all have coefficients of variation of less than 5%. In addition Na, Zn, As, Br, Rb, Sb, Cs, Nd, Sm, Eu, Tb, Hf, and Ca vary less than 5% in one sample, but not the other. Low concentrations and detection limits are again responsible for the discrepancy. The excellent precision for these samples exhibits that the technique for obtaining INAA specimens yields reproducable results indicating that the samples are from a homogeneous stock and are representative of the entire interval from which they are taken.

Float – Clay – Sink Separation

Procedures

From two to 25 grams of each sample analyzed (the amount of sample varied due to ash content) was crushed in a tungsten carbide mortar microjet to -200 mesh. The organic fraction was removed by liquid density separation using carbon tetrachloride (CCl4), (specific gravity 1.7 g/cc). The procedure was as follows:

Table B-4.

Summary Of Unknown Triplicates

Element	Unknown 1 (YM-6)		Unknown 2 (B3-27)	
	Mean	C.V.	Mean	C.V.
As	0.95	2.27%	2.9	20.68%*
Ba	1002.31	0.56%	252.0	5.56%
Br	0.60	2.72%	–	–
Ca				
Ce	32.1	1.67%	41.27	3.45%
Co	2.61	0.63%	6.97	0.29%
Cr	4.3	1.90%	48.38	1.31%
Cs	0.02	50.15%*	7.95	1.51%
Eu	0.638	2.52%	0.544	7.16%
Fe				
Hf	0.667	2.95%	8.12	20.34%
La	17.02	1.74%	21.75	2.20%
Lu	0.093	1.145	0.356	3.80%
Na				
Nd	16.5	5.89%	15.02	3.12%
Rb	0.23	141.23%*	68.4	1.38%
Sb	0.203	7.69%	2.70	2.62%
Sc	2.432	0.27%	10.45	0.43%
Se	1.61	5.59%	0.65	21.36%
Sm	2.19	1.29%	2.87	5.17%
Sr	815	1.32%	108.	0.23%
Ta	0.014	3.60%	1.18	1.79%
Tb	0.229	4.65%	0.528	5.82%
Th	1.94	0.42%	11.83	1.36%
U	1.05	8.59%	3.21	8.95%
Yb	0.640	3.19%	2.12	2.12%
Zn	4.6	32.6%*	39.4	1.47%

* = value at or near detection limit

1). Place approximately 25 ml of sample into a 200 ml test tube.

2). Fill test tube about three fourths full with CCl4, adding a drop of penetrating agent (Triton 100) and stir until well mixed.

3). Centrifuge for approximately 10 to 15 minutes until there is a clear separation of float and sink.

The float was then removed from the test tube with a spatula and placed in a filtering apparatus where it was rinsed with acetone and then deionized water to remove any trace of the CCl4. The sink remained in the tube and the procedure was repeated until the entire sample was separated. The sink was then placed in a filtering apparatus and rinsed in the same manner as the float. The residues were dried in an oven at 80 ° C for 12 to 24 hours and subsequently weighed.

The sink was then suspended in 100 ml of distilled water, centrifuged, and rinsed with distilled water until the clay was considered disaggrated. The liquid was stirred, and after sufficient time (calculated using Stoke's Law) the $<2\ \mu$ fraction was pipetted off. The $<2\ \mu$ liquid was centrifuged and the liquid was poured off. The resulting residue, termed "clay", and the $>2\ \mu$ fraction remaining, termed "sink", were placed in a drying oven at 80° C for 12 hours and weighed.

The samples were then packaged for INAA analysis as described in that section.

Precision and Accuracy

A detailed error analysis was performed on the float-clay-aink separation data. Table C-8 gives the recovery data. In most cases 99% of the original sample was recovered in the separates, indicationg that laboratory procedures were very good. Total trace element abundance from the separates were calculated by multiplying the concentration in a particular phase (as determined by INAA) by the weight percent of that phase. Differences in the two numbers are reflected in differences between the whole coal lines and the total of the stacked bars on the separates distribution graphs. Errors the total error produced in the bulk element calculation are presented in Table C-10.

APPENDIX C

RAW DATA

Table C-1

Proximate Analysis

SAMPLE NUMBER	MOISTURE	ASH	VOLATILE MATTER	FIXED CARBON	TOTAL SULFUR
A2-01B	1.24 %	73.96 %	32.24 %	-6.20 %	0.98 %
A2-02	7.42 %	65.04 %	21.32 %	13.64 %	0.40 %
A2-03	11.91 %	6.19 %	45.09 %	48.72 %	1.03 %
A2-04	13.32 %	4.51 %	46.44 %	49.05 %	0.77 %
A2-05	12.46 %	5.05 %	46.26 %	48.69 %	0.61 %
A2-06	11.88 %	5.00 %	45.13 %	49.87 %	0.58 %
A2-07	14.57 %	4.75 %	43.76 %	51.49 %	0.81 %
A2-08	12.97 %	6.08 %	44.69 %	49.23 %	0.98 %
A2-09	14.16 %	5.91 %	48.07 %	46.02 %	0.59 %
A2-10	14.36 %	4.93 %	48.11 %	46.96 %	0.90 %
A2-11	13.69 %	4.72 %	47.00 %	48.28 %	0.84 %
A2-12	13.38 %	4.73 %	47.54 %	47.73 %	31.08 %
A2-14	6.32 %	72.62 %	16.35 %	11.03 %	1.06 %
A2-15	1.93 %	94.68 %	5.76 %	-0.44 %	0.00 %
A2-16	3.46 %	92.10 %	7.93 %	-0.03 %	0.05 %
A2-B	12.45 %	10.74 %	43.13 %	46.13 %	2.13 %
A3-01	2.62 %	92.89 %	7.29 %	-0.18 %	0.00 %
A3-02	2.64 %	83.49 %	15.27 %	1.24 %	0.22 %
A3-03	11.30 %	14.46 %	40.01 %	45.53 %	0.70 %
A3-04	11.90 %	8.98 %	42.32 %	48.70 %	0.84 %
A3-05	12.15 %	9.61 %	42.41 %	47.98 %	0.63 %
A3-06	12.32 %	9.57 %	41.35 %	49.08 %	0.57 %
A3-07	13.22 %	8.01 %	41.80 %	50.19 %	1.39 %
A3-08	11.61 %	11.16 %	45.34 %	43.50 %	0.65 %
A3-09	11.79 %	3.80 %	48.31 %	47.89 %	0.59 %
A3-10	11.90 %	6.02 %	46.89 %	47.09 %	0.59 %

A3-11	12.20 %	9.82 %	46.51 %	43.67 %	0.55 %
A3-12	12.15 %	6.00 %	46.35 %	47.65 %	0.55 %
A3-13	12.74 %	9.41 %	44.72 %	45.87 %	0.59 %
A3-14	5.76 %	71.91 %	18.47 %	9.62 %	0.16 %
B2-01	1.46 %	94.54 %	5.74 %	−0.28 %	0.01 %
B2-01a	2.97 %	87.91 %	11.03 %	1.06 %	0.11 %
B2-02	13.56 %	22.94 %	36.68 %	40.38 %	0.72 %
B2-03	15.15 %	14.74 %	38.60 %	46.66 %	0.82 %
B2-04	15.77 %	6.13 %	42.59 %	51.28 %	0.78 %
B2-05	16.02 %	5.62 %	43.69 %	50.69 %	0.83 %
B2-06	16.21 %	6.30 %	43.79 %	49.91 %	0.80 %
B2-07	14.55 %	9.90 %	40.15 %	49.95 %	0.78 %
B2-08	14.17 %	11.34 %	41.49 %	47.17 %	0.81 %
B2-09	13.78 %	12.90 %	43.31 %	43.79 %	0.85 %
B2-10	14.38 %	12.32 %	42.54 %	45.14 %	0.80 %
B2-11	15.20 %	11.23 %	43.03 %	45.74 %	0.83 %
B2-12	5.24 %	85.46 %	15.34 %	−0.80 %	0.02 %
B2-13	12.22 %	17.01 %	41.29 %	41.70 %	0.66 %
B2-14	13.01 %	14.71 %	41.86 %	43.43 %	0.67 %
B2-15	13.17 %	14.33 %	41.87 %	43.80 %	0.66 %
B2-16	13.99 %	12.05 %	41.40 %	46.55 %	0.69 %
B2-17	15.59 %	7.23 %	44.45 %	48.32 %	0.66 %
B2-18	15.05 %	5.27 %	45.93 %	48.80 %	0.62 %
B2-19	17.19 %	7.73 %	45.25 %	47.02 %	0.85 %
B2-20	12.82 %	9.88 %	46.28 %	43.84 %	0.88 %
B2-21	7.44 %	11.38 %	52.81 %	35.81 %	0.89 %
B2-22	10.32 %	12.18 %	47.79 %	40.03 %	0.92 %
B2-23	10.47 %	11.71 %	47.34 %	40.95 %	0.82 %
B2-24	11.04 %	11.17 %	46.96 %	41.87 %	0.96 %
B2-25	10.04 %	13.60 %	45.42 %	38.98 %	0.91 %
B2-26	7.60 %	53.80 %	24.91 %	21.29 %	0.51 %
B2-27	4.04 %	83.46 %	12.04 %	4.50 %	0.07 %
B3-01	-0.57 %	96.82 %	3.94 %	−0.73 %	0.00 %
B3-02	4.34 %	90.75 %	8.58 %	0.67 %	0.07 %
B3-03	13.39 %	5.32 %	46.77 %	47.91 %	0.79 %
B3-04	13.29 %	5.80 %	47.90 %	46.30 %	0.69 %

B3-05	11.32 %	9.86 %	46.65 %	43.49 %	0.67 %
B3-06	9.91 %	28.85 %	37.45 %	33.70 %	0.94 %
B3-07	8.94 %	34.38 %	33.69 %	31.93 %	0.97 %
B3-08	12.02 %	10.53 %	41.75 %	47.72 %	1.13 %
B3-09	10.70 %	11.23 %	42.78 %	45.99 %	1.12 %
B3-10	9.58 %	26.05 %	39.40 %	34.55 %	1.15 %
B3-11	10.52 %	13.85 %	42.18 %	43.97 %	0.79 %
B3-12	10.65 %	14.43 %	42.82 %	42.75 %	0.70 %
B3-13	11.15 %	13.78 %	43.17 %	43.05 %	0.62 %
B3-14	1.87 %	85.87 %	14.09 %	0.04 %	---
B3-15	10.15 %	17.82 %	41.54 %	40.64 %	0.67 %
B3-16	10.85 %	15.24 %	42.95 %	41.81 %	0.78 %
B3-17	11.90 %	11.09 %	43.46 %	45.45 %	0.84 %
B3-18	10.10 %	11.88 %	45.38 %	42.74 %	0.65 %
B3-19	13.13 %	5.42 %	48.05 %	46.53 %	0.80 %
B3-20	12.93 %	9.02 %	46.50 %	44.48 %	0.90 %
B3-21	11.83 %	7.18 %	48.15 %	44.67 %	1.05 %
B3-22	9.41 %	17.42 %	44.15 %	38.43 %	0.65 %
B3-23	9.41 %	18.35 %	43.18 %	38.47 %	0.61 %
B3-24	8.95 %	21.13 %	42.76 %	36.11 %	0.67 %
B3-25	8.20 %	31.60 %	37.98 %	30.42 %	0.48 %
B3-26	4.62 %	88.93 %	9.61 %	1.46 %	0.05 %
B3-27	4.50 %	93.35 %	7.45 %	-0.80 %	0.08 %
P1-01	6.29 %	90.41 %	9.16 %	0.43 %	0.02 %
P1-02	8.03 %	73.44 %	16.77 %	9.79 %	0.23 %
P1-03	12.74 %	14.21 %	41.31 %	44.48 %	1.34 %
P1-04	12.65 %	11.24 %	43.47 %	45.29 %	1.00 %
P1-05	12.64 %	8.33 %	44.48 %	47.19 %	0.63 %
P1-06	14.88 %	4.44 %	47.31 %	48.25 %	0.59 %
P1-07	13.42 %	4.78 %	45.41 %	49.81 %	0.69 %
P1-08	13.16 %	6.71 %	46.87 %	46.42 %	0.69 %
P1-09	10.23 %	12.62 %	45.57 %	41.81 %	0.48 %
P1-10	9.23 %	10.40 %	50.18 %	39.42 %	0.43 %
P1-11	7.77 %	24.33 %	42.70 %	32.97 %	0.53 %
P1-12	6.64 %	63.94 %	21.82 %	14.24 %	0.27 %
P1-13	3.66 %	92.33 %	3.69 %	3.98 %	0.01 %

P1-14	13.95 %	4.26 %	45.06 %	50.68 %	0.46 %
P1-15	14.27 %	4.30 %	44.65 %	51.05 %	0.47 %
P2-01	0.74 %	91.45 %	9.00 %	-0.45 %	0.00 %
P2-02	2.31 %	88.21 %	8.80 %	2.99 %	1.84 %
P2-03	12.41 %	7.25 %	44.46 %	48.29 %	0.79 %
P2-04	13.10 %	11.13 %	39.52 %	49.35 %	0.52 %
P2-05	13.48 %	12.11 %	39.71 %	48.18 %	0.61 %
P2-06	13.46 %	6.91 %	42.87 %	50.22 %	0.75 %
P2-07	13.88 %	5.71 %	45.69 %	48.60 %	0.74 %
P2-08	10.03 %	9.44 %	50.18 %	40.38 %	0.53 %
P2-09	10.27 %	5.78 %	50.16 %	44.06 %	0.52 %
P2-10	11.27 %	7.08 %	49.25 %	43.67 %	0.74 %
P2-11	12.02 %	12.23 %	46.10 %	41.67 %	0.79 %
P2-12	9.28 %	52.21 %	27.55 %	20.24 %	0.55 %
P2-13	9.48 %	63.90 %	21.02 %	15.08 %	0.36 %
P2-14	6.86 %	87.89 %	10.91 %	1.20 %	0.04 %
P2-15	14.03 %	4.15 %	45.16 %	50.69 %	0.47 %
YAU-01	1.58 %	6.50 %	36.66 %	56.84 %	0.49 %
YA-01	5.68 %	83.14 %	10.89 %	5.97 %	0.35 %
YA-02	4.76 %	84.16 %	10.59 %	5.25 %	0.34 %
YA-03	4.63 %	77.49 %	13.29 %	9.22 %	0.12 %
YA-04	1.93 %	17.41 %	33.27 %	49.32 %	0.49 %
YA-05	1.75 %	14.26 %	33.35 %	52.39 %	0.47 %
YA-06	1.32 %	9.03 %	31.32 %	59.65 %	0.41 %
YA-07	1.51 %	8.09 %	32.01 %	59.90 %	0.41 %
YA-08	1.44 %	8.92 %	30.65 %	60.43 %	0.40 %
YA-09	1.69 %	10.34 %	32.04 %	57.62 %	0.40 %
YA-10	4.02 %	75.41 %	13.26 %	11.33 %	0.81 %
YA-11	1.59 %	12.85 %	30.03 %	57.12 %	0.41 %
YA-12	1.50 %	9.65 %	32.80 %	57.55 %	0.43 %
YA-13	1.53 %	8.84 %	32.89 %	58.27 %	0.40 %
YA-14	2.01 %	9.18 %	32.83 %	57.99 %	0.42 %
YA-15	1.37 %	16.66 %	32.26 %	51.08 %	0.39 %
YA-16	3.82 %	73.81 %	13.63 %	12.56 %	0.90 %

IAM-01	3.64 %	75.74 %	14.50 %	9.76 %	0.12 %
YM-01	3.65 %	62.92 %	16.26 %	20.82 %	0.54 %
YM-02	1.49 %	12.85 %	29.07 %	58.08 %	0.41 %
YM-03	1.31 %	14.92 %	31.84 %	53.24 %	0.40 %
YM-04	1.18 %	20.02 %	31.28 %	48.70 %	0.39 %
YM-05	1.39 %	11.51 %	34.40 %	54.09 %	0.52 %
YM-06	1.44 %	9.03 %	36.55 %	54.42 %	0.42 %
YM-07	1.32 %	9.61 %	36.58 %	53.81 %	0.40 %
YM-08	1.59 %	6.99 %	36.96 %	56.05 %	0.46 %
YM-09	2.00 %	45.12 %	31.99 %	22.89 %	2.76 %
YM-10	1.70 %	9.77 %	32.35 %	57.88 %	0.49 %
YM-11	1.59 %	7.13 %	29.78 %	63.09 %	0.41 %
YM-12	1.45 %	7.78 %	29.03 %	63.19 %	0.41 %
YM-13	1.65 %	9.91 %	30.20 %	59.89 %	0.43 %
YM-14	1.66 %	6.25 %	60.13 %	33.62 %	0.49 %
YM-15	1.63 %	6.82 %	31.28 %	61.90 %	0.46 %
YM-16	1.64 %	6.57 %	31.47 %	61.96 %	0.52 %
YM-17	1.51 %	5.40 %	36.42 %	58.18 %	0.50 %
YM-18	1.41 %	6.25 %	36.86 %	56.89 %	0.52 %
YM-19	1.62 %	4.86 %	33.99 %	61.15 %	0.76 %
YM-20	1.67 %	3.82 %	35.17 %	61.01 %	0.65 %
YM-21	1.13 %	6.01 %	40.00 %	53.99 %	0.52 %
YM-22	1.96 %	2.90 %	36.35 %	60.75 %	0.88 %
YM-23	2.02 %	6.93 %	33.62 %	59.45 %	0.74 %
YM-24	3.40 %	70.64 %	14.38 %	14.98 %	0.51 %
YM-25	1.81 %	92.47 %	6.90 %	0.63 %	0.06 %
YUM-01	1.82 %	18.06 %	33.39 %	48.55 %	0.43 %
YUM-02	1.69 %	19.39 %	28.71 %	51.90 %	0.36 %
YUM-03	1.51 %	8.08 %	28.83 %	63.09 %	0.38 %
YUM-04	1.50 %	6.73 %	32.09 %	61.18 %	0.40 %
YUM-05	1.41 %	10.13 %	34.60 %	55.27 %	0.38 %
YUM-06	1.30 %	5.21 %	37.71 %	57.08 %	0.40 %
YUM-07	1.47 %	6.74 %	38.26 %	55.00 %	0.43 %
YUM-08	1.62 %	10.15 %	37.22 %	52.63 %	0.43 %
YUM-09	3.01 %	84.53 %	10.54 %	4.93 %	0.25 %

Table C-2
Ultimate Analysis

SAMPLE NUMBER	CARBON	NITROGEN	HYDROGEN	OXYGEN
A2-06	73.80%	4.29%	5.28%	14.05%
A2-09	70.07%	1.28%	5.14%	15.91%
A2-12	73.15%	1.43%	5.48%	14.13%
A3-06	70.66%	1.22%	4.99%	13.09%
A3-09	73.71%	1.23%	5.68%	14.99%
A3-12	72.38%	1.21%	5.48%	14.38%
B2-06	72.67%	1.17%	5.13%	13.93%
B2-19	70.91%	1.29%	5.15%	14.07%
B2-22	6760%	1.23%	5.47%	12.60%
B3-06	53.74%	0.96%	4.62%	11.19%
B3-19	71.02%	1.30%	5.59%	15.87%
B3-22	64.53%	1.03%	5.01%	11.36%
P1-05	71.53%	1.23%	5.33%	12.95%
P1-07	74.19%	1.31%	5.65%	13.38%
P1-09	68.43%	1.23%	5.80%	11.44%
P2-05	68.70%	1.18%	4.74%	12.66%
P2-07	72.54%	1.31%	0.00%	14.65%
P2-09	73.90%	1.30%	5.71%	12.79%
YA-06	77.85%	1.54%	5.18%	15.43%
YA-09	75.20%	1.62%	5.11%	18.07%
YA-13	76.57%	1.69%	5.10%	16.64%
YM-08	78.88%	1.69%	5.75%	13.68%
YM-10	75.66%	1.55%	5.26%	17.53%

YM-13	75.86%	1.51%	4.95%	17.69%
YM-17	79.72%	1.63%	5.50%	13.15%
YM-21	80.76%	1.72%	5.96%	11.56%
YUM-03	78.64%	1.55%	4.88%	14.93%
YUM-05	76.52%	1.60%	4.79%	17.09%
YUM-07	77.84%	1.69%	5.80%	14.67%

Table C-3

Forms of Sulfur

SAMPLE NUMBER	PYRITIC	SULFATE	ORGANIC	TOTAL SULFUR
A2-06	0.04 %	0.00 %	0.54 %	0.54 %
A2-09	0.10 %	0.00 %	0.49 %	0.59 %
A2-12	0.31 %	0.00 %	0.77 %	1.08 %
A3-06	0.06 %	0.00 %	0.51 %	0.57 %
A3-09	0.09 %	0.00 %	0.50 %	0.29 %
A3-12	0.02 %	0.00 %	0.53 %	0.55 %
B2-06	0.01 %	0.00 %	0.79 %	0.80 %
B2-19	0.03 %	0.00 %	0.82 %	0.85 %
B2-22	0.02 %	0.00 %	0.90 %	0.92 %
B3-06	0.01 %	0.00 %	0.63 %	0.64 %
B3-19	0.02 %	0.00 %	0.78 %	0.80 %
B3-22	0.01 %	0.00 %	0.64 %	0.65 %
P1-05	0.02 %	0.00 %	0.61 %	0.63 %
P1-07	0.03 %	0.00 %	0.66 %	0.69 %
P1-09	0.01 %	0.00 %	0.47 %	0.48 %
P2-05	0.02 %	0.00 %	0.59 %	0.61 %
P2-07	0.02 %	0.00 %	0.72 %	0.74 %
P2-09	0.01 %	0.01 %	0.50 %	0.52 %
YA-06	0.01 %	0.00 %	0.40 %	0.41 %
YA-09	0.04 %	0.00 %	0.36 %	0.40 %
YA-13	0.01 %	0.00 %	0.39 %	0.40 %
YM-08	0.07 %	0.00 %	0.39 %	0.46 %
YM-10	0.09 %	0.00 %	0.40 %	0.49 %
YM-13	0.11 %	0.00 %	0.32 %	0.43 %

YM-17	0.18 %	0.00 %	0.32 %	0.50 %
YM-21	0.06 %	0.00 %	0.46 %	0.52 %
YUM-03	0.02 %	0.00 %	0.36 %	0.38 %
YUM-05	0.01 %	0.00 %	0.37 %	0.38 %
YUM-07	0.03 %	0.00 %	0.40 %	0.43 %

Table C-4A

Petrographic Data Vitrinite Group

SAMPLE NUMBER	VITRINITE A	VITRINITE'	VITRO DETRINITE	TOTAL VITRINITE
A2-06	20.5 %	1.4 %	9.6 %	31.5 %
A2-09	53.3 %	3.0 %	24.9 %	81.2 %
A3-06	46.1 %	8.7 %	23.6 %	78.4 %
A3-09	43.0 %	1.0 %	32.4 %	76.4 %
A3-12	60.1 %	3.1 %	22.5 %	85.7 %
B2-06	55.4 %	4.9 %	16.0 %	76.3 %
B2-19	67.2 %	4.3 %	17.3 %	88.8 %
B2-22	47.2 %	3.5 %	26.4 %	77.1 %
B3-06	33.6 %	2.8 %	18.0 %	54.4 %
B3-19	52.4 %	2.0 %	31.8 %	86.2 %
B3-22	44.1 %	3.4 %	27.2 %	74.7 %
P1-05	46.0 %	2.2 %	21.1 %	69.3 %
P1-07	46.3 %	3.5 %	27.3 %	77.1 %
P1-09	42.4 %	1.9 %	34.1 %	78.4 %
P2-05	51.3 %	1.0 %	12.7 %	65.0 %
P2-07	61.7 %	5.1 %	18.2 %	85.0 %
P2-09	0.0 %	0.0 %	0.0 %	0.0 %
YA-06	33.0 %	7.7 %	19.4 %	60.1 %
YA-09	50.8 %	7.5 %	19.3 %	77.6 %
YA-13	34.8 %	5.0 %	28.7 %	68.5 %
YM-08	46.1 %	11.7 %	28.0 %	85.8 %
YM-10	42.6 %	9.8 %	25.9 %	78.3 %
YM-13	49.5 %	9.2 %	11.9 %	70.6 %

YM-17	64.2 %	5.4 %	18.6 %	88.2 %
YM-21	54.9 %	9.1 %	15.4 %	79.4 %
YUM-03	34.1 %	7.4 %	17.1 %	58.6 %
YUM-05	61.8 %	4.4 %	16.2 %	82.4 %
YUM-07	53.1 %	3.4 %	31.4 %	87.9 %

Table C-4B

Petrographic Data Inertinite Group

SAMPLE NUMBER	SEMI-FUSINITE	FUSINITE	SCLEROTINITE	INERTO DETRINITE	TOTAL
A2-06	3.40 %	3.00 %	0.20 %	0.90 %	7.50 %
A2-09	5.00 %	2.00 %	0.20 %	1.10 %	8.30 %
A3-06	7.50 %	2.30 %	0.30 %	2.20 %	12.30 %
A3-09	6.20 %	2.40 %	0.10 %	2.10 %	10.80 %
A3-12	1.40 %	1.00 %	0.20 %	0.80 %	3.40 %
B2-06	9.10 %	3.60 %	0.00 %	2.30 %	15.00 %
B2-19	2.60 %	0.40 %	0.10 %	0.70 %	3.80 %
B2-22	4.10 %	2.00 %	0.00 %	1.30 %	7.40 %
B3-06	3.30 %	1.50 %	0.00 %	1.50 %	6.30 %
B3-19	2.50 %	1.70 %	0.10 %	0.00 %	4.30 %
B3-22	3.60 %	2.60 %	0.20 %	1.40 %	7.80 %
P1-05	9.20 %	4.70 %	0.00 %	1.10 %	15.00 %
P1-07	6.80 %	3.60 %	0.10 %	1.20 %	11.70 %
P1-09	2.60 %	0.70 %	0.30 %	0.60 %	4.20 %
P2-05	17.30 %	3.70 %	0.10 %	1.00 %	22.10 %
P2-07	4.60 %	1.60 %	0.40 %	0.60 %	7.20 %
P2-09	0.00 %	0.00 %	0.00 %	0.00 %	0.00 %
YA-06	15.50 %	6.40 %	0.30 %	4.50 %	26.70 %
YA-09	8.80 %	3.00 %	0.00 %	1.60 %	13.40 %
YA-13	12.90 %	7.70 %	0.00 %	2.80 %	23.40 %
YM-08	2.50 %	0.60 %	0.60 %	0.40 %	4.10 %
YM-10	6.00 %	2.60 %	0.00 %	1.60 %	10.20 %
YM-13	14.10 %	2.00 %	0.00 %	1.30 %	17.40 %
YM-17	4.90 %	0.80 %	0.50 %	0.80 %	7.00 %
YM-21	7.80 %	0.40 %	0.20 %	1.60 %	10.00 %

UM-03	19.00 %	6.30 %	0.10 %	3.60 %	29.00 %
UM-05	3.70 %	4.20 %	0.00 %	1.00 %	8.90 %
UM-07	3.80 %	0.80 %	0.50 %	1.10 %	6.20 %

YUM-03	1.90 %	0.90 %	7.20 %	1.00 %	11.00 %
YUM-05	0.60 %	0.10 %	1.80 %	0.40 %	2.90 %
YUM-07	1.20 %	0.60 %	1.90 %	0.40 %	4.10 %

Table C-4D

Petrographic Data Mineral Matter

SAMPLE NUMBER	QUARTZ	PYRITE	CALCITE	MINERAL MATTER	TOTAL
A2-06	0.00 %	0.10 %	0.90 %	0.10 %	1.10 %
A2-09	0.00 %	0.30 %	2.60 %	0.10 %	3.00 %
A3-06	0.00 %	0.00 %	2.00 %	0.70 %	2.70 %
A3-09	0.20 %	0.40 %	0.00 %	0.50 %	1.10 %
A3-12	0.10 %	0.50 %	2.20 %	0.30 %	3.10 %
B2-06	0.10 %	0.00 %	0.30 %	0.30 %	0.70 %
B2-19	2.10 %	0.00 %	0.00 %	0.90 %	3.00 %
B2-22	0.10 %	0.50 %	1.30 %	0.90 %	2.80 %
B3-06	0.00 %	0.30 %	0.40 %	0.00 %	0.70 %
B3-19	0.20 %	0.20 %	1.50 %	0.00 %	1.90 %
B3-22	0.20 %	0.40 %	1.80 %	0.60 %	3.00 %
P1-05	0.00 %	0.20 %	0.90 %	1.40 %	2.50 %
P1-07	0.20 %	0.00 %	0.50 %	0.20 %	0.90 %
P1-09	0.00 %	0.30 %	0.80 %	0.70 %	1.80 %
P2-05	0.30 %	0.40 %	0.10 %	2.30 %	3.10 %
P2-07	0.00 %	0.00 %	1.40 %	1.20 %	2.60 %
P2-09	0.00 %	0.00 %	0.00 %	0.00 %	0.00 %
YA-06	0.00 %	0.00 %	0.90 %	0.10 %	1.00 %
YA-09	0.00 %	0.00 %	0.20 %	2.30 %	2.50 %
YA-13	0.00 %	0.00 %	0.70 %	0.00 %	0.70 %
YM-08	0.20 %	0.10 %	0.20 %	0.90 %	1.40 %
YM-10	0.00 %	0.20 %	0.00 %	0.20 %	0.40 %
YM-13	0.10 %	0.10 %	0.30 %	1.00 %	1.50 %
YM-17	0.00 %	0.50 %	1.90 %	0.00 %	2.40 %
YM-21	0.00 %	0.20 %	0.20 %	**** %	**** %
YUM-03	0.00 %	0.10 %	1.30 %	0.00 %	1.40 %
YUM-05	0.00 %	0.10 %	1.90 %	3.80 %	5.80 %
YUM-07	0.00 %	0.00 %	0.80 %	1.00 %	1.80 %

Table C-5

Petrographic Vitrinite Reflectance

SAMPLE NUMBER	MEAN	STANDARD DEVIATION	VARIANCE
A2-06	0.391	0.040	0.002
A2-09	0.420	0.033	0.001
A3-06	0.408	0.071	0.005
A3-09	0.392	0.030	0.001
A3-12	0.390	0.035	0.001
B2-06	0.421	0.040	0.002
B2-19	0.379	0.046	0.002
B2-22	0.370	0.029	0.001
B3-06	0.382	0.033	0.001
B3-19	0.397	0.046	0.002
B3-22	0.370	0.035	0.001
P1-05	0.382	0.033	0.001
P1-07	0.365	0.023	0.001
P1-09	0.377	0.027	0.001
P2-05	0.394	0.045	0.002
P2-07	0.369	0.032	0.001
P2-09	0.375	0.027	0.001
YA-06	0.660	0.060	0.004
YA-09	0.581	0.053	0.003
YA-13	0.649	0.054	0.003
YM-08	0.596	0.043	0.002
YM-10	0.661	0.052	0.003
YM-13	0.696	0.051	0.003

YM-17	0.653	0.050	0.003
YM-21	0.550	0.050	0.003
YUM-03	0.662	0.057	0.003
YUM-05	0.704	0.033	0.001
YUM-07	0.606	0.067	0.005

Table C-6

X-RAY Identification of Mineral Matter in Coal

SAMPLE NUMBER	MINERALS
P1-05	quartz, calcite, anhydrite, clay
P1-07	quartz, anhydrite, calcite, pyrite
P1-09	quartz, calcite, clay, anhydrite
P2-05	quartz, anhydrite
P2-07	calcite, quartz, anhydrite, pyrite
P2-09	quartz, calcite, anhydrite
A2-05	quartz, anhydrite
A2-08	calcite, quartz, anhydrite, clay
A2-11	quartz, anhydrite, clay
A3-05	quartz, anhydrite, clay
A3-08	pyrite, quartz, anhydrite, magnetite?
A3-11	quartz, anhydrite, clay
B2-05	quartz, anhydrite
B2-09	quartz, anhydrite
B2-21	quartz, anhydrite, calcite
B3-05	quartz, anhydrite
B3-10	quartz
B3-22	quartz, calcite, anhydrite
YA-05	quartz, clay, calcite
YA-09	calcite, quartz, clay
YA-14	calcite, anhydrite, quartz, clay
YUM-03	quartz, clacite, gypsum, anhydrite
YUM-05	calcite, anhydrite, clay
YUM-07	calcite, anhydrite, quartz

YM-05	quartz, clacite
YM-13	calcite, quartz, unidentified oxide
YM-21	quartz, calcite, anhydrite

Minerals identified in order of decreasing abundance.
The measured anhydrite occurs as gypsum in the coal.

Table C-7A

Raw INAA Data fron the Lee Ranch P1 Drill Core

SAMPLE	SUL. %	As ppm	Ba ppm	Br ppm	Ca ppm	Ce ppm	Co ppm
1	0.02	51	345	-99	-99	61.44	7.98
2	0.23	5.9	300	0	-99	138.5	19.7
3	1.34	1.3	52.2	0.29	7700	20.7	22.35
4	1	0.8	36.3	0.48	7800	16.63	16.28
5	0.63	0.59	28.1	0.49	7500	9.6	14.13
6	0.59	0.5	35.7	0.39	6400	7.27	10.16
7	0.69	0.41	62.6	0.62	4100	5.65	5.96
8	0.69	0.63	60.5	0.47	8100	5.8	8.73
9	0.48	0.72	62.9	0.72	6300	12.19	10.65
10	0.43	0.55	93.5	0.8	5100	13.35	10.49
11	0.53	1.05	143.3	0.42	4400	16.71	10.17
12	0.27	1.91	2362.3	1.8	-99	31.75	11.22
13	0.01	2.48	348.6	0.6	-99	41.43	5.08

SAMPLE	Cr ppm	Cs ppm	Eu ppm	Fe ppm	Hf ppm	La ppm	Lu ppm
1	45.15	14.24	0.777	19200	4.89	31.92	0.364
2	34.15	10.81	2.033	17650	4.03	62.81	0.396
3	7.83	0.79	0.466	11570	0.84	8.57	0.225
4	6.6	0.44	0.465	7390	0.72	7.7	0.217
5	3.32	0.16	0.337	3220	0.529	3.72	0.174
6	1.73	0.056	0.108	3230	0.235	3.49	0.0276
7	1.98	0.042	0.0701	3250	0.325	3.35	0.0182
8	2.27	0.107	0.071	3020	0.346	3.14	0.0217
9	8.9	0.384	0.261	1940	0.93	5.29	0.09
10	6.47	0.109	0.38	1520	0.81	4.74	0.122
11	12.7	0.26	0.589	3050	2.2	6.74	0.266
12	33.4	5.62	0.609	9090	4.89	16.63	0.379
13	47.5	12.72	0.479	21000	6.25	23.07	0.375

SAMPLE	Na ppm	Nd ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sm ppm
1	1300	19.9	119	1.29	15.72	1.3	4
2	1200	57.4	92	1.48	12.16	2.5	10.91
3	699	8.8	7.2	4.42	4.76	1.19	2.3
4	659	8.3	3.3	3.33	2.583	1.81	2.12
5	654	4.5	–99	2.49	1.424	0.93	1.499
6	696	3.3	–99	0.153	0.563	0.57	0.558
7	690	1.7	0.1	0.076	0.597	0.72	0.319
8	685	2.2	0.7	0.54	0.741	0.94	0.372
9	746	6	3	2.71	2.577	1.65	1.23
10	704	6.8	1.1	4.63	2.755	2.08	1.75
11	742	8.4	2.6	6.79	4.35	2.7	2.46
12	1320	9.6	40.6	4.61	8.99	1.7	2.61
13	2030	13	99	2.1	13.71	0.5	2.41

SAMPLE	Sr ppm	Ta ppm	Tb ppm	Th ppm	U ppm	Yb ppm	Zn ppm
1	265	0.97	0.592	16.34	4.44	2.54	56.2
2	189	0.837	1.19	11.69	5.75	2.75	101
3	148	0.163	0.481	2.45	2.54	1.54	70.1
4	108	0.136	0.396	1.84	1.14	1.42	19.4
5	122	0.119	0.284	1.36	0.6	1.115	61.9
6	116	0.051	0.057	0.449	0.21	0.192	14.1
7	127	0.069	0.043	0.705	0.25	0.134	4.4
8	117	0.087	0.047	0.664	0.35	0.161	1.8
9	141	0.205	0.162	2.78	1.32	0.581	3.8
10	145	0.183	0.273	2.33	1.59	0.808	11.3
11	129	0.516	0.482	4.51	3.66	1.78	10.9
12	173	1.177	0.55	10.53	4.96	2.43	40.5
13	165	1.35	0.448	13	4.07	2.37	75.9

Table C-7B

Raw INAA Data from the Lee Ranch P2 Drill Core

SAMPLE	SUL. %	As ppm	Ba ppm	Br ppm	Ca ppm	Ce ppm	Co ppm
1	0	5.23	483.7	0.08	55000	78.23	33.88
2	1.84	15.11	502.3	0	1200	78.7	51.78
3	0.79	0.63	15	0.54	4200	9.01	8.6
4	0.52	0.67	33.8	0.52	4400	9.56	9.24
5	0.61	1.63	22.6	0.51	3800	9.05	12.46
6	0.75	0.53	14.9	0.51	5100	8.03	8.55
7	0.74	0.4	19.4	0.44	12600	7.06	5.39
8	0.53	0.56	69.9	0.59	14200	8.36	8.19
9	0.52	0.56	53.4	0.59	6300	8.02	10.04
10	0.74	0.6	165.6	0.62	5000	10.29	13.53
11	0.79	0.71	5125.8	0.49	5100	10.09	15.5
12	0.55	1.92	8066.1	0.18	3300	30.93	9.98
13	0.36	2.15	3790.8	0.21	4100	34.76	7.39

SAMPLE	Cr ppm	Cs ppm	Eu ppm	Fe ppm	Hf ppm	La ppm	Lu ppm
1	13.7	2.48	1.204	9000	9.01	38.73	0.391
2	22.38	5.24	1.18	28720	5.51	37.52	0.338
3	3.8	0.039	0.208	3030	0.618	4.04	0.103
4	4.95	0.038	0.152	1050	1.12	4.5	0.062
5	4.72	0.028	0.132	2220	1.27	4.35	0.06
6	3.68	0.024	0.1117	2610	0.577	3.95	0.0407
7	1.75	0.026	0.0845	2540	0.203	3.74	0.0245
8	5.37	0.045	0.0935	1350	0.588	4.88	0.0365
9	3.04	0.005	0.116	2110	0.456	3.96	0.0237
10	4.63	0.014	0.226	4280	0.576	4.19	0.069
11	8.8	0.194	0.357	2640	0.8	4	0.128
12	34.78	8.15	0.557	12300	3.48	17.54	0.283
13	42.53	12.43	0.537	16680	3.98	19.95	0.284

SAMPLE	Na ppm	Nd ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sm ppm

1	8154	30.7	82	0.76	4.92	0.24	6
2	6474	32	89	2.39	7.59	1.13	5.83
3	409	3.34	0.8	1.86	1.907	1.14	0.911
4	399	3	0	0.447	1.603	1.91	0.736
5	383	3.1	0.6	0.327	1.619	2.22	0.655
6	393	2.8	0	0.22	1.114	1.24	0.583
7	403	2.4	0	0.189	0.656	0.65	0.463
8	386	2.7	0	0.235	1.386	1.03	0.494
9	356	3.1	0	1.95	1.182	1.24	0.572
10	355	5	0.2	8.8	1.773	2.2	1.038
11	380	5.1	1.1	13.97	3.34	2.21	1.44
12	639	12.6	54.8	7.63	9.61	2.2	2.44
13	771	11.6	85	6.21	11.83	1.4	2.35

SAMPLE	Sr ppm	Ta ppm	Tb ppm	Th ppm	U ppm	Yb ppm	Zn ppm
1	148	1.25	0.75	9.4	2.63	2.63	46.1
2	140	1.13	0.665	10.34	3.24	2.22	85.6
3	144	0.161	0.176	1.48	1.21	0.613	6.2
4	139.5	0.282	0.105	3	1.01	0.395	4.5
5	117.5	0.362	0.093	3.02	1.06	0.332	−99
6	167	0.142	0.061	1.52	0.5	0.252	1.1
7	135	0.06	0.049	0.545	0.16	0.143	1.8
8	166	0.168	0.069	1.84	0.85	0.234	4.4
9	148	0.087	0.078	0.96	0.43	0.193	1.9
10	185	0.15	0.195	1.42	1.05	0.435	8.2
11	265.5	0.222	0.343	2.51	3.43	0.857	13.4
12	370	0.963	0.508	9.16	5.27	1.88	34.2
13	350	1	0.481	10.99	5.72	1.86	68.5

Table C-7C

Raw INAA Data from the Lee Ranch A2 Drill Core

SAMPLE	As ppm	Ba ppm	Br ppm	Ca ppm	Ce ppm	Co ppm	Cr ppm
1	4.3	160.7	0	3900	32.88	5.09	15.3
2	5.8	227.1	0.11	-99	58.9	17.56	30.7
3	0.59	109.7	0.49	2900	5.69	8.43	2.55
4	0.51	52.1	0.42	2900	6.36	8.33	1.97
5	0.49	38.9	0.58	2900	6.5	5.38	1.79
6	0.59	44.9	0.65	3600	7.25	3.78	2.54
7	0.42	99.5	0.44	3600	6.01	3.31	2.8
8	0.51	81.1	0.73	10100	5.46	4.67	2.55
9	0.28	72.2	0.55	24200	3.92	5.63	1.95
10	0.3	83.4	0.52	18300	4.47	11.12	1.1
11	0.21	38.5	0.68	15000	5.01	10.11	1.1
12	0.45	27.6	0.81	11300	4.89	14.55	0.95
13	1.06	108.3	0.42	5400	7.08	12.71	5
14	4.14	218.5	0.18	1100	48.4	15.32	36.2
15	7	544.4	0.11	1000	41.82	20.63	23.78

SAMPLE	Cs ppm	Eu ppm	Fe ppm	Hf ppm	La ppm	Lu ppm	Na ppm
1	5.35	0.696	298400	1.68	17.66	0.346	550
2	10.44	0.824	32500	4.28	28.79	0.343	1110
3	0.054	0.263	5740	0.538	2.73	0.156	205
4	0.032	0.187	3890	0.322	2.57	0.098	225
5	0.01	0.1543	2760	0.383	2.86	0.0638	208
6	0.019	0.1509	1707	0.535	3.21	0.0583	217
7	0.017	0.0897	2920	0.284	3	0.0243	227
8	0.012	0.0872	5180	0.523	2.95	0.0258	215
9	0.003	0.0479	2016	0.194	2.64	0.0427	163
10	0.016	0.1095	3799	0.112	2.04	0.0376	143
11	0.008	0.182	3150	0.108	2.13	0.0815	153
12	0.003	0.211	5848	0.105	1.96	0.122	133
13	0.38	0.378	15290	0.64	2.96	0.241	142
14	15.35	0.686	16910	6.33	25.87	0.412	360
15	3.38	0.562	5380	7.28	21.66	0.328	480

SAMPLE	Nd ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sm ppm	Sr ppm
1	14.2	42	0.76	7.37	1.2	3.13	50
2	21.7	68	2.22	10.07	2.1	4.19	144
3	3	-5	3.58	2.487	1.01	1.063	107
4	3.5	0	2.59	0.969	0.73	0.851	110
5	3.1	0	0.88	0.737	0.86	0.755	98.5
6	3.4	0	0.42	0.874	1.14	0.711	109
7	2.15	0.2	0.255	0.833	1.09	0.431	98
8	2.18	0.1	0.074	0.689	1.32	0.434	121
9	2.3	0.3	0.07	0.452	0.75	0.279	110
10	2.8	0	1.86	0.644	0.69	0.529	137
11	3.1	0	4.44	0.809	0.91	0.715	142
12	3.2	0.5	8.52	1.231	1.15	0.857	125
13	3.5	2.4	17.2	4.39	1.63	1.37	97
14	15.8	84	4.14	10.93	2	3.43	153.4
15	15.3	94	1.35	8	0.66	2.92	57.5

SAMPLE	Ta ppm	Tb ppm	Th ppm	U ppm	Yb ppm	Zn ppm
1	0.386	0.56	5.37	2.47	2.13	38.5
2	0.954	0.6	14.03	4.66	2.12	98.7
3	0.112	0.319	1.04	0.77	1.041	3.1
4	0.057	0.214	0.59	0.22	0.669	2.3
5	0.079	0.134	0.812	0.26	0.416	1.4
6	0.123	0.123	1.285	0.48	0.361	1.47
7	0.051	0.058	0.662	0.34	0.153	1.6
8	0.075	0.049	0.694	0.19	0.172	1.1
9	0.04	0.008	0.299	0.19	0.09	1.6
10	0.041	0.099	0.232	0.14	0.268	1.3
11	0.033	0.163	0.263	0.11	0.515	1.4
12	0.053	0.354	0.292	0.31	0.834	2.3
13	0.204	0.471	1.62	2.16	1.53	8.5
14	1.19	0.702	12.95	3.45	2.56	29.9
15	1.14	0.41	11.12	3.68	2.01	48.4

Table C-7D

Raw INNAA Data from the Lee Ranch A3 Drill Core

SAMPLE	As ppm	Ba ppm	Br ppm	Ca ppm	Ce ppm	Co ppm	Cr ppm
1	-99	1192.2	-99	-99	53.2	13.48	46.9
2	10.3	3002.7	8.7	-99	72.2	19.6	40.03
3	3.6	366.3	1.95	2300	13.3	20.4	9.5
4	-99	162.5	-99	2900	9.32	17.43	4.3
5	-99	127.4	-99	1600	9.75	15.3	4.1
6	-99	109.2	-99	3300	8.43	11.18	3.55
7	-99	66.3	-99	2600	6.73	14.21	2.66
8	-99	85.5	-99	4700	6.24	7.69	2.43
9	-99	57.9	-99	2700	6.08	4.71	1.93
10	-99	51.5	-99	3500	8.45	8.19	3.41
11	-99	57.4	-99	2700	9.11	9.13	2.99
12	-99	34	-99	3000	8.12	11.26	4.32
13	-99	37.9	-99	2300	11.57	10.18	6.7
14	-99	358.7	-99	-99	47.1	11.64	33.68

SAMPLE	Cs ppm	Eu ppm	Fe ppm	Hf ppm	La ppm	Lu ppm	Na ppm
1	17.41	0.674	25230	6.08	28.91	0.424	1400
2	12.49	1.048	58700	4.65	36.5	0.406	1800
3	0.78	0.426	5810	1.42	5.93	0.32	610
4	0.123	0.27	5360	0.92	4.01	0.177	610
5	1.58	0.238	3000	0.84	4.57	0.139	210
6	0.125	0.191	3310	0.846	4.07	0.112	300
7	0.22	0.09	15620	0.58	3.3	0.035	-99
8	0	0.084	34900	0.51	3.49	0.031	-99
9	0.012	0.078	3280	0.257	3.51	0.026	-99
10	0.012	0.203	2320	0.483	4.04	0.067	0
11	0.034	0.246	1410	0.419	4.45	0.112	650
12	0.032	0.334	1420	0.445	3.32	0.178	400
13	0.3	0.467	1590	0.68	4.95	0.231	650
14	11.87	0.734	19270	8.17	24.2	0.417	-99

SAMPLE	Nd ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sm ppm	Sr ppm
1	17.2	107	1.64	14.38	0.7	3.25	250
2	27.5	98	2.38	12.97	1.5	5.29	270
3	6.2	6.2	9.17	4.98	2.29	1.76	146
4	3.8	-99	4.83	1.91	2.39	1.11	114
5	4.5	2	2.65	1.649	2.37	1.03	106
6	2.5	1.2	1.4	1.31	2.3	0.89	120
7	2.9	0.4	0.195	0.879	1.81	0.47	125
8	2.9	1.2	0.188	0.808	1.34	0.43	90
9	2.2	0.7	0.166	0.82	1.02	0.432	123
10	3.9	0.9	2.07	1.15	1.31	0.859	152
11	5.4	0.5	4.72	1.439	1.39	1.08	147
12	4.3	0.8	7.41	2.109	1.67	1.25	160
13	6.1	2.2	9.61	4.13	1.96	1.79	135
14	17.5	63	2.86	9.24	1	3.4	144

SAMPLE	Ta ppm	Tb ppm	Th ppm	U ppm	Yb ppm	Zn ppm
1	1.27	0.55	15.56	4.3	2.81	77.3
2	0.98	0.7	13.18	4	2.86	148
3	0.615	0.499	6.57	3.15	1.98	71
4	0.448	0.304	3.37	1.37	1.12	9.7
5	0.482	0.234	3.73	1.44	0.96	9.2
6	0.442	0.191	3.24	0.98	0.68	9.5
7	0.095	0.026	1.24	0.37	0.195	1.9
8	0.098	0.046	0.96	0.26	0.195	5.9
9	0.058	0.054	0.662	0.09	0.146	3.7
10	0.088	0.155	1.155	0.28	0.407	1.9
11	0.075	0.242	1.2	0.31	0.71	2.4
12	0.099	0.329	1.73	0.55	1.07	7.3
13	0.159	0.462	3.42	1.12	1.44	4.6
14	1.24	0.66	12.13	3.8	2.78	47.9

Table C-7E

Raw INAA Data from the Lee Ranch B2 Drill Core

SAMPLE	As ppm	Ba ppm	Br ppm	Ca ppm	Ce ppm	Co ppm
1	11.2	510.8	0.075	1500	101.64	23.66
2	1.65	2717	0.7	2300	30.3	17.54
3	1.29	78.8	0.2	2700	25.9	17.56
4	1.12	93.1	0.47	3300	10.7	15.22
5	1.2	21.6	0.64	1900	8.79	14.16
6	0.93	28.8	0.33	2100	11.99	10.89
7	1.09	38.6	0.66	1800	20.06	12.29
8	0.69	23.5	0.62	1800	25.8	9.86
9	1.1	47.8	0.51	1900	35	7.5
10	0.5	172.3	0.33	1600	37.39	7.72
11	0.4	51.5	0.26	1900	49.6	4.15
12	0.4	43.4	0	6000	24.44	5.19
13	0.55	7.7	0.97	3400	16.97	9.46
14	0.8	42.8	0.72	3500	13.17	8.99
15	1.6	18.5	0.54	2100	14.51	6.79
16	1.2	31.49	0.53	2900	19.18	6.11
17	0.2	39.9	0.53	3200	9.87	4.84
18	1.24	37.3	0.21	1500	6.5	4.92
19	1.1	41	0.05	400	3.89	5.04
20	0.3	51.1	0.5	4000	7.21	2.94
21	3	58.2	0.6	4000	8.77	2.396
22	2.2	36.03	0.4	3000	8.53	5.6
23	4.6	29.3	0	0	8.18	8.4
24	2.4	26.1	0.7	5000	7.19	9.41
25	2.2	16.3	0.4	3000	8.11	9.53
26	2	99.4	0	0	25.19	9.84
27	2.9	252	0	0	41.27	6.97

SAMPLE	Cr ppm	Cs ppm	Eu ppm	Fe ppm	Hf ppm	La ppm	Lu ppm

1	40.93	14.24	1.588	42400	4.58	49.9	0.485
2	14.9	2.97	0.572	7830	1.46	14.4	0.204
3	5.7	1.38	0.499	3090	1.1	11.78	0.191
4	4.52	0.235	0.346	2310	0.65	4.6	0.148
5	2.67	0.065	0.263	2110	0.427	3.55	0.109
6	3.19	0.041	0.259	2210	0.544	5.08	0.096
7	6.1	0.179	0.315	2210	1.03	8.84	0.122
8	5.8	0.245	0.327	2870	1.45	12.36	0.129
9	7.4	0.461	0.381	4090	1.78	17.92	0.143
10	6.63	0.46	0.393	4760	2.07	19.51	0.138
11	6.38	0.217	0.459	4380	5.31	26.76	0.11
12	2.83	1.25	0.293	10610	5.77	25.37	0.074
13	10.9	0.288	0.358	5810	3.04	8.4	0.165
14	9.08	0.086	0.298	7580	1.69	6.08	0.141
15	7.6	0.082	0.279	14250	1.65	6.74	0.124
16	5.1	0.051	0.263	17330	1.5	9.18	0.105
17	1.85	0.005	0.127	8220	0.569	4.61	0.0346
18	1.99	0.015	0.0694	7980	0.313	3.72	0.0235
19	1.11	0.003	0.0552	27130	0.145	2.29	

0.0166

20	4.08	0.022	0.1117	10280	1.16	3.68	0.031
21	6.2	0.023	0.109	5040	1.27	4.83	0.062
22	5.41	0	0.18	2870	0.96	3.64	0.0525
23	5.67	0.011	0.215	3770	0.99	3.32	0.067
24	6.2	0.028	0.245	4770	0.9	2.85	0.083
25	8.8	0.052	0.369	4840	1.39	3.39	0.141
26	27.6	1.66	0.479	4560	6.2	13.33	0.302
27	48.38	7.95	0.544	8430	8.12	21.75	0.356

SAMPLE	Na ppm	Nd ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sm ppm
1	2160	44.8	145	1.66	14.67	1	8.55
2	212	12.6	16.5	5.52	6.62	1.89	2.92
3	199	12.6	8.5	5.59	4.33	1.56	2.56
4	173	6.2	1.9	5.91	2.694	0.85	1.528
5	147	4.9	0.1	3.98	1.589	1.01	1.266
6	127	6.1	1.4	2.1	1.403	0.85	1.34
7	150	8.2	1.2	0.8	2.521	1.91	1.69
8	170	9.1	1.6	1.23	2.852	2.44	1.73

9	150	12.1	2.5	1.61	3.121	3.24	1.97
10	150	12.4	2	2.9	3.29	3.04	1.85
11	140	12.2	0.7	3.74	2.665	3.06	2.09
12	153	12.3	5.7	0.43	1.787	5.5	1.36
13	140	5	1.1	0.96	3.703	5.2	1.25
14	120	5.5	1.2	1.08	3.345	3	1.08
15	140	5.7	0.3	1.09	2.756	2.89	1.19
16	110	7.5	0.4	1.18	2.166	2.84	1.3
17	70	4.4	0.2	0.322	0.923	1.1	0.705
18	110	2.23	0.1	0.077	0.66	0.72	0.387
19	180	1.35	0.5	0.197	0.539	0.48	0.312
20	120	2.46	0.3	0.26	1.524	1.44	0.451
21	220	3.24	0	0.253	2.11	1.31	0.54
22	160	3.58	0.4	3.51	1.807	1.18	0.774
23	180	3.65	0.1	5.04	1.736	1.99	0.865
24	400	3.74	0	7.6	2.033	1.78	0.99
25	200	5.3	0	8.82	4.04	1.85	1.43
26	0	10.68	17.1	3.87	6.06	2.87	2.21
27	250	15.02	64.8	2.7	10.45	0.65	2.87

SAMPLE	Sr ppm	Ta ppm	Tb ppm	Th ppm	U ppm	Yb ppm	Zn ppm
1	205	1.07	1.08	15.99	4.27	3.19	112
2	183.5	0.331	0.44	4.52	2.76	1.36	39.85
3	124.5	0.241	0.397	3.08	1.76	1.49	25.6
4	79.5	0.17	0.302	1.61	1.04	0.96	19.6
5	127	0.143	0.241	1.25	0.53	0.718	9.5
6	120.5	0.167	0.219	0.167	0.67	0.603	9.4
7	120.5	0.283	0.236	4.12	1.56	0.707	17.2
8	104.5	0.443	0.23	8.02	2.66	0.787	11.9
9	108	0.499	0.262	9.64	4.16	0.845	14.3
10	88	0.451	0.259	19.71	9	0.74	11
11	113	0.863	0.284	47.6	15	0.75	7.8
12	52	3.48	0.121	14.15	9.5	0.314	7.5
13	123.5	0.436	0.28	15.72	9.8	0.96	13.3
14	132.5	0.361	0.245	7.1	7.3	0.83	14.6
15	116	0.354	0.23	7.59	4.54	0.754	17.8
16	86	0.343	0.176	8.26	2.52	0.616	11.1
17	110	0.105	0.074	1.95	0.63	0.203	1.2

18	99.5	0.072	0.049	0.579	0.34	0.165	1.3
19	79.5	0.035	0.029	0.267	–99	0.084	1.2
20	111	0.216	0.086	2.74	1.14	0.182	1.2
21	108.5	0.217	0.069	2.11	0.72	0.344	3.9
22	134	0.172	0.13	1.98	0.57	0.358	5.8
23	119.5	0.153	0.165	1.58	0.71	0.408	6.2
24	147	0.155	0.214	1.45	0.74	0.534	19.5
25	154.5	0.222	0.353	2.21	1.46	0.94	13.7
26	106	0.918	0.481	7.95	3	1.76	17.2
27	100	1.18	0.528	11.83	3.21	2.12	39.4

Table C–7F

Raw INAA Data from the Lee Ranch B3 Dirll Core

SAMPLE	As ppm	Ba ppm	Br ppm	Ca ppm	Ce ppm	Co ppm
1	6.6	621	0.3	8200	46.3	15.52
2	6.7	493.9	0.1	−99	107.7	20.3
3	1.71	163.8	0.5	2700	6.04	9.96
4	0.48	43.9	0.66	2070	4.98	9.41
5	0.53	48.3	0.67	2400	7.36	7.58
6	2.02	84.6	0.21	1900	23.76	6.61
7	7.4	139.5	0.52	2400	38.9	10.72
8	0.75	76	0.45	1500	11.4	9.46
9	0.38	76.6	0.43	2700	15.99	4.14
10	0.7	120.8	0.52	2200	51.08	4.97
11	0.68	84.87	−99	2600	16.9	4.3
12	−99	87.6	0.44	2400	18.6	4.27
13	−99	120.8	0.57	1500	30.5	4.55
14	−99	82.4	0.8	−99	63.3	0.98
15	0.6	84.5	0.5	1400	44.2	7
16	1.1	54.8	0.45	2700	16.6	6.59
17	−99	49.7	0.5	5100	15.1	4.22
18	−99	73.3	0.36	3400	16.8	3.39
19	−99	53.3	0.58	6900	8.78	2.54
20	1.3	39.3	0.74	10300	7.99	4.95
21	0.9	61.2	0.57	9400	6.12	4.17
22	1.1	144.7	−99	7800	10.43	8.28
23	−99	177.8	0.7	6800	10.8	7.62
24	−99	109.5	0.96	6600	12.1	7.4
25	−99	39.2	0.95	1800	13.6	7.66
26	−99	241.9	−99	−99	47.59	6.53
27	10.7	385.2	−99	−99	85.2	15.77

SAMPLE	Cr ppm	Cs ppm	Eu ppm	Fe ppm	Hf ppm	La ppm	Lu ppm
1	12.53	2.17	0.792	8386.9	7.16	21.44	0.355
2	43.1	14.74	1.6	30210	5.01	52.9	0.532
3	8.05	0.08	0.367	2070	0.56	2.63	0.308

4	3.03	0.015	0.282	1200	0.39	2	0.26
5	5.2	0.22	0.338	1150	0.67	3.34	0.232
6	16.3	4.32	0.413	4.28	0.2	12.51	0.22
7	17.48	4.13	0.52	21120	2.26	19.38	0.191
8	4.2	0.187	0.255	5810	0.65	5.53	0.086
9	5.4	0.082	0.327	3750	1.01	6.6	0.105
10	9.48	2.48	0.437	38710	1.77	26.64	0.125
11	7.73	0.68	0.26	7380	1.46	8.14	0.107
12	6.2	0.7	0.282	6100	1.57	8.9	0.11
13	6	0.216	0.351	3420	4.45	15.4	0.126
14	3.7	1	0.342	11260	6.29	33.7	0.093
15	9.7	0.24	0.455	9600	3.95	22.15	0.14
16	7.1	0.1	0.32	17150	2.36	7.48	0.14
17	4.3	0.07	0.277	20790	1.23	6.64	0.099
18	5.4	0.036	0.268	5550	1.84	7.57	0.12
19	2.04	0.029	0.109	3860	0.402	4.57	0.0325
20	2.43	–99	0.091	3660	0.299	4.33	0.0327
21	2.85	0.021	0.101	4210	0.404	4.84	0.03
22	10.1	0.047	0.214	950	1.97	5.01	0.119
23	10.88	0.048	0.244	960	1.98	4.67	0.138
24	17.2	0.13	0.339	1850	2.42	5.56	0.182
25	29.9	1.44	0.681	2200	3.49	8.92	0.27
26	53.13	19.1	0.55	13090	6.57	25.74	0.399
27	60.2	11.78	1.295	16070	7.1	40.2	0.416

SAMPLE	Na ppm	Nd ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sm ppm
1	10190	17.8	93	0.88	5.6	–99	3.68
2	2820	46.1	155	1.37	15.78	2.3	8.47
3	270	3.7	2.1	17.9	6.77	0.83	1.279
4	250	2.6	0.6	10.98	3.414	0.7	1.117
5	240	3.6	1.1	6.46	2.822	1	1.241
6	300	9.4	22.5	2.5	5.38	2.6	1.86
7	321	15.4	24.4	1.18	6.33	4.4	2.53
8	195	5.9	1.2	2.13	2.122	1.36	1.209
9	192	7	0.7	1.22	2.598	2.08	1.53
10	200	17.51	9	1.47	3.237	2.2	2.36
11	206	6.32	3.2	1.52	2.97	2.32	1.16
12	170	5.43	2.5	1.61	3.217	2.1	1.04
13	170	8.37	1.4	2.1	2.799	2.78	1.4
14	140	17	6.2	0.228	2.166	3.1	1.75

15	170	12.9	2.6	1.17	3.236	5.7	2.1
16	170	5.6	1.3	1.48	2.983	3.4	1.16
17	180	5.9	1.4	2.48	2.19	1.75	1.12
18	180	6.2	0.6	0.71	2.188	2.66	1.29
19	210	3.5	0.4	0.369	0.978	0.93	0.579
20	150	2.8	0	0.264	1.168	0.4	0.479
21	130	2.9	–99	0.75	1.264	0.5	0.441
22	220	4.6	0.2	5.72	2.383	1.39	0.853
23	150	5.1	0.4	7.65	2.716	1.75	0.98
24	140	6.1	0	9.53	4.28	2.2	1.36
25	90	9.5	8	7.45	7.21	2.8	2.51
26	–99	16.5	106	2.46	12.12	2.2	2.87
27	–99	34.2	119	2.11	16	0.3	6.3

SAMPLE	Sr ppm	Ta ppm	Tb ppm	Th ppm	U ppm	Yb ppm	Zn ppm
1	67	0.887	0.55	9.85	2.88	2.38	52.4
2	243	1.08	1.04	16.87	5.08	3.6	124
3	117	0.058	0.51	1.2	1.38	2.04	39.8
4	113	0.076	0.354	0.97	0.68	1.65	6.7
5	103	0.162	0.323	2.02	1.66	1.47	6.4
6	175	0.481	0.309	6.85	3.94	1.41	19.4
7	132	0.614	0.34	7.67	5.83	1.2	41.6
8	72	0.264	0.188	2.4	1.26	0.567	20
9	96	0.234	0.232	3.34	1.44	0.703	14.4
10	123	0.454	0.249	8.35	2.95	0.81	14.8
11	91.5	0.348	0.171	7.54	3.67	0.613	12.4
12	82	0.388	0.187	10.07	6.94	0.707	12.8
13	73	0.579	0.272	31.43	10.2	0.73	13.8
14	84	3.2	0.131	16.09	9.25	0.344	–99
15	106	0.552	0.285	27.86	8	0.89	12.2
16	88	0.377	0.22	10.16	6.01	0.85	–99
17	99	0.274	0.164	5.66	3.67	0.67	11.3
18	156	0.485	0.178	8.49	2.72	0.644	9.5
19	105	0.082	0.06	0.895	0.39	0.208	5.2
20	105	0.077	0.059	0.814	0.38	0.181	4
21	82	0.068	0.055	0.876	0.44	0.219	1.3
22	102	0.377	0.188	2.94	1.33	0.692	9
23	104	0.393	0.228	3.17	1.26	0.8	12.9
24	66	0.412	0.352	3.95	2.54	1.21	18.4
25	59	0.646	0.667	6.68	3.25	1.62	18.1

26	98	1.24	0.48	12.81	3.7	2.55	59.5
27	99	1.23	0.84	14.96	4.3	2.88	85

Table C-7G

Raw INAA Data from the York Canyon 'A' Seam

SAMPLE	SUL. %	As ppm	Ba ppm	Br ppm	CaO wt %	Ce ppm	Co ppm
1	0.35	1.21	698.5	0	0.23	70.6	9.36
2	0.34	1.43	692.8	0	0.28	73.1	5.88
3	0.12	2.08	719	0.19	0.28	74.9	5.71
4	0.49	0.43	425.7	0.42	0.56	35	9.62
6	0.41	0.61	390.9	0.22	0.49	49.7	3.9
7	0.41	0.55	773.7	0.65	1.05	61.9	4.09
8	0.4	0.79	375.9	0.36	0.64	11	3.03
9	0.4	0.73	207.4	0.61	0.49	5.8	4.1
10	0.81	2.51	524.1	0.22	0.4	58.6	3
11	0.41	0.63	156.8	0.58	1.62	22.82	3.38
12	0.43	0.59	120.8	1	1.52	37	4.31
13	0.4	0.62	140.6	0.57	1.63	38	7.24
14	0.42	0.62	171.9	0.77	2.5	44.6	6.4
15	0.39	0.53	196	0.56	2.28	35.5	7.16
16	0.9	1.1	417.5	0.01	0.1	93.3	3.59

SAMPLE	Cr ppm	Cs ppm	Eu ppm	FeO wt %	Hf ppm	La ppm	Lu ppm
1	51.05	12.64	0.808	1.789	4.01	37.9	0.303
2	51.5	9.94	0.868	1.9	4.12	39.7	0.295
3	52.75	8.29	0.919	2.343	3.74	41.3	0.274
4	18.8	0.81	0.678	0.452	1.19	16.6	0.283
6	7	0.05	0.541	0.568	1.31	35.9	0.184
7	4.19	0.001	0.778	0.876	0.697	29.5	0.134
8	7.9	0.048	0.307	0.449	1.18	7.78	0.134
9	18.5	0.095	0.298	0.633	1	10.19	0.135
10	63.9	3.86	0.862	2.217	3.17	30.67	0.334
11	16.83	0.07	0.474	0.872	0.73	9.56	0.172
12	7.78	0.107	0.649	0.73	0.63	15.7	0.153
13	7.08	0.12	0.695	0.724	1.59	17.13	0.191
14	5.47	0.042	0.765	0.64	0.392	19.05	0.186
15	18.73	0.3	0.81	0.513	1.57	18.13	0.374
16	60.98	9.23	1.48	1.731	3.79	44	0.37

SAMPLE	Na2O	Nd	Rb	Sb	Sc	Se	Sm
	wt %	ppm	ppm	ppm	ppm	ppm	ppm
1	0.1205	24.4	104	0.745	13.17	1.46	4.56
2	0.126	29.8	97	0.89	14.17	2.1	5.01
3	0.106	31	80.9	0.77	14.32	3.3	4.99
4	0.0315	35.3	8.6	0.76	9.02	4.2	4.02
6	0.0224	18.9	0.05	0.096	3.97	2.1	2.84
7	0.0279	36.1	0.3	0.178	2.52	1.27	4.11
8	0.0617	5.6	0	0.132	2.95	2	1.48
9	0.01732	4	1.2	0.57	7.61	3.2	4.22
10	0.1001	21.3	44	0.47	15.7	1.7	4.3
11	0.0144	13.3	1.2	0.64	9.41	3.1	2.62
12	0.01162	16	0.9	0.325	3.96	1.48	3.56
13	0.0125	22.7	0.4	0.239	3.53	1.59	3.89
14	0.01266	26.6	0.2	0.12	3.21	1.57	4.13
15	0.0234	18.6	3.5	0.76	9.13	2.25	3.77
16	0.069	41.2	67.6	0.65	19.08	2.1	7.67

SAMPLE	Sr	Ta	Tb	Th	U	Yb	Zn
	ppm	ppm	ppm	ppm	ppm	ppm	ppm
1	386.1	0.299	0.561	9.49	3.68	0.199	34.8
2	395	1.261	0.601	11.8	3.92	1.98	46.8
3	306	1.08	0.575	16.46	5.32	1.8	52.4
4	121	0.263	0.522	5.52	3.49	1.79	–99
6	164	0.158	0.412	4.21	1.38	1.171	–99
7	785	0.15	0.452	2.41	1.14	0.993	6.7
8	74	0.197	0.254	4.04	1.97	0.826	–99
9	88	0.218	0.267	3.43	2.59	0.917	11.7
10	280	1.175	0.577	11.05	2.84	2.17	33.5
11	79	0.144	0.342	3.96	3.36	1.085	22.6
12	245	0.084	0.429	1.56	1.02	1.52	6.3
13	221	0.073	0.492	1.56	0.81	1.252	–99
14	540	0.07	0.52	1.52	0.51	1.325	14.9
15	102	0.438	0.658	4.88	2.5	2.55	22.4
16	191	1.082	0.905	12.47	4.56	2.48	36.1

Table C-7H

Raw INAA Data from the York Canyon Upper Main Seam

SAMPLE	SUL. %	As ppm	Ba ppm	Br ppm	CaO wt %	Ce ppm	Co ppm
1	0.43	0	216.7	2.07	13	9.24	2.326
2	0.36	0.21	198.4	0.51	5.4	51.9	8.23
3	0.38	0.3	277.6	0.59	0.56	78.56	9.76
4	0.4	0.42	442.3	0.47	2.69	67.98	8.97
5	0.38	0.564	293.6	0.67	12.9	13.17	5.86
6	0.4	0.89	634.7	0.43	2.19	7.8	6.16
7	0.43	0.907	808.4	0.36	2.97	17.6	4.42
8	0.43	0.59	391.7	0.65	1.72	26.6	4.89
9	0.25	4.64	415.1	0	0.35	69.4	8.81

SAMPLE	Cr ppm	Cs ppm	Eu ppm	FeO wt %	Hf ppm	La ppm	Lu ppm
1	12.58	0.41	0.416	1.306	0.63	3.35	0.183
2	14.85	0.81	0.968	1.078	1.05	20.64	0.32
3	3.99	0.041	0.838	0.3395	1.028	45.08	0.315
4	4.26	0.026	0.799	0.539	0.469	32.16	0.25
5	1.32	0.01	0.396	0.576	0.225	5.96	0.159
6	2.77	0	0.251	0.594	0.465	3.59	0.141
7	2.12	0	0.262	0.662	0.397	9.57	0.088
8	9.75	0.055	0.301	0.479	0.787	20.26	0.115
9	59.68	8.97	0.976	2.334	0.436	36.6	0.326

SAMPLE	Na2O wt %	Nd ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sm ppm
1	-99.99	8.1	3.4	0.163	6.48	-99	1.65
2	0.0178	28.74	7.35	0.51	7.68	2.4	5.75
3	0.0121	39.2	0.9	0.125	3.94	1.92	4.36
4	0.018	45.9	0.1	0.088	1.2	0.88	4.61
5	0.0183	13.2	0.04	0.06	0.906	1.09	1.58
6	0.0674	8.7	0.04	0.04	1.198	1.07	1.78
7	0.0741	19.1	0.7	0.063	1.213	1.15	1.61

8	0.0392	5.5	0.8	0.711	0.384	2.76	1.52
9	0.0849	26.1	84	0.83	14.56	2.1	5.03

SAMPLE	Sr ppm	Ta ppm	Tb ppm	Th ppm	U ppm	Yb ppm	Zn ppm
1	440	0.083	0.325	1.53	4.54	1.24	29.45
2	102	0.244	0.69	5.6	2.45	2.11	-99
3	339	0.149	0.627	3.14	1.01	2.04	50.7
4	495	0.08	0.603	1.23	0.53	1.6	19.25
5	450	0.05	0.288	0.544	0.35	0.975	10.9
6	403	0.076	0.176	0.89	0.31	0.823	27.6
7	665	0.028	0.172	0.846	0.4	0.529	-99
8	254	0.168	0.239	2.01	2.04	0.814	8.6
9	295	1.179	0.63	15.13	5.68	2.17	37.9

Table C-7I

Raw INAA Data from the York Canyon Main Seam

SAMPLE	SUL. %	As ppm	Ba ppm	Br ppm	CaO wt %	Ce ppm	Co ppm
1	0.54	2.63	748.8	0.14	0.54	55.9	5.78
2	0.41	0.54	142.9	0.74	2.1	9.6	4.07
3	0.4	1.15	374.4	0.37	1.38	26.1	2.93
4	0.39	1.45	412.1	0.32	0.74	33.8	2.51
5	0.52	1.24	360.7	0.84	0.34	19.7	2.53
6	0.42	0.95	1003	0.69	1.86	32.1	2.61
7	0.4	1.26	1150	0.38	2.74	16.9	2.54
8	0.46	1.14	1158.9	0.49	1.07	30.9	2.65
9	2.76	1	327	0.56	0.48	15.8	4.12
10	0.49	1.34	387.3	0.68	0.21	14	1.98
11	0.41	0.99	284.4	1.17	0.48	11.3	1.94
12	0.41	0.81	321.2	1.43	1.36	13.3	1.78
13	0.43	1.5	423.1	1.36	1.27	11.2	1.36
14	0.49	0.9	358	0.96	0.35	7.9	1.43
15	0.46	1.2	441.4	0.57	5.1	4.8	1.94
16	0.52	0.99	494.9	0.41	3.23	9.3	2.01
17	0.5	1.33	508.9	0.33	3.31	3.18	1.7
18	0.52	4.1	506	0.37	0.32	5.94	1.42
19	0.76	0.49	556.1	0.54	0.46	6.55	1.62
20	0.65	0.63	825.8	0.47	0.63	4.81	2.41
21	0.52	1.45	486.6	0.85	0.69	14.88	2.26
22	0.88	0.7	126.2	0.29	0.19	1.31	2.95
23	0.74	0.3	206.8	0.58	0.15	5.12	4.05
24	0.51	2.1	519.6	0.2	0.5	74.46	10.72
25	0.06	1	1398.8	1.7	0.1	99.5	6.97

SAMPLE	Cr ppm	Cs ppm	Eu ppm	FeO wt %	Hf ppm	La ppm	Lu ppm
1	40.38	5.85	0.695	1.911	3.77	29.52	0.228
2	8.1	0.17	0.408	0.481	1.44	3.34	0.173
3	8.13	0.04	0.439	0.551	1.53	18.02	0.199
4	12	0.01	0.495	0.495	2.36	24.65	0.263

5	12.4	0.082	0.329	0.645	1.68	11.95	0.143
6	4.3	0.02	0.368	0.738	0.667	17.02	0.093
7	5.7	0.007	0.364	0.626	1.45	9.29	0.119
8	4.3	0.045	0.318	0.642	0.545	20.66	0.087
9	15	1.24	0.239	18.94	1.04	8.84	0.122
10	10.7	0.1	0.247	0.478	1.55	7.97	0.136
11	3.96	0.1	0.213	0.578	0.723	5.18	0.0791
12	2.92	0.124	0.224	0.583	0.597	6.38	0.0684
13	3.53	0.059	0.195	0.542	1.33	5.29	0.0688
14	2.83	0.081	0.141	0.559	0.579	4.42	0.0455
15	1.83	0.008	0.08	0.589	0.329	2.65	0.0339
16	1.65	0.046	0.116	0.7	0.382	5.23	0.0303
17	1.68	0.018	0.059	0.595	0.269	1.7	0.0254
18	3.49	0.021	0.092	0.588	0.815	3.53	0.0473
19	2	0.029	0.104	0.692	0.566	4.09	0.0317
20	1	0.036	0.103	0.591	0.279	2.88	0.024
21	2.74	0.008	0.219	0.598	0.626	7.89	0.0959
22	1.3	0.033	0.09	0.604	0.188	0.5	0.0869
23	7.55	0.509	0.143	0.432	0.534	2.72	0.157
24	46.4	9.59	1.059	1.991	3.41	37.52	0.363
25	57.53	9.58	1.562	1.637	7.14	53.16	0.519

SAMPLE	Na2O	Nd	Rb	Sb	Sc	Se	Sm
	wt %	ppm	ppm	ppm	ppm	ppm	ppm
1	0.0597	23.7	46.5	0.6	11.93	3.8	4.15
2	0.01569	8.5	1.4	0.64	5.86	4.8	2.05
3	0.0539	10.3	0	0.38	2.933	2.2	2.32
4	0.0547	15.9	0	0.27	4.038	4	2.65
5	0.0831	8.9	1	0.474	3.709	2.72	1.67
6	0.0699	16.5	0	0.203	2.632	1.61	2.19
7	0.1122	14.7	0.5	0.074	2.392	2.3	1.98
8	0.0917	18.4	0.2	0.084	2.077	1.53	2.03
9	0.107	7.1	19.5	0.22	3.503	1.14	1.27
10	0.0584	7.6	1.7	0.027	3.085	2.7	1.39
11	0.1805	6.2	0.4	0.132	1.959	1.56	1.15
12	0.282	6.4	0.9	0.1	1.654	1.19	1.29
13	0.182	5.9	0.6	0.145	2.45	1.81	0.99
14	0.2288	3.19	0.1	0.117	1.717	1.52	0.691
15	0.146	2.1	0.3	0.056	0.815	1.42	0.489
16	0.213	6.1	0.4	0.049	0.84	1.46	0.766

17	0.117	1.8	0.1	0.046	0.668	1.21	3.43
18	0.1428	1.8	0.2	0.258	1.063	2	0.389
19	0.222	2.6	0.2	0.328	0.849	3.5	0.482
20	0.1557	2.7	0.1	0.074	0.704	1.83	0.517
21	0.089	7.2	0.3	0.072	1.559	1.68	1.145
22	0.023	1.13	0.3	0.06	1.289	0.65	0.392
23	0.006	2.6	4.9	0.504	2.87	1.54	0.646
24	0.03	35.9	98	0.88	12.33	4.9	5.9
25	0.524	43	120.5	0.54	17.33	0.2	7.32

SAMPLE	Sr ppm	Ta ppm	Tb ppm	Th ppm	U ppm	Yb ppm	Zn ppm
1	230	0.902	0.38	13.3	5.5	1.46	45.1
2	99	0.191	0.41	6.5	5.05	1.159	23.5
3	117	0.445	0.37	4.21	2.7	1.27	22
4	122	0.788	0.31	6.87	3.56	1.49	-99
5	137	0.324	0.23	5.64	2.69	0.97	8.3
6	815	0.104	0.229	1.94	1.05	0.64	4.6
7	800	0.264	0.2	2.97	1.12	0.699	-99
8	850	0.116	0.192	1.92	0.95	0.542	-99
9	46	0.316	0.185	3.07	1.27	0.75	63
10	51	0.56	0.161	6.74	3.02	0.084	-99
11	56	0.122	0.155	2.96	1.1	0.52	4.7
12	153	0.115	0.139	2.24	0.94	0.468	7.9
13	123	0.201	0.141	2.76	0.97	0.445	17
14	58	0.122	0.1	1.62	0.57	0.31	6.5
15	239	0.072	0.041	0.899	0.31	0.209	1.5
16	410	0.085	0.045	1.66	0.55	0.178	2.5
17	228	0.063	0.044	0.827	0.44	0.142	0.8
18	129	0.207	0.04	4.95	2.15	0.255	2.1
19	243	0.143	0.056	4.3	2.51	0.139	12.3
20	440	0.052	0.061	1.65	1.13	0.122	1.6
21	271	0.109	0.152	1.35	0.69	0.604	3.4
22	66	0.039	0.089	0.599	0.45	0.533	2.1
23	69	0.126	0.137	2.47	1.45	0.952	-99
24	145	0.981	0.697	12.2	4.3	2.065	54.6
25	195	1.45	0.997	17.16	6.4	3.33	106

Table C-8

Recovery from Float-Clay--Sink Separation

SAMPLE NUMBER	INITIAL WEIGHT	FINAL WEIGHT	% RECOVERY
A2-03	16.2694	16.1673	99.37
A2-07	19.4633	19.4023	99.69
A2-09	15.5785	15.4397	99.10
A2-11	18.7249	18.6940	99.83
A2-14	2.7513	2.6665	96.92
YA-03	4.4381	4.2911	96.69
YA-05	16.2622	16.2507	99.93
YA-07	17.7608	17.6184	99.20
YA-09	20.2418	20.1300	99.58
YA-11	16.2044	16.0984	99.35
YA-16	4.6743	4.5428	97.19

all weights in grams

Table C-9

Raw INAA Data for Separates

SAMPLE #	%	As	Ba
A2-3 FLOAT	97.6100	0.5000	11.8000
A2-3 CLAY	0.3000		831.0200
A2-3 SINK	2.0900	2.0700	2381.5000
A2-3 WHOLE		0.5900	109.7000
A2-7 FLOAT	99.1600	0.4100	14.9000
A2-7 CLAY	0.2100		665.2800
A2-7 SINK	0.4700	2.5000	3195.0000
A2-7 WHOLE		0.4200	99.5000
A2-9 FLOAT	95.6000		18.7000
A2-9 CLAY	0.6800		351.3300
A2-9 SINK	3.7200	0.7300	419.5000
A2-9 WHOLE		0.2800	72.2000
A2-11 FLOAT	98.5000		17.5200
A2-11 CLAY	0.4500		506.4600
A2-11 SINK	1.0500	1.1200	199.0000
A2-11 WHOLE		0.2100	385.0000
A2-14 FLOAT	19.7600	3.4000	147.0000
A2-14 CLAY	22.1600		203.5300
A2-14 SINK	58.0800	5.0000	216.6000
A2-14 WHOLE		4.1400	218.5000
Ya-3 FLOAT	2.7400	1.6800	342.0700
Ya-3 CLAY	28.6800	1.9000	766.6700
Ya-3 SINK	68.5900	2.4000	695.6000
Ya-3 WHOLE		2.0800	719.0000
Ya-5 FLOAT	97.6300	0.4900	144.9300
Ya-5 CLAY	0.2200	1.4500	716.3400
Ya-5 SINK	2.1600	1.0200	639.8000
Ya-5 WHOLE			

Ya-7 FLOAT	97.7100	0.5600	689.0000
Ya-7 CLAY	0.3600		2233.1300
Ya-7 SINK	1.9300	1.1800	1730.0000
Ya-7 WHOLE		0.5500	773.7000
Ya-9 FLOAT	95.3300	0.7200	209.0000
Ya-9 CLAY	0.5100		494.8100
Ya-9 SINK	4.1600	1.1800	349.5000
Ya-9 WHOLE		0.7300	207.4000
Ya-10 FLOAT	7.9100	2.3000	406.4000
Ya-10 CLAY	25.7600		521.9200
Ya-10 SINK	66.3300	2.2000	556.6000
Ya-10 WHOLE		2.5100	524.1000
Ya-11 FLOAT	92.9200		100.1100
Ya-11 CLAY	1.1300		901.6400
Ya-11 SINK	5.9500		561.1200
Ya-11 WHOLE		0.6300	156.8000
Ya-16 FLOAT	7.4600	0.6000	165.3000
Ya-16 CLAY	23.7500		382.9400
Ya-16 SINK	68.7900		453.8600
Ya-16 WHOLE		1.1000	417.5000

SAMPLE #	Br	Ca	Ce	Co	Cr
A2-3 FLOAT	1.4700	2752.0000	5.3200	9.6200	2.6000
A2-3 CLAY	4.5000		11.0000	9.9100	39.6300
A2-3 SINK	2.8000		6.0900	3.0800	20.4500
A2-3 WHOLE	0.4900	2900	5.6900	8.4300	2.5500
A2-7 FLOAT	1.6000	2930.7000	5.9400	5.5900	1.7900
A2-7 CLAY	4.1500	2400.0000	6.2500	7.4600	9.0800
A2-7 SINK	19.2000		4.2000	2.8400	19.9000
A2-7 WHOLE	0.4400	3600.0000	6.0100	3.3100	2.8000
A2-9 FLOAT	4.1000	4360.3000	3.5600	6.7200	1.2000
A2-9 CLAY		156800.00	15.0800	24.4300	6.9700

A2-9 SINK	1.0700	317013.80	11.7700	3.5000	4.8200
A2-9 WHOLE	0.5500	24200.0000	3.9200	5.6300	1.9500
A2-11 FLOAT	1.5500	4145.8000	4.7300	10.8800	1.1000
A2-11 CLAY		90700.00	5.8200	16.3400	4.2600
A2-11 SINK	0.7900	294497.60	8.4200	1.6840	7.6300
A2-11 WHOLE	0.6800	15000.0000	5.0100	10.1100	1.1000
A2-14 FLOAT	2.9000		41.4000	22.7800	34.3000
A2-14 CLAY	0.3000		54.0400	25.2400	41.4500
A2-14 SINK	0.7600		47.6300	18.6900	47.0500
A2-14 WHOLE	0.1800	1100.0000	48.4000	15.3200	36.2000
Ya-3 FLOAT	10.4500		26.7700	52.1800	8.2600
Ya-3 CLAY	0.2800		75.7300	7.9000	52.8500
Ya-3 SINK	0.4000	2787.7200	77.4700	6.5100	55.6500
Ya-3 WHOLE	0.1900	2001.0000	74.9000	5.7100	52.7500
Ya-5 FLOAT	1.2900		27.6800	5.9600	13.9300
Ya-5 CLAY	1.7700		117.0400	5.3900	48.2500
Ya-5 SINK	0.9000	24303.2000	116.0200	3.5300	20.6300
Ya-5 WHOLE					
Ya-7 FLOAT	1.1300		56.1000	4.0600	4.0200
Ya-7 CLAY	2.4000	87800.0000	213.9700	4.0800	57.6300
Ya-7 SINK	1.1000	85543.6900	147.0200	2.0100	14.5300
Ya-7 WHOLE	0.6500	7505.0000	61.9000	4.0900	4.1900
Ya-9 FLOAT	1.1200	1072.0000	11.2500	4.0000	15.7000
Ya-9 CLAY	1.0000	150000.000	23.5800	4.3600	35.6500
Ya-9 SINK	.8700	40443.6000	18.8600	2.0440	33.1000
Ya-9 WHOLE	0.6100	3502.0000	15.8000	4.1000	18.5000
Ya-10 FLOAT	3.3000	1608.3000	42.8600	4.0400	58.8800
Ya-10 CLAY			58.5300	3.4800	61.9000
YA-10 SINK		2072.9000	60.4500	2.9500	61.3000
Ya-10 WHOLE	0.2200	2859.0000	58.6000	3.0000	63.9000
Ya-11 FLOAT	1.5000	1358.1000	18.0100	3.4500	15.6000
Ya-11 CLAY	1.1000	67400.0000	80.0300	2.8600	20.1000

Ya-11 SINK	0.5400	82202.0000	68.1500	1.8020	18.4500
Ya-11 WHOLE	0.5800	11579.0000	22.8000	3.3800	16.8300
Ya-16 FLOAT	2.7000		27.0700	5.4600	69.3800
Ya-16 CLAY			97.9100	5.1300	59.7500
Ya-16 SINK	0.7300		96.1600	3.5300	58.9300
Ya-16 WHOLE	0.0100	715.0000	93.3000	3.5900	60.9800

SAMPLE #	Cs	Eu	Fe	Hf	La
A2-3 FLOAT	0.0380	0.2800	2056.5000	0.4150	2.2000
A2-3 CLAY	1.1700	0.2400	40300.0000	1.6900	5.3000
A2-3 SINK	0.3800	0.1250	***********	5.6800	3.6600
A2-3 WHOLE	0.0540	0.2630	2900.0000	0.5380	2.7300
A2-7 FLOAT	0.0120	0.0863	1475.3000	0.2250	3.0100
A2-7 CLAY	0.1300	0.0900	11800.00	0.8500	2.9200
A2-7 SINK	0.1700	0.0720	92323.80	2.5800	2.2600
A2-7 WHOLE	0.0170	0.0897	2920.00	0.2840	3.0000
A2-9 FLOAT		0.0521	690.8000	0.1470	1.2000
A2-9 CLAY	0.0600	0.0900	6100.0000	0.3900	10.8900
A2-9 SINK	0.0380	0.0775	16972.30	0.4110	11.3100
A2-9 WHOLE	0.0030	0.0479	2016.00	0.1940	2.6400
A2-11 FLOAT	0.0010	0.1650	1238.6000	0.0870	2.0800
A2-11 CLAY	0.0400	0.1600	14600.00	0.2800	2.7500
A2-11 SINK	0.0190	0.1950	27631.10	0.1140	6.7300
A2-11 WHOLE	0.0080	0.1820	3150.00	0.1080	2.1300
A2-14 FLOAT	13.4400	0.6470	15538.20	5.5200	22.2900
A2-14 CLAY	21.7500	0.7400	13700.00	4.2400	29.3700
A2-14 SINK	13.4900	0.6610	21340.80	7.6500	25.3700
A2-14 WHOLE	15.3500	0.6860	16910.00	6.3300	25.8700
Ya-3 FLOAT	2.7300	0.4410	6677.070	6.8100	14.0100
Ya-3 CLAY	8.7100	0.8700	14900.00	3.3700	41.0900
Ya-3 SINK	8.3300	0.9300	20841.36	3.7200	41.8300
Ya-3 WHOLE	8.2900	0.9190	18212.00	3.7400	41.3000

Ya-5 FLOAT	0.3960	0.6520	3892.330	1.0200	10.9100
Ya-5 CLAY	1.6700	2.0400	19200.00	1.4800	44.6700
Ya-5 SINK	1.4700	2.1600	28859.210	2.1200	43.8600
Ya-5 WHOLE					
Ya-7 FLOAT	0.0200	0.5940	5136.010	0.6230	25.4700
Ya-7 CLAY	0.2600	6.1000	52800.00	1.1700	77.8700
Ya-7 SINK	0.1530	4.8400	43101.29	2.6000	53.8000
Ya-7 WHOLE	0.0010	0.7780	6809.000	0.6970	29.5000
Ya-9 FLOAT	0.0510	0.2810	3694.10	0.8800	8.8800
Ya-9 CLAY	0.8300	0.4800	19400.00	1.8800	14.5100
Ya-9 SINK	0.7300	0.4110	17182.1000	2.1200	11.3500
Ya-9 WHOLE	0.0950	0.2980	4920.0000	1.0000	10.1900
Ya-10 FLOAT	3.1000	0.6560	12118.1000	3.1400	21.1600
Ya-10 CLAY	4.3800	0.8100	12300.0000	2.9300	28.1400
YA-10 SINK	3.8900	0.8800	19972.7000	3.2000	29.2800
Ya-10 WHOLE	3.8600	0.8620	17232.0000	0.3170	30.6700
Ya-11 FLOAT	0.0600	0.4380	4743.4000	0.7000	6.8300
Ya-11 CLAY	0.4600	1.5500	32400.0000	1.2000	31.1100
Ya-11 SINK	0.3400	1.3770	25777.2000	2.0200	27.2500
Ya-11 WHOLE	0.0700	0.4740	6778.0000	0.7300	9.5600
Ya-16 FLOAT	2.4200	0.5710	4259.6000	5.0000	12.4800
Ya-16 CLAY	10.8500	1.5400	12300.0000	3.5500	42.9600
Ya-16 SINK	10.0300	1.5700	14735.7000	3.7200	43.9000
Ya-16 WHOLE	9.2300	1.4800	13455.0000	3.7900	44.0000

SAMPLE #	Lu	Na	Nd	Rb	Sb
A2-3 FLOAT	0.1580	207.5300	2.9500		3.5600
A2-3 CLAY	0.1700	1295.3700	4.1900	10.1000	3.0300
A2-3 SINK	0.1710	1295.3700	2.1300		5.0100
A2-3 WHOLE	0.1560	205.0000	3.0000	0.5000	3.5800
A2-7 FLOAT	0.0173	192.8000	2.5500		0.3210
A2-7 CLAY	0.0400		1.8200	0.5000	0.5100

A2-7 SINK	0.0780	666.5600			0.6300
A2-7 WHOLE	0.0243	227.0000	2.1500	0.2000	0.2550
A2-9 FLOAT	0.0161	168.0300	1.0500		0.0690
A2-9 CLAY	0.0200		4.1400	0.7500	0.0700
A2-9 SINK	0.0147	79.0000	3.5000		0.2120
A2-9 WHOLE	0.0427	163.0000	2.3000	0.3000	0.0700
A2-11 FLOAT	0.0790		3.2800		4.2000
A2-11 CLAY	0.0500	560.2200	3.5300	1.3000	3.9900
A2-11 SINK	0.0540	62.5000	4.9000		2.7100
A2-11 WHOLE	0.0815	153.0000	3.1000	0.0000	4.4400
A2-14 FLOAT	0.3910	289.4900	2.7500	68.0000	5.1100
A2-14 CLAY	0.3900		20.7800	105.0000	2.5200
A2-14 SINK	0.4310	225.8100	16.4900	69.0000	4.5100
A2-14 WHOLE	0.4120	360.0000	15.8000	84.0000	4.1400
Ya-3 FLOAT	0.1710	192.2000	9.3800	25.6000	1.8100
Ya-3 CLAY	0.2800	1321.2200	28.6300	88.0000	0.6800
Ya-3 SINK	0.2820	672.7000	29.5300	80.0000	0.7400
Ya-3 WHOLE	0.2740	625.0000	31.0000	80.9000	0.7700
Ya-5 FLOAT	0.2240	117.9000	12.8500	4.0000	0.3420
Ya-5 CLAY	0.3500	275.3900	65.0700	9.6000	0.4900
Ya-5 SINK	0.3600	165.1000	30.9900	13.4000	0.2950
Ya-5 WHOLE					
Ya-7 FLOAT	0.1090	151.2000	25.3000		0.1770
Ya-7 CLAY	0.8400	1064.4100	156.4800	2.6500	0.3000
Ya-7 SINK	0.6790	775.0000	103.5000		0.1420
Ya-7 WHOLE	0.1340	800.0000	36.1000	0.3000	0.1780
Ya-9 FLOAT	0.1140	73.1000	3.2300		0.5260
Ya-9 CLAY	0.2100	422.2800	7.9700	9.9000	0.4700
Ya-9 SINK	0.2150	169.5000	6.6200	8.2000	0.3640
Ya-9 WHOLE	0.1350	102.0000	4.0000	1.2000	0.5700
Ya-10 FLOAT	0.2650	585.9000	17.3300	34.7000	0.5600
Ya-10 CLAY	0.3300	697.8100	22.1700	44.0000	0.4900

YA-10 SINK	0.3340	315.6000	23.3800	44.4000	0.4900
Ya-10 WHOLE	0.3340	590.0000	21.3000	44.0000	0.4700
Ya-11 FLOAT	0.1440	67.2000	8.0600		
Ya-11 CLAY	0.2000		41.1300	4.7500	0.4400
Ya-11 SINK	0.2470	64.8000	33.4600	5.6000	0.3270
Ya-11 WHOLE	0.1720	84.0000	13.3000	1.2000	0.6400
Ya-16 FLOAT	0.2740	141.5000	12.6000	17.6000	1.0100
Ya-16 CLAY	0.3800		44.0200	72.5000	0.5800
Ya-16 SINK	0.3730	300.7000	41.1000	68.0000	
Ya-16 WHOLE	0.3700	407.0000	41.2000	67.6000	0.6500

SAMPLE #	Sc	Se	Sm	Sr	Ta
A2-3 FLOAT	2.4960	0.7900	1.0690	108.0000	0.1180
A2-3 CLAY	2.3400	3.4500	1.1000	64.5000	0.6100
A2-3 SINK	1.4480	1.6000	0.5950	97.5000	0.5120
A2-3 WHOLE	2.4870	1.1000	1.0630	107.0000	0.1120
A2-7 FLOAT	0.8390	1.0200	0.4410	108.0000	0.0840
A2-7 CLAY	0.7900	2.1000	0.3800	94.0000	0.1200
A2-7 SINK	0.4930	5.8000	0.2760	70.0000	0.1400
A2-7 WHOLE	0.8330	1.0900	0.4310	98.0000	0.0510
A2-9 FLOAT	0.4760	0.7300	0.2640	120.0000	0.0690
A2-9 CLAY	0.4500	1.4300	0.4900	276.0000	0.2500
A2-9 SINK	0.2880	1.1300	0.4130	368.0000	0.0990
A2-9 WHOLE	0.4520	0.7500	0.2790	110.0000	0.0400
A2-11 FLOAT	0.8260	0.8100	0.6820	145.0000	0.0530
A2-11 CLAY	0.6100	3.5000	0.6400	178.0000	0.3000
A2-11 SINK	0.3250	1.0100	0.8310	409.5000	0.0420
A2-11 WHOLE	0.8090	0.9100	0.7150	142.0000	0.0330
A2-14 FLOAT	10.1700	1.1000	3.0800	165.0000	1.8200
A2-14 CLAY	12.9800	1.7000	3.4800	295.0000	1.3100
A2-14 SINK	10.0900	1.4000	3.3100	92.0000	1.5900
A2-14 WHOLE	10.9300	2.0000	3.4300	153.4000	1.1900

Ya-3 FLOAT	11.2700	1.8000	1.9100	129.0000	1.0280
Ya-3 CLAY	13.6600	2.2500	4.9700	345.0000	1.0700
Ya-3 SINK	14.9500	3.6000	5.1500	303.5000	1.0270
Ya-3 WHOLE	14.3200	3.3000	4.9900	306.0000	1.0800
Ya-5 FLOAT	5.1400	1.8500	3.0100	55.0000	0.2640
Ya-5 CLAY	6.1100	13.9000	11.1200	78.5000	1.6800
Ya-5 SINK	5.9400	7.7000	11.1200	221.0000	0.2910
Ya-5 WHOLE					
Ya-7 FLOAT	2.3870	1.3400	3.1600	700.0000	0.1460
Ya-7 CLAY	5.4300	6.7500	27.2000	2540.0000	0.2900
Ya-7 SINK	4.3500	4.0000	20.5000	1860.0000	0.2300
Ya-7 WHOLE	2.5200	1.2700	4.1100	785.0000	0.1500
Ya-9 FLOAT	7.0900	3.1000	1.0310	84.0000	0.1880
Ya-9 CLAY	10.2300	9.5000	1.8700	247.0000	0.5400
Ya-9 SINK	9.7300	6.1000	1.7800	340.0000	0.5610
Ya-9 WHOLE	7.6100	3.2000	4.2200	88.0000	0.2180
Ya-10 FLOAT	13.9500	2.8000	3.1600	215.0000	0.9640
Ya-10 CLAY	14.4300	1.3500	3.8800	265.0000	1.1000
YA-10 SINK	15.8300	1.9000	4.2400	244.0000	1.1300
Ya-10 WHOLE	15.7000	1.7000	4.3000	280.0000	1.1750
Ya-11 FLOAT	8.8500	2.9400	1.7600	34.0000	0.1460
Ya-11 CLAY	11.6400	10.7500	7.5500	1250.0000	0.2400
Ya-11 SINK	11.0200	5.4000	6.5500	925.0000	0.2840
Ya-11 WHOLE	9.4100	3.1000	2.6200	79.0000	0.1440
Ya-16 FLOAT	13.7400	5.0000	2.4300	53.0000	0.7290
Ya-16 CLAY	15.0600	0.9000	7.5400	143.0000	1.0800
Ya-16 SINK	15.3500	1.9000	7.7800	163.0000	1.0930
Ya-16 WHOLE	19.0800	2.1000	7.6700	191.0000	1.0820

SAMPLE #	Tb	Th	U	Yb	Zn
A2-3 FLOAT	0.3100	1.0500	0.7200	1.1000	5.0000
A2-3 CLAY	0.2200	2.1300	0.7800	1.0100	44.7000

A2-3 SINK	0.1410	1.7300	0.8100	1.1000	24.7000
A2-3 WHOLE	0.3190	1.0400	0.7700	1.0400	3.1000
A2-7 FLOAT	0.0540	0.6610	0.2500	0.1510	4.5000
A2-7 CLAY	0.0600	0.7300	0.1400	0.1900	56.2000
A2-7 SINK	0.0100	1.3000		0.3600	87.5000
A2-7 WHOLE	0.0580	0.6620	0.3400	0.1530	1.6000
A2-9 FLOAT	0.0300	0.2910	0.0700	0.0880	21.2000
A2-9 CLAY	0.0300	0.2900	0.0300	0.1200	27.0000
A2-9 SINK	0.0270	2.1400	0.1200	0.0830	272.0000
A2-9 WHOLE	0.0080	0.2990	0.1900	0.0900	1.6000
A2-11 FLOAT	0.1420	0.2620	0.0900	0.5340	3.2000
A2-11 CLAY	0.1500	0.2600	0.1000	0.4200	29.1000
A2-11 SINK	0.1890	0.0760		0.4010	219.0000
A2-11 WHOLE	0.1630	0.2620	0.1100	0.5150	1.4000
A2-14 FLOAT	0.7000	12.0500	3.0800	2.5700	25.8000
A2-14 CLAY	0.5800	13.8300	3.2000	2.6200	40.5500
A2-14 SINK	0.6800	12.7000	3.4000	2.7800	43.0000
A2-14 WHOLE	0.7020	12.9500	3.4500	2.5600	29.9000
Ya-3 FLOAT	0.3330	9.2700	6.4000	1.2000	205.0000
Ya-3 CLAY	0.5100	16.3300	4.3800	1.8400	40.2000
Ya-3 SINK	0.6300	16.6900	4.5900	1.9600	63.9000
Ya-3 WHOLE	0.5750	16.4600	5.3200	1.8000	52.4000
Ya-5 FLOAT	0.4800	4.0500	1.6400	1.5600	14.7000
Ya-5 CLAY	1.1200	9.8000	2.0600	2.1600	189.5000
Ya-5 SINK	1.2500	8.9800	1.5600	2.3900	195.0000
Ya-5 WHOLE					
Ya-7 FLOAT	0.3190	2.2100	0.7900	0.7200	5.6000
Ya-7 CLAY	4.2400	8.1300	2.4900	6.2300	54.8000
Ya-7 SINK	3.0100	5.2700	2.3100	5.1000	50.0500
Ya-7 WHOLE	0.4520	2.4100	1.1400	0.9930	6.7000
Ya-9 FLOAT	0.2410	3.1100	2.2500	0.8150	
Ya-9 CLAY	0.3600	6.3000	2.5600	1.4100	36.5000

Ya-9 SINK	0.3170	6.0200	2.0500	1.4700	82.0000
Ya-9 WHOLE	0.2670	3.4300	2.5900	0.9170	11.7000
Ya-10 FLOAT	0.4350	10.4300	2.7100	1.7800	38.6000
Ya-10 CLAY	0.5600	10.3600	2.5300	1.8900	30.4500
YA-10 SINK	0.5500	11.1400	2.7200	2.3500	39.0000
Ya-10 WHOLE	0.5770	11.0500	2.8400	2.1700	33.5000
Ya-11 FLOAT	0.3340	3.6500	2.5500	0.9200	14.7000
Ya-11 CLAY	0.8500	6.0500	2.7300	1.4200	64.6000
Ya-11 SINK	0.8300	5.3900	2.5600	1.8000	116.0000
Ya-11 WHOLE	0.3420	3.9600	3.3600	1.0850	22.6000
Ya-16 FLOAT	0.4900	6.3200	4.8500	1.7500	21.9000
Ya-16 CLAY	1.0000	12.6900	4.0000	2.2500	34.7000
Ya-16 SINK	0.4963	12.7700	4.2700	2.5400	43.2000
Ya-16 WHOLE	0.9050	12.4700	4.5600	2.4800	36.1000

Table C-10.

Standard Deviation for Calculation of Bulk Trace Element Abundance from Separates Data

Sample	As	Ba	Br	Ca	Ce	Co
A2-3	11.82	838.06	39.32	63335.5	42.07	29.81
A2-7	10.98	497.29	25.32	64411.2	32.93	17.66
A2-9	0.08	491.3	58.59	73666.9	17.81	21.56
A2-11	31.96	1693.2	27.65		117.19	59.48
A2-14	0.35	692.26	59.30	96711.0	31.82	34.57
YA-3	18.02	3681.2	16.63		216.3	19.03
YA-5	11.82	1528.4	13.26	8483.1	100.42	19.54
YA-7	12.82	3811.5	27.57	17022.6	171.89	14.24
YA-9	14.48	1731.9	36.40	75723.4	57.63	14.30
YA-10	33.47	2895.9	6.38	95162.1	158.66	10.07
YA-11		1444.57	37.49	90011.14	52.56	57.05
YA-16	4.48	2660.5	31.58		251.50	11.88

Cr	Cs	Eu	Fe	Hf	La	Lu
49.46	2.34	1.00	13350.2	3.20	7.00	0.91
24.40	1.49	0.41	6004.1	2.09	9.50	2.67
19.47	0.08	0.23	3582.4	1.31	4.45	0.22
120.7	31.11	3.20	41928.9	17.81	52.50	1.475
27.78	1.77	1.09	4866.5	1.69	9.24	0.54
172.9	24.37	2.27	48033.6	11.59	102.17	1.37
41.39	2.53	2.24	13068.2	4.92	36.13	1.17
53.20	2.34	1.97	17432.3	3.62	82.20	0.75
88.79	3.73	1.04	12331.4	5.40	29.66	0.83
176.36	10.36	2.39	43711.7	10.42	66.06	1.35
86.38	3.74	1.61	14046	5.07	21.10	1.01
5.72	0.19	0.04	2912.4	0.49	1.02	0.02

Na	Nd	Rb	Sb	Sc	Se	Sm
882.7	59.25	0.56	14.97	7.70	20.64	4.28
1044.6	40.40	0.21	2.65	2.65	17.14	1.91
787.0	32.76	0.68	1.26	1.48	9.82	1.29
1335.2	117.19	364.45	12.06	21.61	23.78	9.10
1933.0	50.22	0.45	17.84	2.56	15.49	3.74
575.6	142.09	0.42	3.09	15.83	26.06	11.81
867.0	200.5	0.46	2.21	7.39	21.89	12.22
496.0	76.94	0.98	4.10	21.38	48.26	4.83
941.7	156.1	98.8	2.87	35.41	40.84	12.24
1441.5	97.23	1.47	0.22	26.13	35.70	7.58
41.51	0.99	1.34	0.18	1.06	0.41	0.19

Sr	Ta	Tb	Th	U	Yb	Zn
1690.0	1.12	1.56	4.89	9.04	5.21	79.57
1522.5	0.83	0.71	3.81	5.01	1.46	61.04
1025.9	0.69	0.48	2.55	3.84	1.17	120.19
1674.2	4.42	2.28	28.58	19.41	7.69	145.43
1729.5	1.09	2.31	22.67	3.16	59.48	60.60
2584.4	3.38	4.39	42.58	22.63	7.84	209.6
1377.9	1.48	2.18	14.22	12.67	7.43	116.9
4866.6	1.15	2.99	8.74	10.05	37.20	18.50
2026.39	1.35	1.67	11.75	15.70	4.40	14.92
3499.3	3.56	2.35	27.78	18.50	8.52	162.19
1746.01	1.10	1.77	13.23	19.97	6.17	122.57
2098.7	3.27	2.93	32.18	28.03	10.25	78.54

Table C-11

Calculated Kd Values for Float-Clay-Sink Separates

KD	As	Ba	Br	Ca	Ce	Co
A2-3 F/C		0.0142	0.3267		0.4836	0.9707
A2-7 F/C		0.0224	0.3855	1.2211	0.9504	0.7493
A2-9 F/C		0.0532		0.0278	0.2361	0.2751
A2-11 F/C		0.0346		0.0457	0.8127	0.6659
A2-14 F/C		0.7223	9.6667		0.7661	0.9025
YA-3 F/C	0.8842	0.4462	37.3214		0.3535	6.6051
YA-5 F/C	0.3379	0.2023	0.7288		0.2365	1.1058
YA-7 F/C		0.3085	0.4708		0.2622	0.9951
YA-9 F/C		0.4224	1.1200	0.0071	0.4771	0.9174
YA-10 F/C		0.7787			0.7323	1.1609
YA-11 F/C		o.1110	1.3636	0.0201	0.2250	1.2063
YA-16 F/C		0.4317			0.2765	1.0643
A2-3 S/C		2.8658	0.6222		0.5536	0.3108
A2-7 S/C		4.8025	4.6265		0.6720	0.3807
A2-9 S/C		1.1940		2.0218	0.7805	0.1433
A2-11 S/C		0.3929		3.2469	1.4476	0.1031
A2-14 S/C		1.0642	2.5333		0.8814	0.7405
YA-3 S/C	1.2632	0.9073	1.4286		1.0230	0.8241
YA-5 S/C	0.7034	0.8932	0.5085		0.9913	0.6549
YA-7 S/C		0.7747	0.4583	0.9743	0.6871	0.4926
YA-9 S/C		0.7063	0.8700	0.2696	0.7998	0.4688
YA-10 S/C		1.0664			1.0328	0.8477
YA-11 S/C		0.6223	0.4909	1.2196	0.8516	0.6301
YA-16 S/C		1.1852			0.9821	0.6881

Cr	Cs	Eu	Fe	Hf	La	Lu	Na
0.0656	0.0352	1.1667	0.0510	0.2456	0.4151	0.9294	
0.1971	0.0923	0.9589	0.1250	0.2647	1.0308	0.4325	
0.1722		0.5789	0.1132	0.3769	0.1102	0.8050	
0.2582	0.0250	1.0313	0.0848	0.3107	0.7589	1.0026	
0.8275	0.6179	0.5069	0.4481	2.0208	0.3410	0.6107	0.145
0.1563	0.3134	0.3196	0.2027	0.6892	0.2442	0.6400	0.428
0.2887	0.2371	0.0974	0.0973	0.5325	0.3271	0.1298	0.142
0.0698	0.0769	0.5854	0.1904	0.4681	0.6120	0.5429	0.173
0.4404	0.0614	0.5854	0.1904	0.4681	0.6120	0.5429	0.173
0.9512	0.7078	0.8099	0.9852	1.0537	0.7520	0.8030	0.839
0.7761	0.1304	0.2826	0.1464	0.5833	0.2195	0.7200	
1.1612	0.2230	0.3708	0.3463	1.4085	0.2905	0.7211	
0.5160	0.3248	0.5208	2.9371	3.3609	0.6906	1.0059	1.00
2.1916	1.3007	0.800	7.8241	3.0353	0.7740	1.9500	
0.6915	0.6333	0.8611	2.7823	1.0538	1.0386	0.7350	
1.7911	0.4750	1.2188	1.8925	0.4081	2.4473	1.0800	0.116
1.1351	0.6202	0.8932	1.5577	1.8042	0.8638	1.1051	
1.0530	0.9564	1.0690	1.3987	1.1039	1.0180	1.0071	0.509
0.4276	0.8802	1.0588	1.5031	1.4324	0.9819	1.0286	0.599
0.2521	0.5885	0.7934	0.8163	2.2222	0.6909	0.8083	0.728
0.9285	0.8795	0.8563	0.8857	1.1277	0.7822	1.0238	0.401
0.9903	0.8881	1.0864	1.6238	1.0738	1.0405	1.0121	0.452
0.9179	0.7391	0.8884	0.7956	1.6833	0.8759	1.2350	
0.9863	0.9244	1.0195	1.1980	1.0479	1.0219	0.9816	

Nd	Rb	Sb	Sc	Se	Sm	Sr	Ta
0.7041		1.1749	1.0667	0.2290	0.9718	1.6744	0.193
1.4011		0.6294	1.0620	0.4857	1.1605	1.1489	0.700
0.2536		0.9857	1.0578	0.5105	0.5388	0.4348	0.276
0.9292		1.0562	1.3541	0.2314	1.0656	0.8146	0.176
0.1323	0.6476	2.0278	0.7835	0.6471	0.8851	0.5993	1.389
0.3276	0.2909	2.6618	0.8250	0.8000	0.3843	0.3739	0.961
0.1975	0.4167	0.6980	0.8412	0.1331	0.2707	0.7006	0.157
0.1617		0.5900	0.4396	0.1985	0.1162	0.2756	0.503
0.4053		1.1191	0.6931	0.3263	0.5513	0.3401	0.348
0.7817	0.7886	1.1429	0.9667	2.0741	0.8144	0.8113	0.876
0.1960			0.7603	0.2735	0.2331	0.0272	0.604
0.2862	.2428	1.7414	0.9124	5.5556	0.3223	0.3706	0.675
0.5084		1.6535	0.4638	0.5409	1.5116	0.8393	0.641
		1.2353	0.6241	2.7638	0.7263	0.7747	1.167
0.8454		3.0286	0.6400	0.7902	0.8429	1.3333	0.396
1.3881		0.6792	0.5328	0.2886	1.2984	2.3006	0.140
0.7936	0.6571	1.7897	0.7773	0.8325	0.9511	0.3119	1.214
1.0314	0.9091	1.0882	1.0944	1.600	1.0362	0.8797	0.959
0.4763	1.3958	0.6020	0.9722	0.5540	1.000	2.8153	0.172
0.6614		0.4733	0.8011	0.5926	0.7537	0.7323	0.793
0.8306	0.7745	0.9511	0.6421	0.9519	1.3765	1.3089	0.881
1.0546	1.0091	1.000	1.0970	1.4074	1.0928	0.9208	1.027
0.8135	1.1789	0.7423	0.9467	0.5023	0.8675	0.7400	1.183
0.9337	0.9379		1.0193	2.111	1.0318	1.1399	1.01

Tb	Th	U	Yb	Zn
1.4091	0.4930	0.9231	1.0891	0.1119
0.9000	0.9055	1.7857	0.7947	0.0801
1.0000	1.0034	2.3333	0.7333	0.7852
0.9467	1.0077	0.9000	1.2714	0.1100
1.2069	0.8713	0.9625	0.9809	0.6363
0.6529	0.5677	1.4612	0.6522	5.0995
0.4286	0.4133	0.7961	0.7222	0.0776
0.0752	0.2718	0.3173	0.1156	0.1022
0.6694	0.4937	0.8789	0.5780	
0.7768	1.0068	1.0711	0.9418	1.2677
0.3929	0.6033	0.9341	0.6479	0.2276
0.4900	0.4980	1.2125	0.7778	0.6311
0.6409	0.8122	1.0385	1.0891	0.5526
0.1667	1.7808		1.8947	1.5569
0.9000	7.3793	4.0000	0.6917	10.0741
1.2600	0.2923		0.9548	7.5258
1.1724	0.9183	1.0625	1.0611	1.0604
1.2353	1.0220	1.0479	1.0652	1.5896
1.1161	0.9163	0.7573	1.1065	1.0290
0.7099	0.6482	0.9277	0.8186	0.9133
0.8806	0.9556	0.8008	1.0426	2.2466
0.9821	1.0753	1.0751	1.2434	1.2808
0.9765	0.8909	0.9377	1.2676	1.7957
0.4963	1.0063	1.0675	1.1288	1.2450

APPPENDIX D

DISTRIBUTION PROFILES FOR WHOLE COAL AND SEPARATES

ASH DISTRIBUTION
IN THE LEE RANCH P1 DRILL CORE

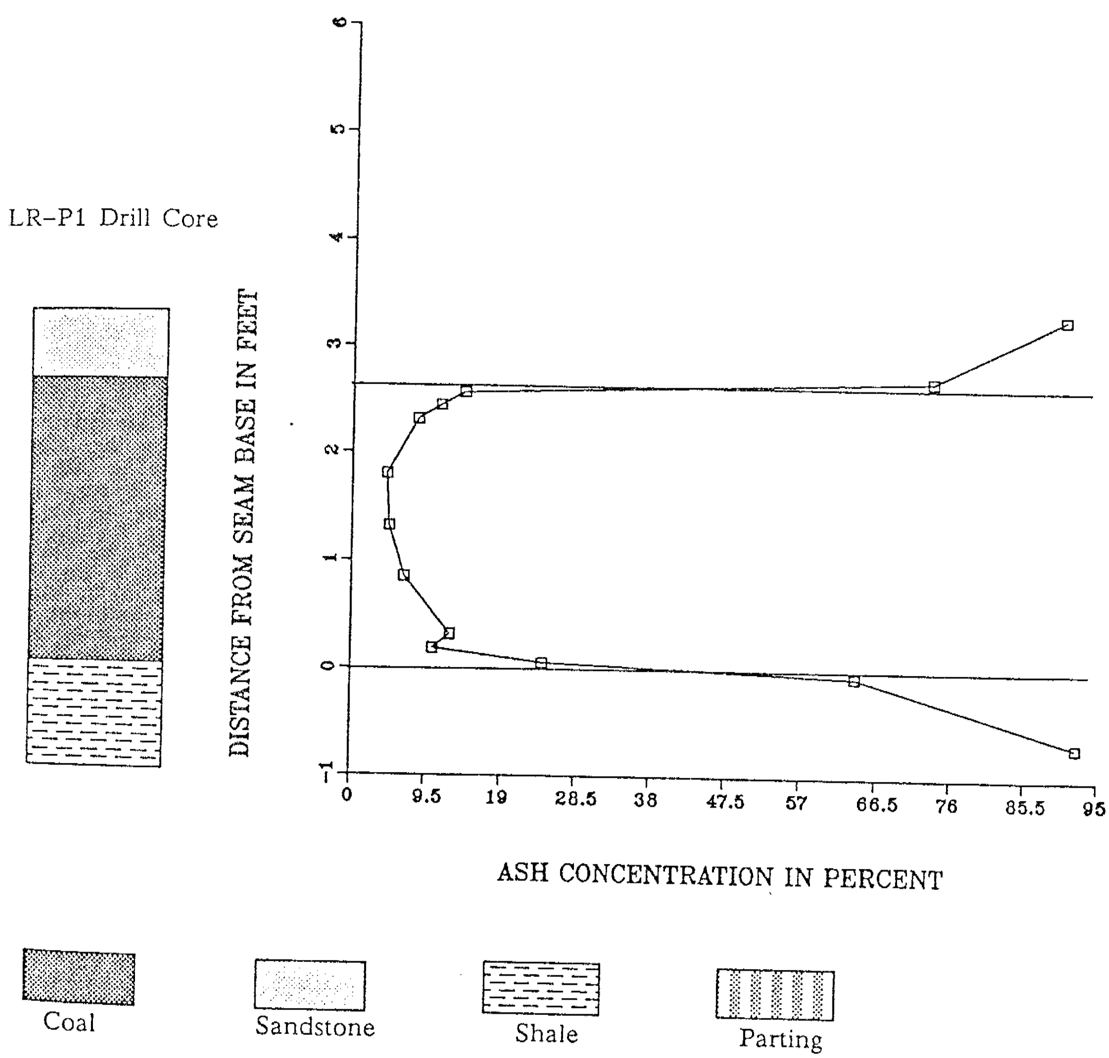


Figure D-1.

ASH DISTRIBUTION
IN THE LEE RANCH P2 DRILL CORE

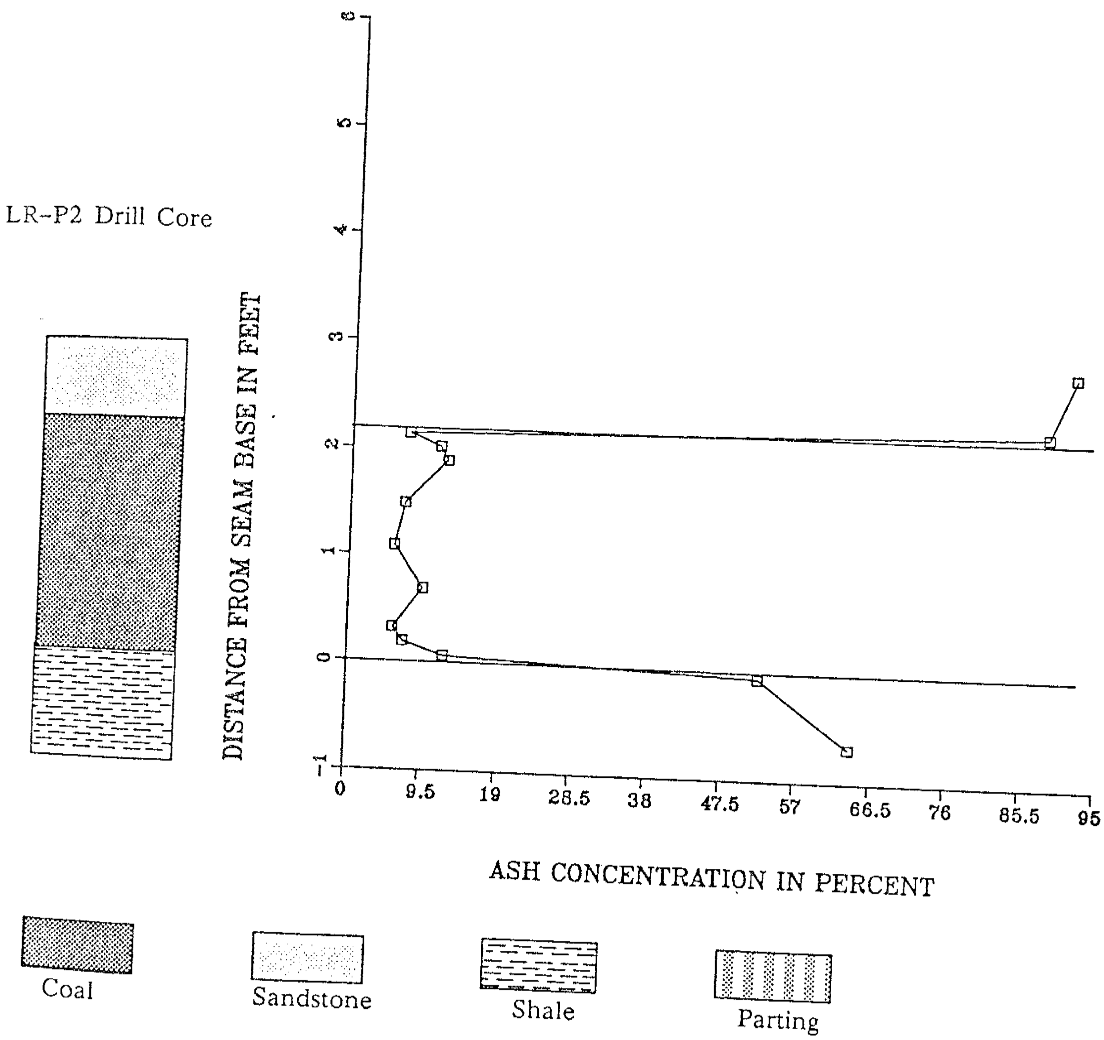


Figure D-2

ASH DISTRIBUTION
IN THE LEE RANCH A2 DRILL CORE

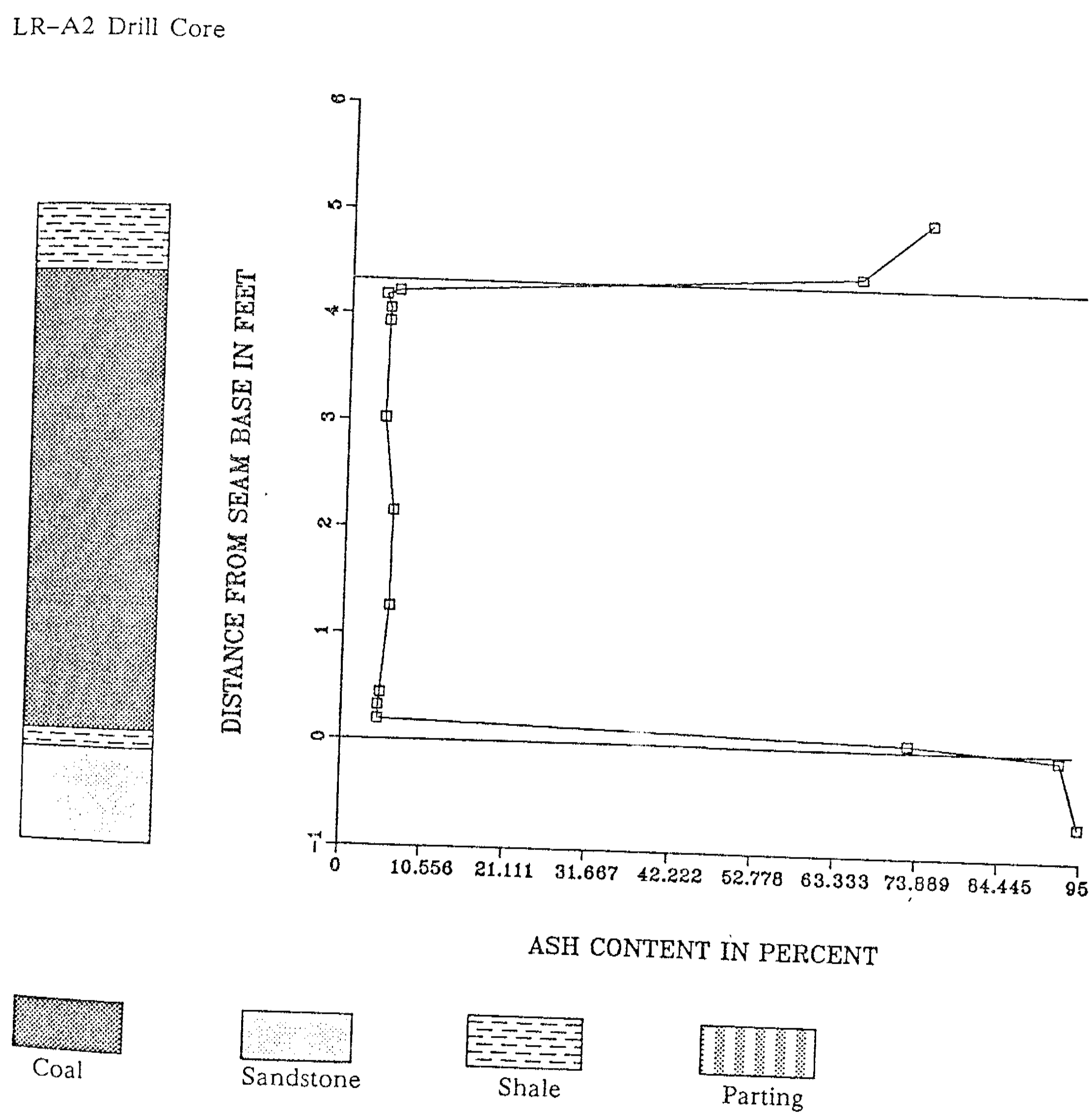


Figure D-3

ASH DISTRIBUTION
IN THE LEE RANCH A3 DRILL CORE

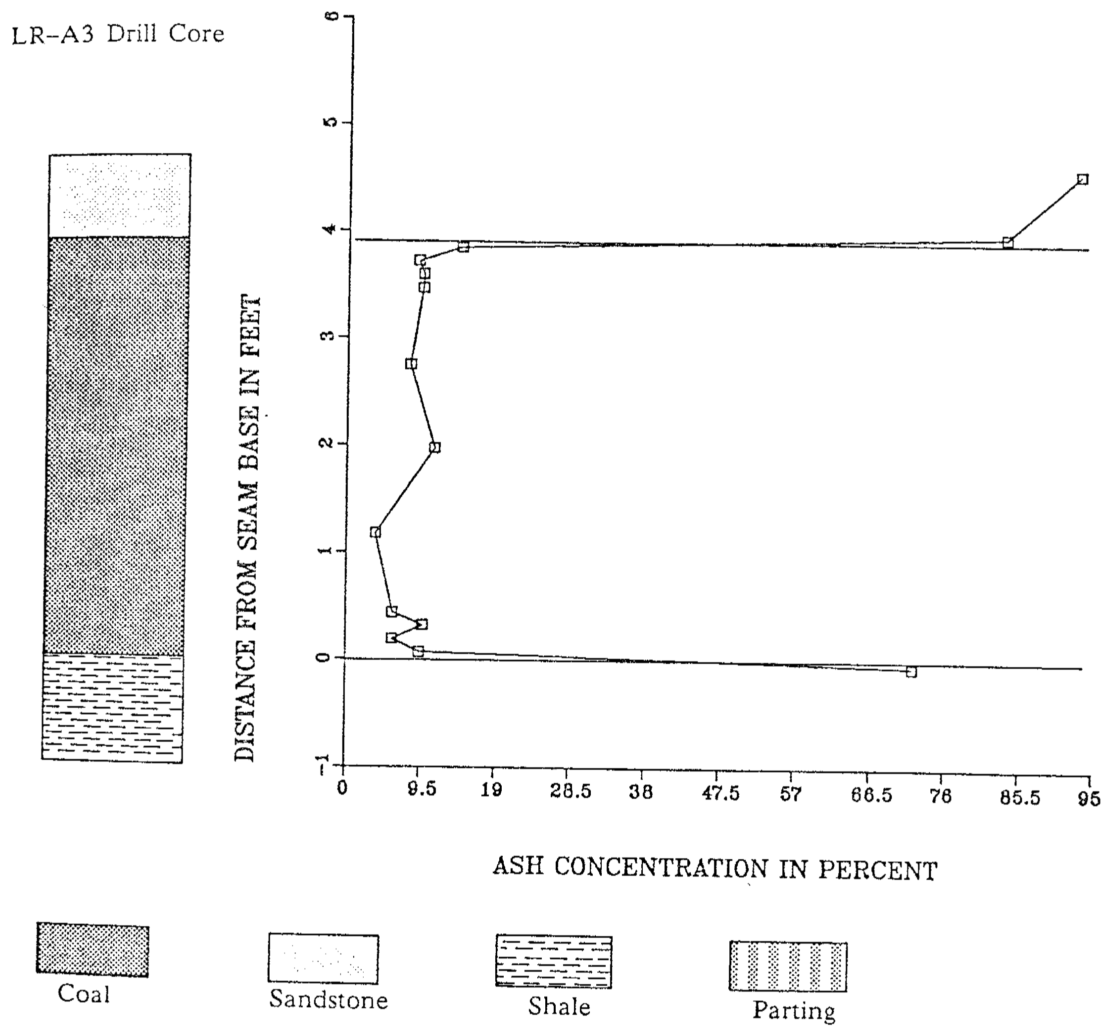


Figure D-4.

ASH DISTRIBUTION
IN THE LEE RANCH B2 DRILL CORE

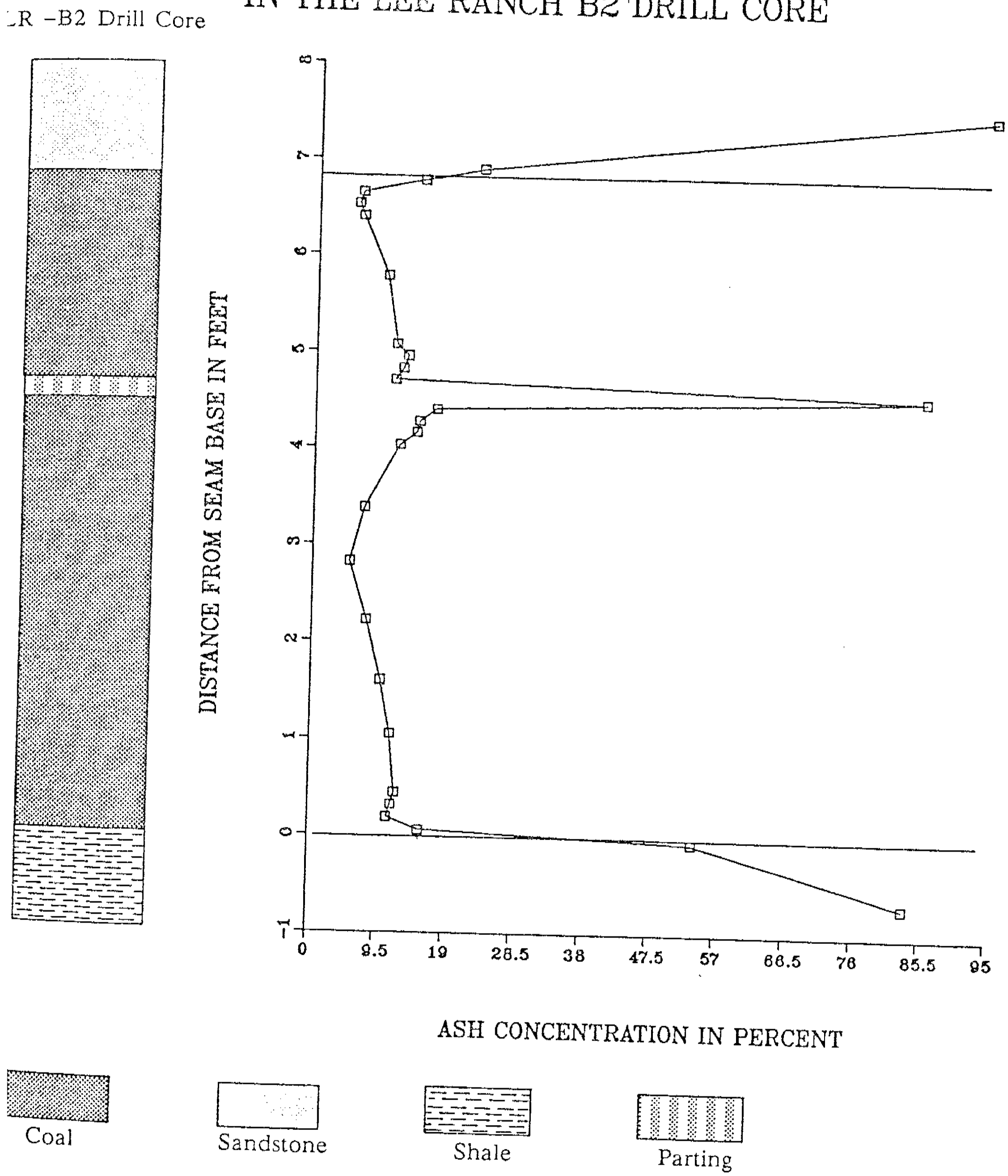


Figure D-5.

ASH CONTENT IN THE LEE RANCH B3 DRILL CORE

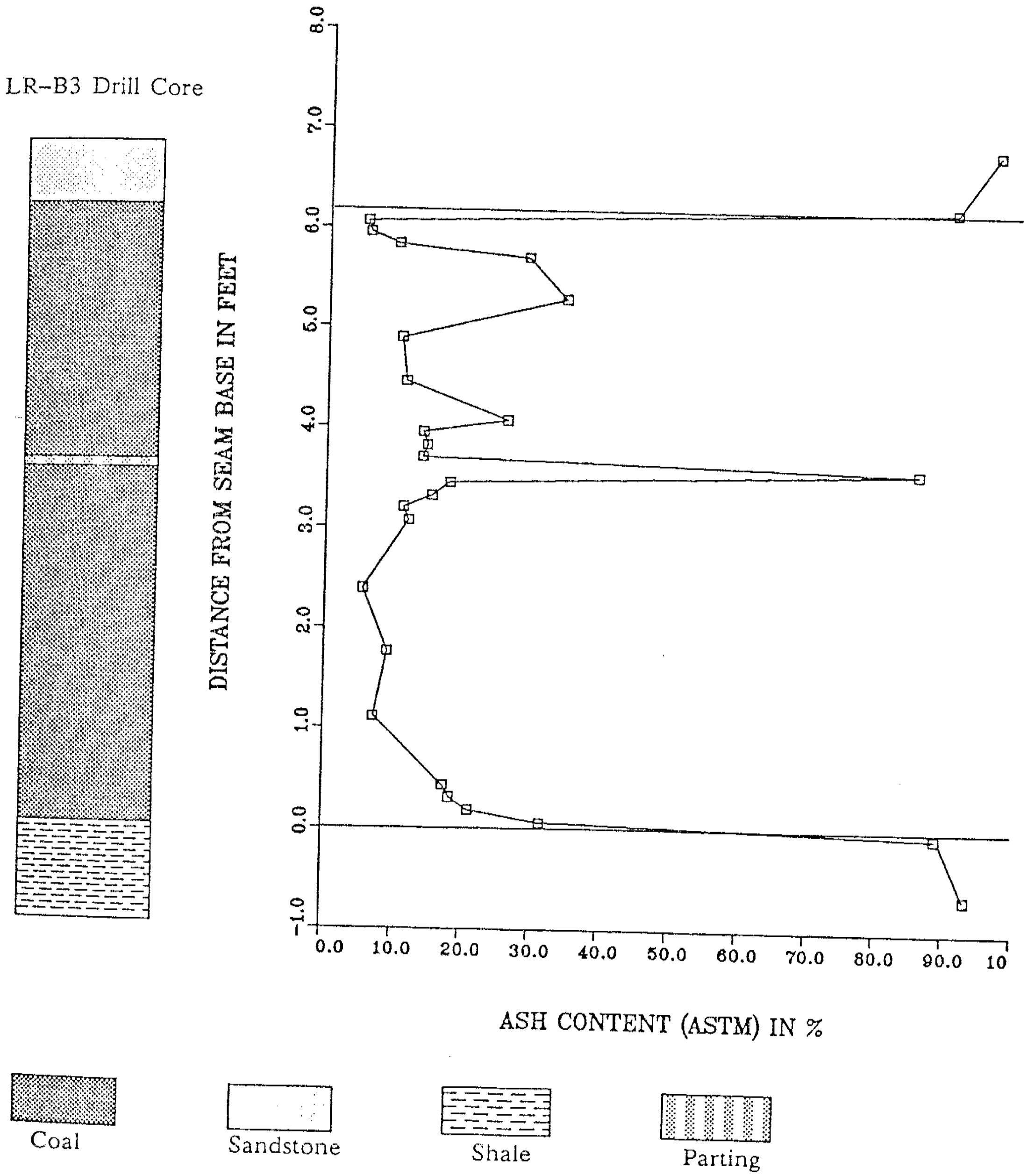


Figure D-6.

ASH DISTRIBUTION
IN THE YORK CANYON "A" AND "MAIN" SEAMS

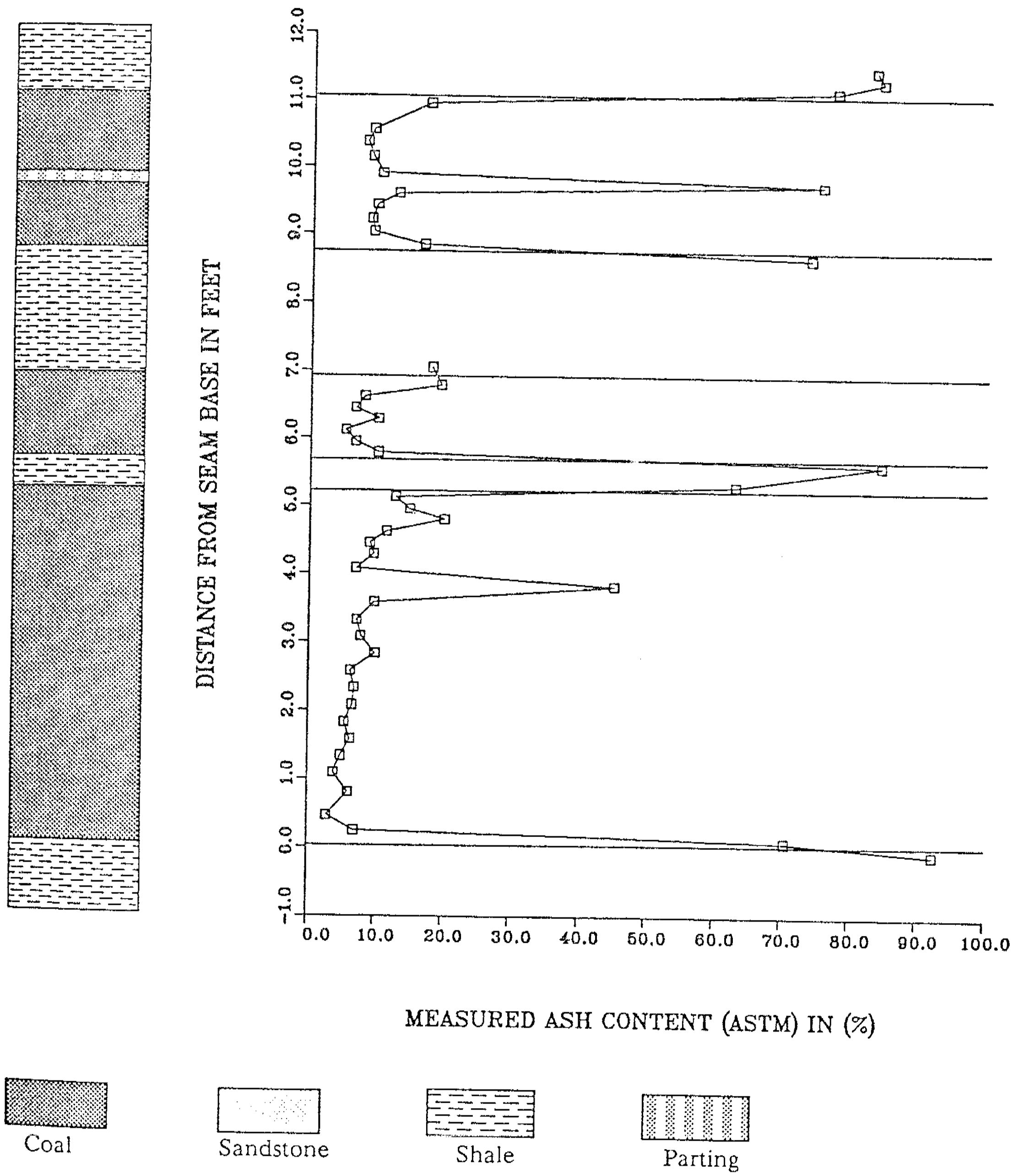


Figure D-7.

BROMINE DISTRIBUTION
IN THE LEE RANCH P1 DRILL CORE

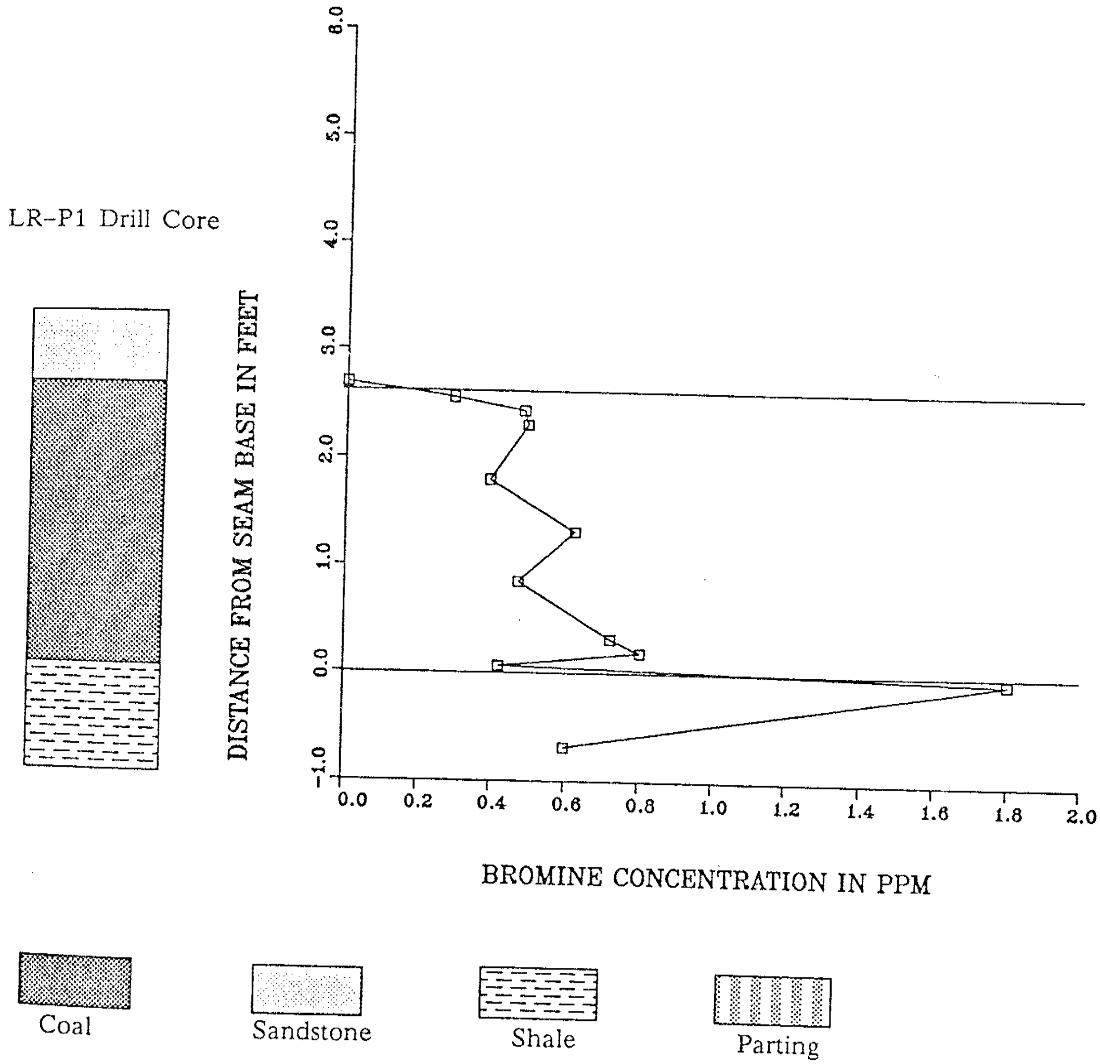


Figure D-8.

BROMINE DISTRIBUTION
IN THE LEE RANCH P2 DRILL CORE

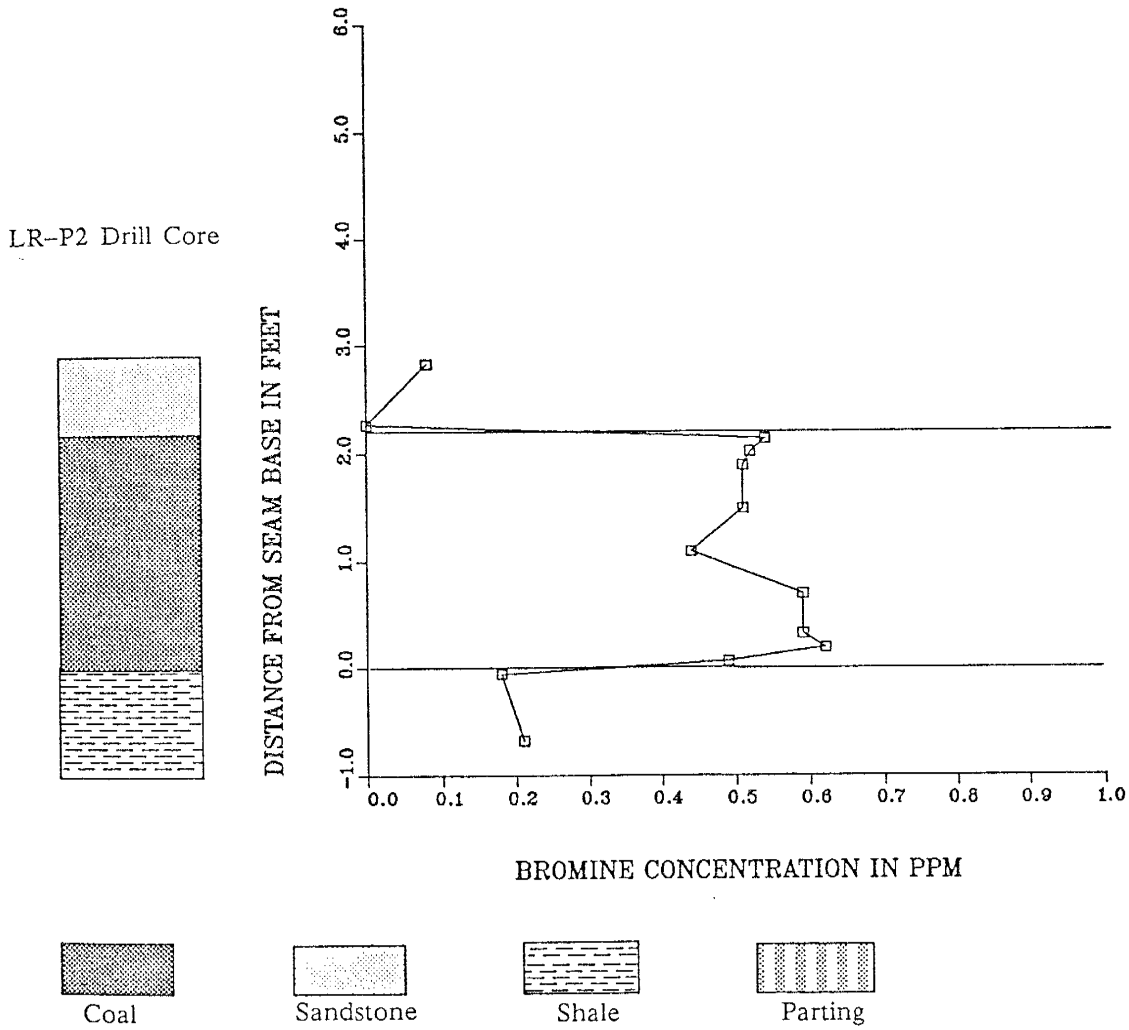


Figure D-9.

BROMINE DISTRIBUTION
IN THE LEE RANCH A2 DRILL CORE

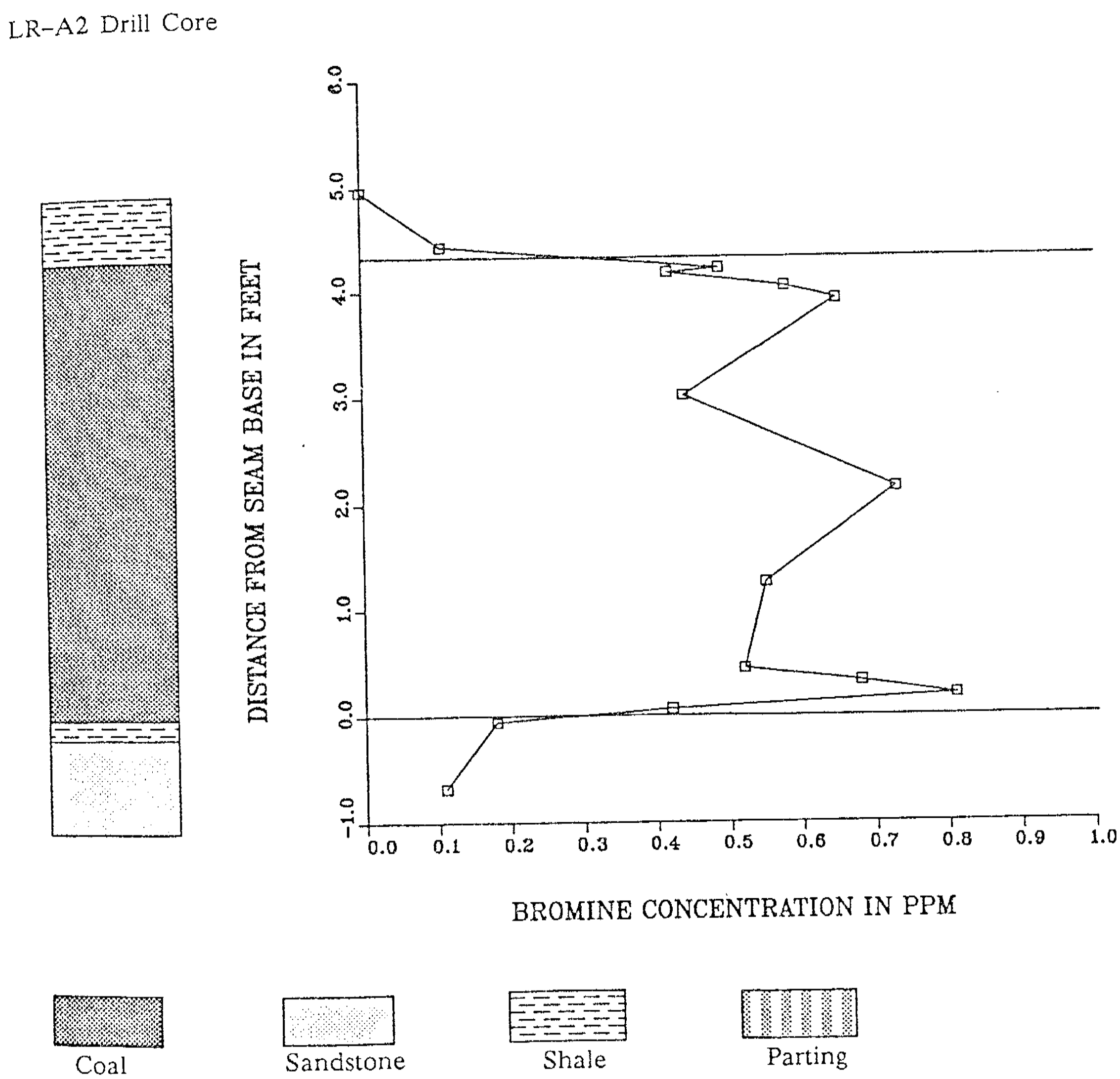


Figure D-10.

BROMINE DISTRIBUTION IN THE LEE RANCH B2 DRILL CORE

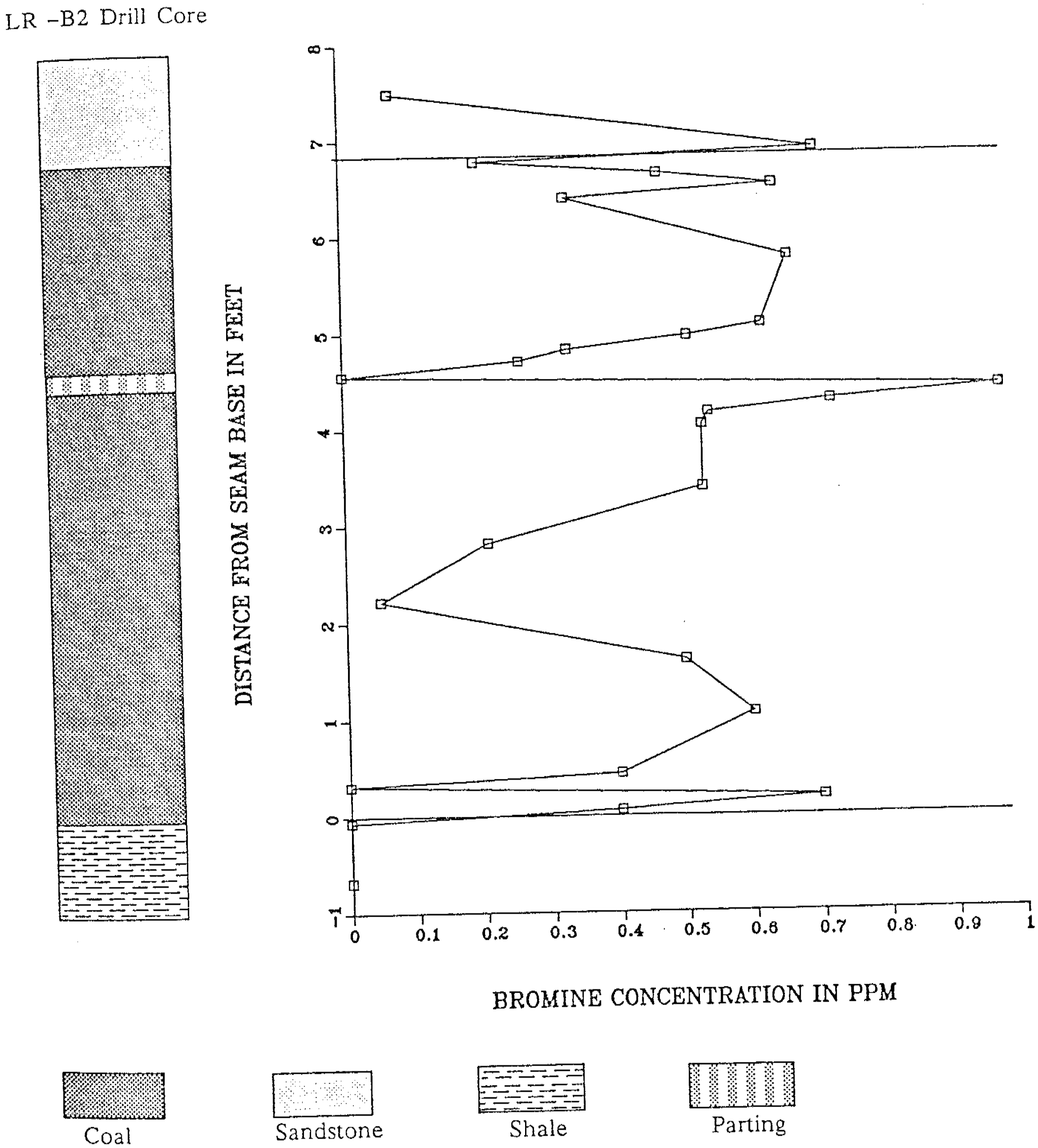


Figure D-11.

BROMINE DISTRIBUTION IN THE LEE RANCH B3 DRILL CORE

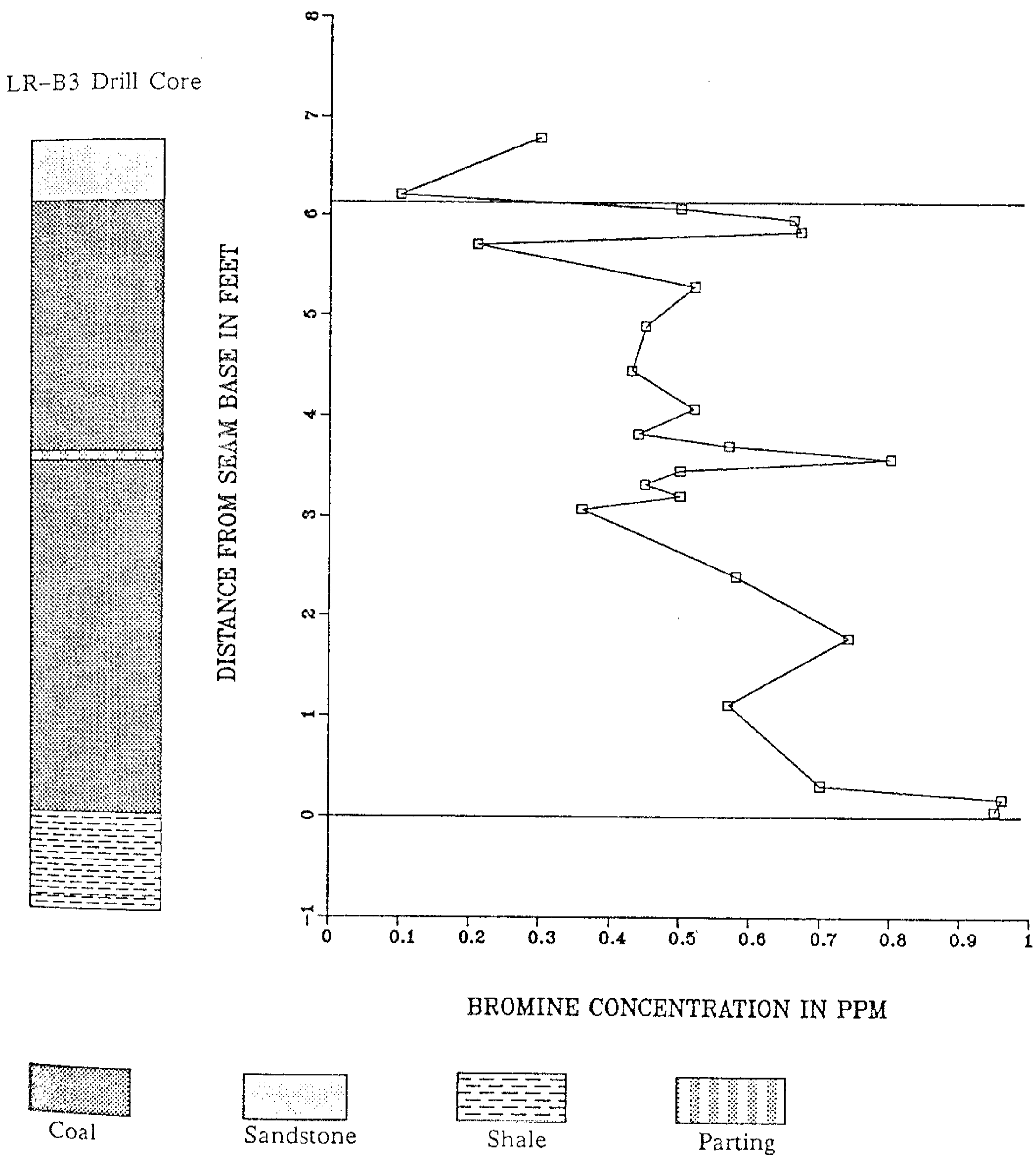


Figure D-12.

BROMINE DISTRIBUTION
IN THE YORK CANYON "A" AND "MAIN" SEAMS

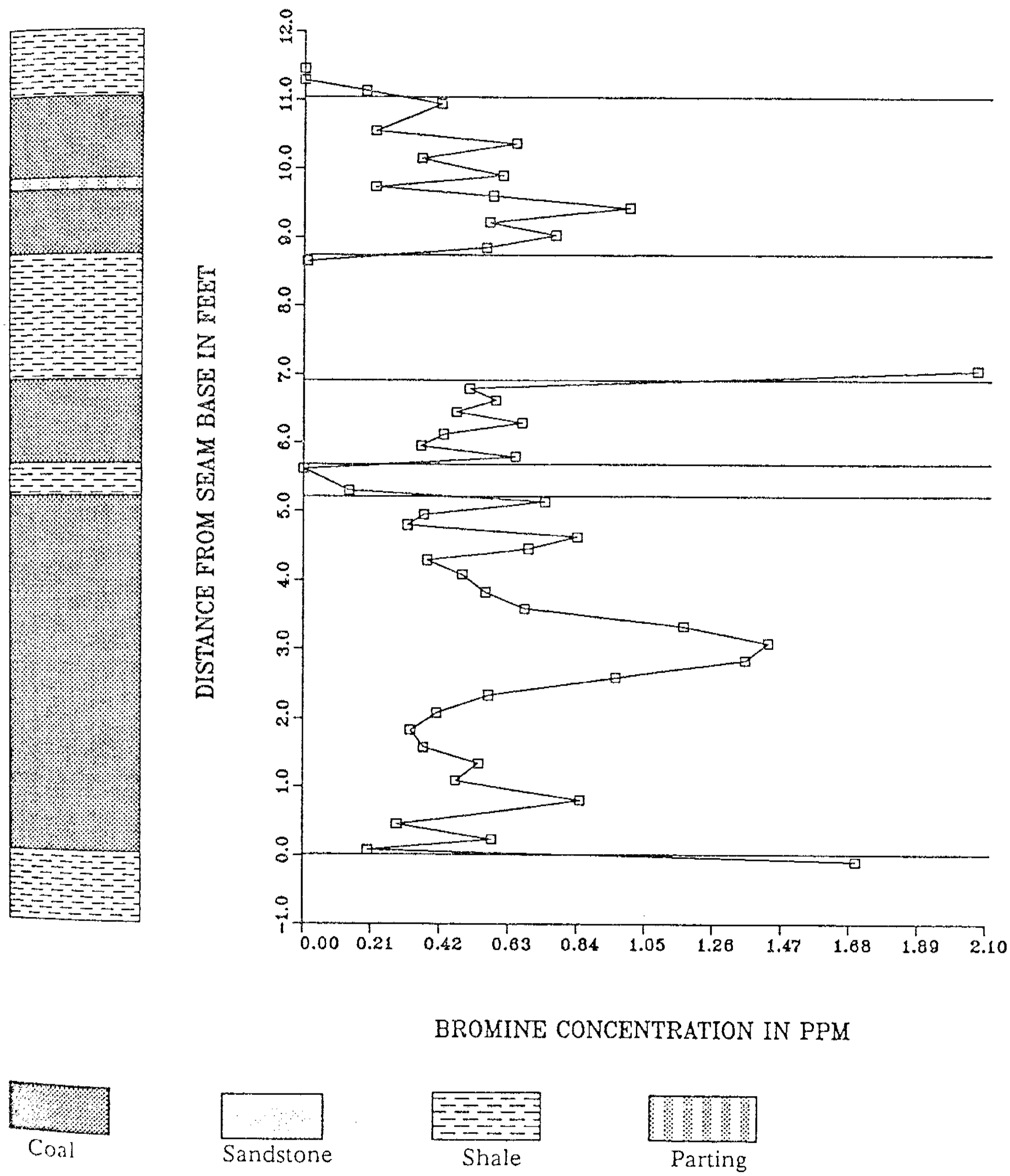


Figure D-13.

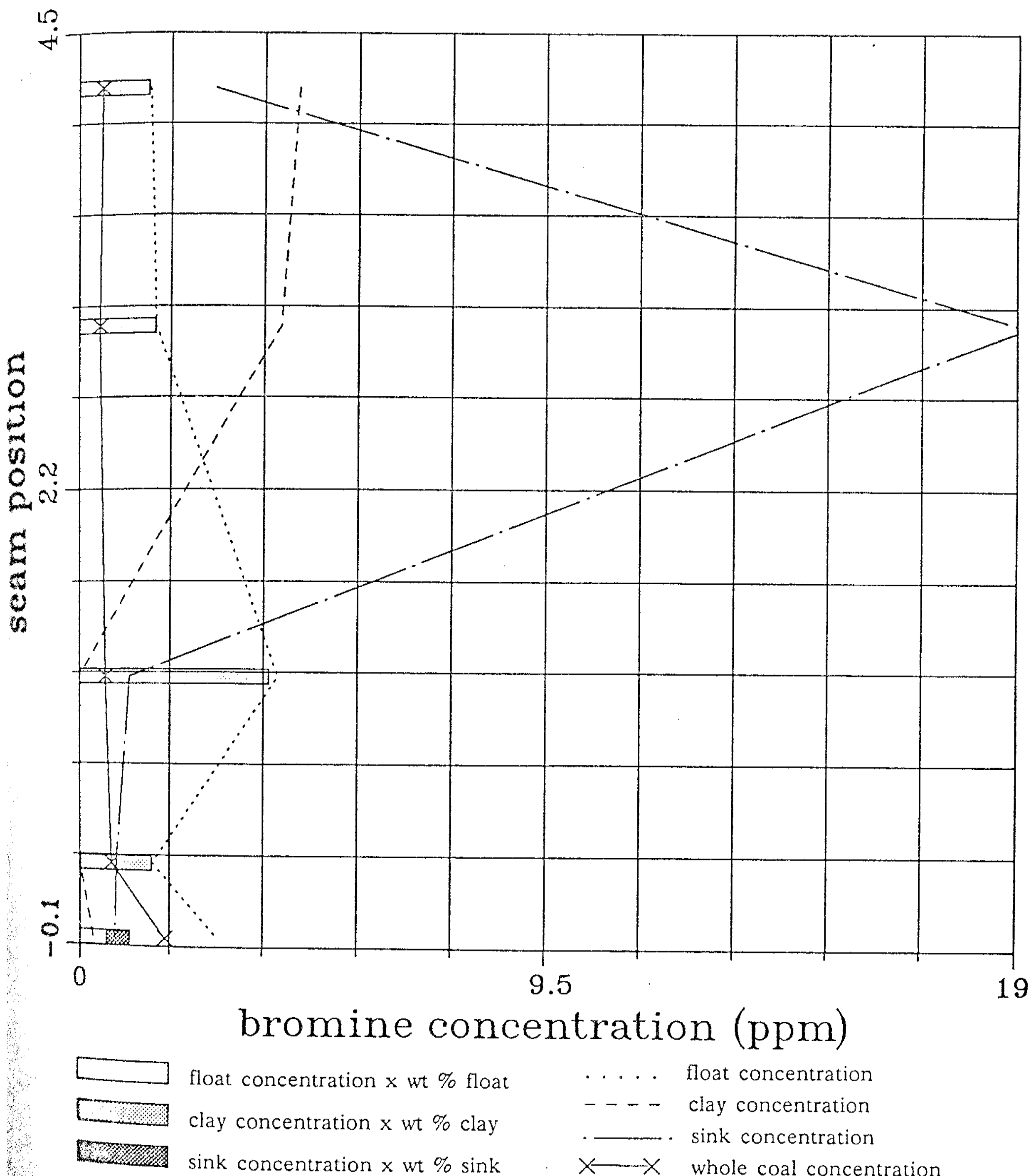


Figure D-14. Bromine float–clay–sink distributions in the LRA2 seam.

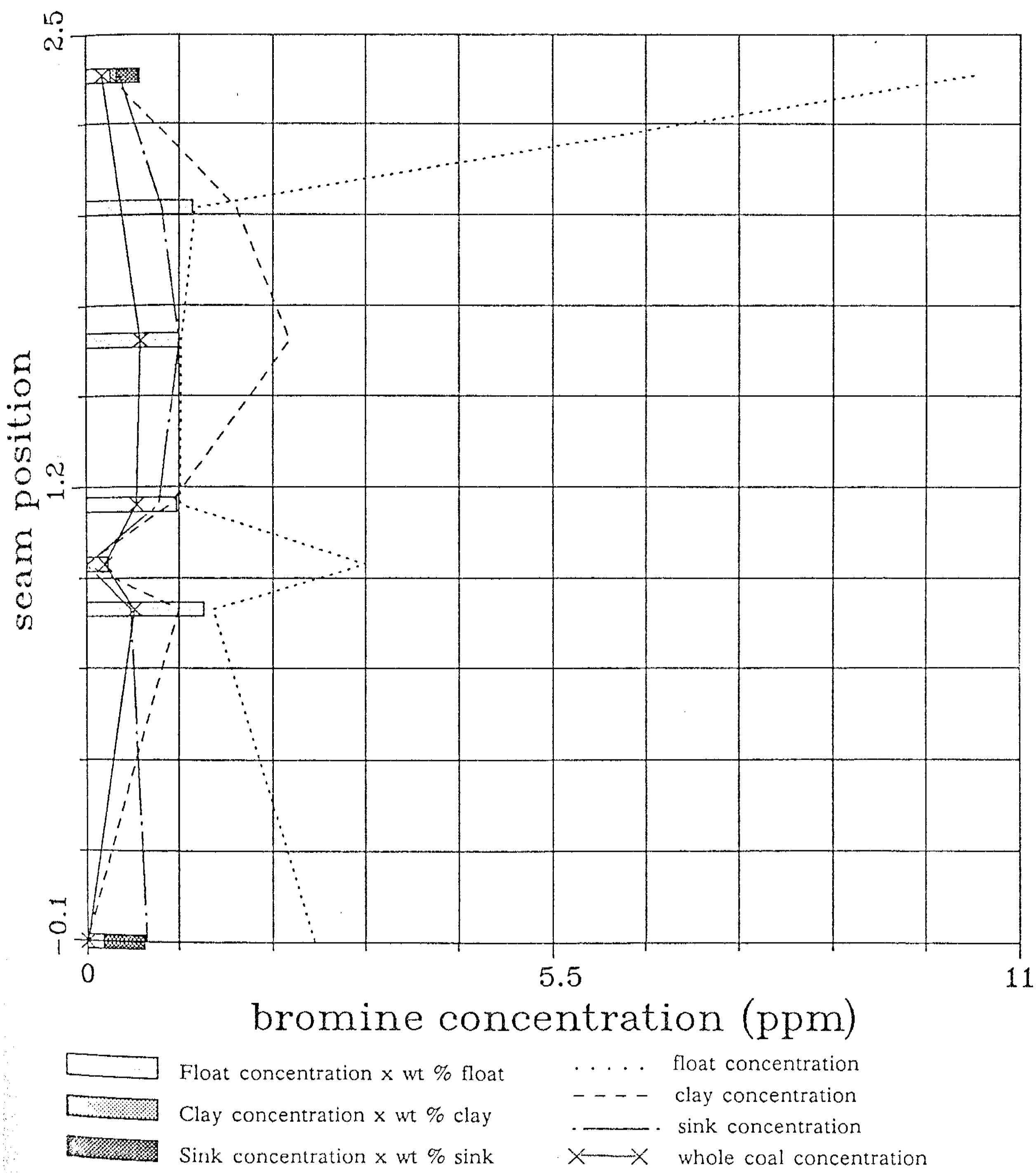


Figure D-15. Bromine float-clay-sink distributions in the YA seam.

SELENIUM DISTRIBUTION IN THE LEE RANCH P1 DRILL CORE

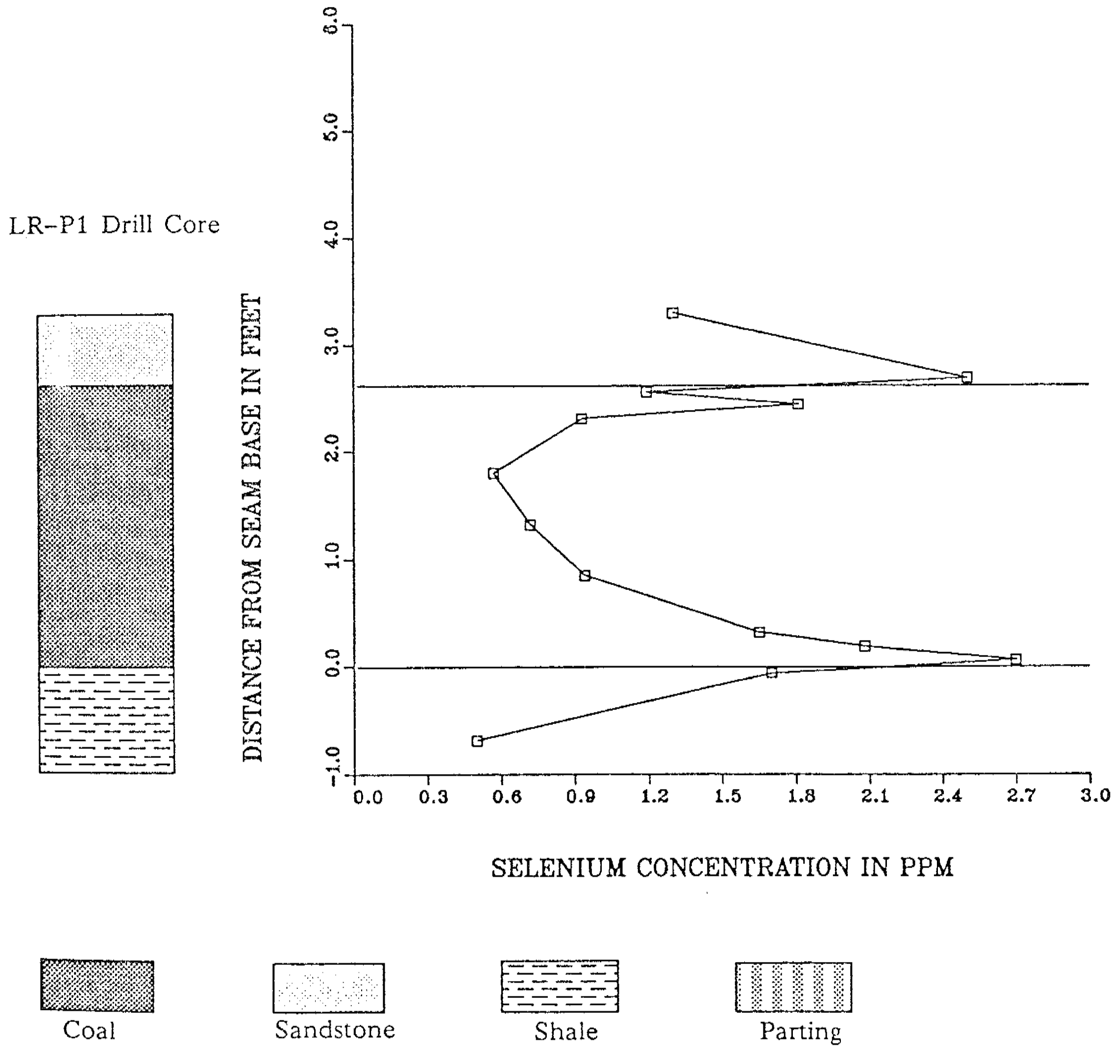


Figure D-16.

SELENIUM DISTRIBUTION
IN THE LEE RANCH P2 DRILL CORE

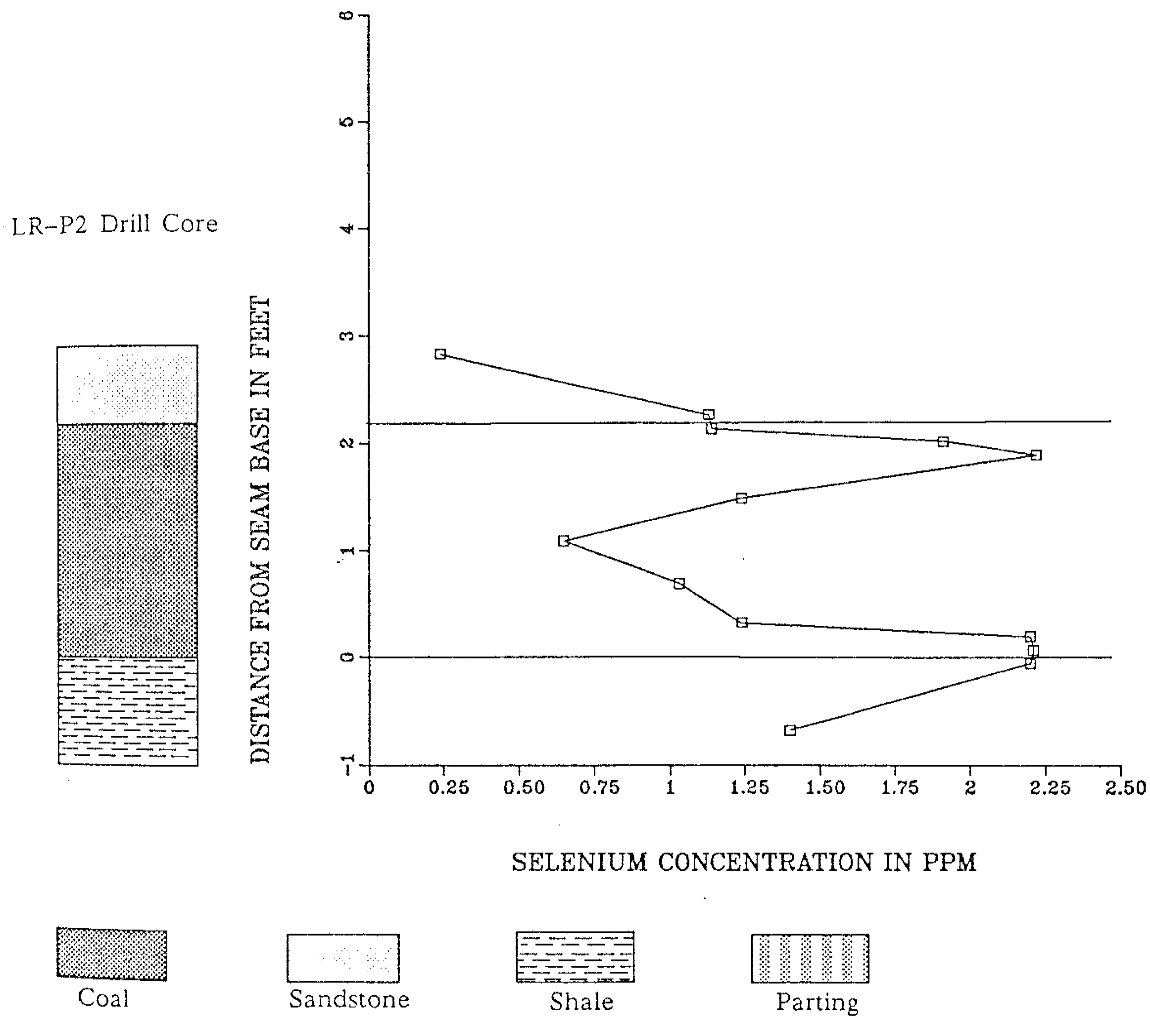


Figure D-17.

SELENIUM DISTRIBUTION
IN THE LEE RANCH A2 DRILL CORE

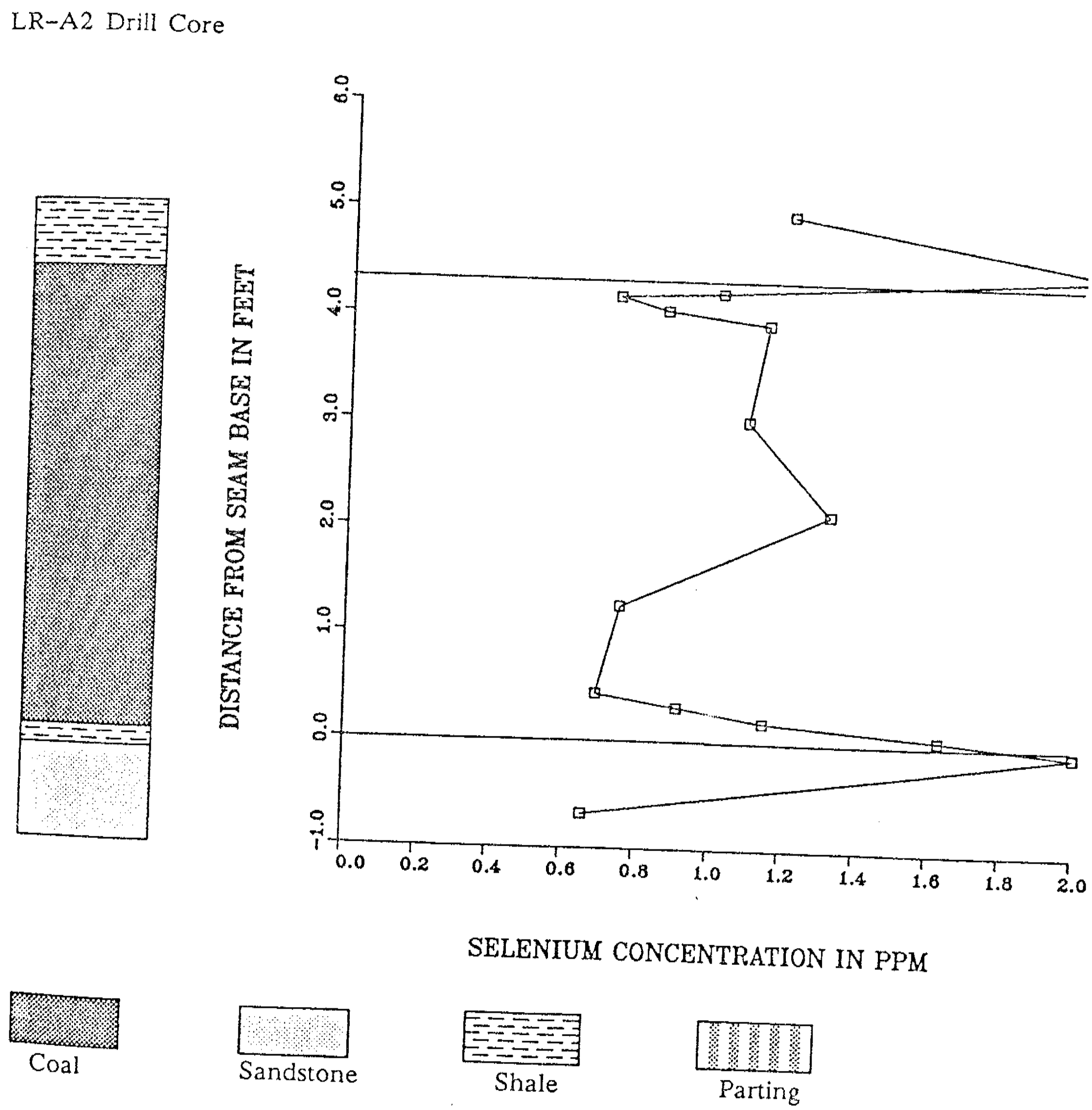


Figure D-18.

SELENIUM DISTRIBUTION IN THE LEE RANCH A3 DRILL CORE

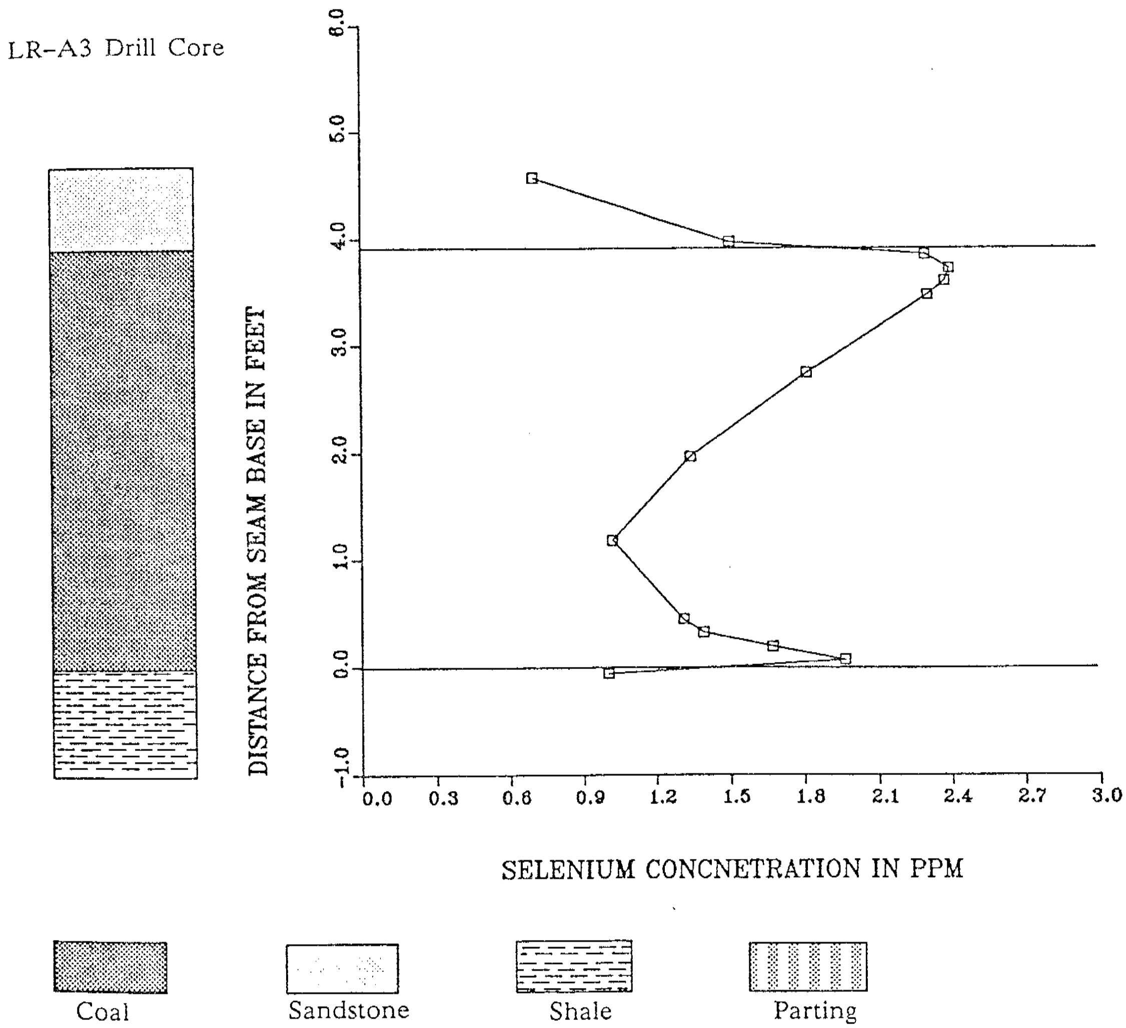


Figure D-19.

SELENIUM DISTRIBUTION
IN THE LEE RANCH B2 DRILL CORE

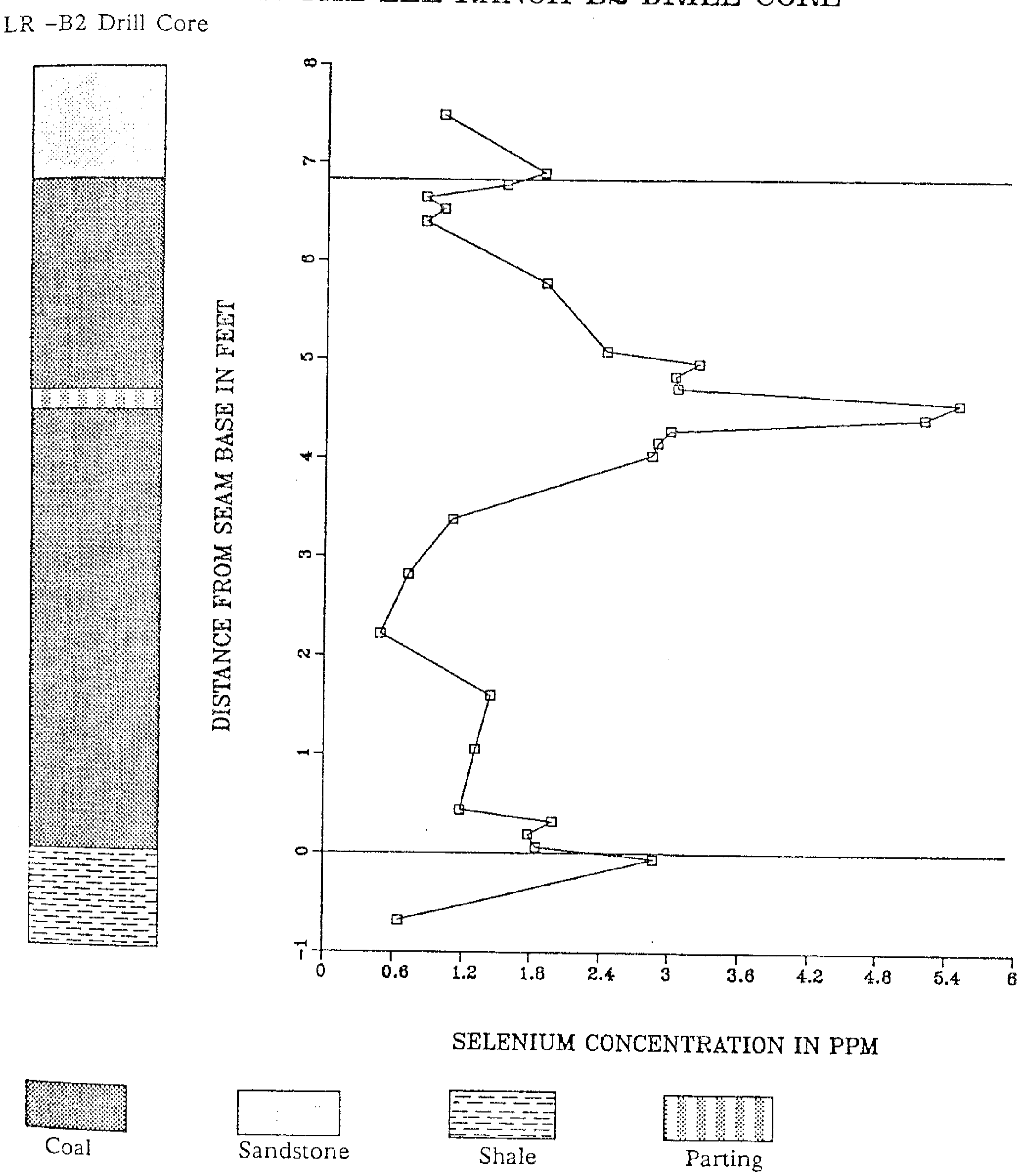


Figure D-20.

SELENIUM DISTRIBUTION IN THE LEE RANCH B3 DRILL CORE

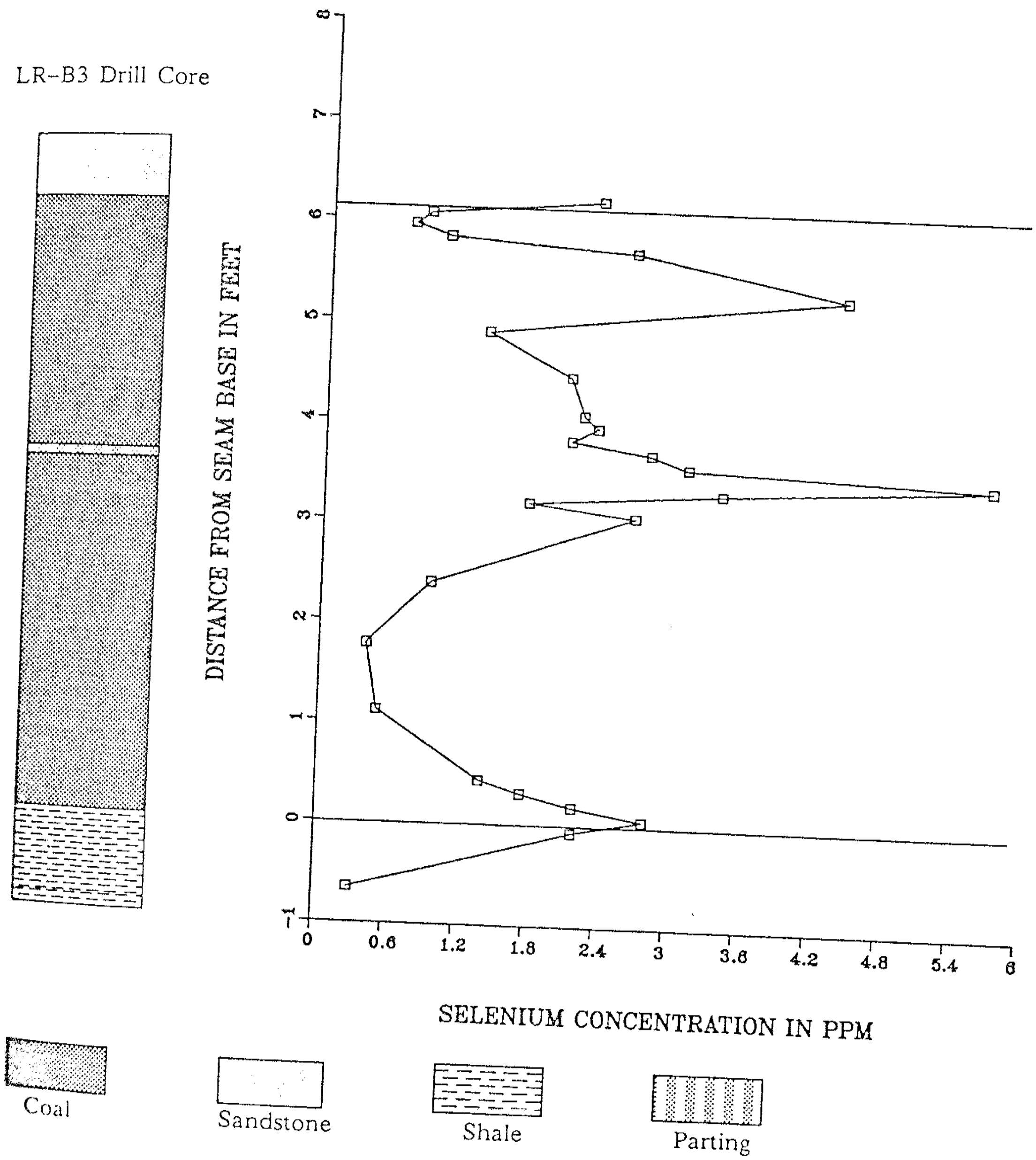


Figure D-21.

SELENIUM DISTRIBUTION IN THE YORK CANYON "A" AND "MAIN" SEAMS

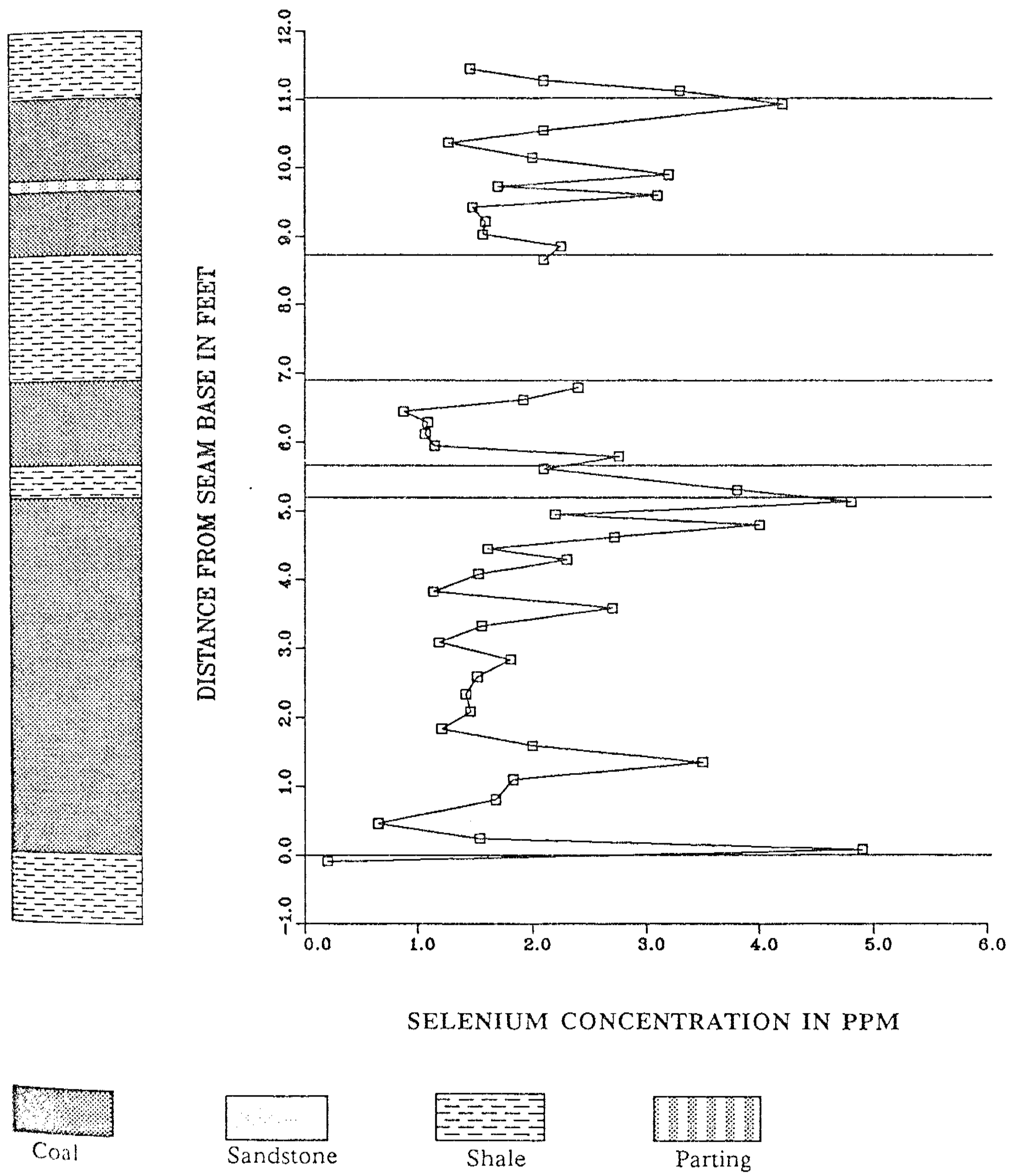
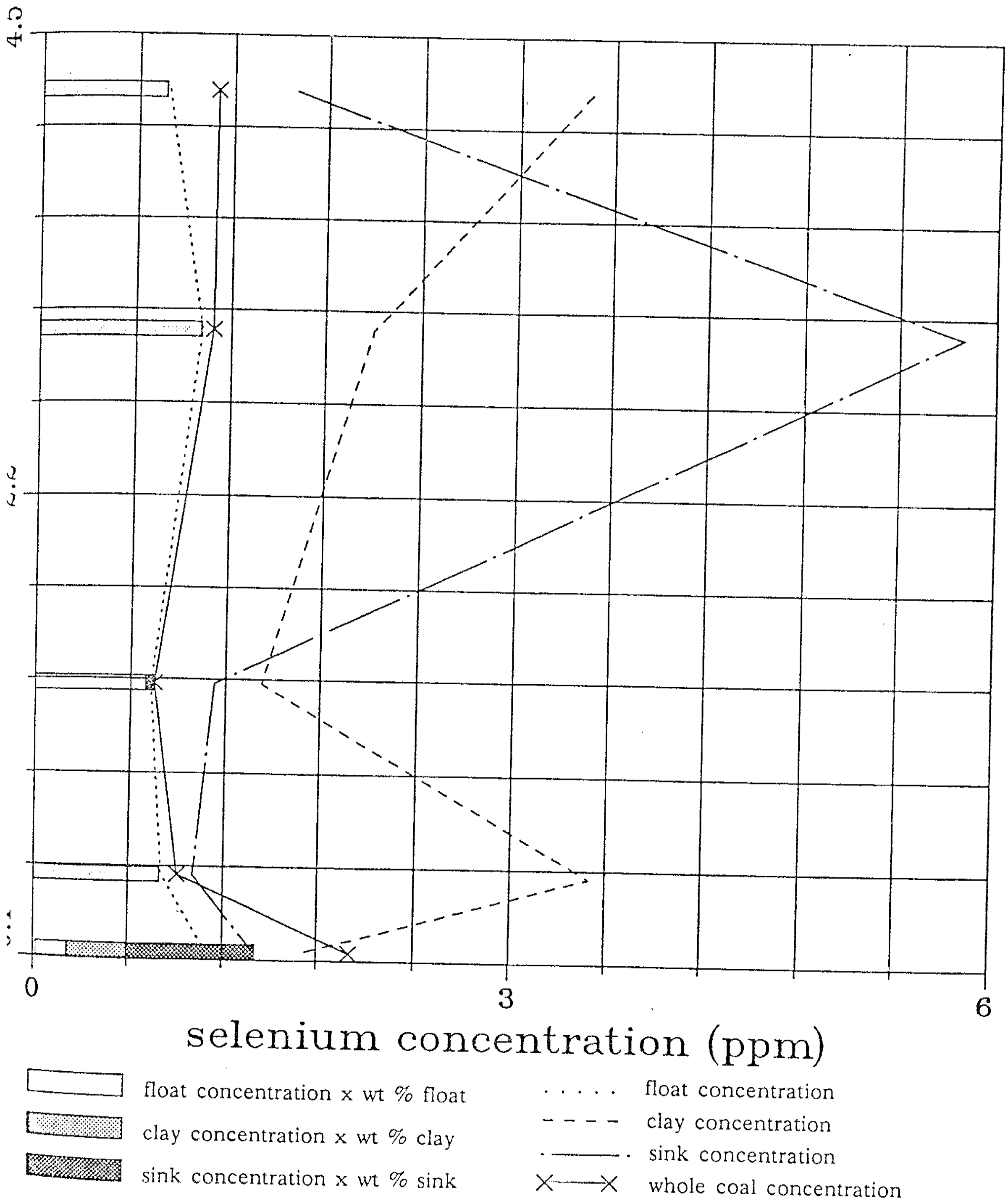


Figure D-22.



igure D-23. Selenium float-clay-sink distributions for the LRA2 seam.

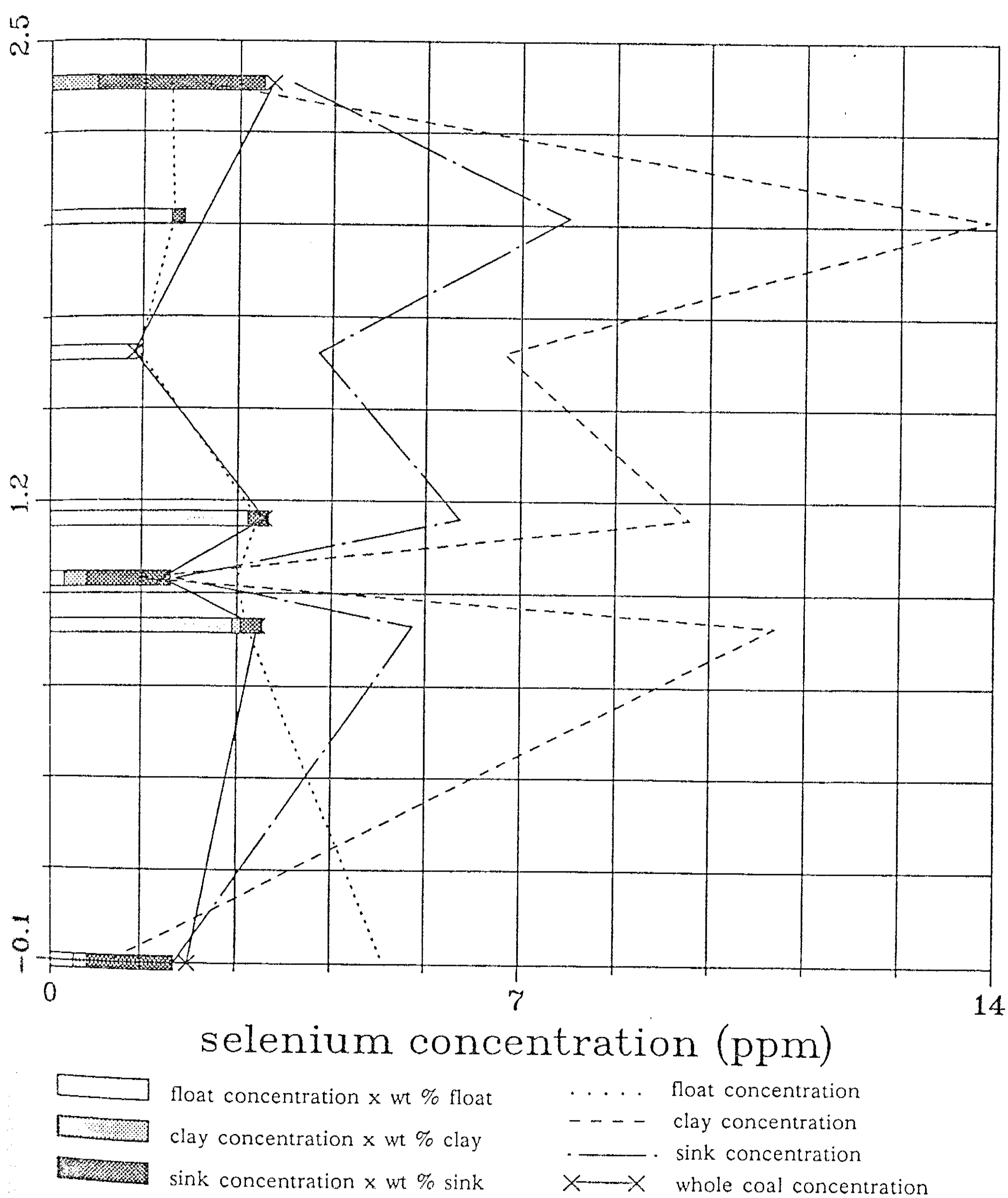


Figure D-24. Selenium float–clay–sink diatributions for the YA seam.

SULFUR DISTRIBUTION
IN THE LEE RANCH P1 DRILL CORE

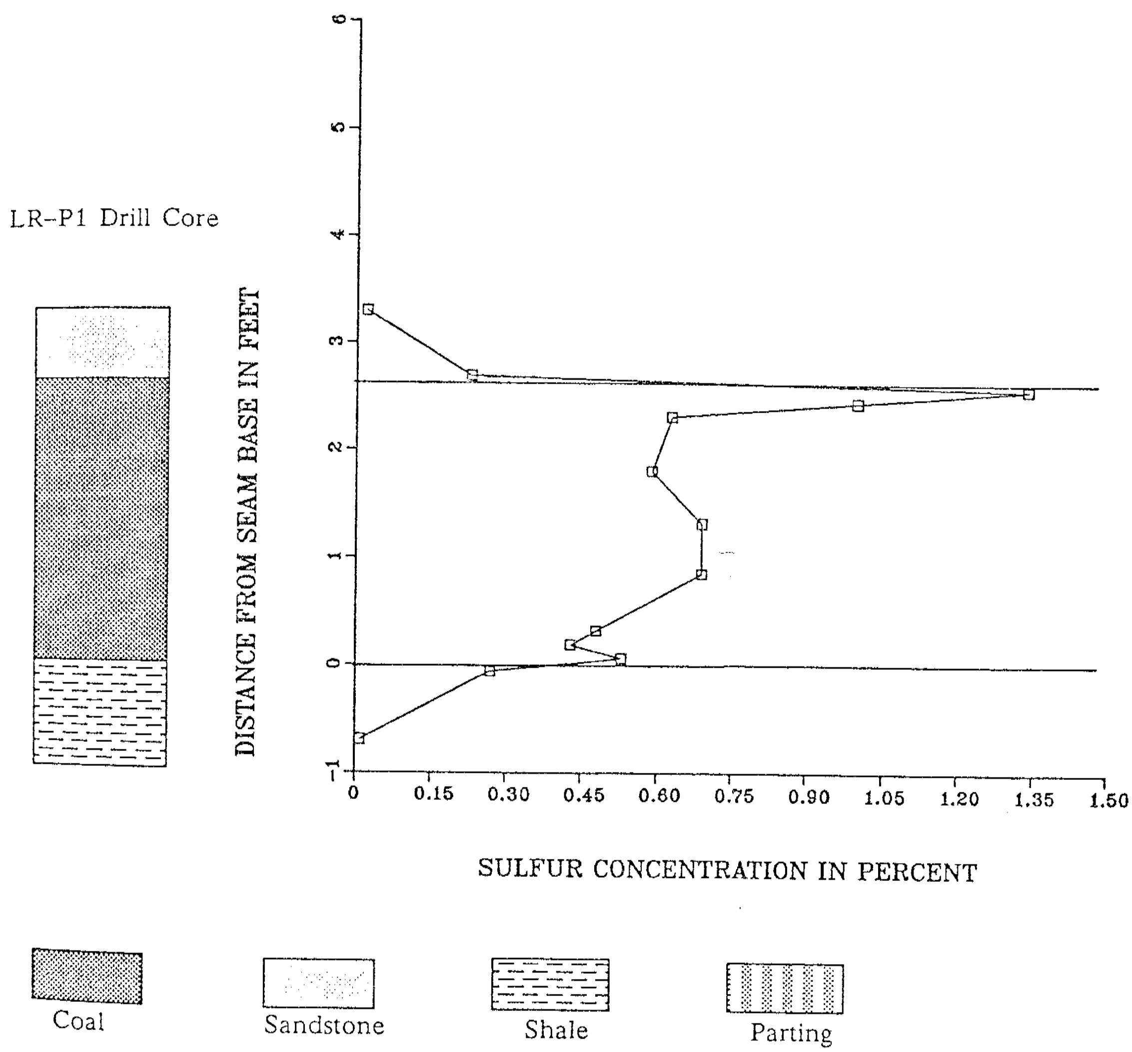


Figure D-25.

SULFUR DISTRIBUTION
IN THE LEE RANCH P2 DRILL CORE

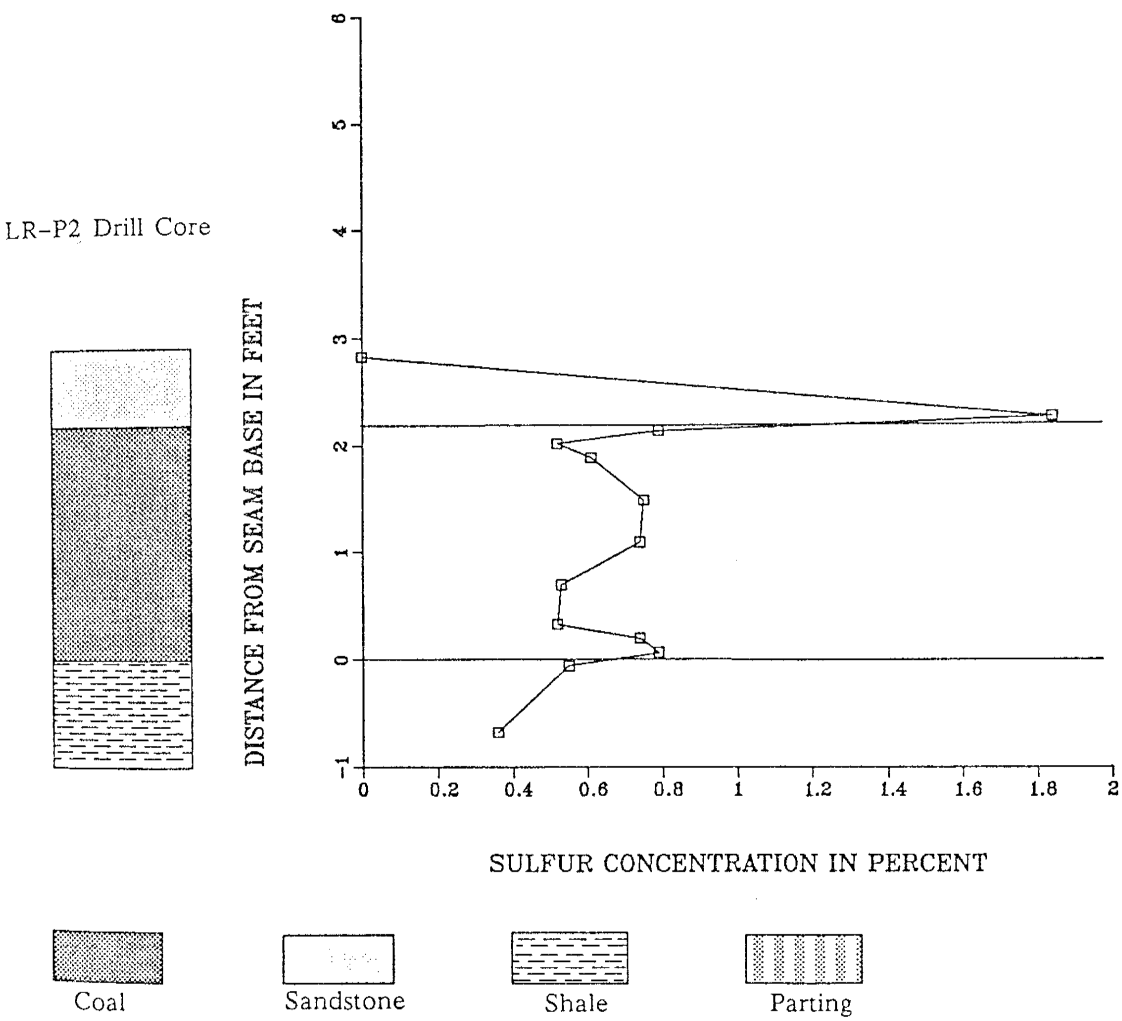


Figure D-26.

SULFUR DISTRIBUTION
IN THE LEE RANCH A2 DRILL CORE

LR-A2 Drill Core

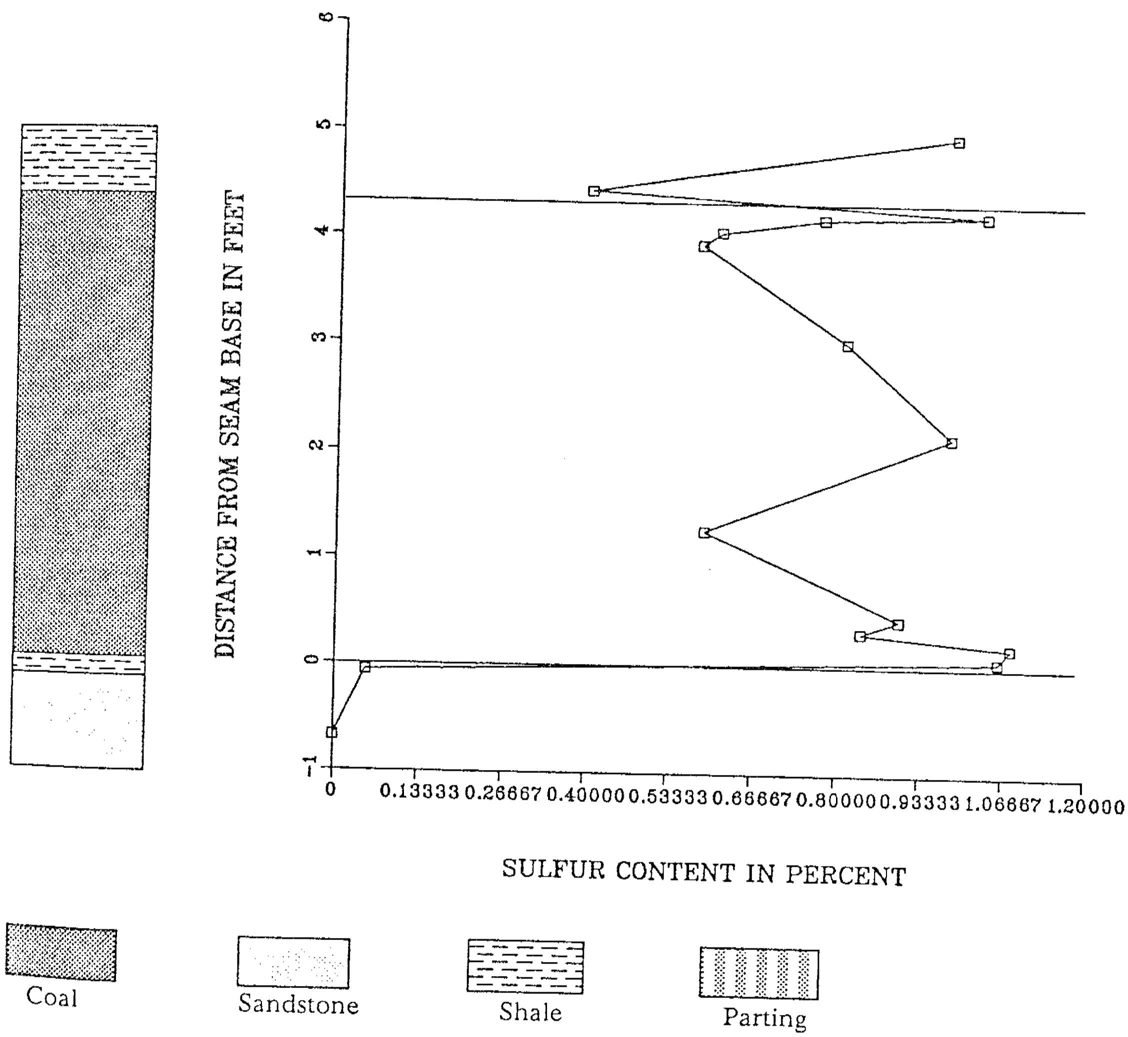


Figure D-27.

SULFUR DISTRIBUTION
IN THE LEE RANCH A3 DRILL CORE

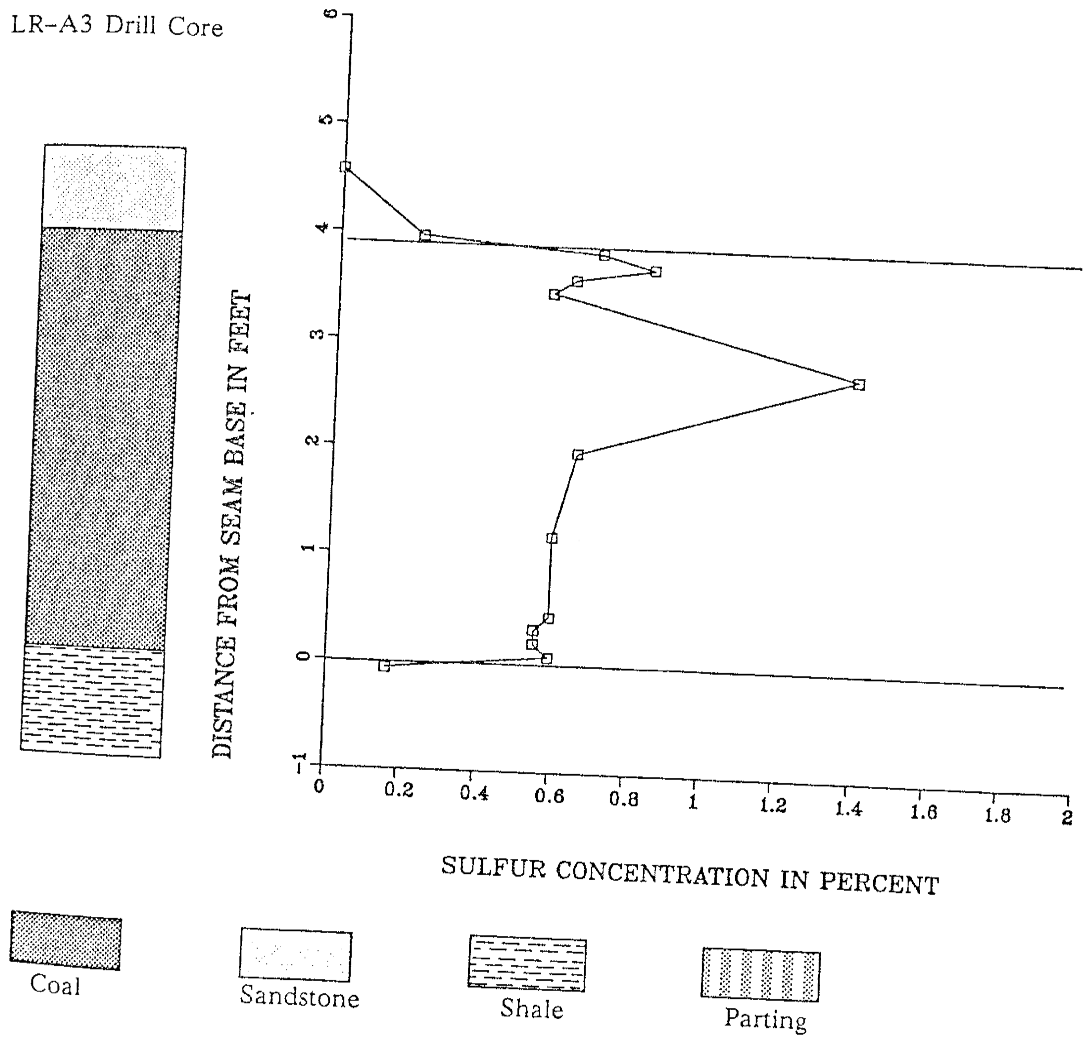


Figure D-28.

SULFUR DISTRIBUTION
IN THE LEE RANCH B2 DRILL CORE

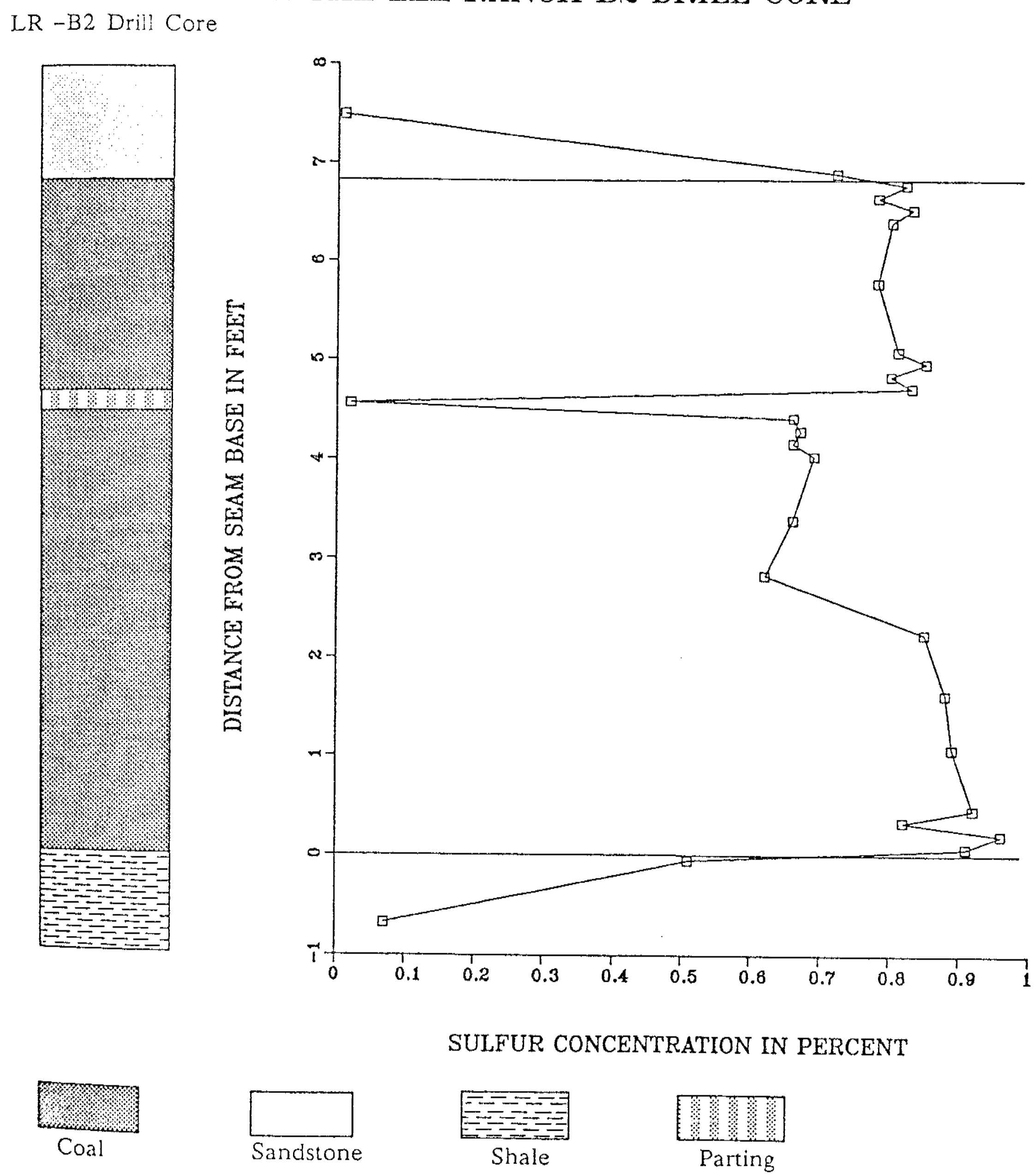


Figure D-29.

SULFUR DISTRIBUTION
IN THE LEE RANCH B3 DRILL CORE

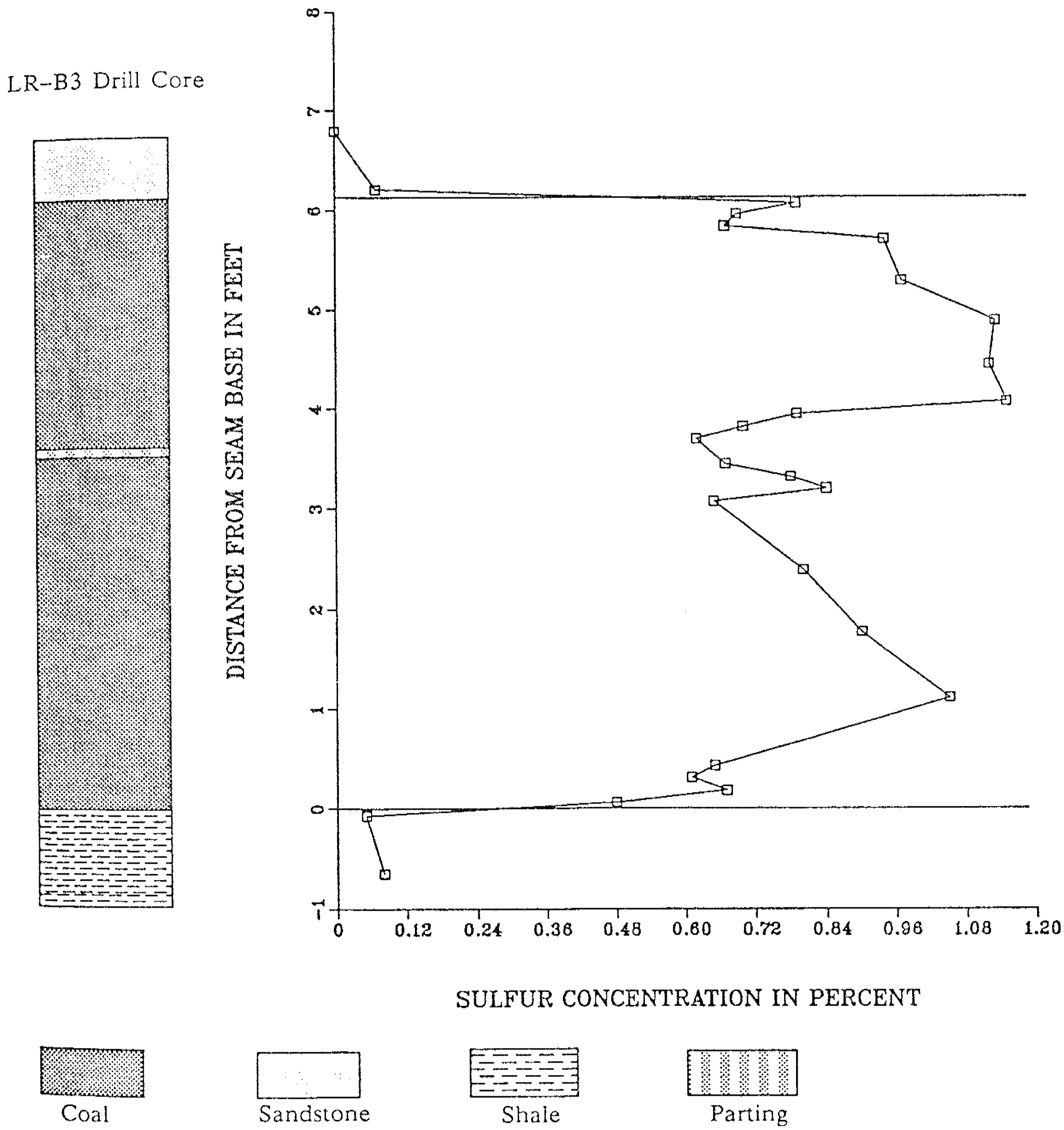


Figure D-30.

TOTAL SULFUR DISTRIBUTION

IN THE YORK CANYON "A" AND "MAIN" SEAMS

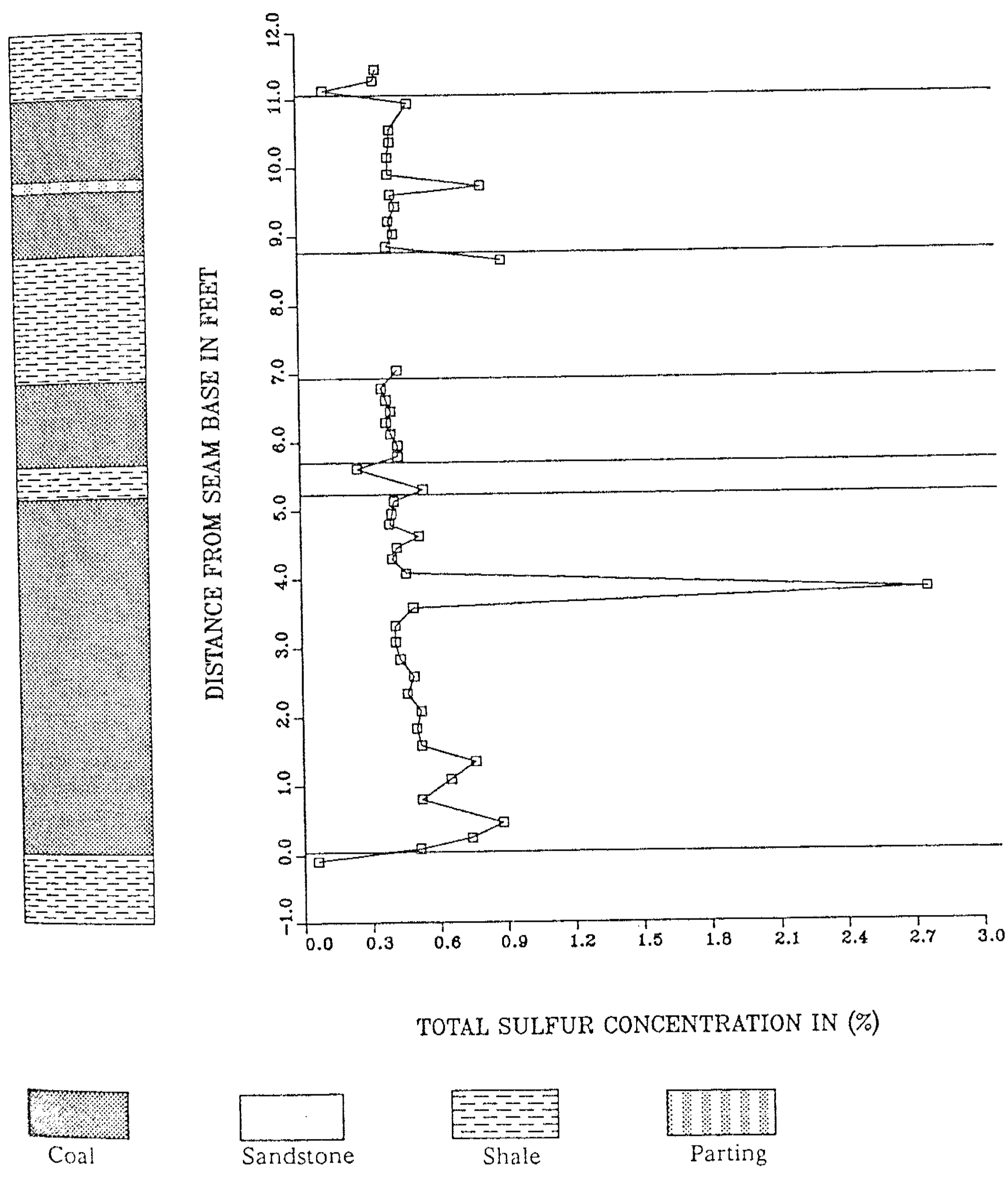


Figure D-31.

SODIUM DISTRIBUTION IN THE LEE RANCH P1 DRILL CORE

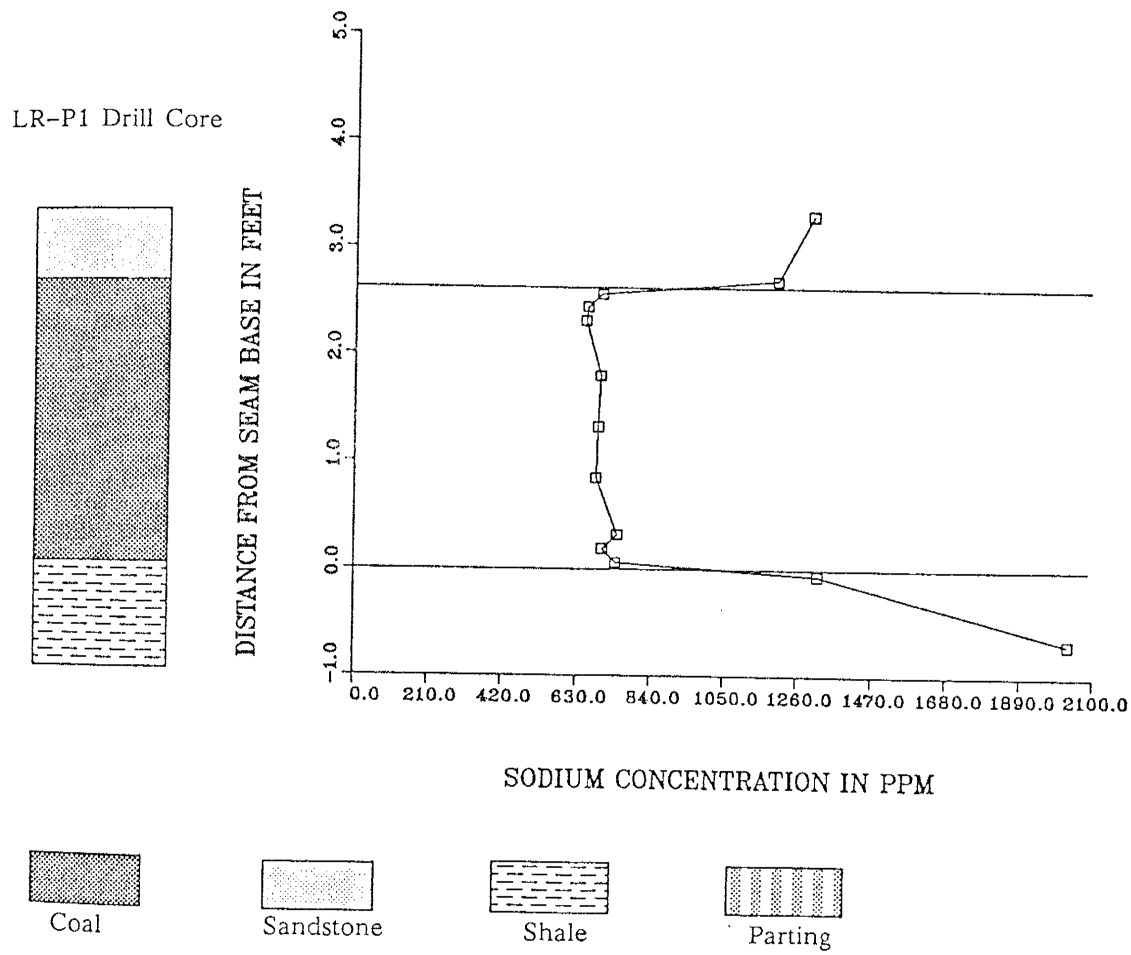


Figure D-32.

SODIUM DISTRIBUTION IN THE LEE RANCH P2 DRILL CORE

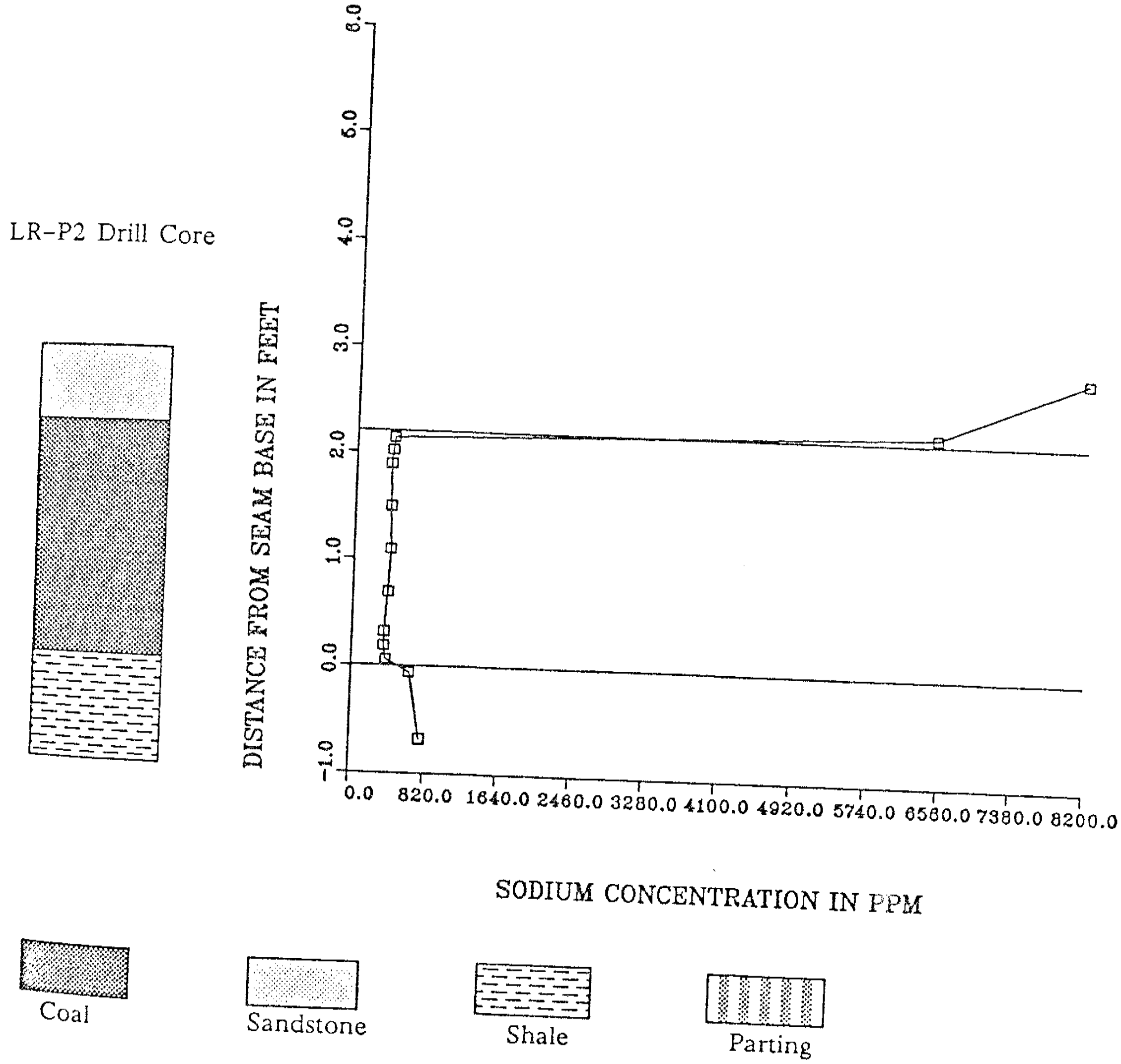


Figure D-33.

SODIUM DISTRIBUTION
IN THE LEE RANCH A2 DRILL CORE

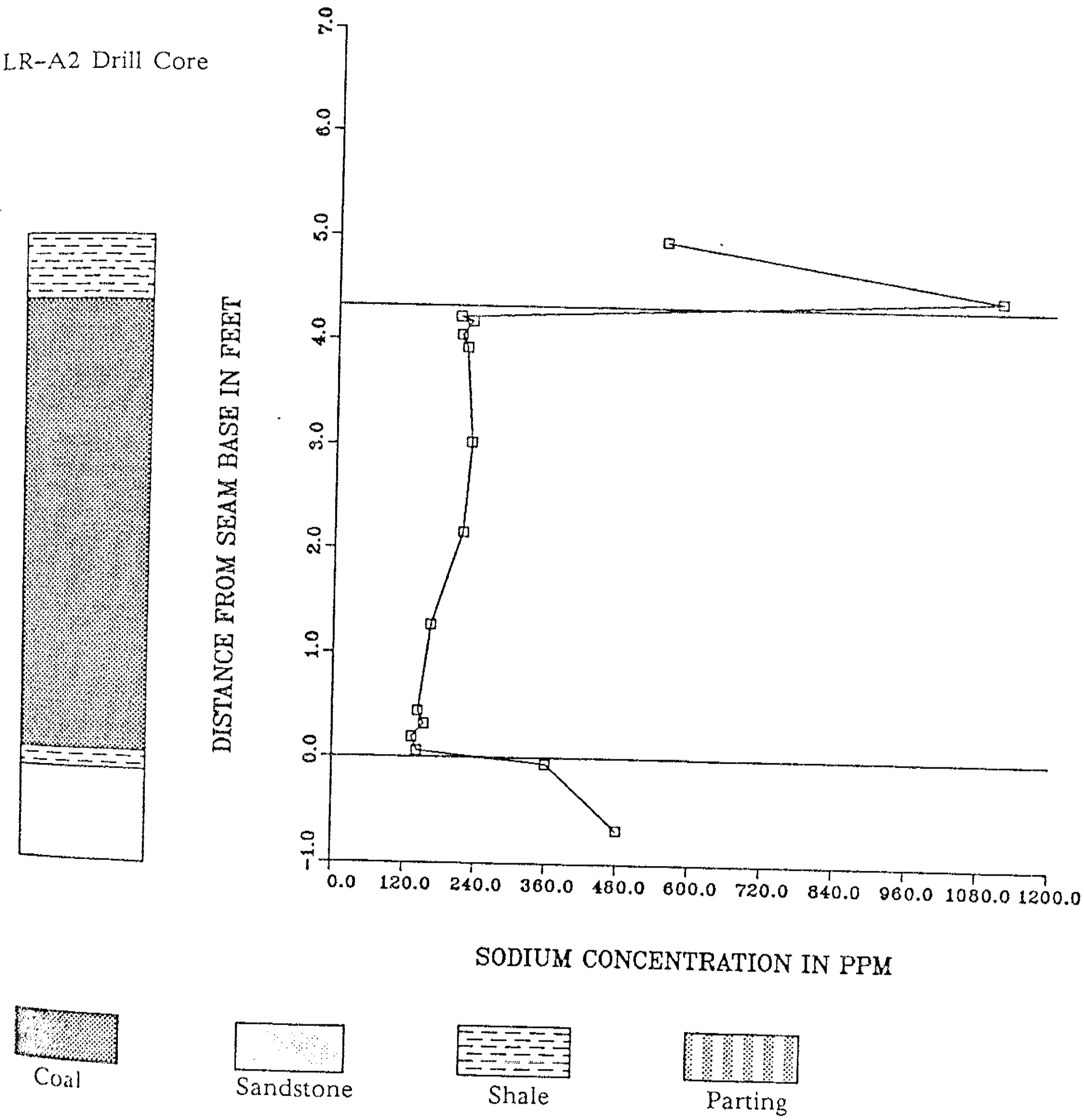


Figure D-34.

SODIUM DISTRIBUTION
IN THE LEE RANCH A3 DRILL CORE

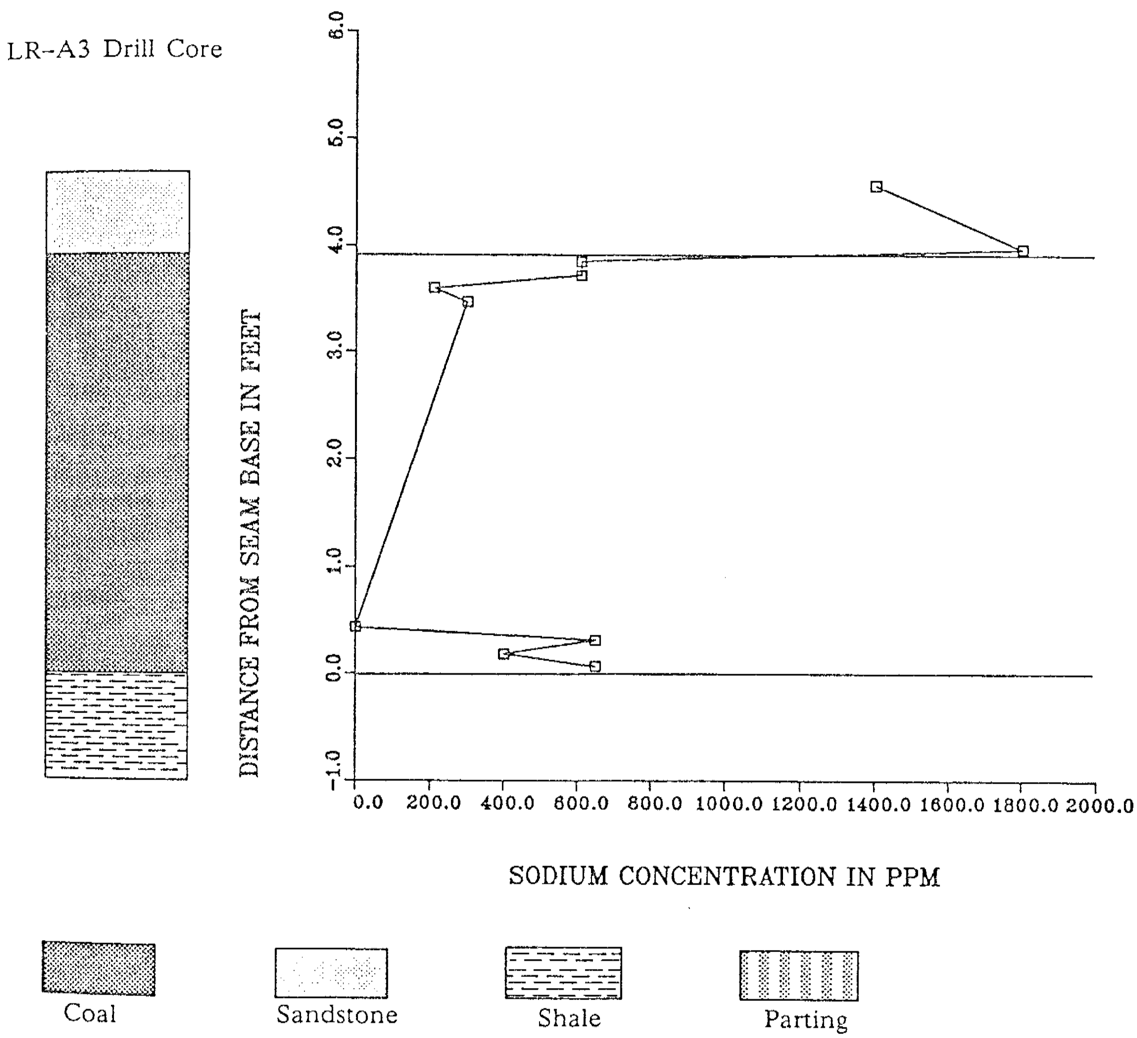


Figure D-35.

SODIUM DISTRIBUTION

IN THE LEE RANCH B2 DRILL CORE

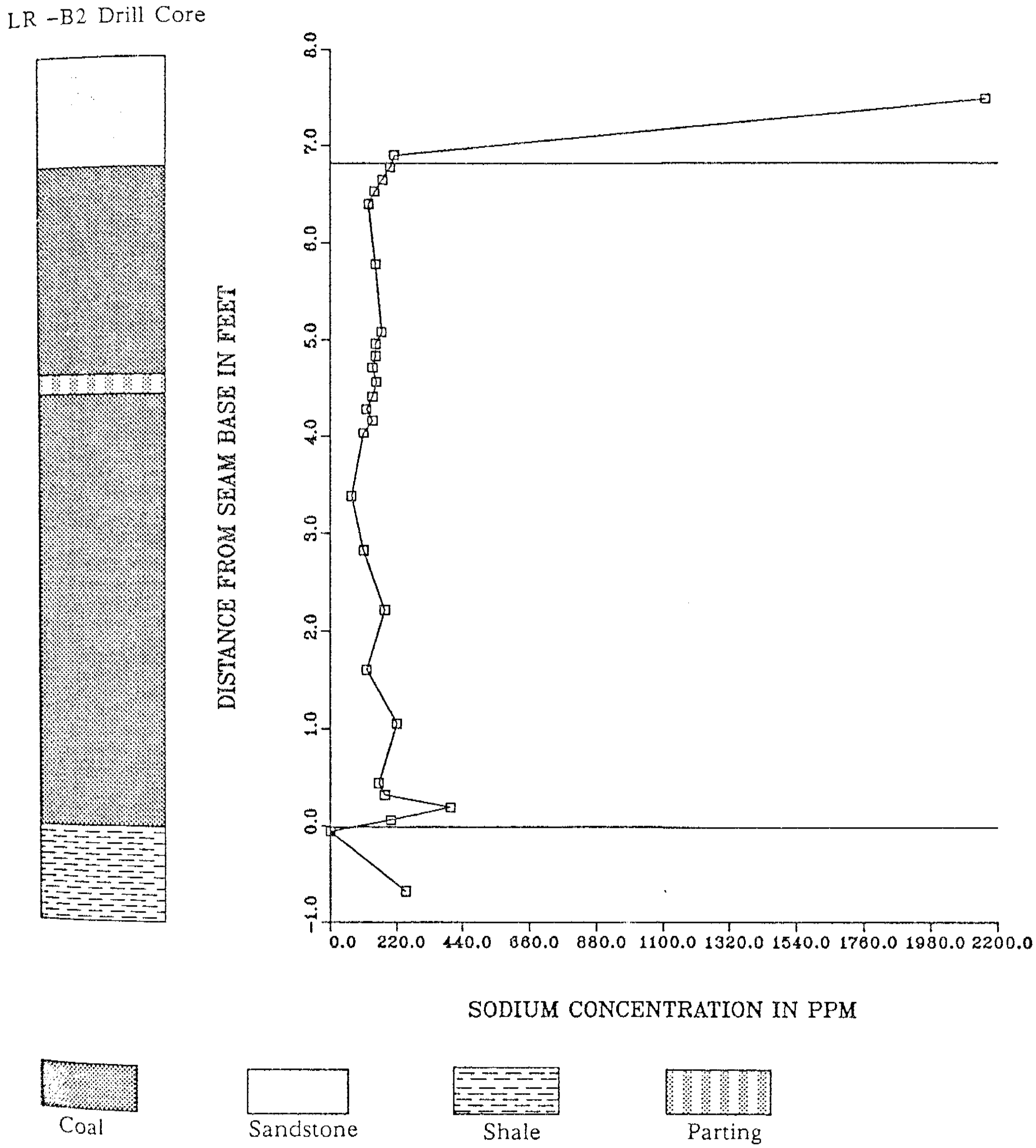


Figure D-36.

SODIUM DISTRIBUTION
IN THE LEE RANCH B3 DRILL CORE

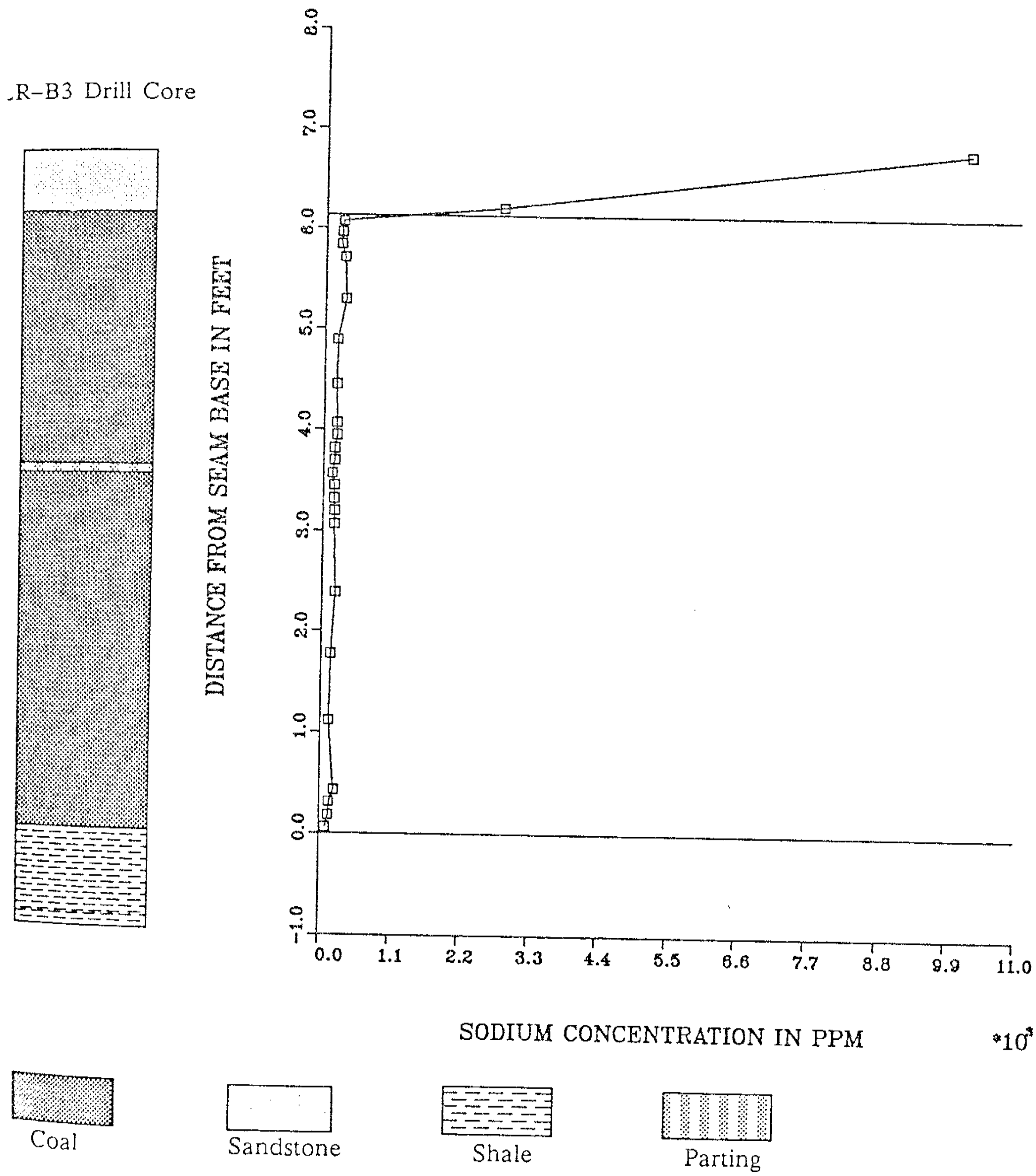


Figure D-37.

SODIUM DISTRIBUTION
IN THE YORK CANYON "A" AND "MAIN" SEAMS

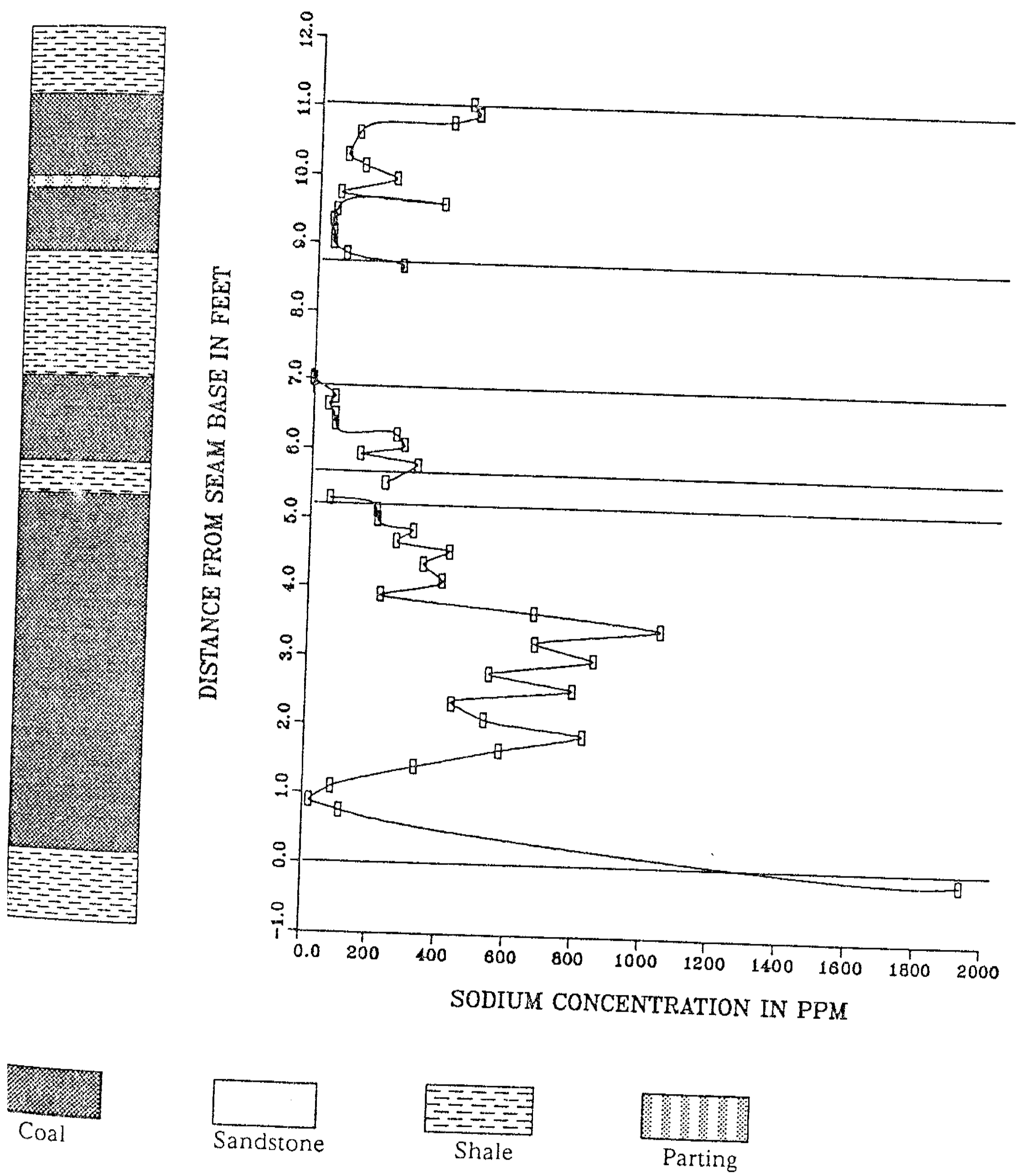


Figure D-38.

Figure D-38.

RUBIDIUM DISTRIBUTION IN THE LEE RANCH P1 DRILL CORE

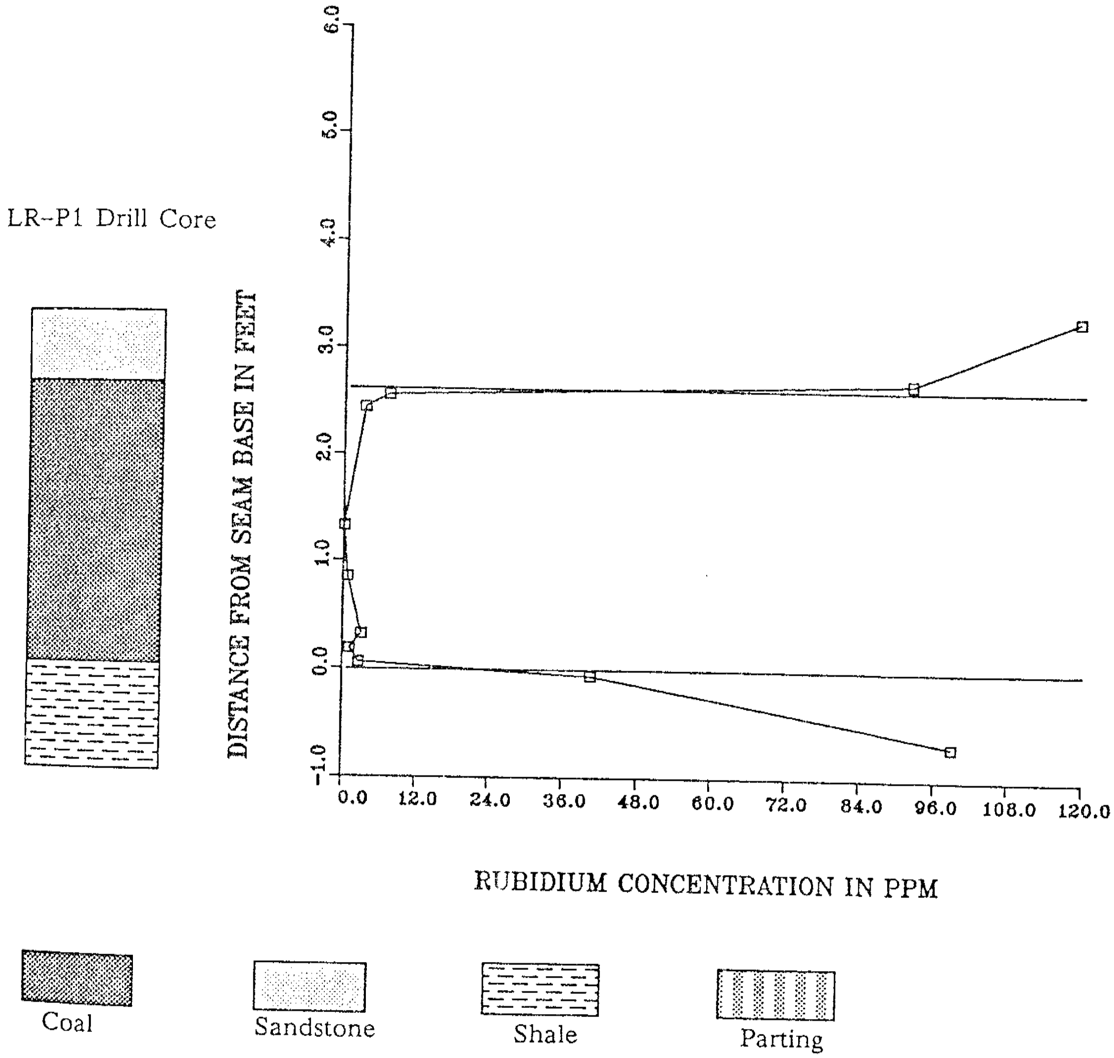


Figure D-39.

RUBIDIUM DISTRIBUTION
IN THE LEE RANCH P2 DRILL CORE

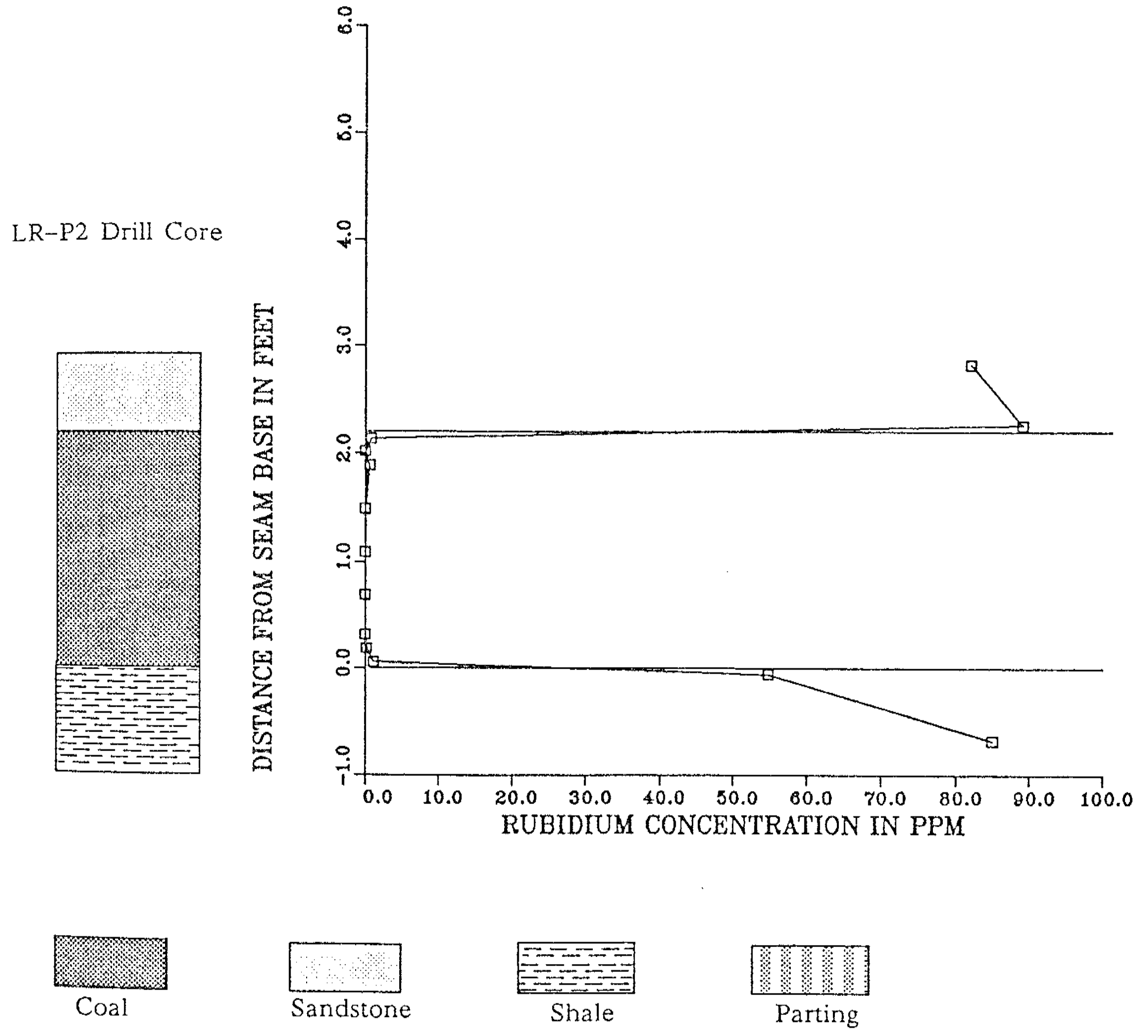


Figure D-40.

RUBIDIUM DISTRIBUTION IN THE LEE RANCH A2 DRILL CORE

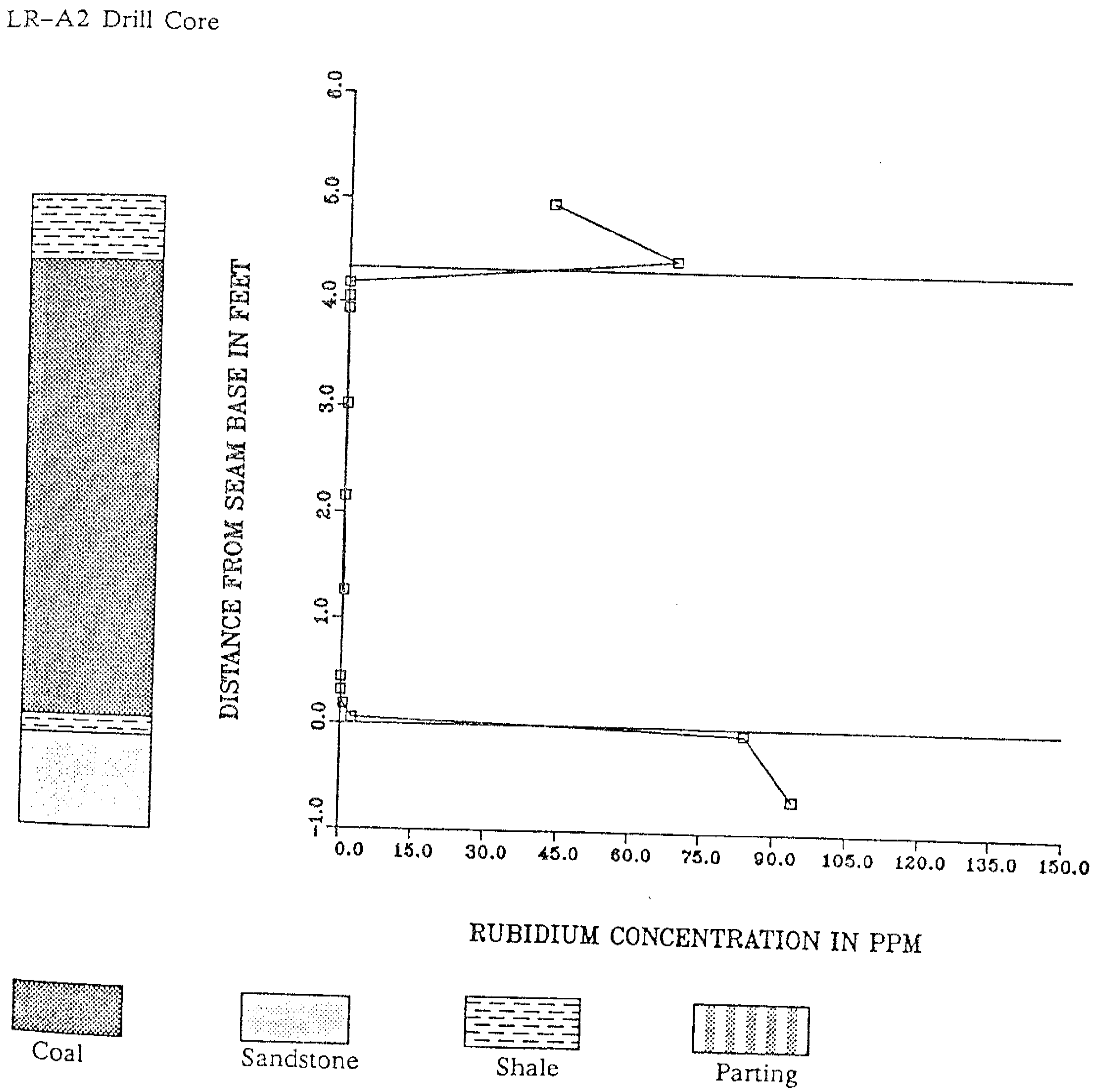


Figure D-41.

RUBIDIUM DISTRIBUTION
IN THE LEE RANCH A3 DRILL CORE

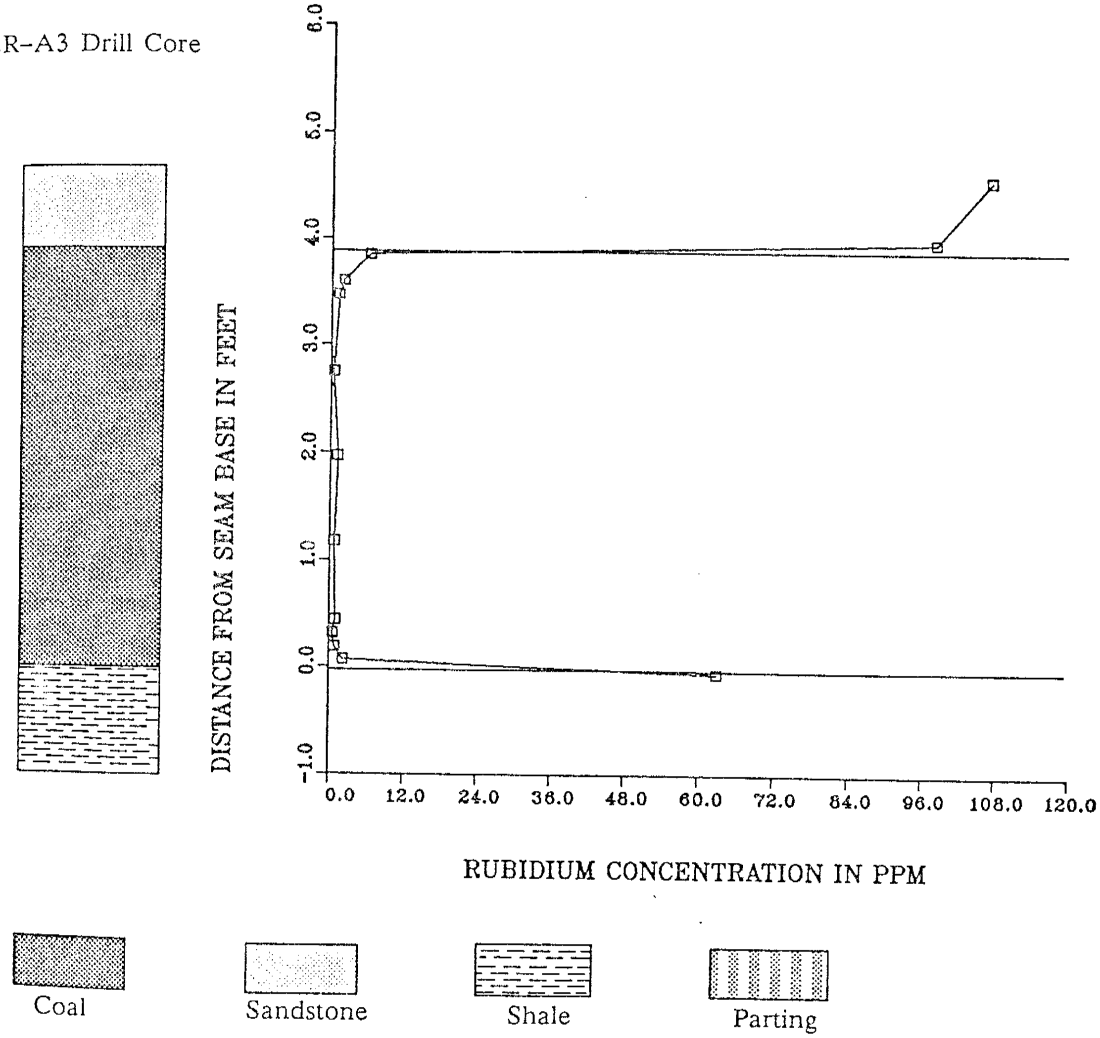


Figure D-42.

RUBIDIUM DISTRIBUTION
IN THE LEE RANCH B2 DRILL CORE

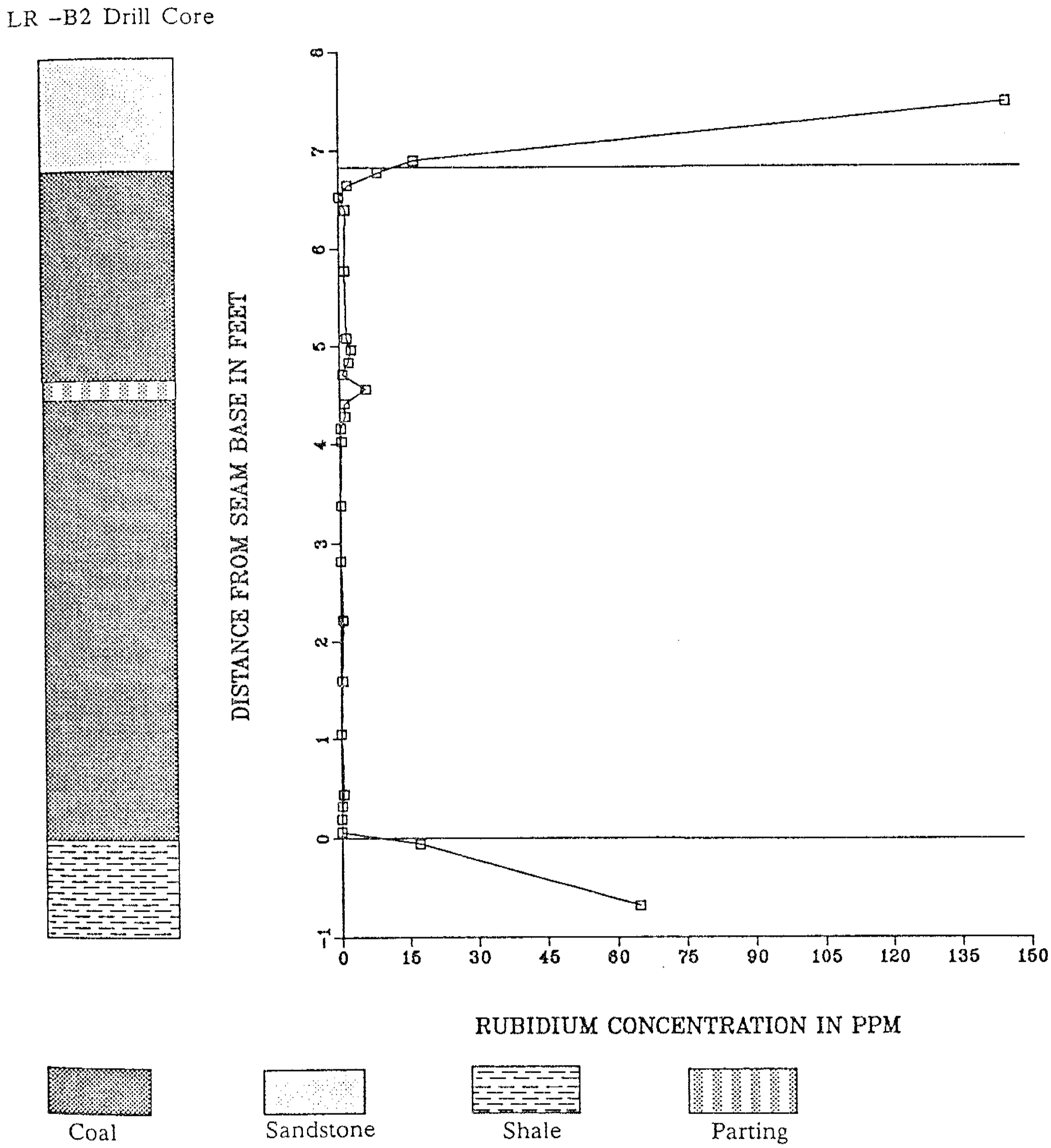


Figure D-43.

RUBIDIUM DISTRIBUTION
IN THE LEE RANCH B3 DRILL CORE

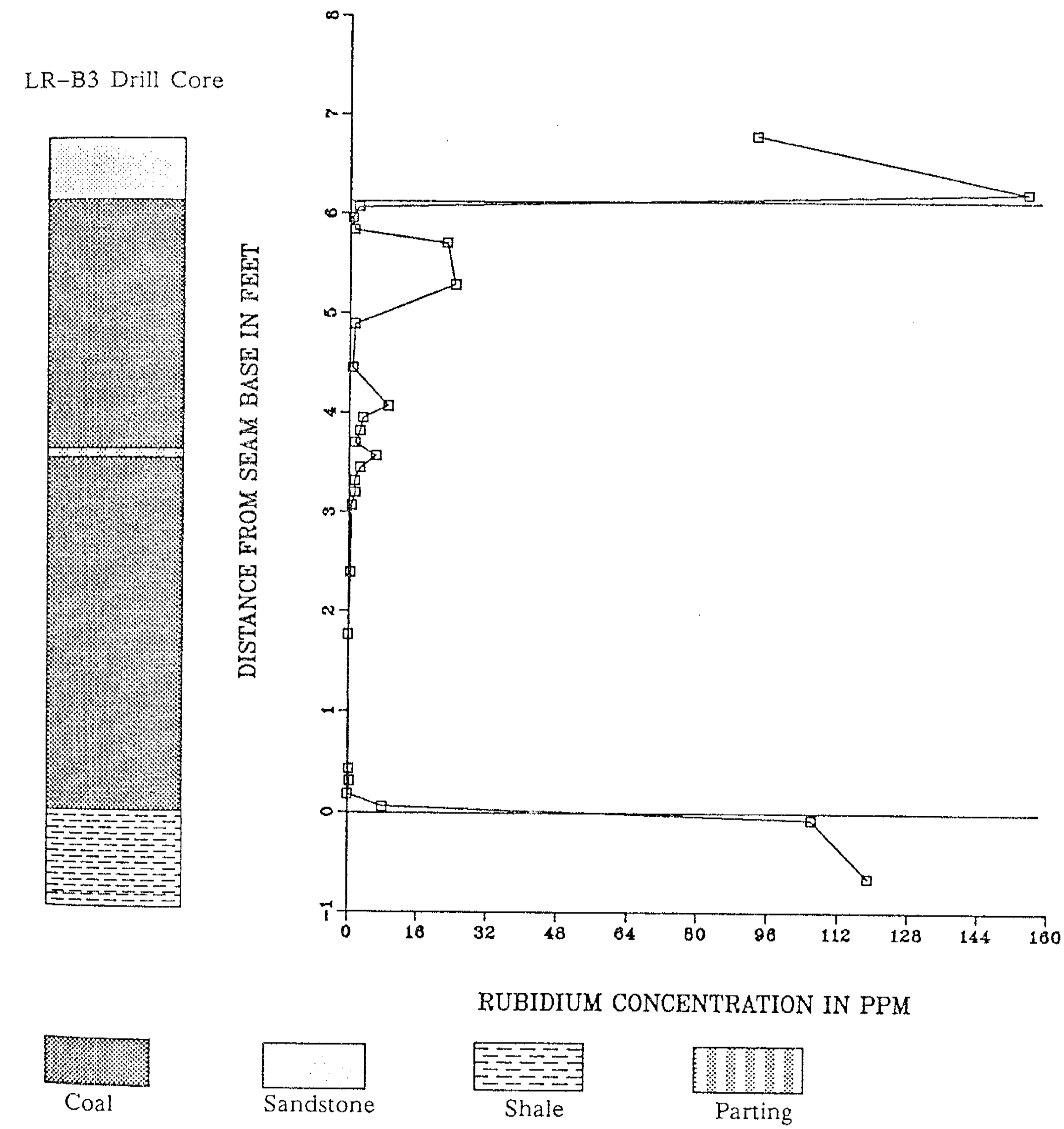


Figure D-44.

RUBIDIUM DISTRIBUTION
IN THE YORK CANYON "A" AND "MAIN" SEAMS

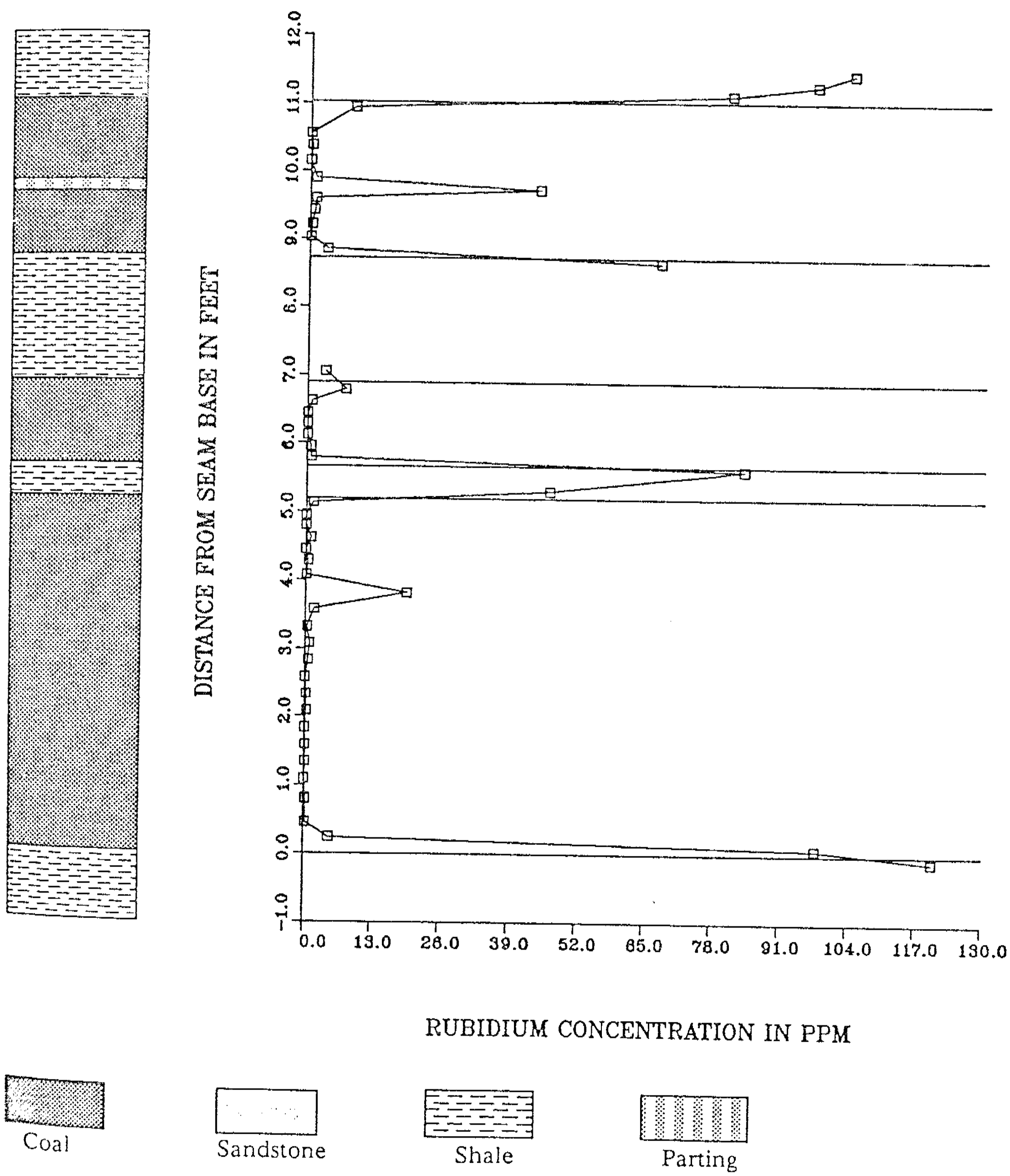


Figure D-45.

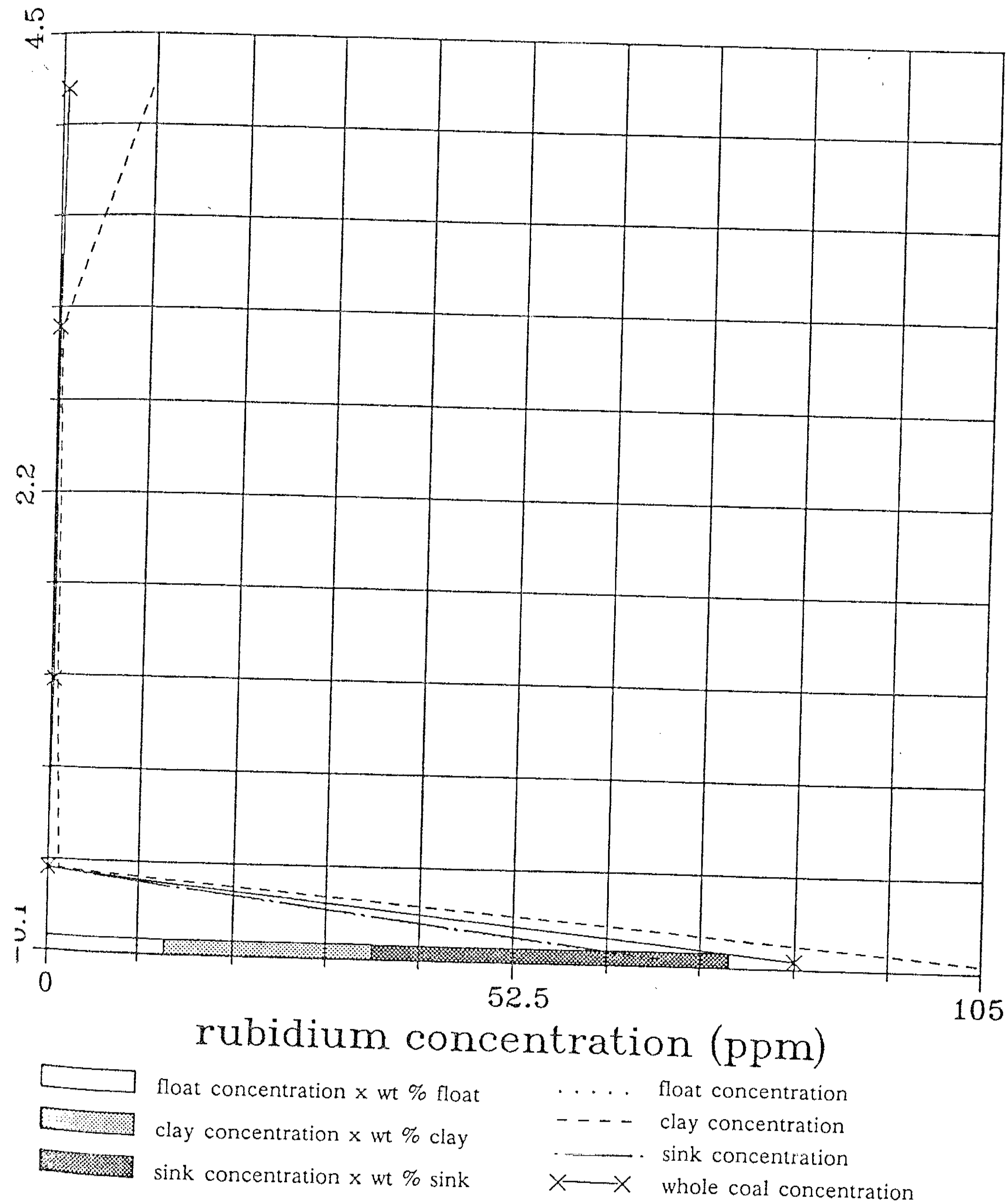


Figure D-46. Rubidium float-clay-sink distributions in the LRA2 seam.

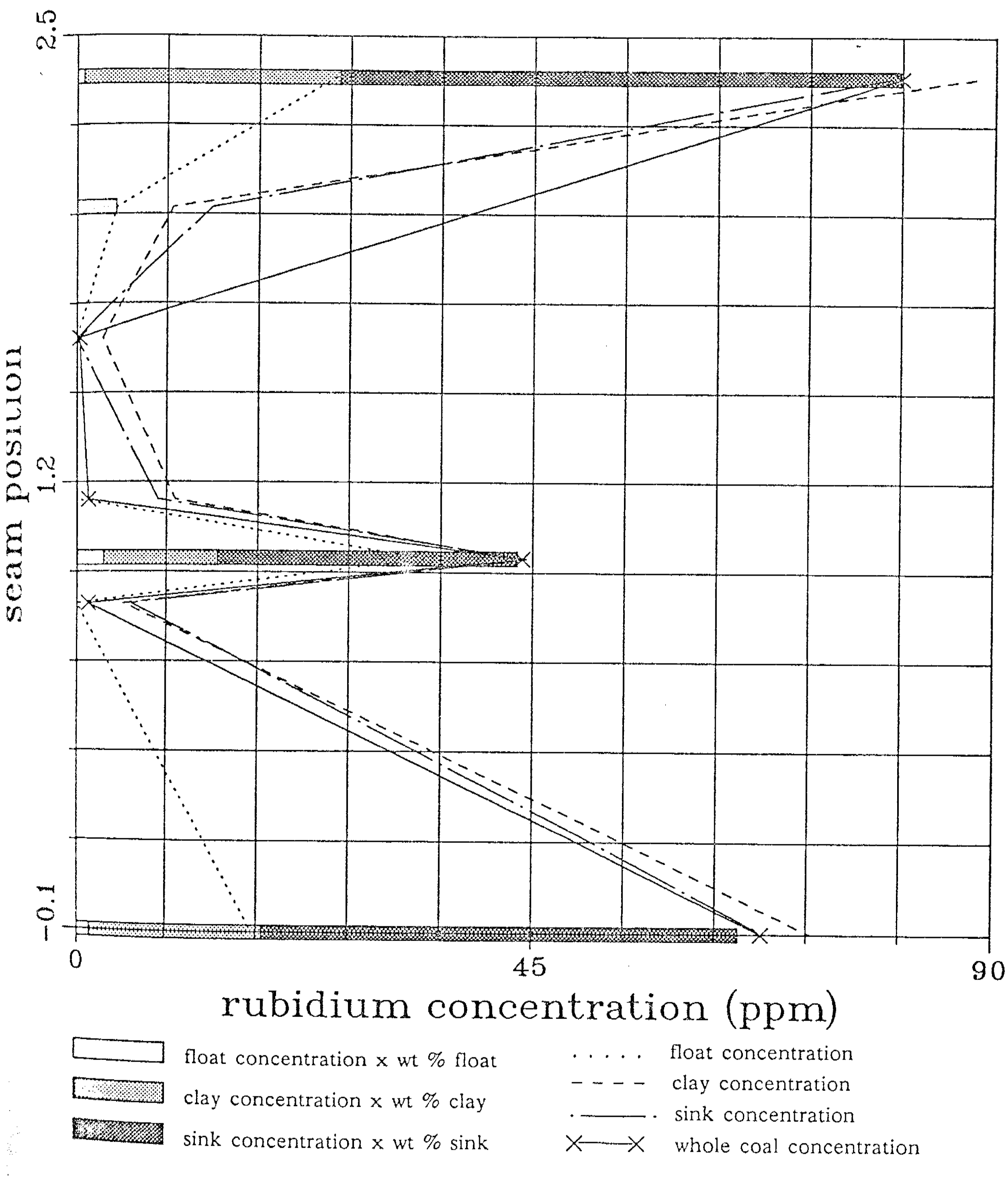


Figure D-47. Rubidium float-clay-sink distributions in the YA seam.

CESIUM DISTRIBUTION IN THE LEE RANCH P1 DRILL CORE

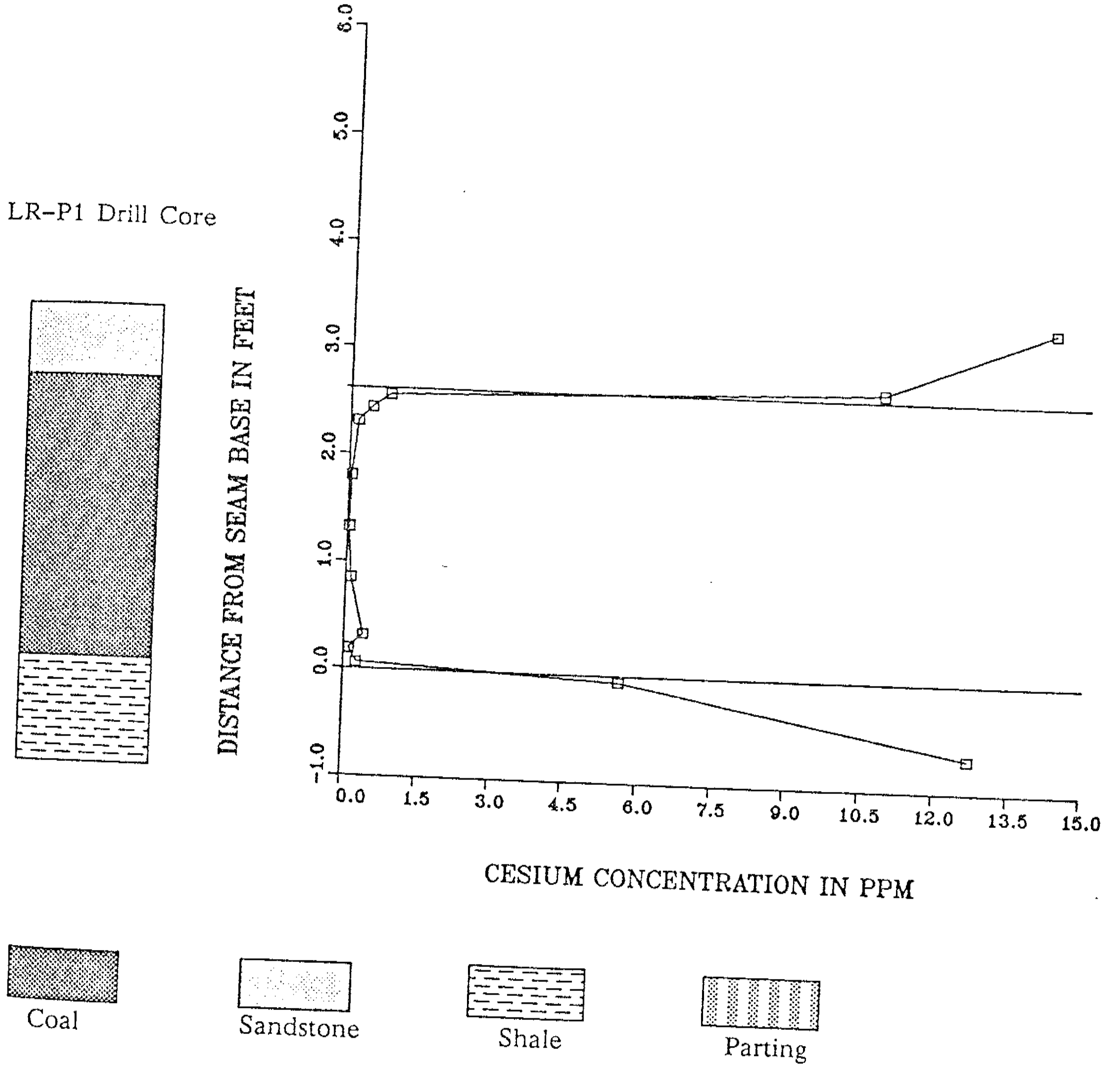


Figure D-48.

CESIUM DISTRIBUTION IN THE LEE RANCH P2 DRILL CORE

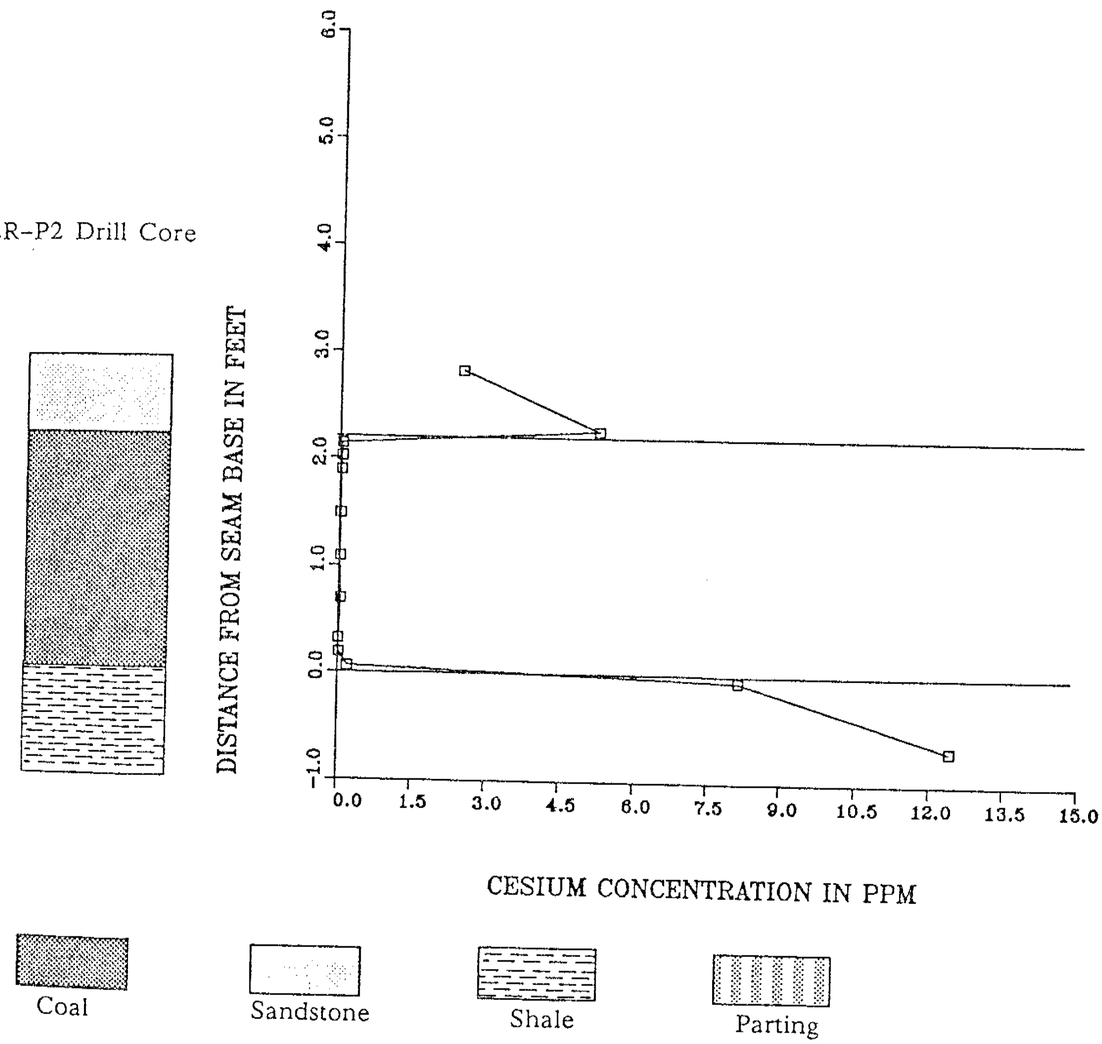


Figure D-49.

CESIUM DISTRIBUTION
IN THE LEE RANCH A2 DRILL CORE

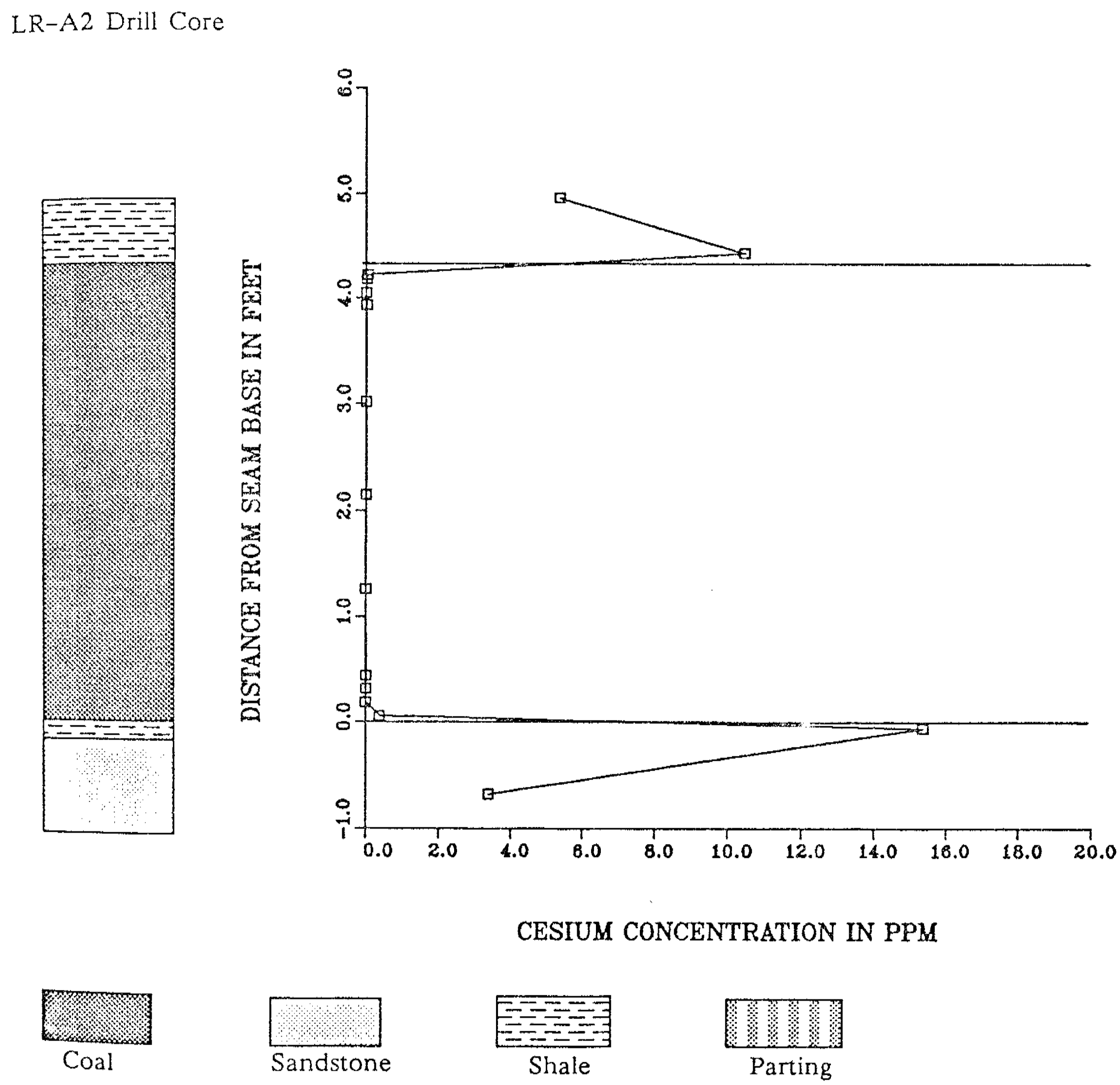


Figure D-50.

CESIUM DISTRIBUTION
IN THE LEE RANCH A3 DRILL CORE

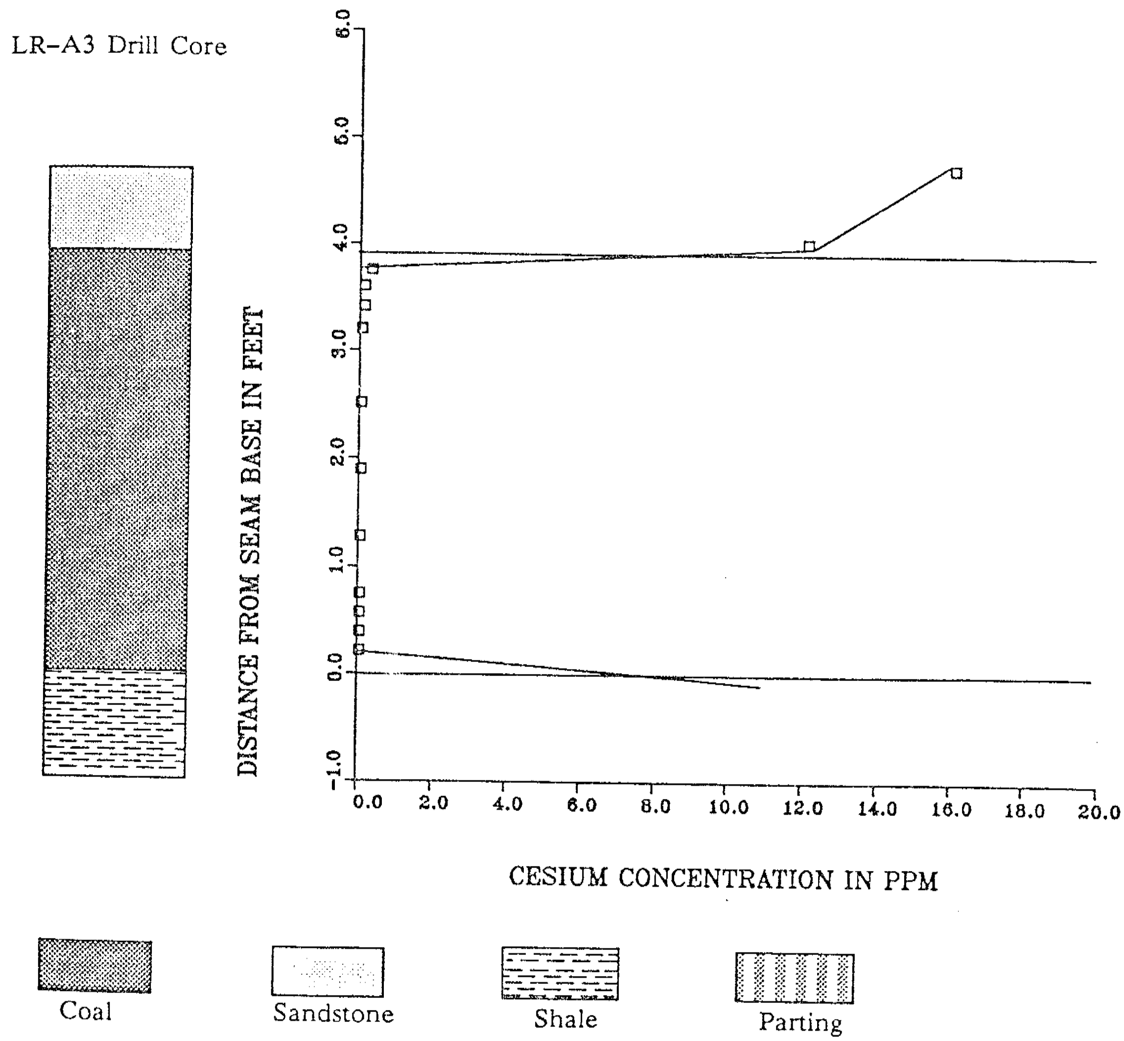
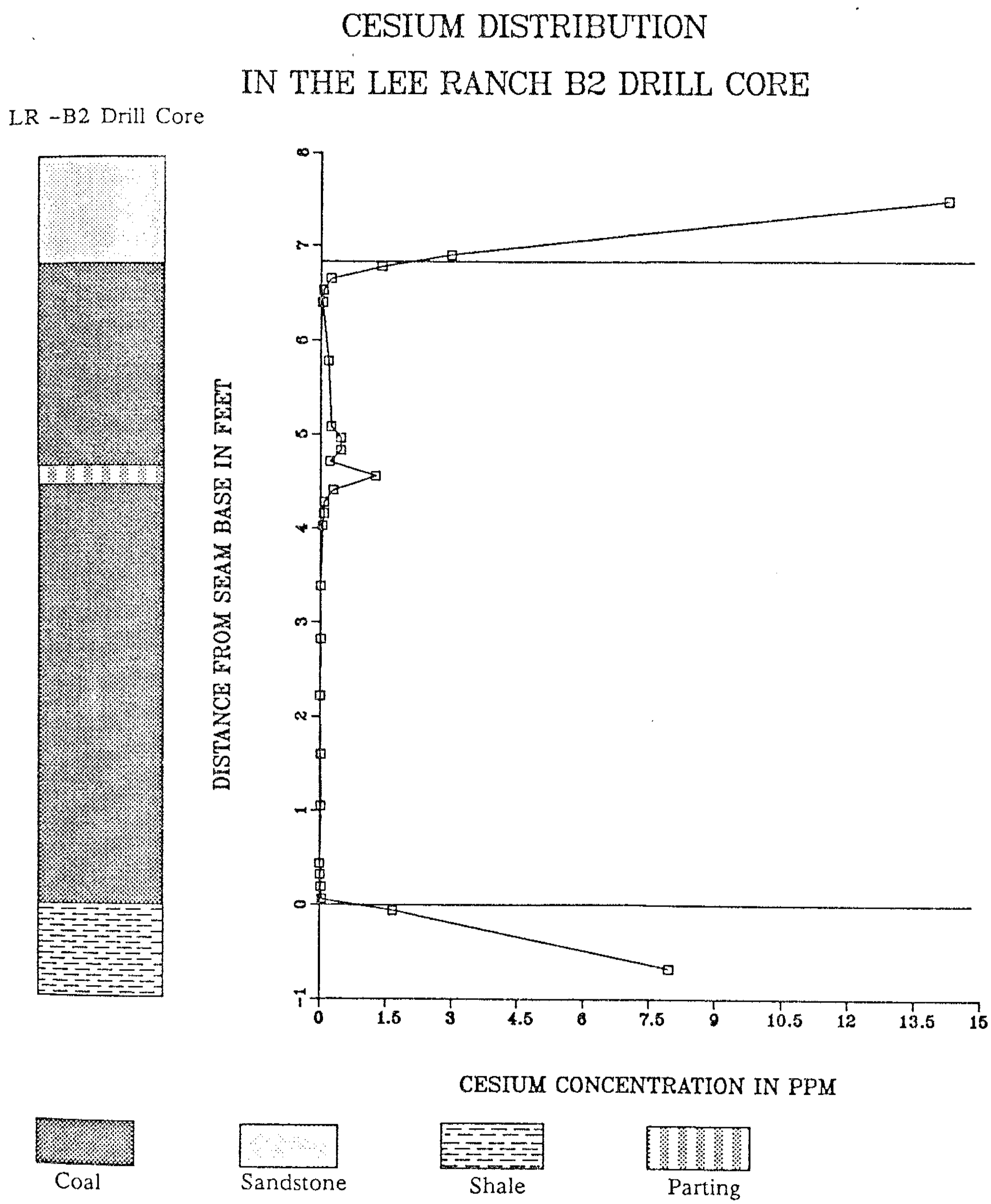


Figure D-51.



CESIUM DISTRIBUTION
IN THE LEE RANCH B2 DRILL CORE
LR -B2 Drill Core
DISTANCE FROM SEAM BASE IN FEET
-1
0
1
2
3
4
5
6
7
8
0
1.5
3
4.5
6
7.5
9
10.5
12
13.5
15
CESIUM CONCENTRATION IN PPM
Coal
Sandstone
Shale
Parting

Figure D-52.

CESIUM DISTRIBUTION IN THE LEE RANCH B3 DRILL CORE

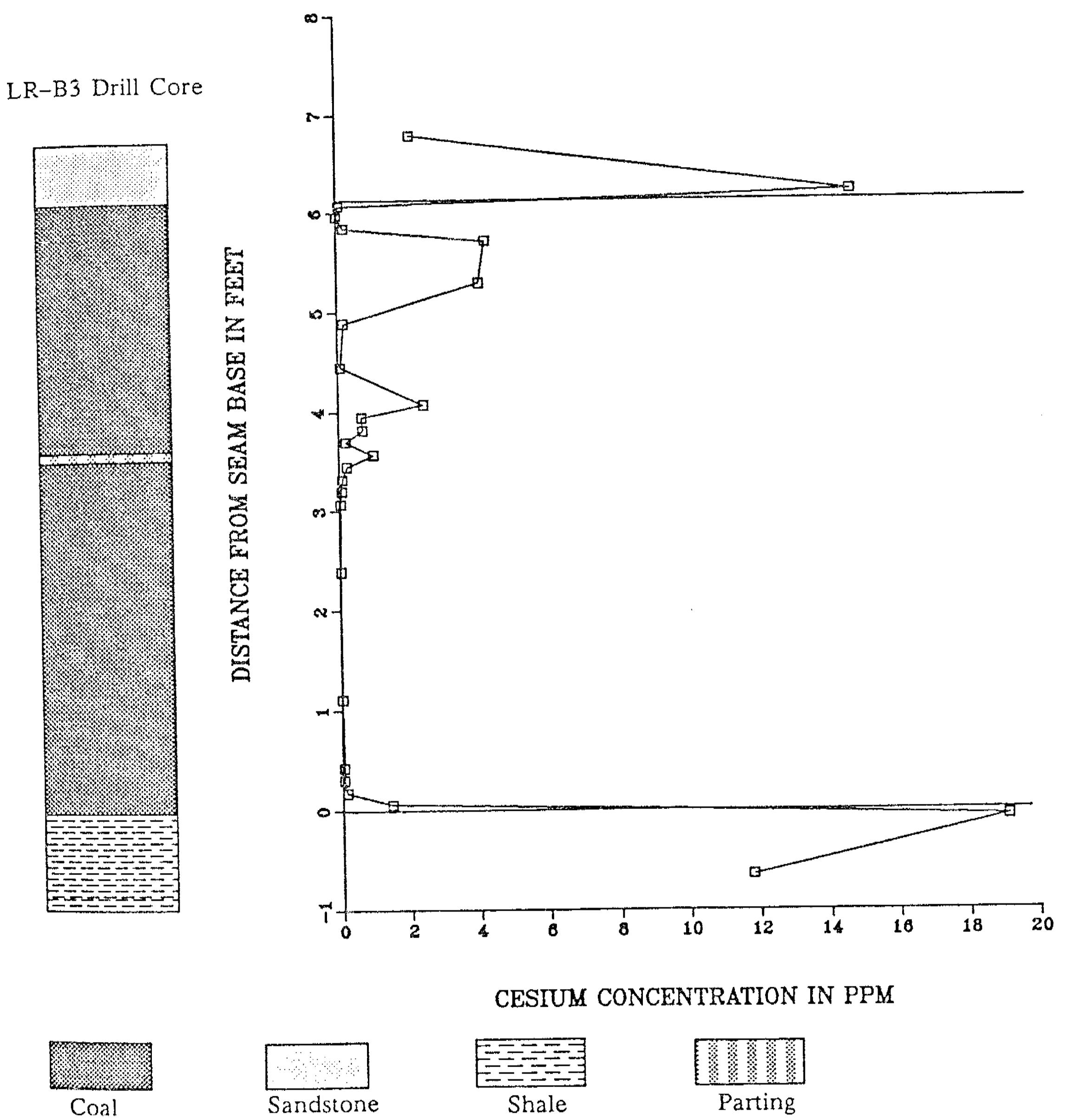


Figure D-53.

CESIUM DISTRIBUTION IN THE YORK CANYON "A" AND "MAIN" SEAMS

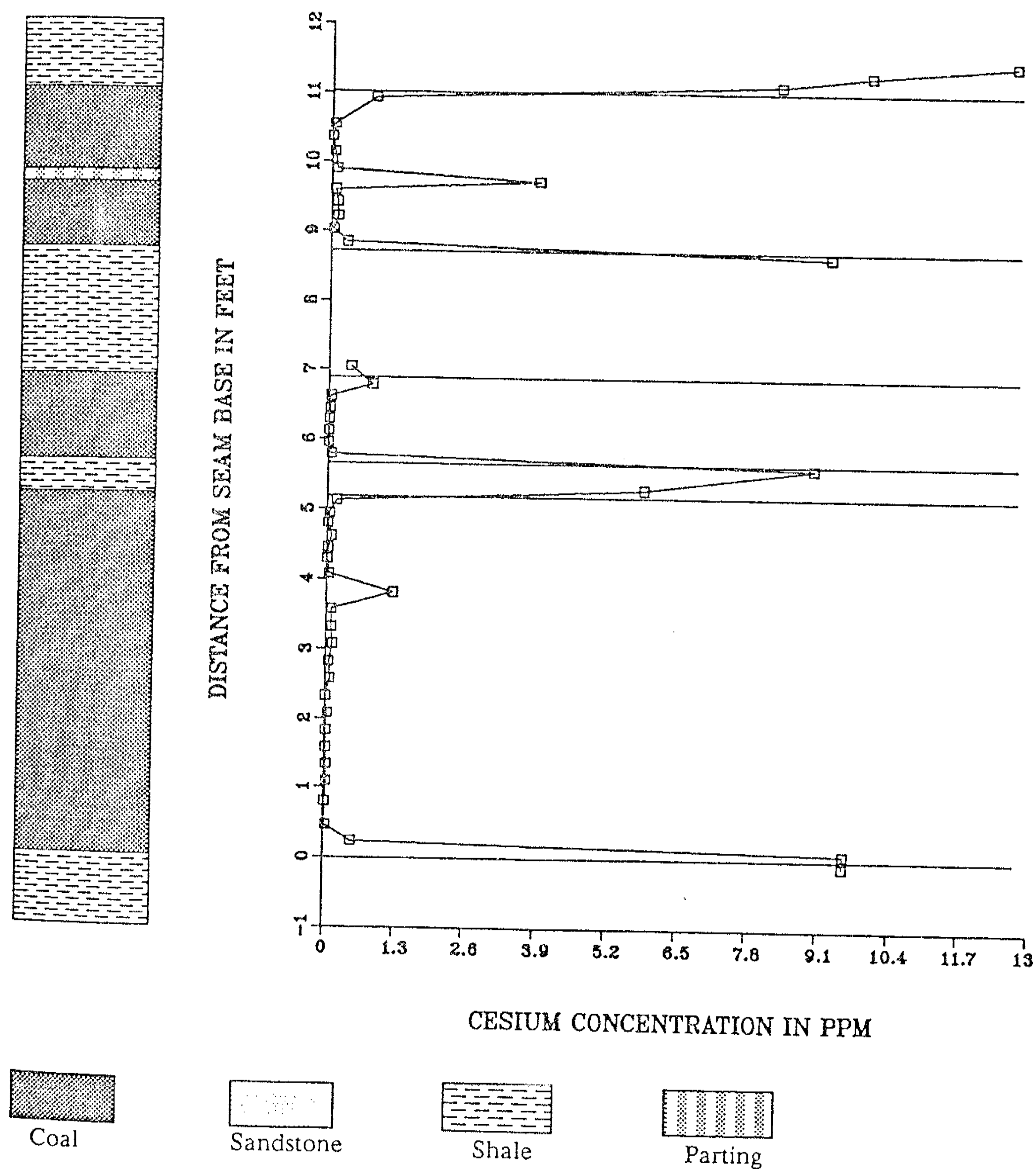


Figure D-54.

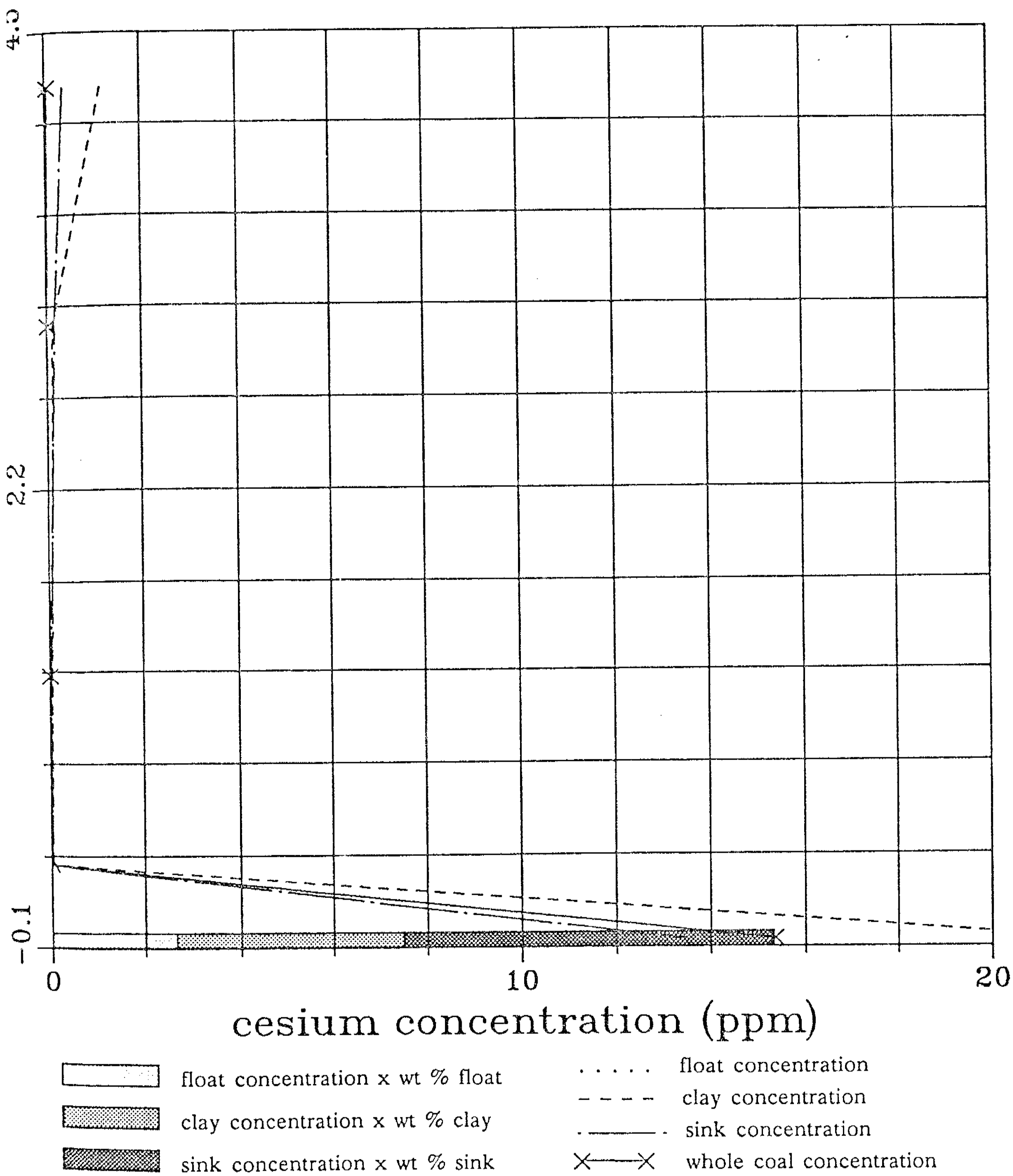


Figure D-55. Cesium float-clay-sink distributions in the LRA2 seam.

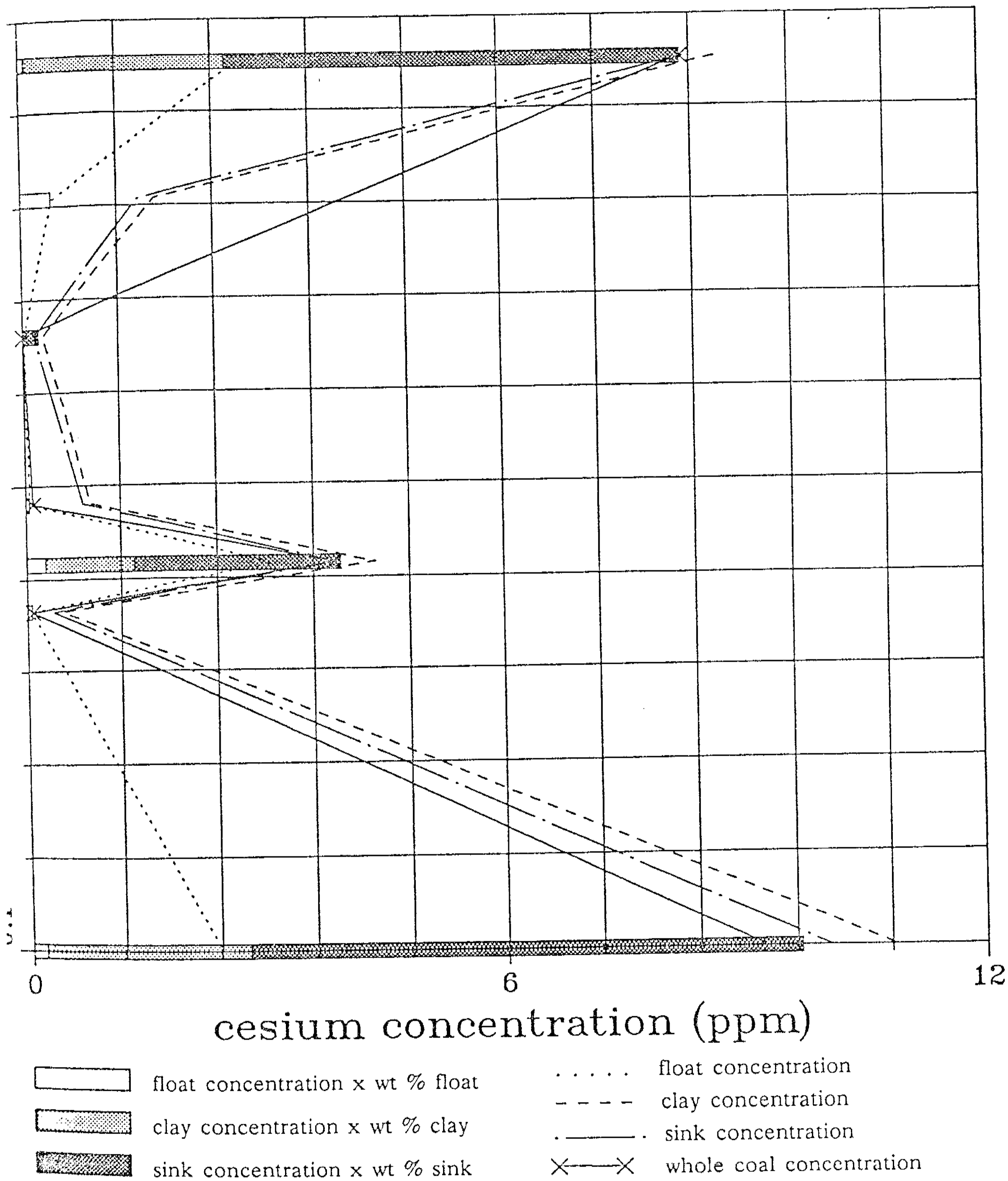


Figure D-56. Cesium float-clay-sink distributions in the YA seam.

BARIUM DISTRIBUTION
IN THE LEE RANCH P1 DRILL CORE

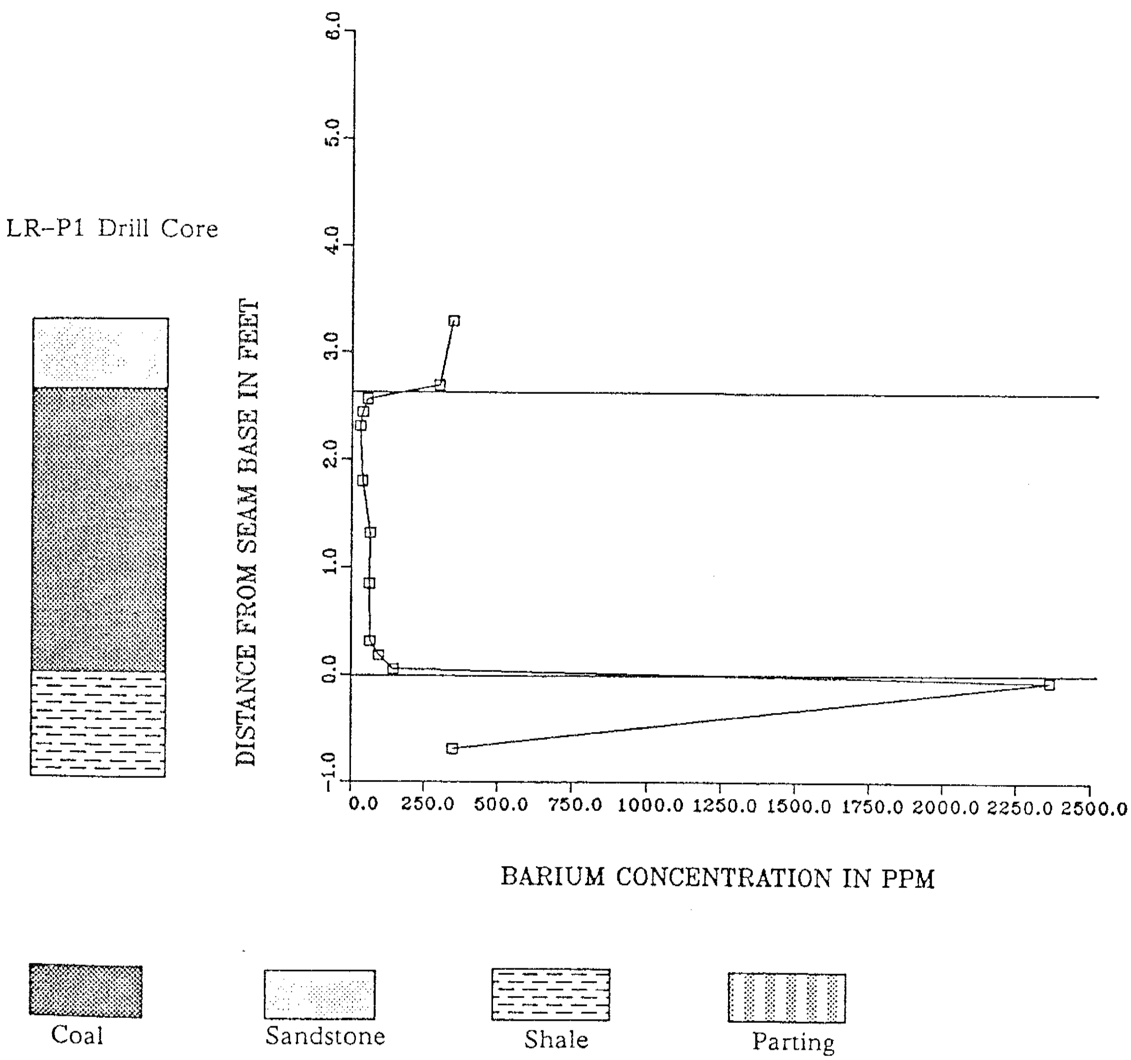


Figure D-57.

BARIUM DISTRIBUTION
IN THE LEE RANCH P2 DRILL CORE

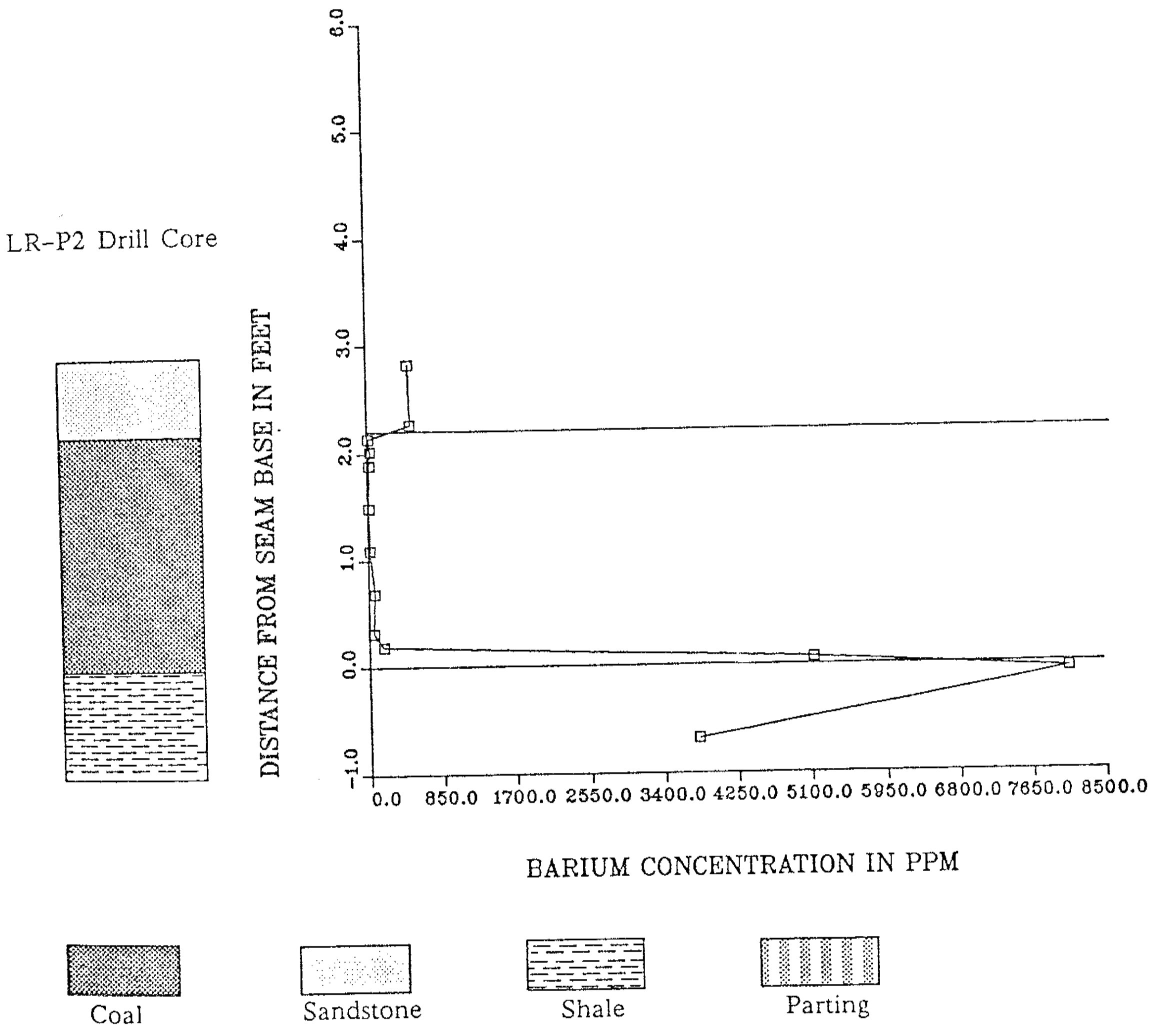


Figure 58.

BARIUM DISTRIBUTION
IN THE LEE RANCH A3 DRILL CORE

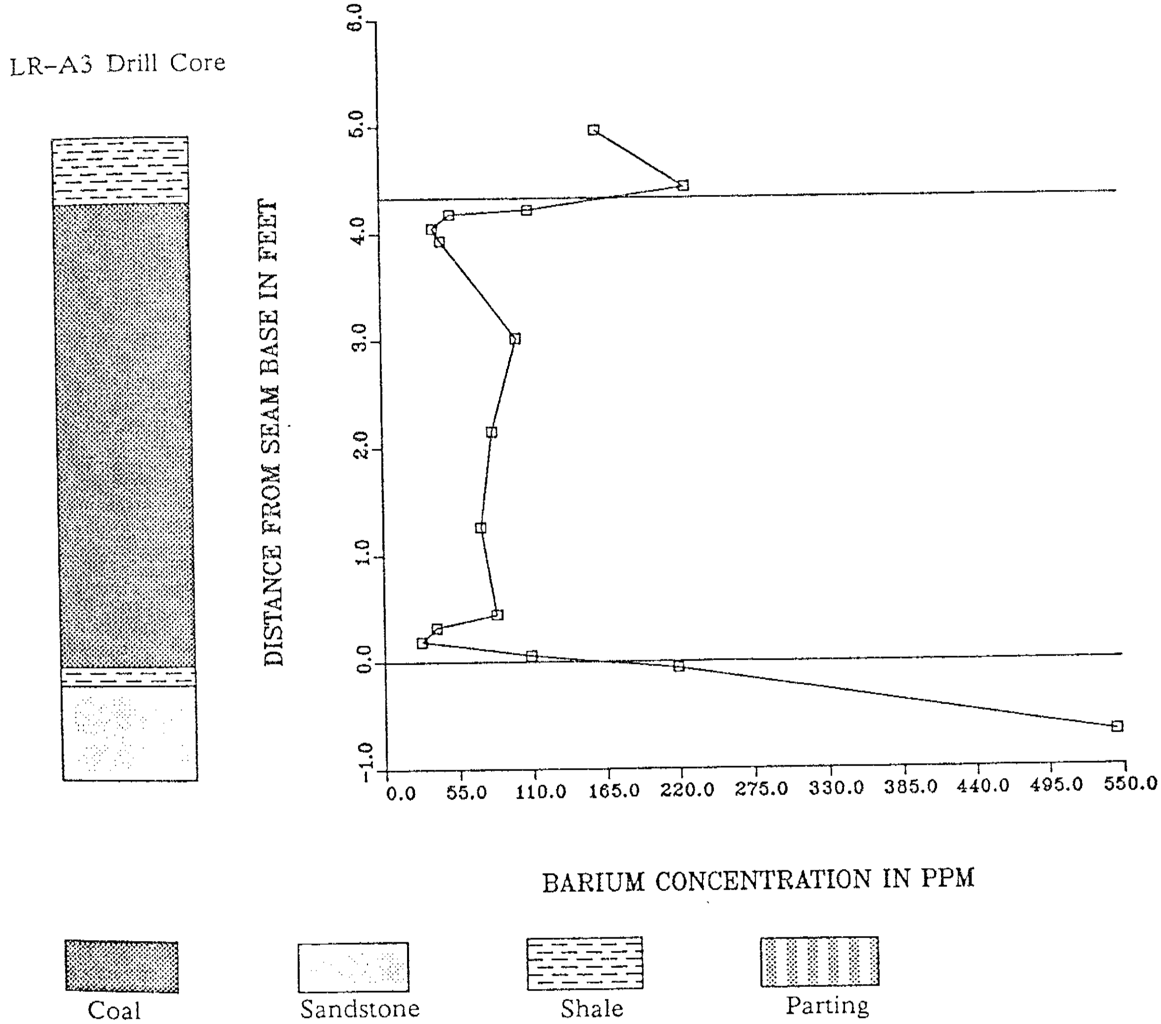


Figure D-59.

BARIUM DISTRIBUTION
IN THE LEE RANCH A2 DRILL CORE

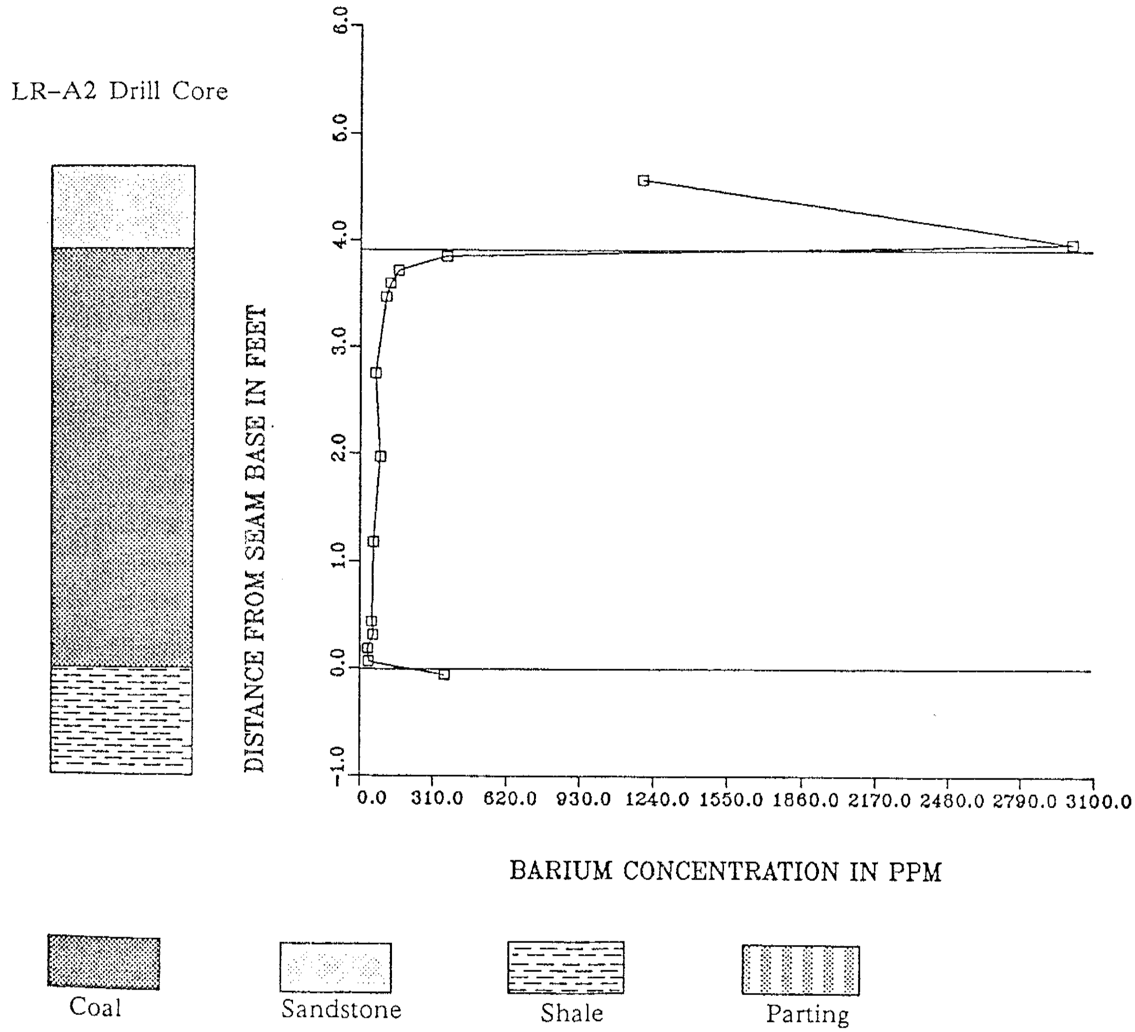


Figure D-58.

BARIUM DISTRIBUTION
IN THE LEE RANCH B2 DRILL CORE

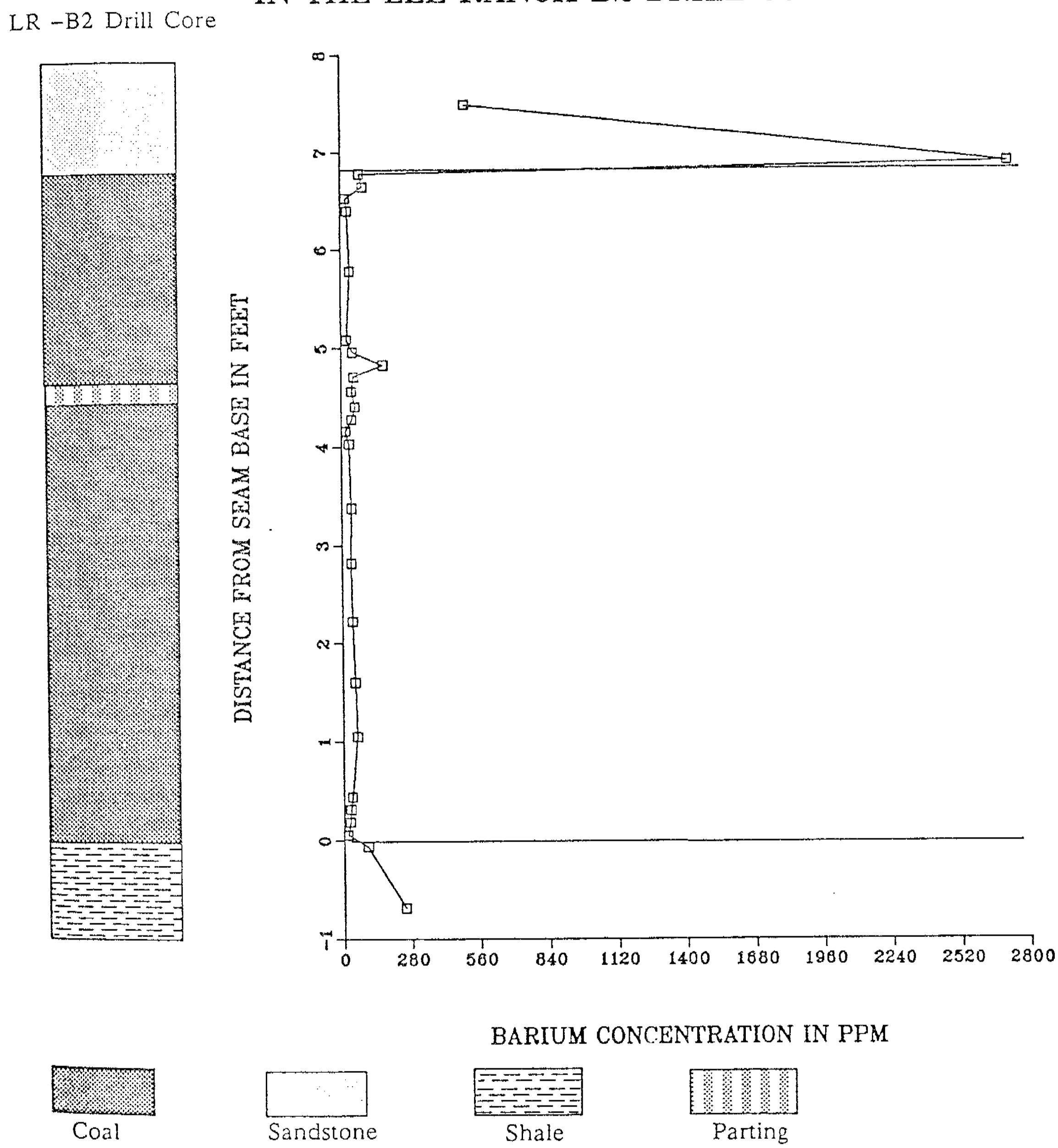


Figure D-61.

BARIUM DISTRIBUTION
IN THE LEE RANCH B3 DRILL CORE

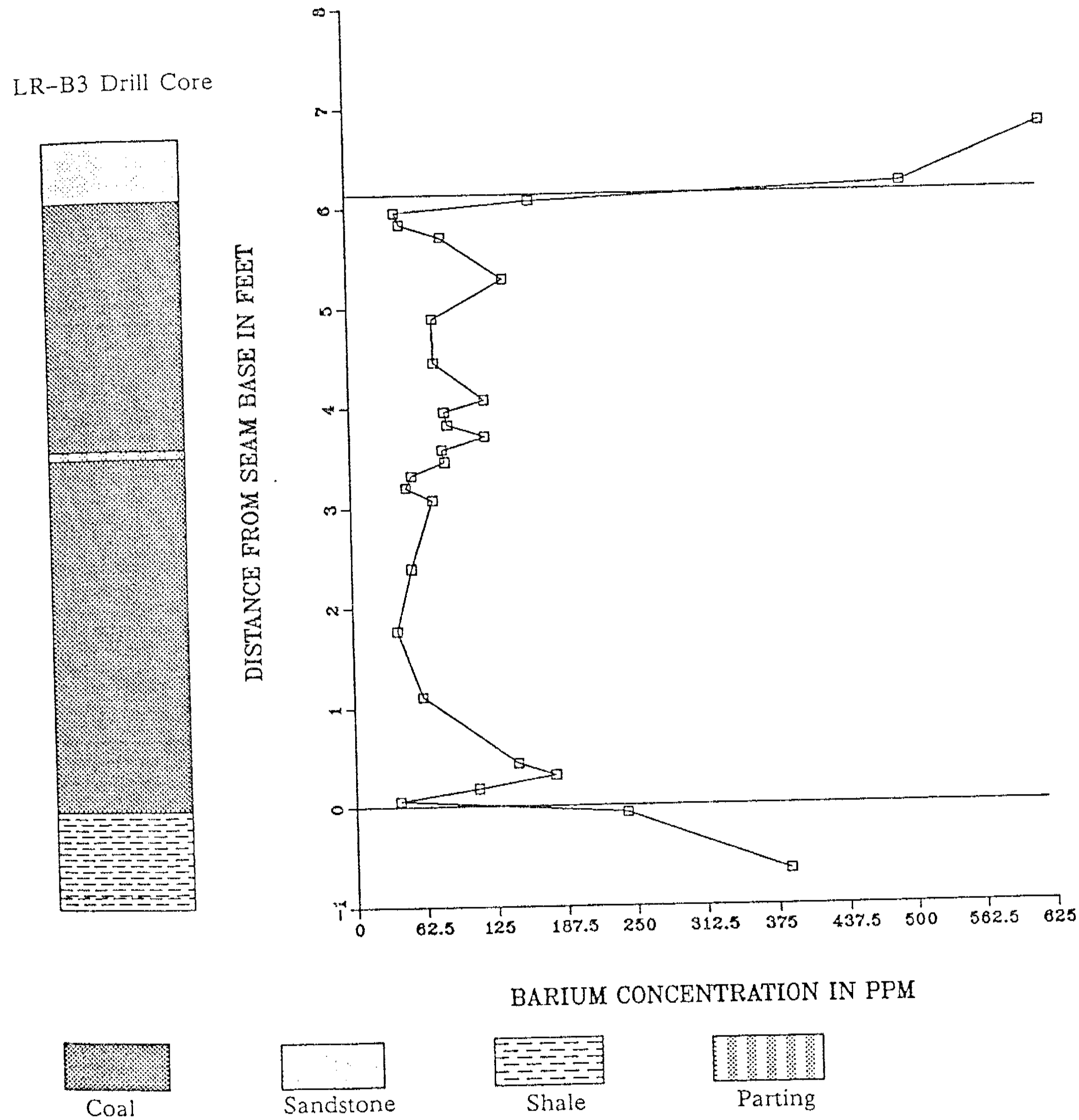


Figure D-62.

BARIUM DISTRIBUTION
IN THE YORK CANYON "A" AND "MAIN" SEAMS

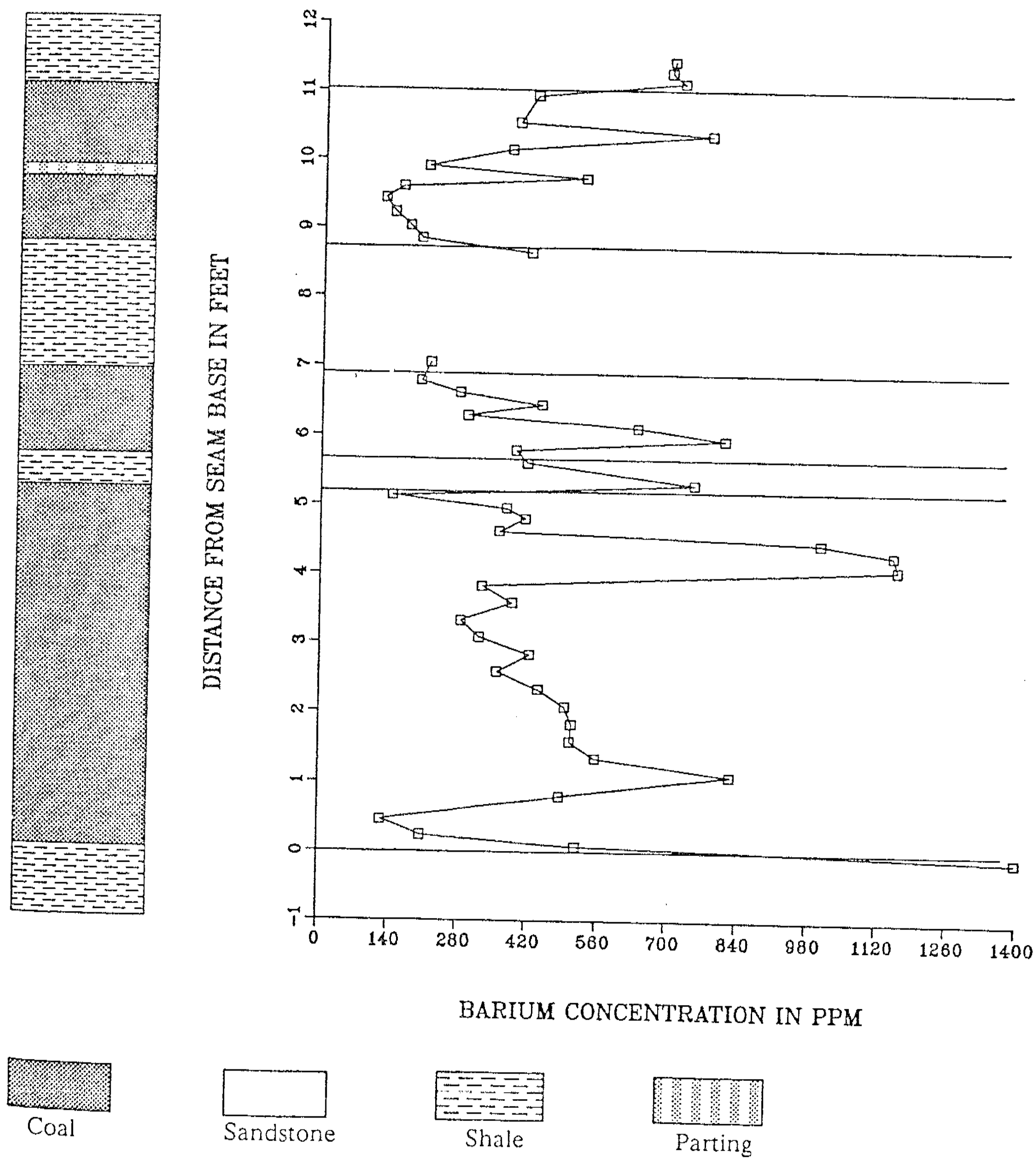
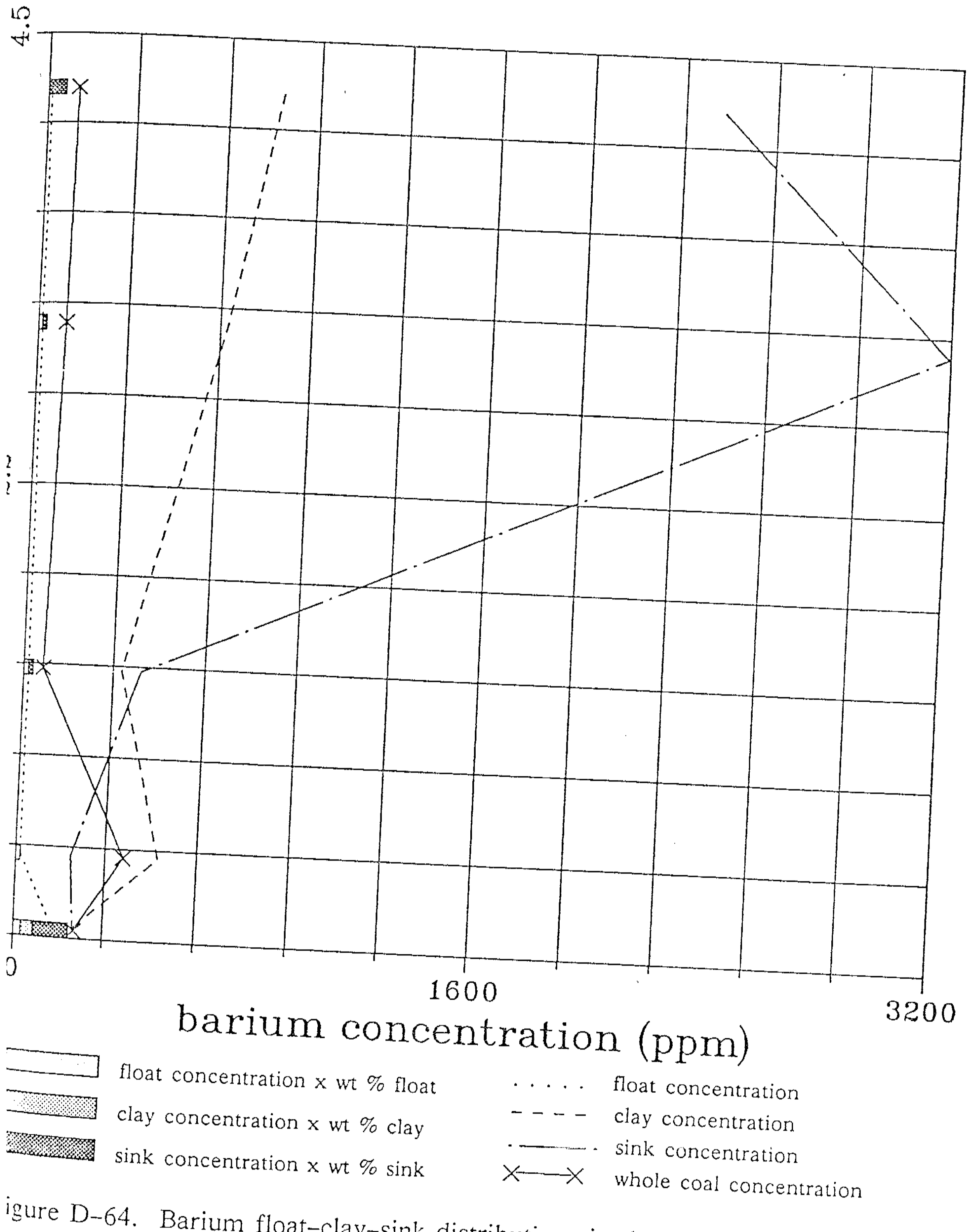


Figure D-63.



igure D-64. Barium float-clay-sink distributions in the LRA2 seam.

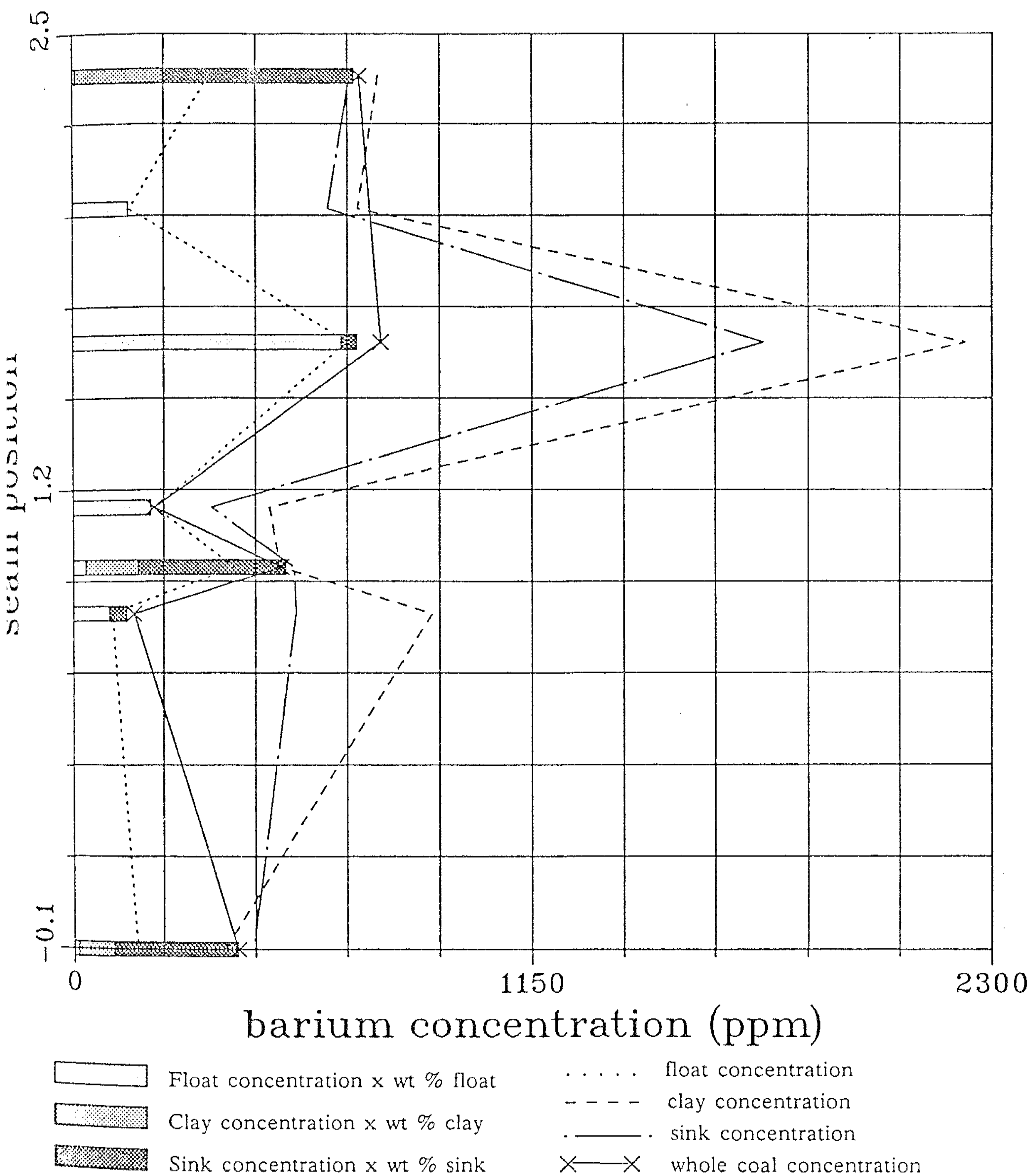


Figure D-65. Barium float-clay-sink distributions in the YA seam.

CALCIUM DISTRIBUTION IN THE LEE RANCH P1 DRILL CORE

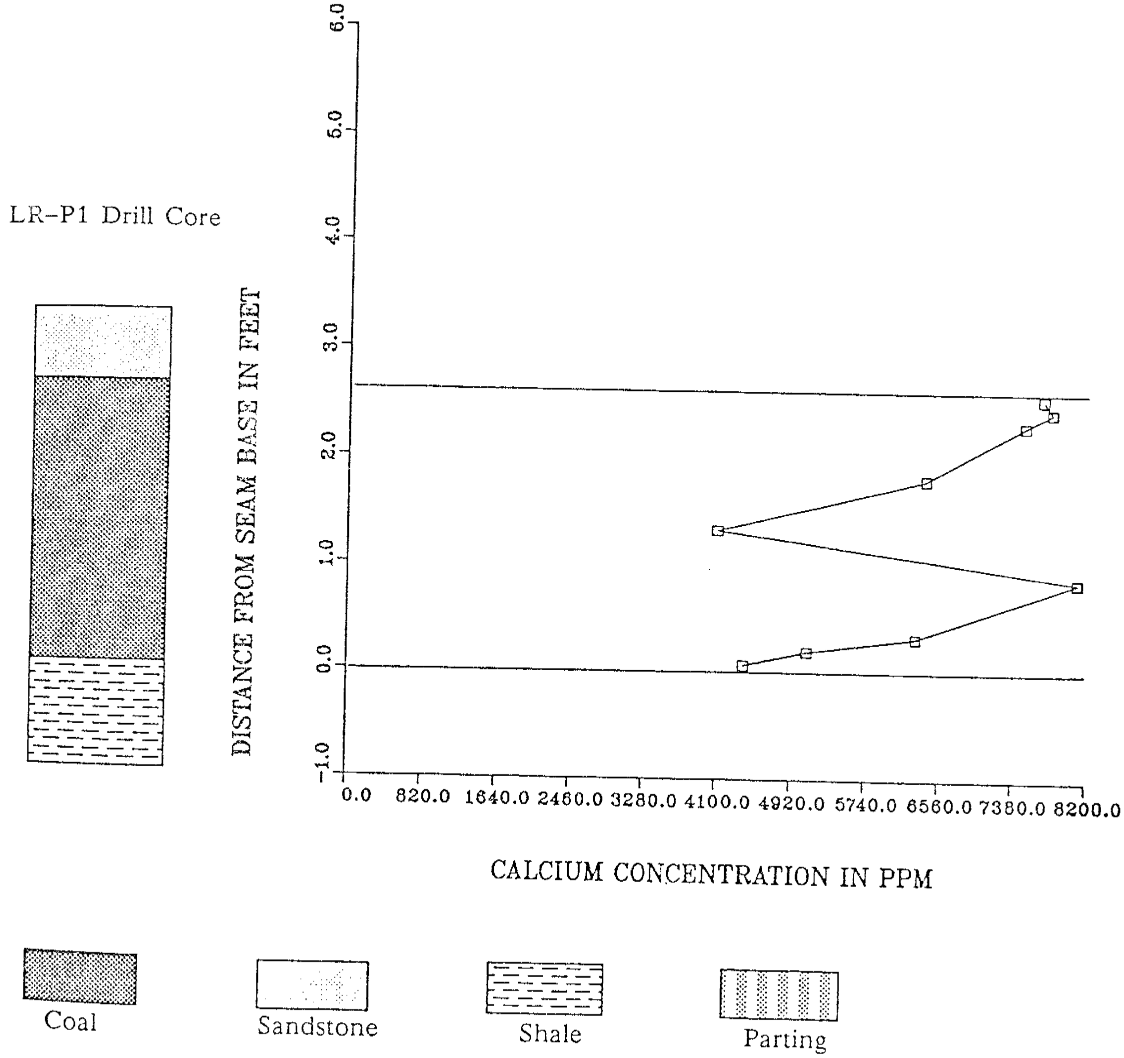


Figure D-66.

CALCIUM DISTRIBUTION IN THE LEE RANCH P2 DRILL CORE

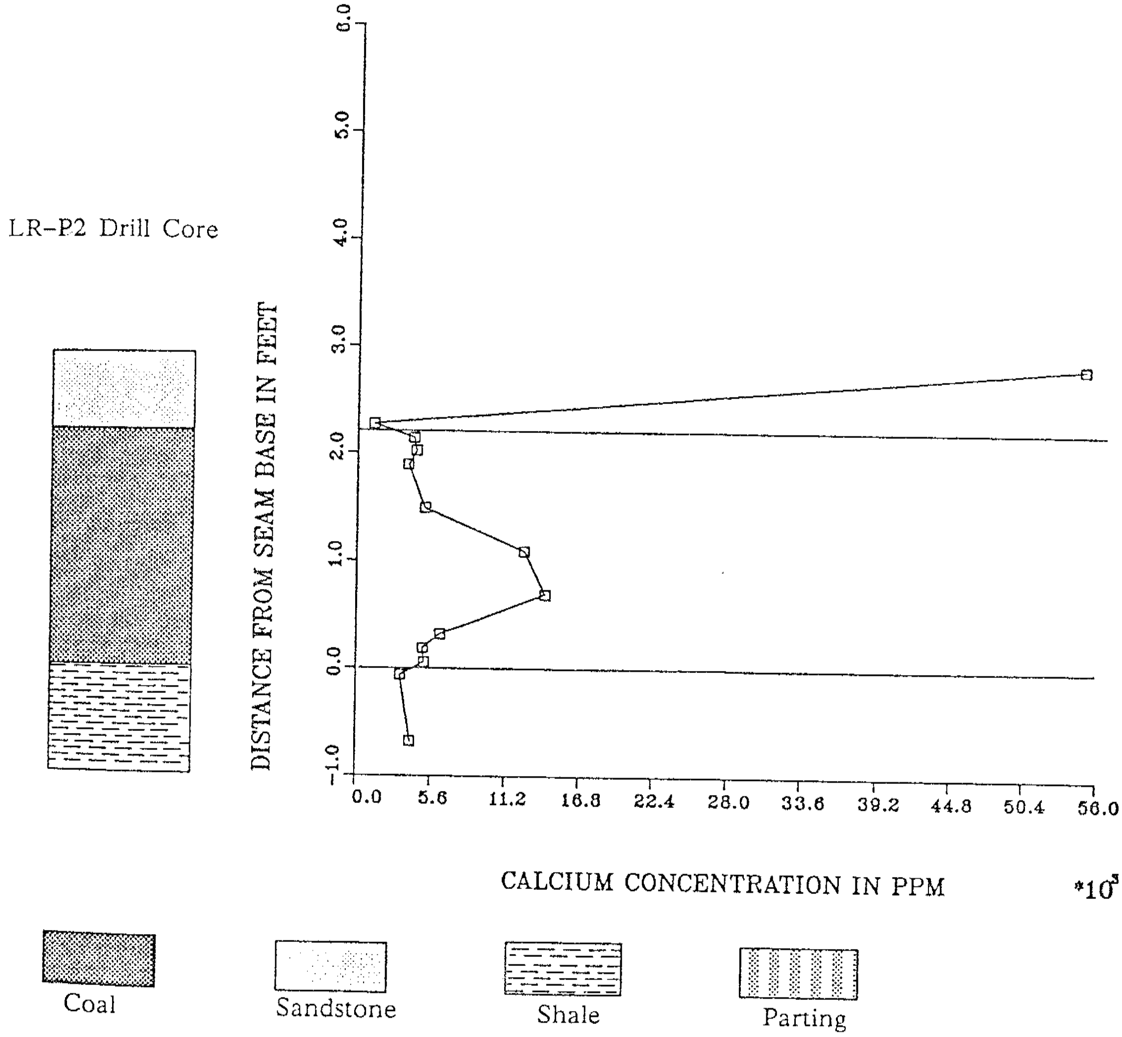


Figure D-67.

CALCIUM DISTRIBUTION IN THE LEE RANCH A2 DRILL CORE

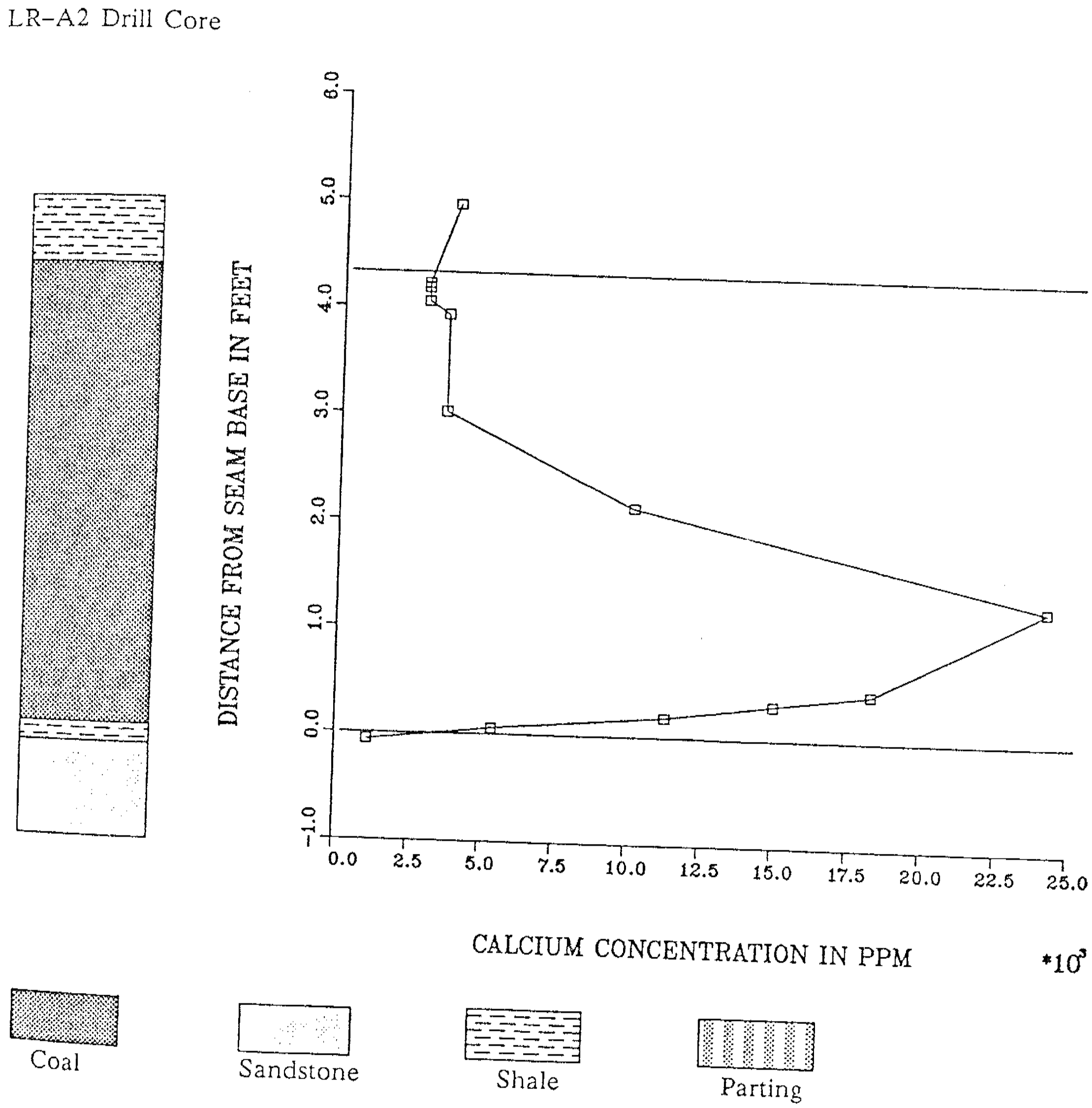


Figure D-68.

CALCIUM DISTRRIBUTION
IN THE LEE RANCH A3 DRILL CORE

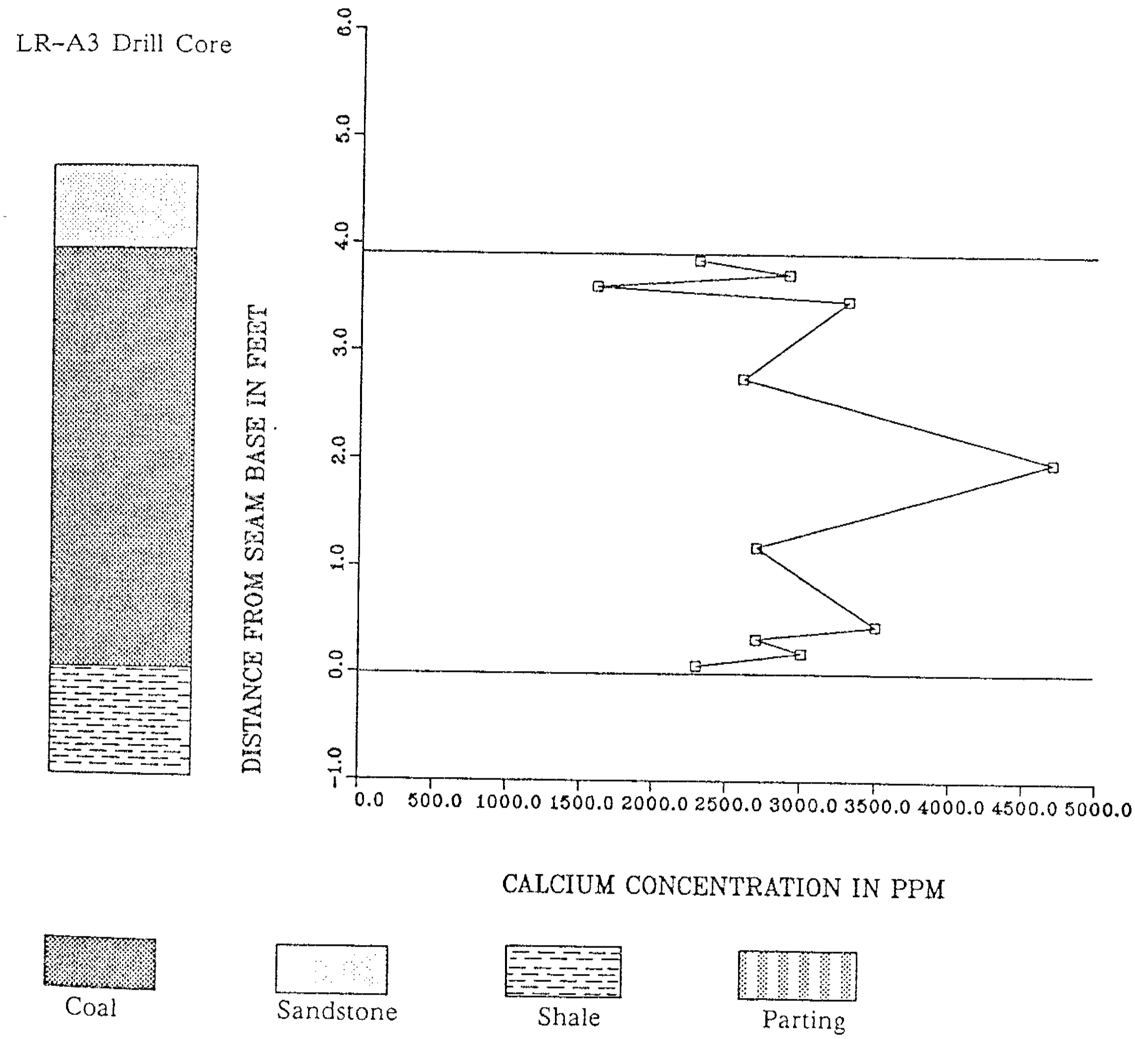


Figure D-69.

CALCIUM DISTRIBUTION

IN THE LEE RANCH B2 DRILL CORE

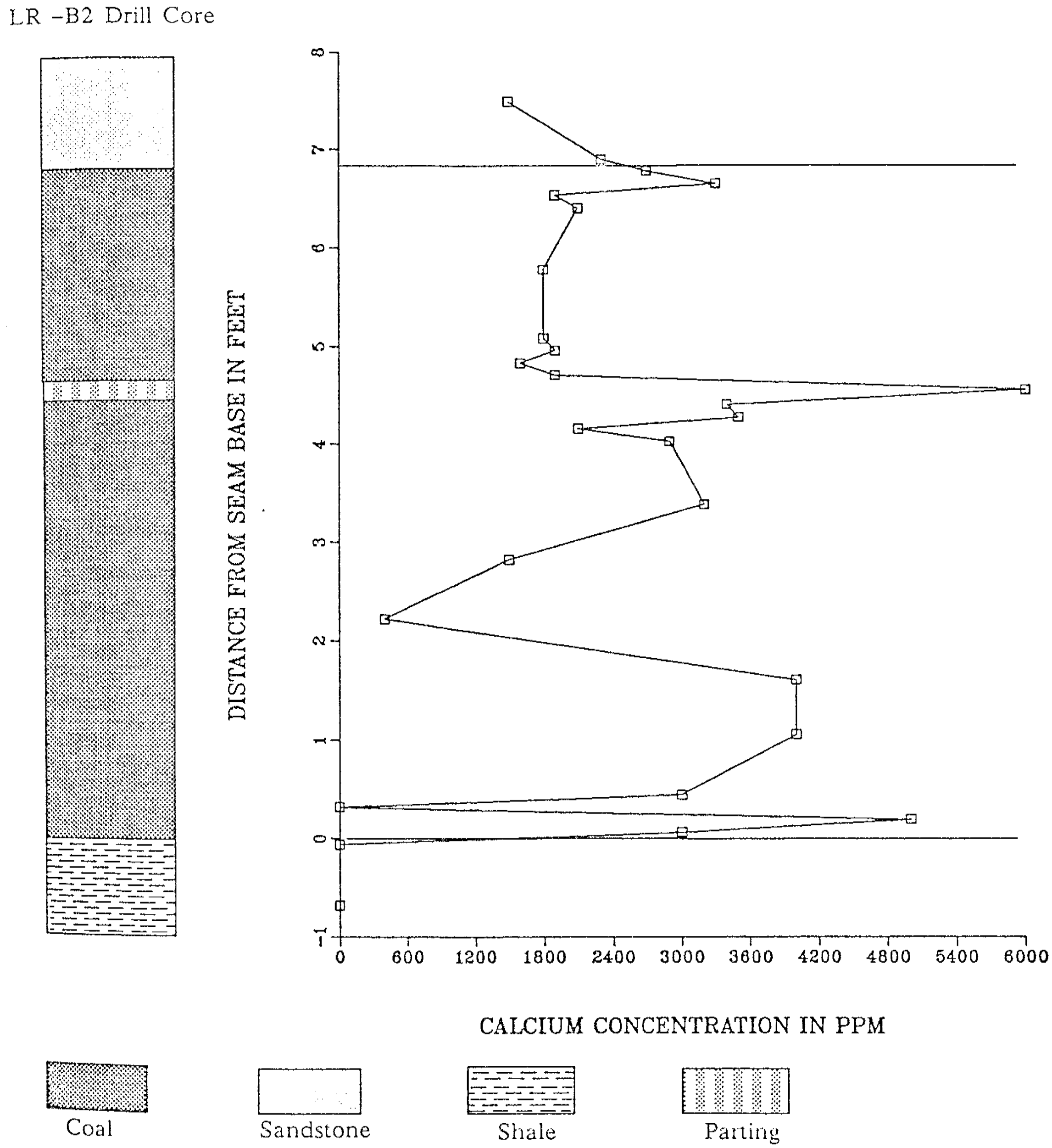


Figure D-70.

CALCIUM DISTRIBUTION
IN THE LEE RANCH B3 DRILL CORE

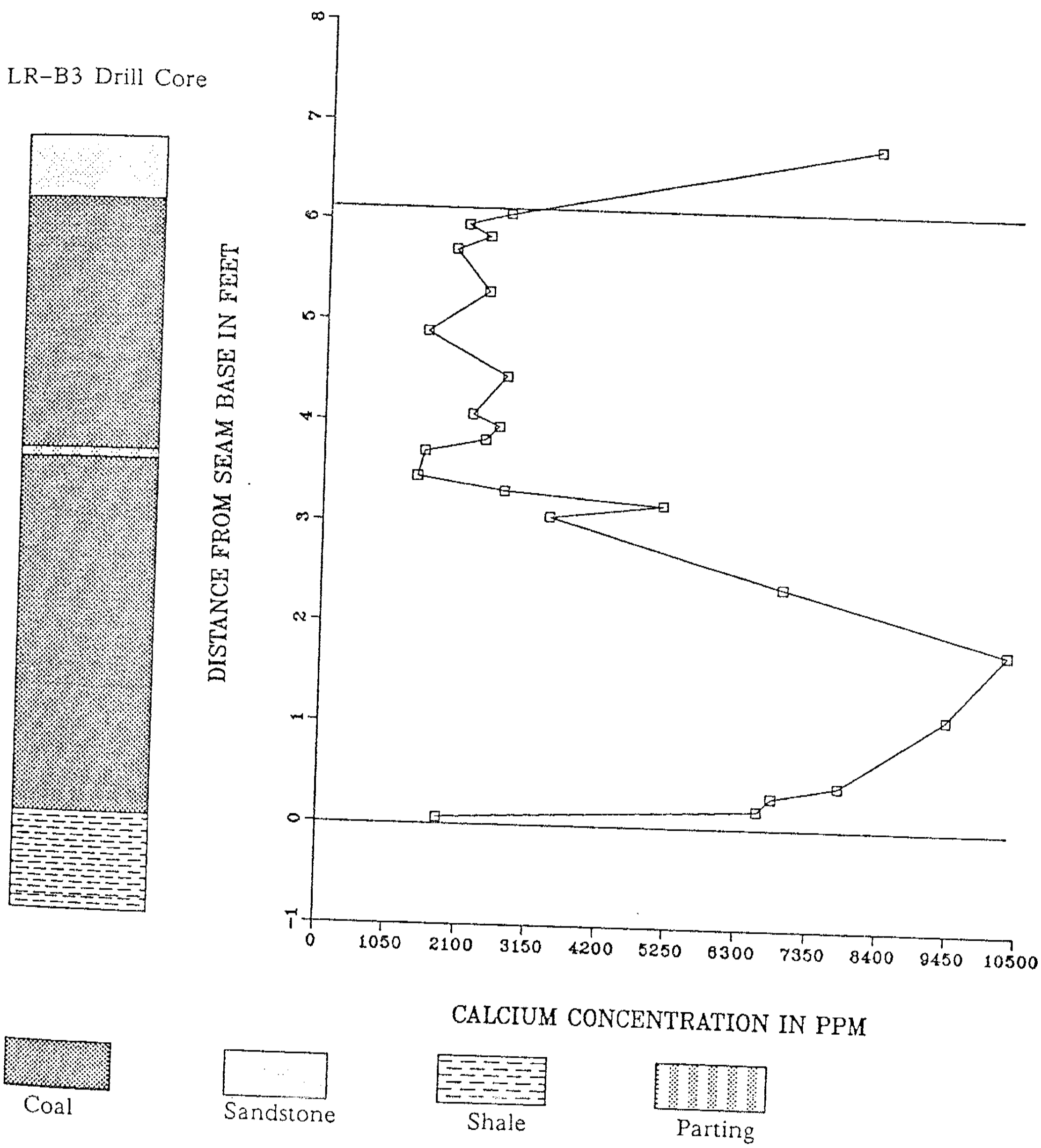


Figure D-71.

CALCIUM DISTRIBUTION
IN THE YORK CANYON "A" AND "MAIN" SEAMS

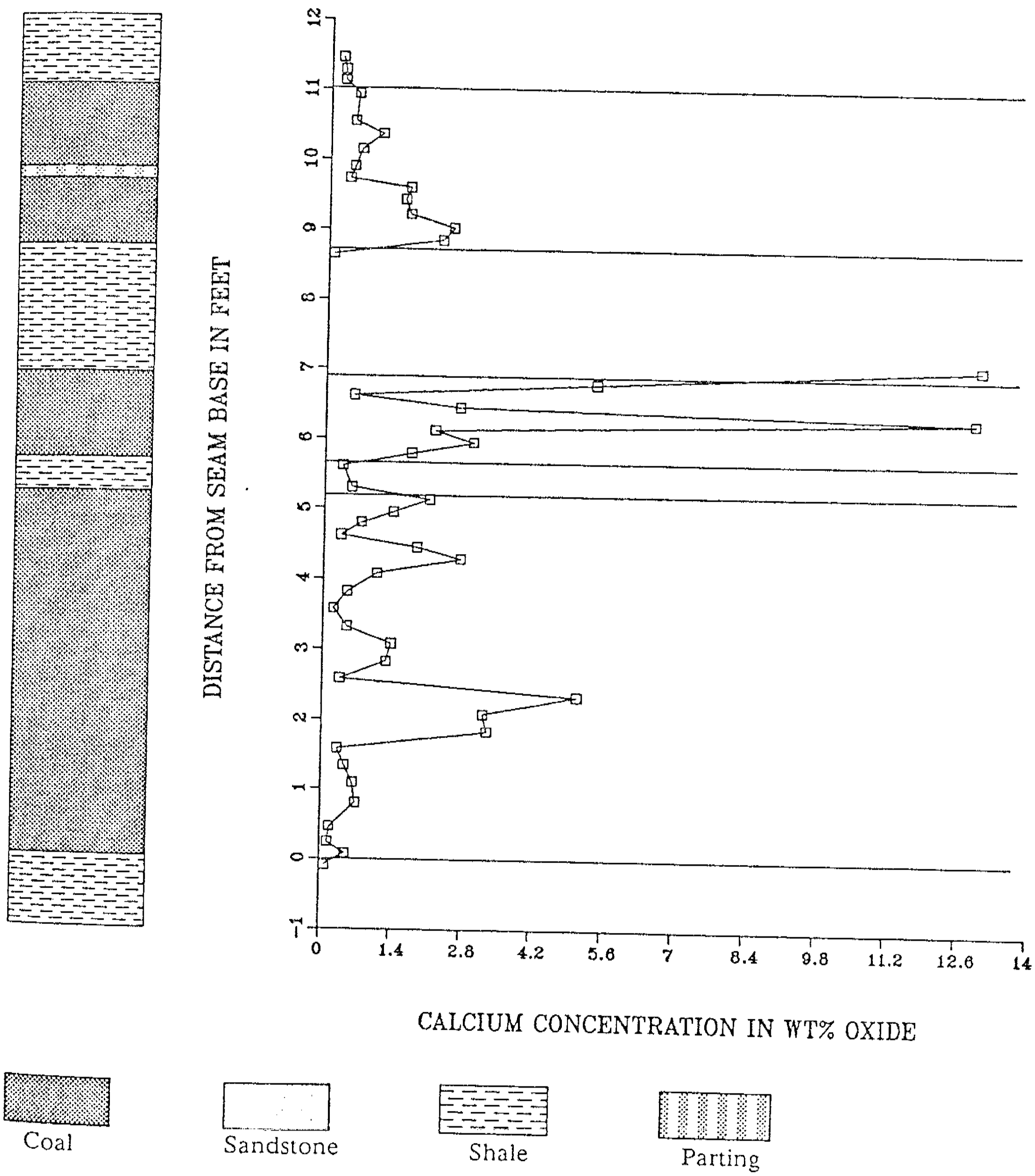


Figure D-72.

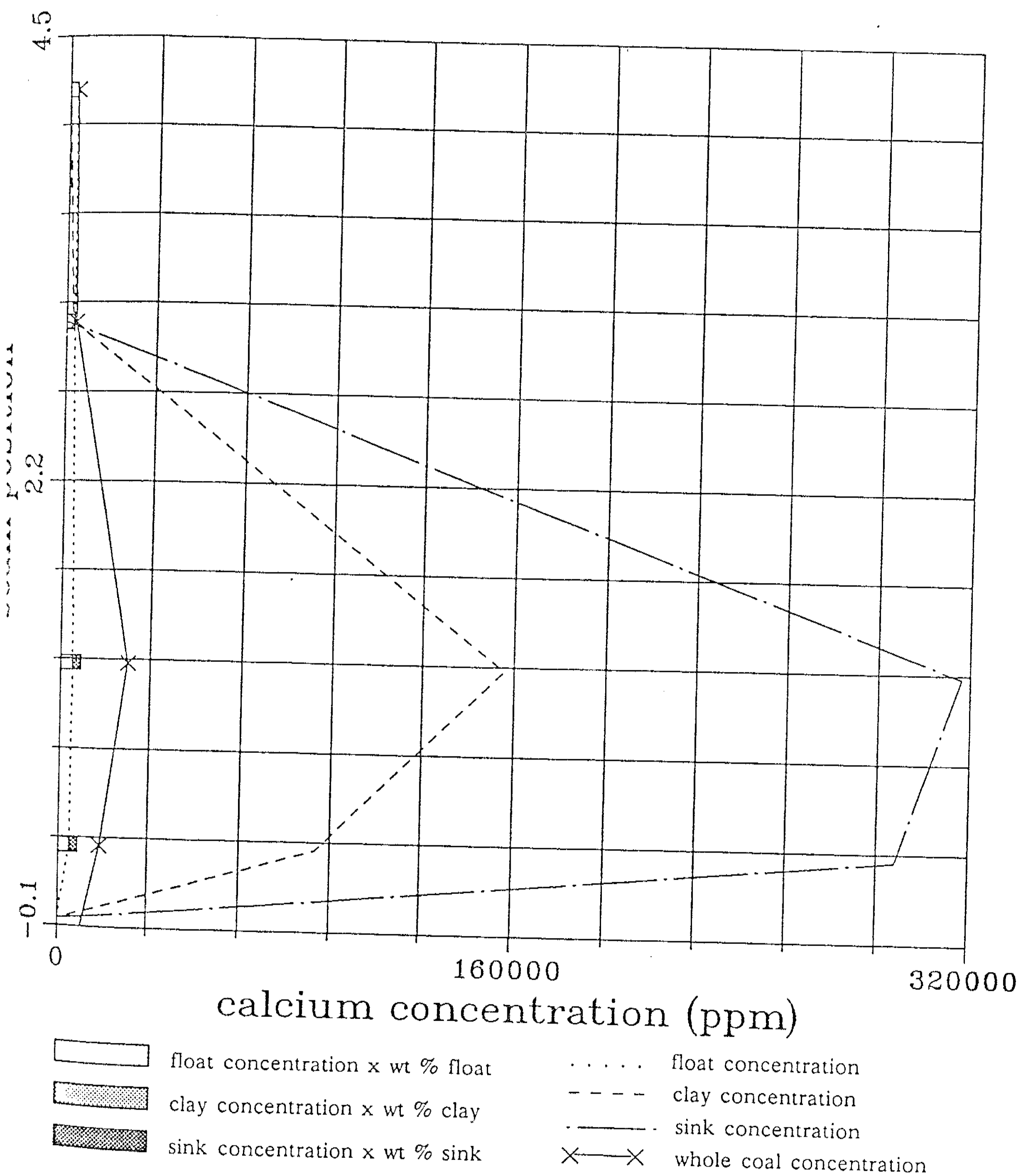


Figure D-73. Calcium float-clay-sink distributions in the LRA2 seam.

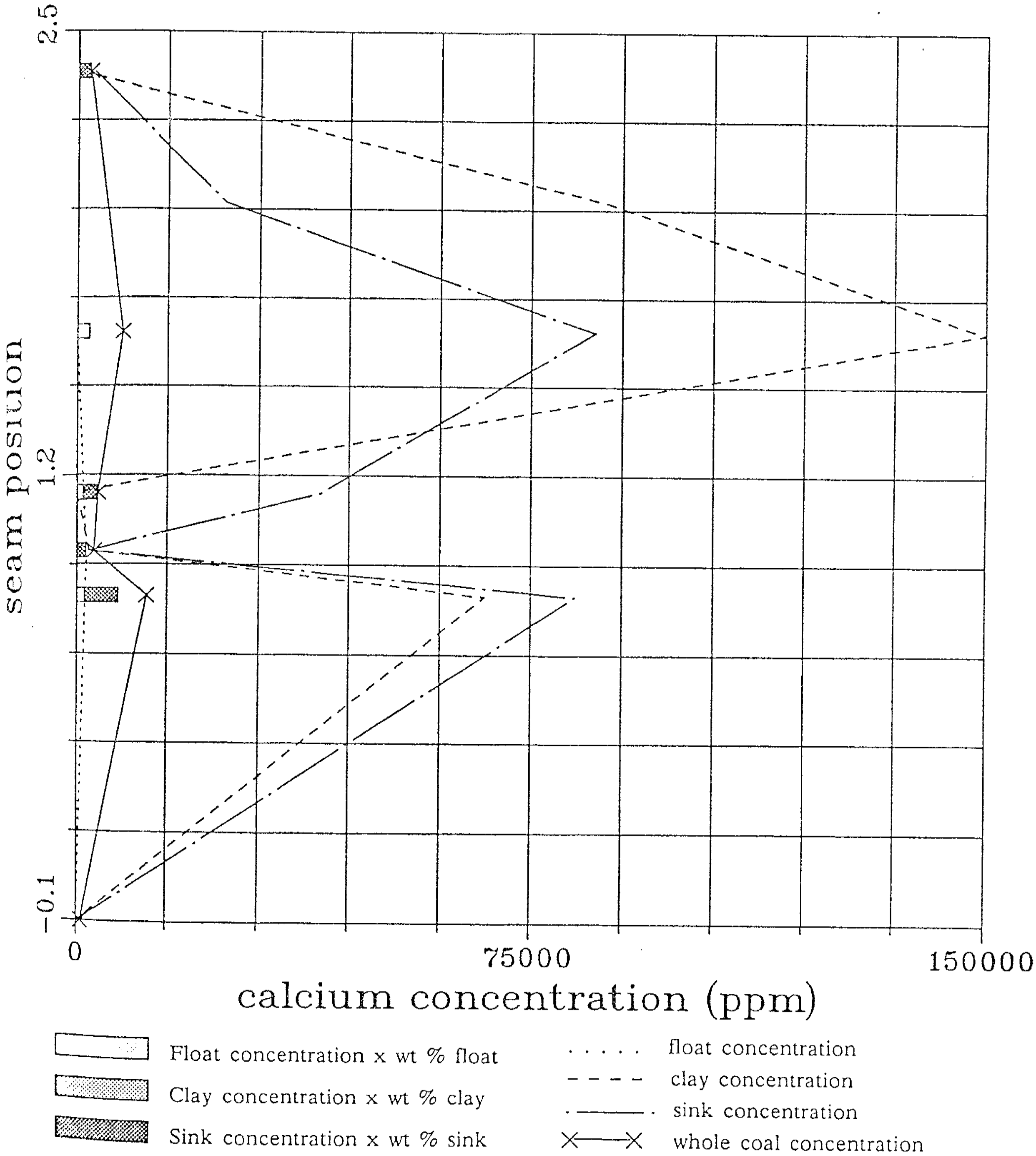


Figure D-74. Calcium float-clay-sink distributions in the YA seam.

STRONTIUM DISTRIBUTION

IN THE LEE RANCH P1 DRILL CORE

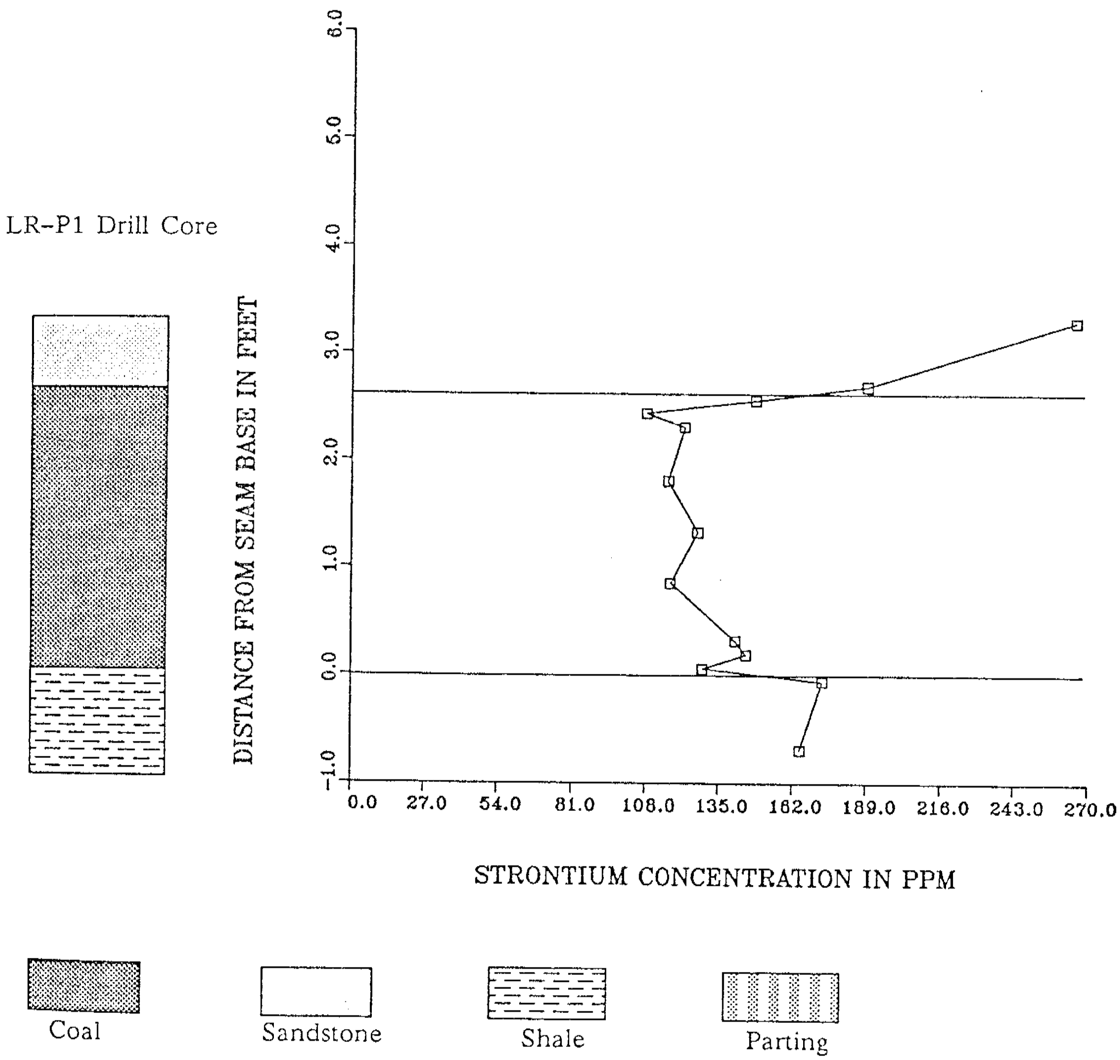


Figure D-75.

STRONTIUM DISTRIBUTION
IN THE LEE RANCH P2 DRILL CORE

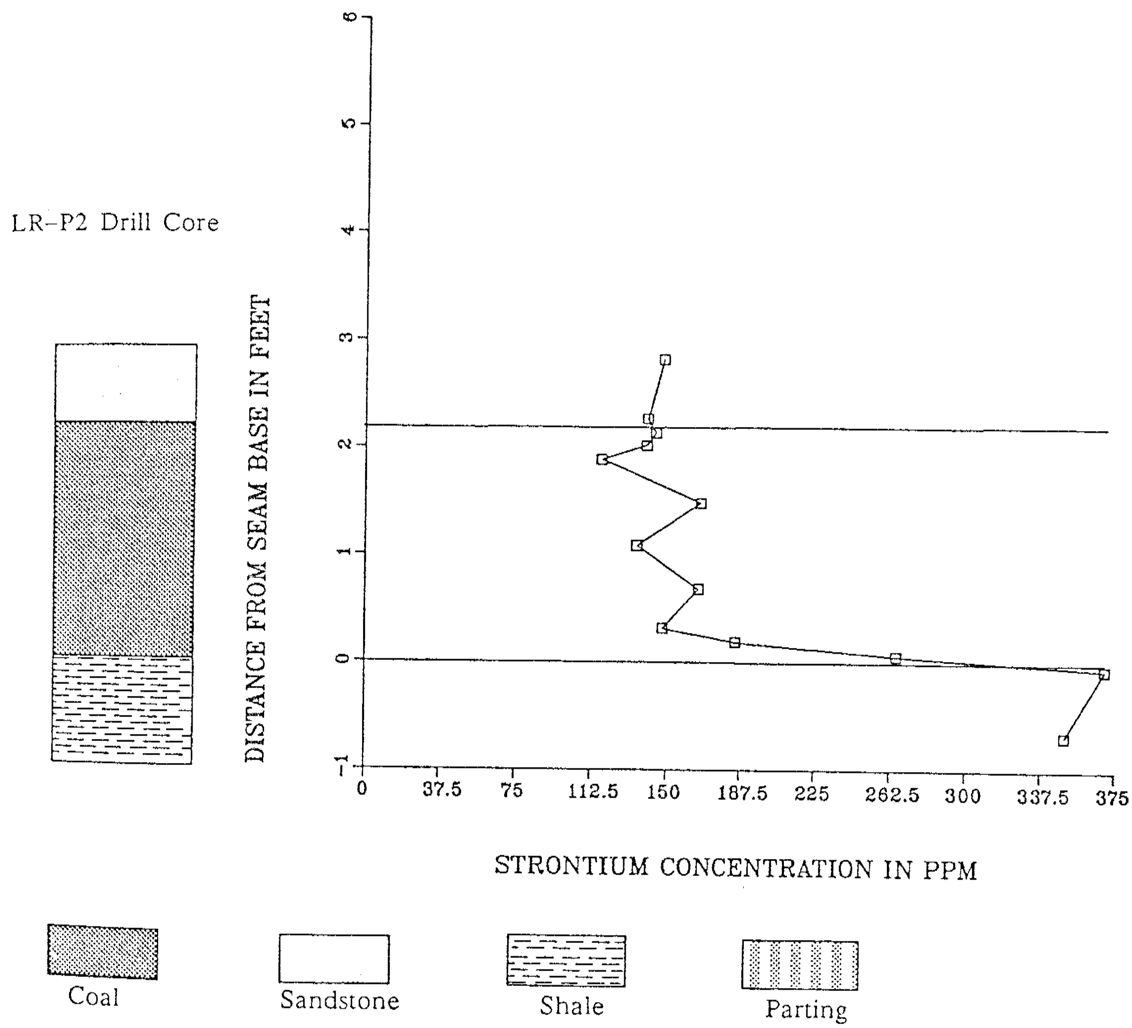


Figure D-76.

STRONTIUM DISTRIBUTION
IN THE LEE RANCH A2 DRILL CORE

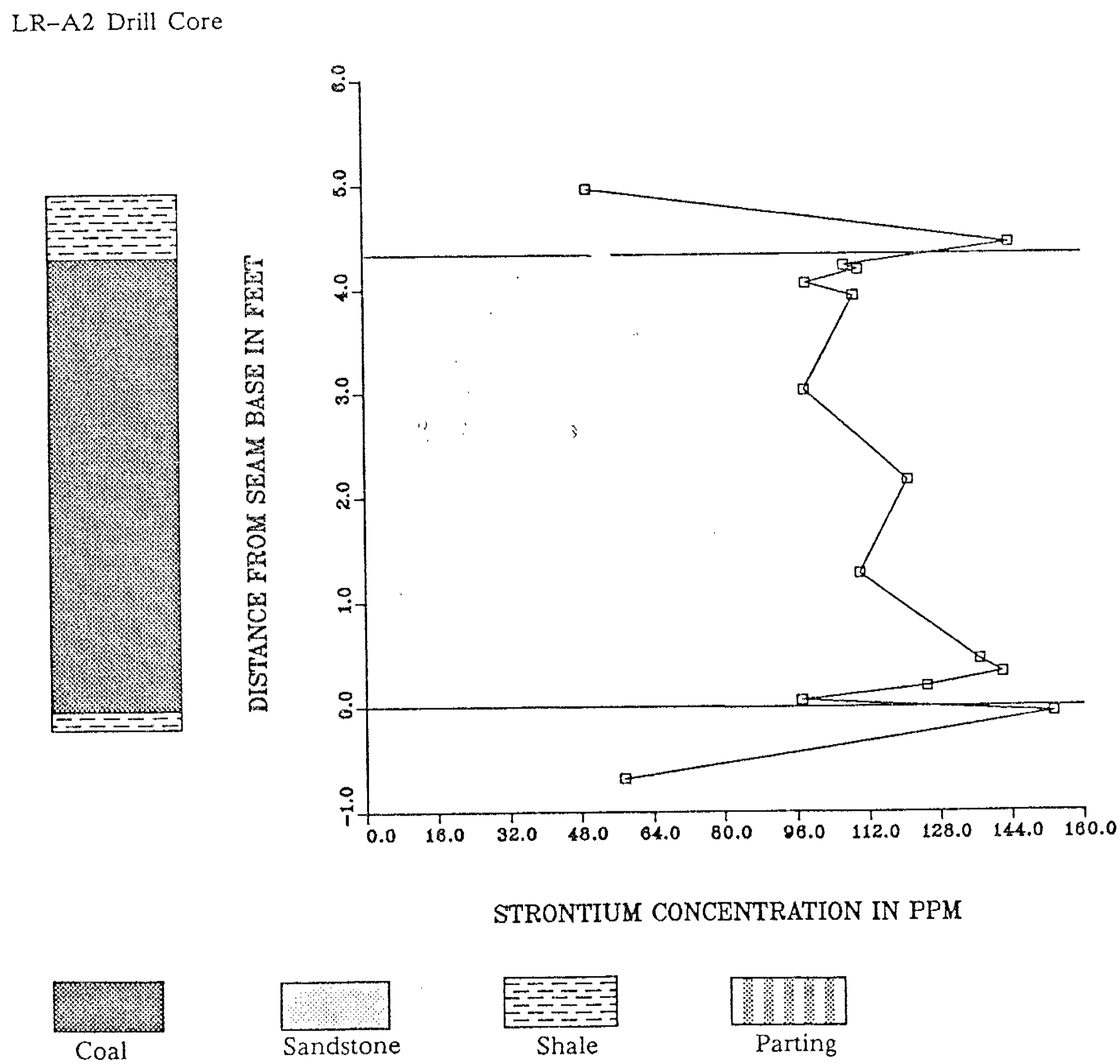


Figure D-77.

STRONTIUM DISTRIBUTION
IN THE LEE RANCH A3 DRILL CORE

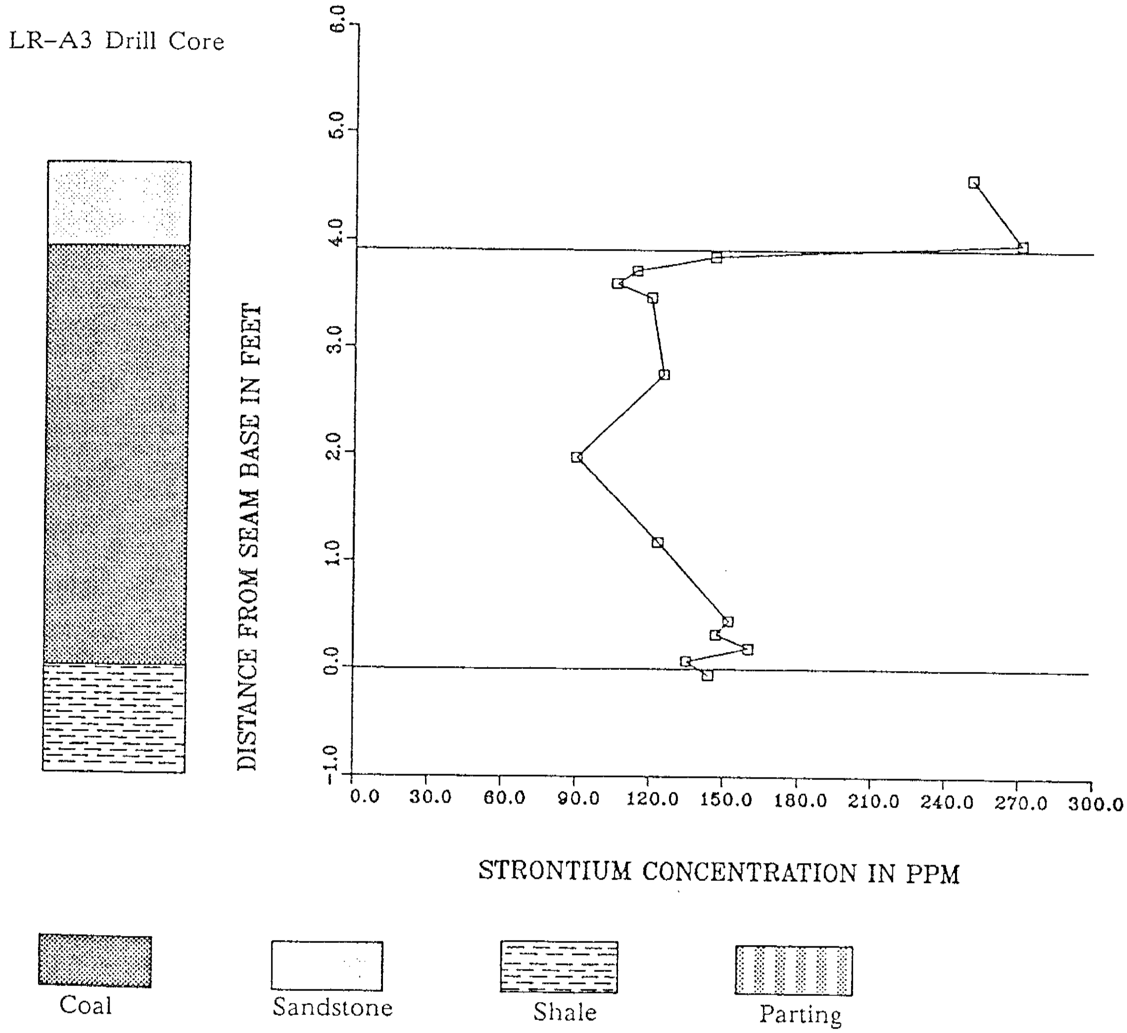


Figure D-78.

STRONTIUM DISTRIBUTION IN THE LEE RANCH B2 DRILL CORE

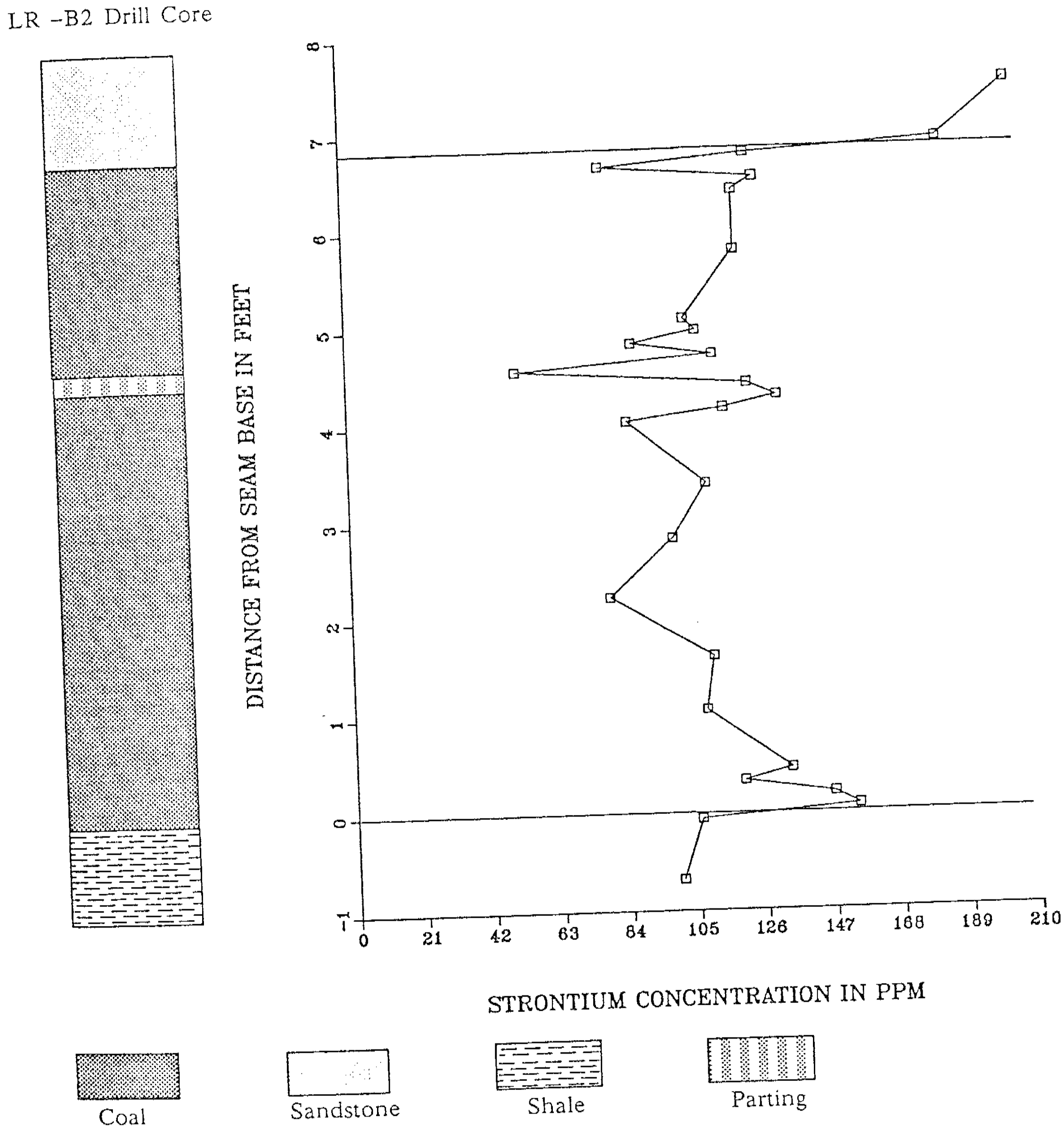


Figure D-79.

STRONTIUM DISTRIBUTION IN THE LEE RANCH B3 DRILL CORE

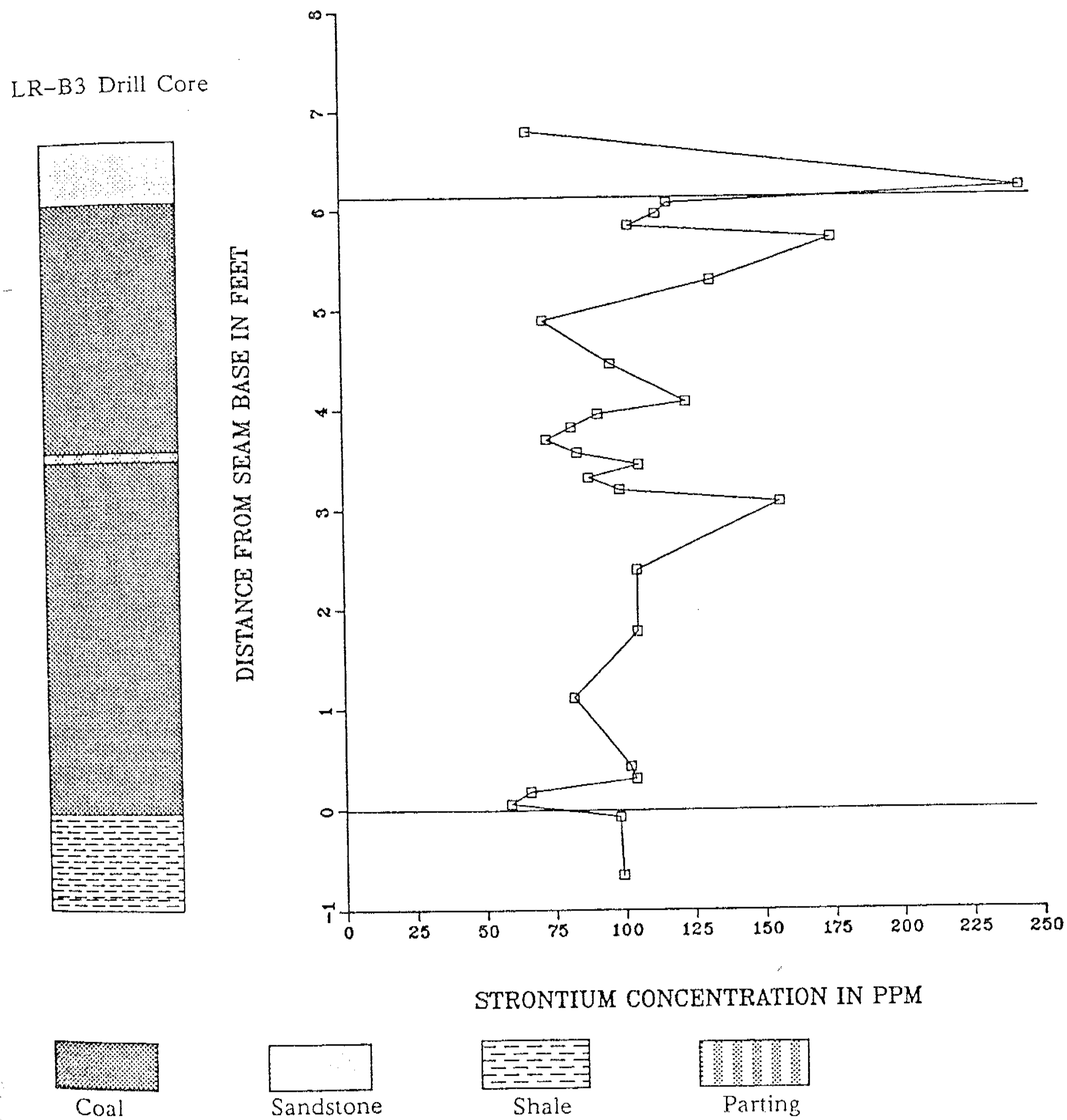


Figure D-80.

STRONTIUM DISTRIBUTION
IN THE YORK CANYON "A" AND "MAIN" SEAMS

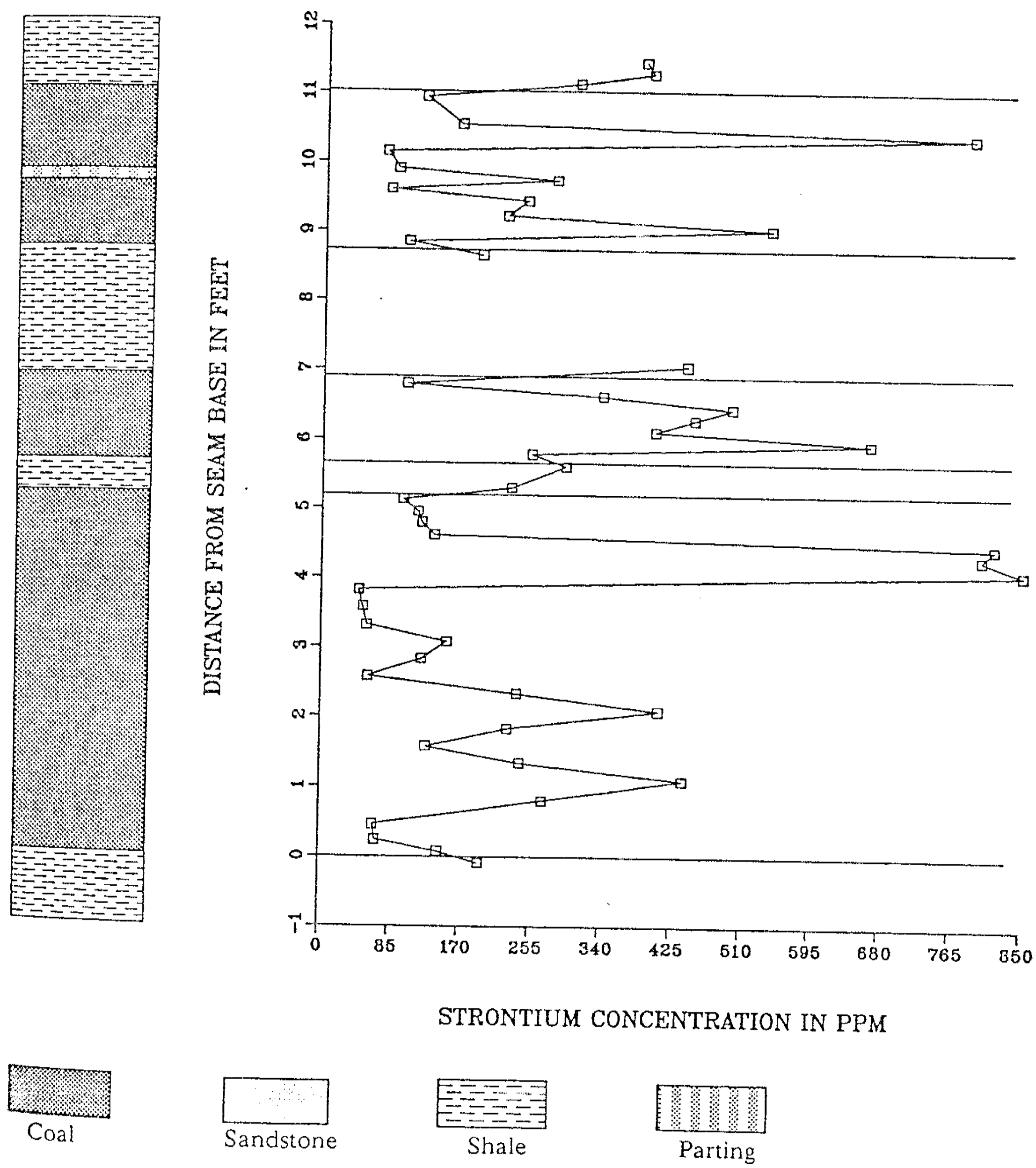


Figure D-81.

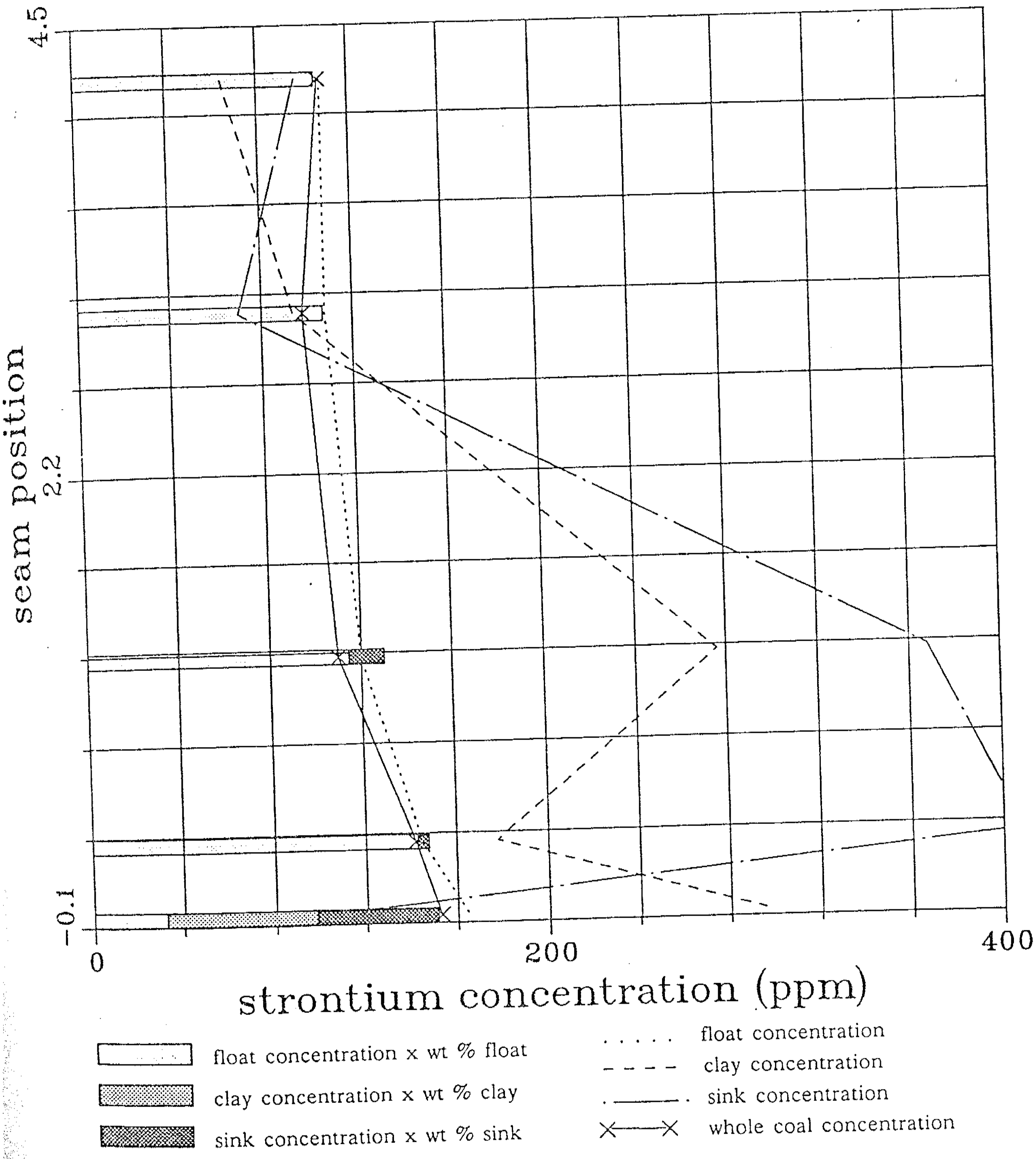


Figure D–82. Strintium float–clay–sink distributions in the LRA2 seam.

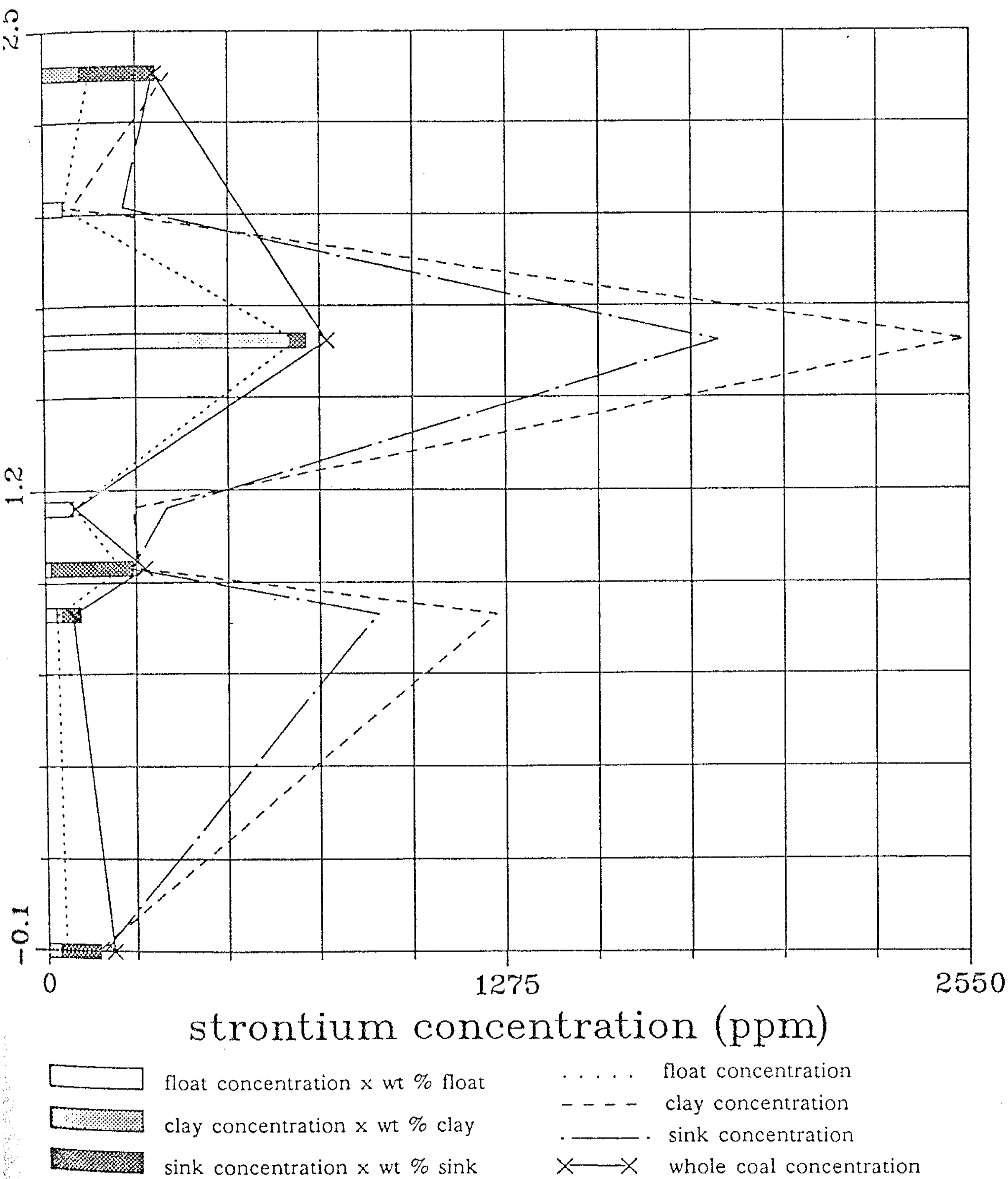


Figure D-83. Strontium float-clay-sink distributions in the YA seam.

COBALT DISTRIBUTION
IN THE LEE RANCH P1 DRILL CORE

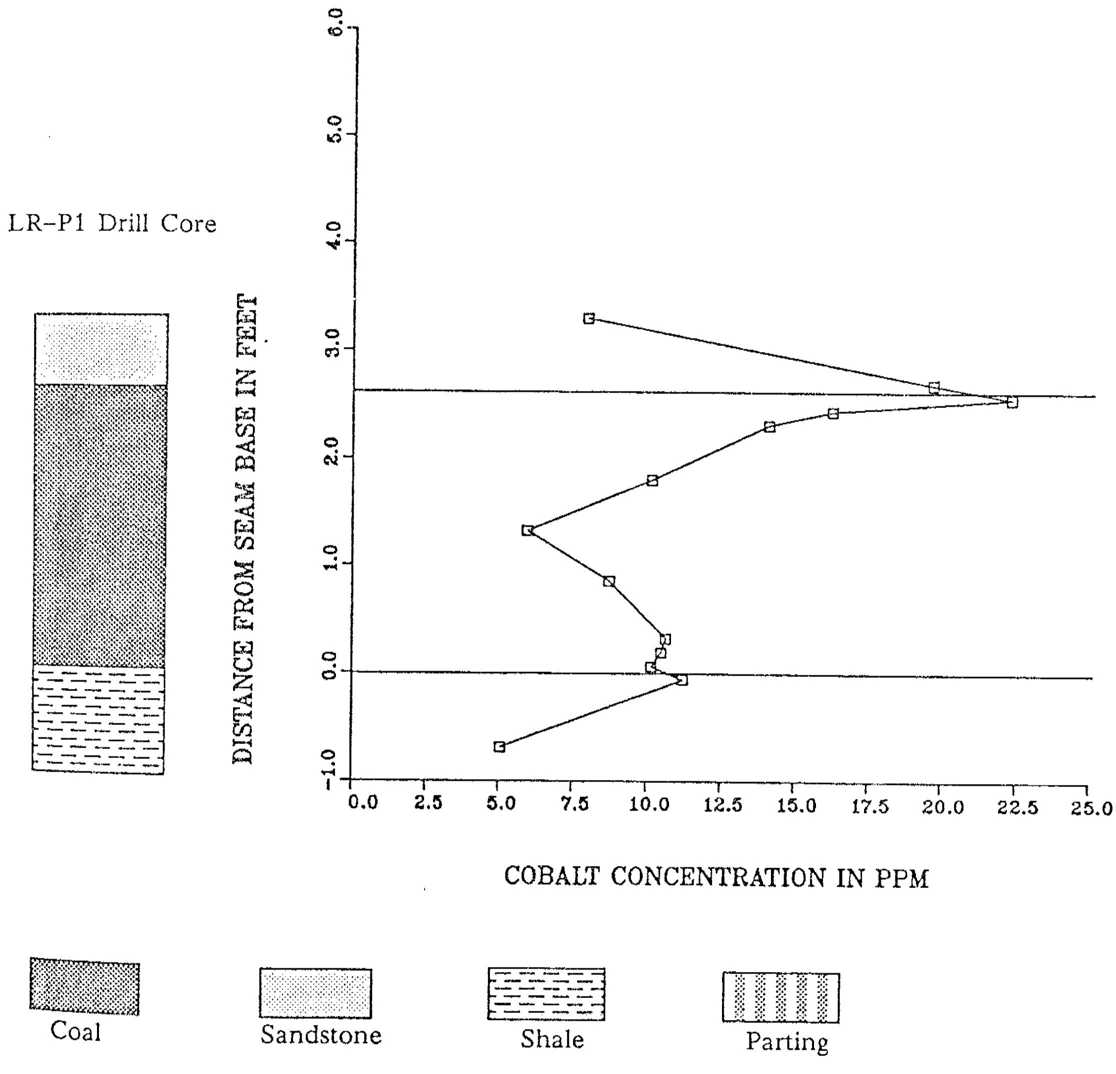


Figure D-84.

COBALT DISTRIBUTION
IN THE LEE RANCH P2 DRILL CORE

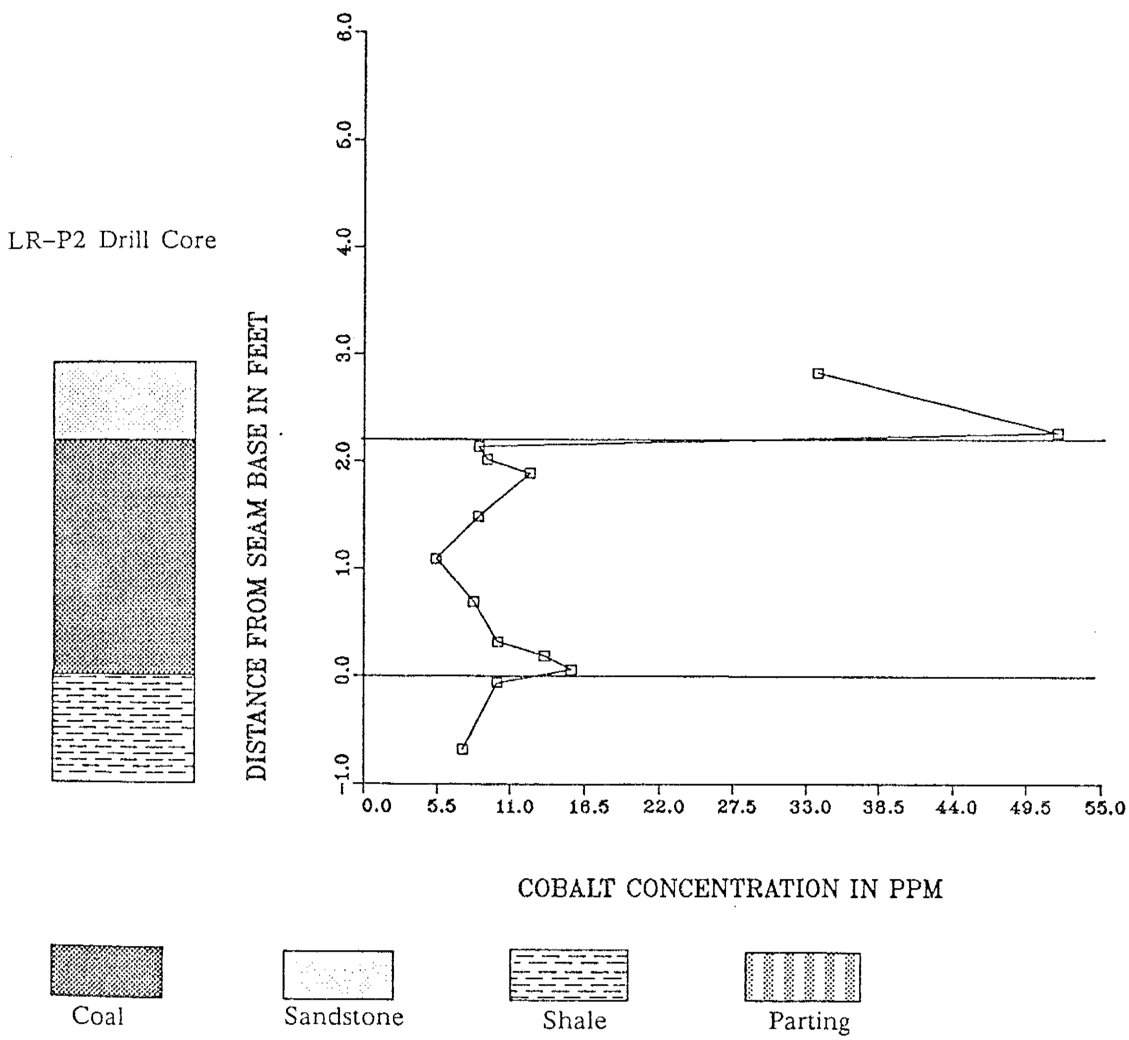


Figure D-85.

COBALT DISTRIBUTION IN THE LEE RANCH A2 DRILL CORE

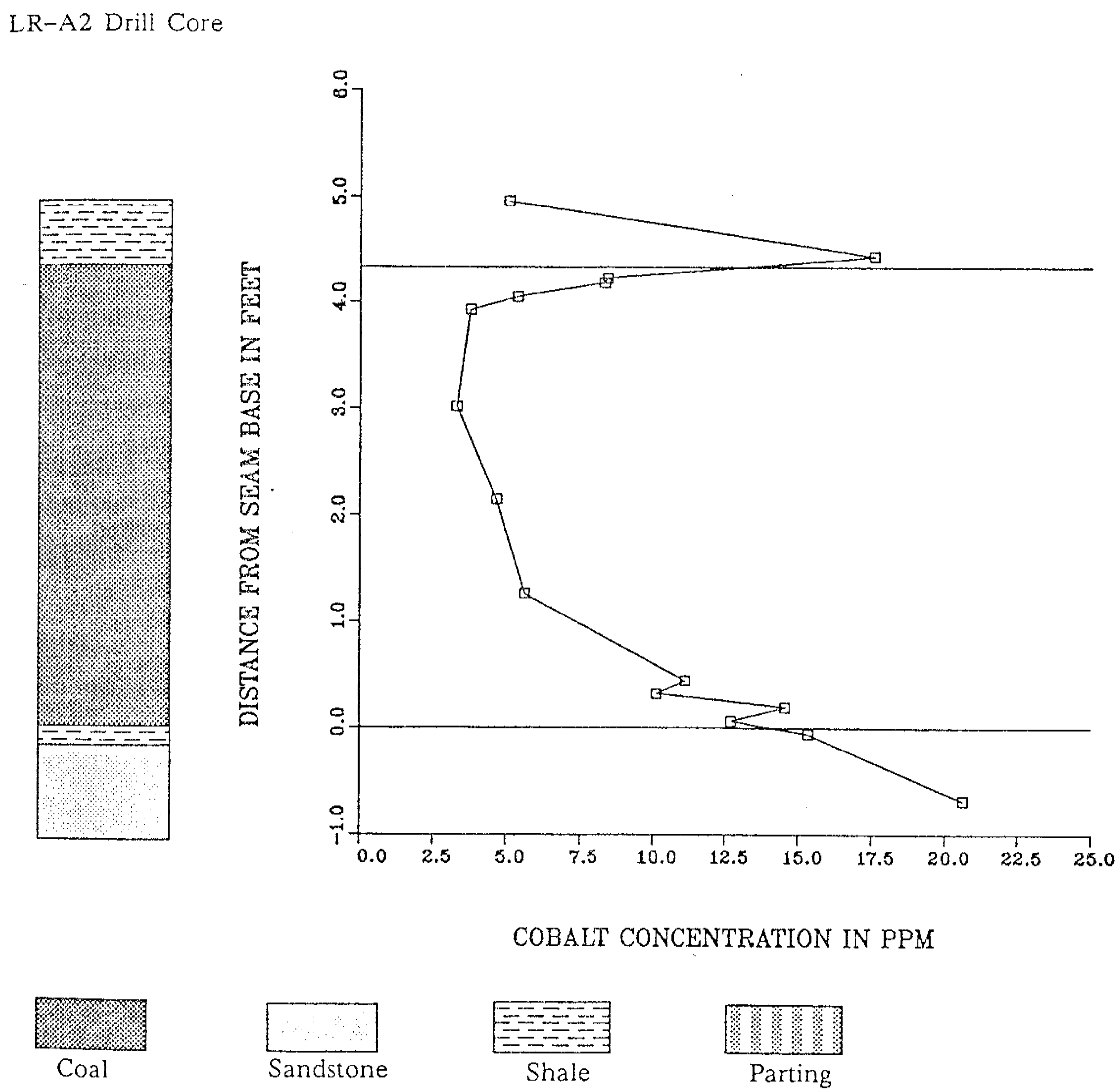


Figure D-86.

COBALT DISTRIBUTION IN THE LEE RANCH A3 DRILL CORE

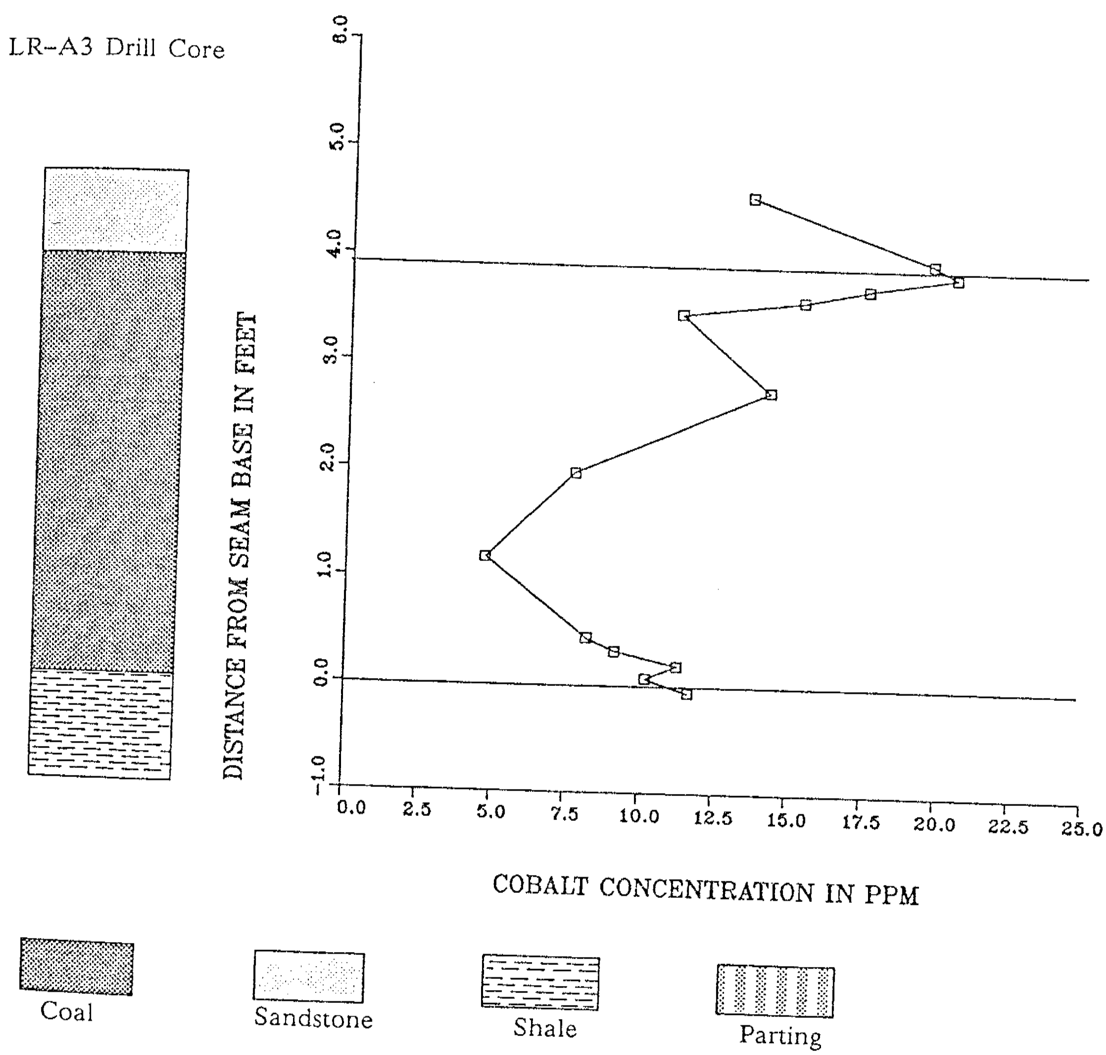


Figure D-87.

COBALT DISTRIBUTION IN THE LEE RANCH B2 DRILL CORE

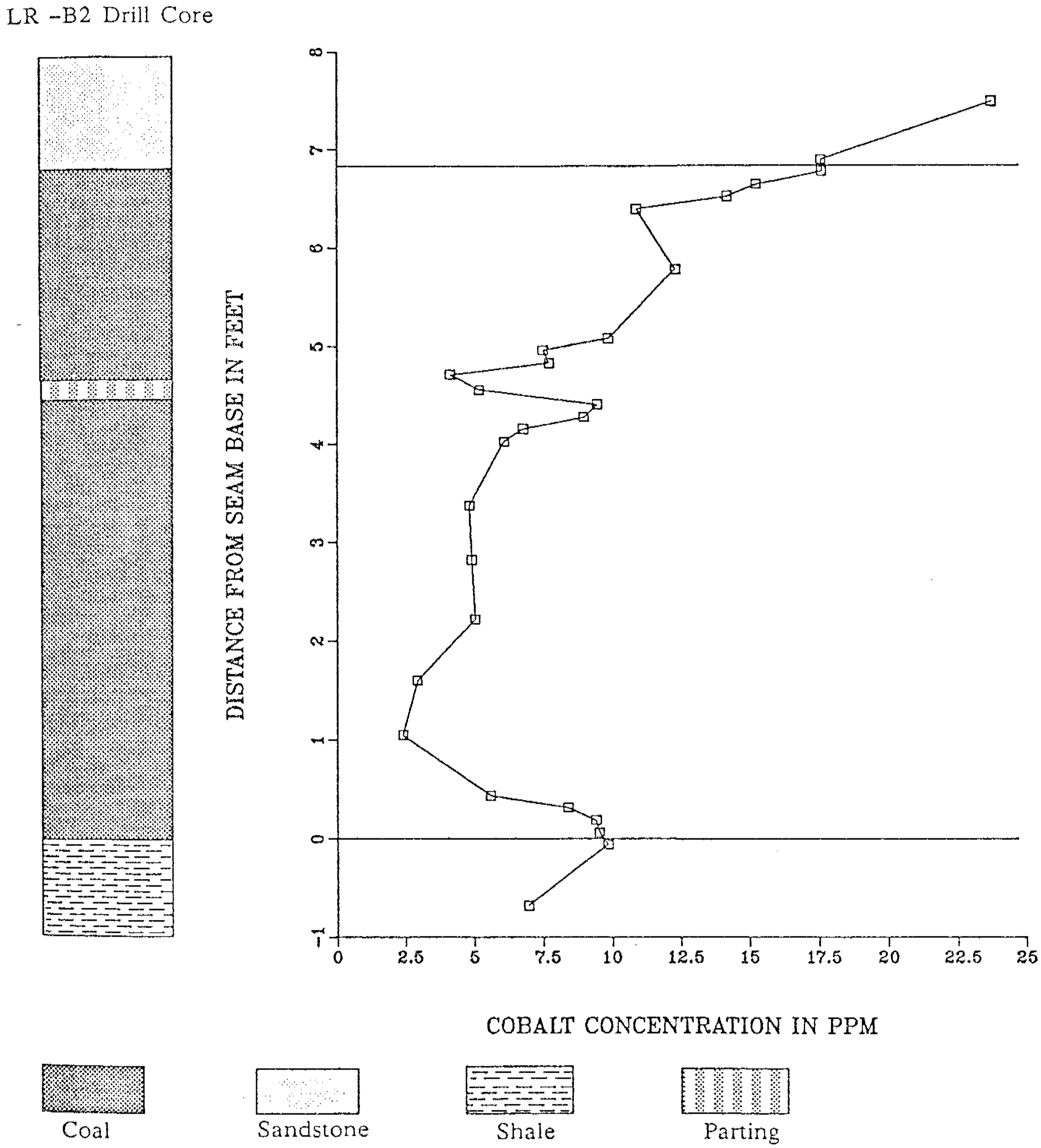


Figure D-88.

COBALT DISTRIBUTION
IN THE LEE RANCH B3 DRILL CORE

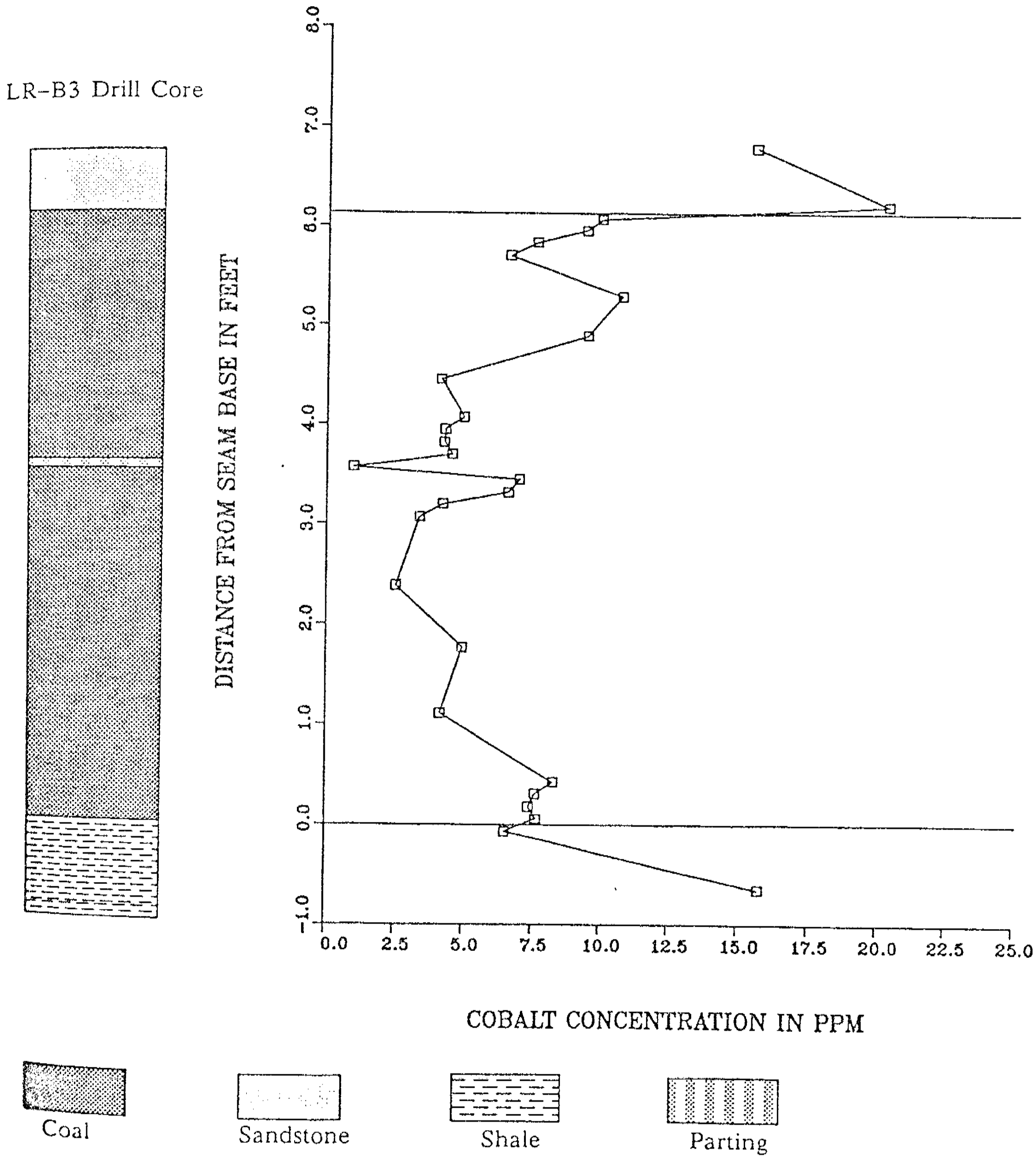


Figure D-89.

COBALT DISTRIBUTION
IN THE YORK CANYON "A" AND "MAIN" SEAMS

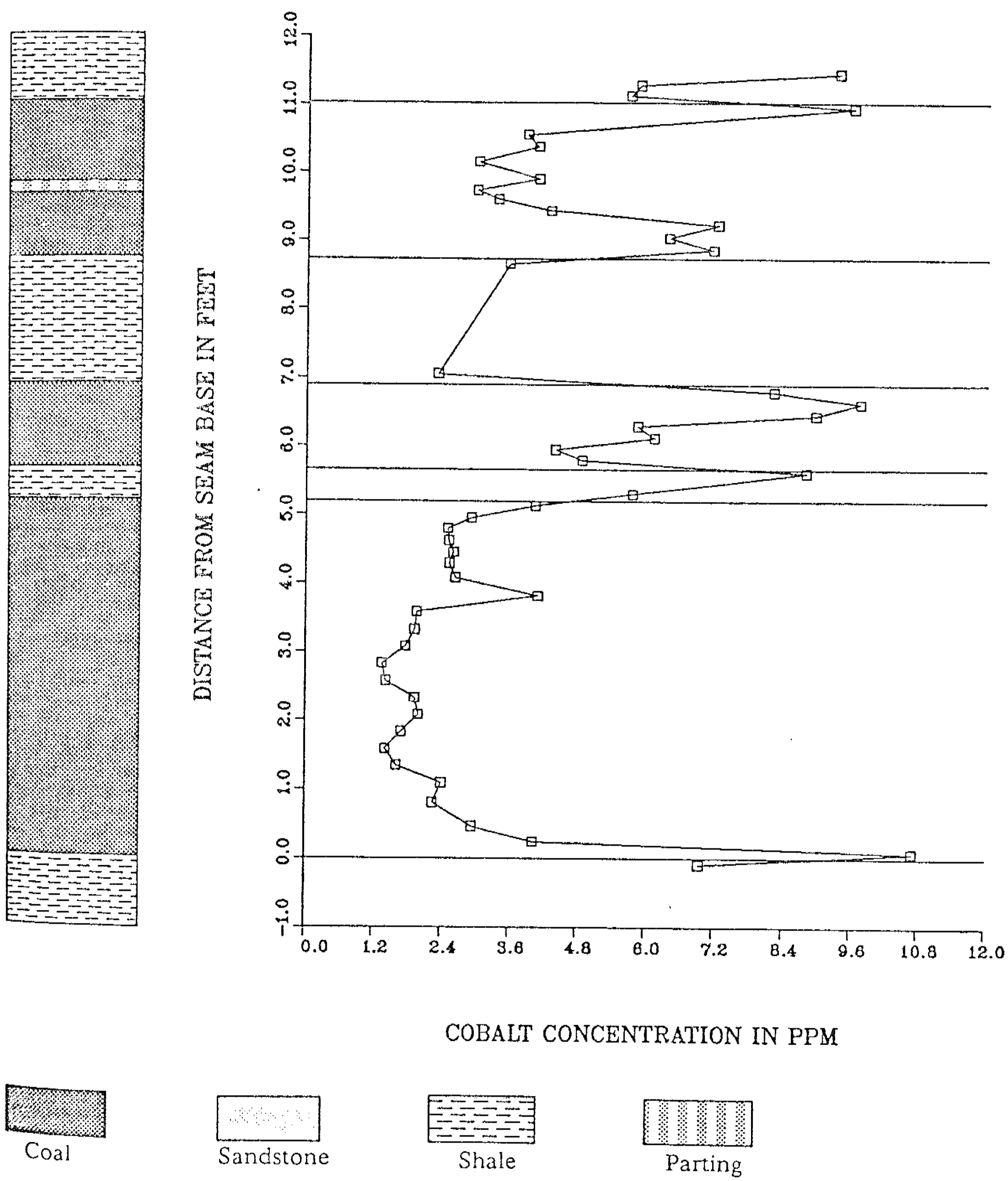


Figure D-90.

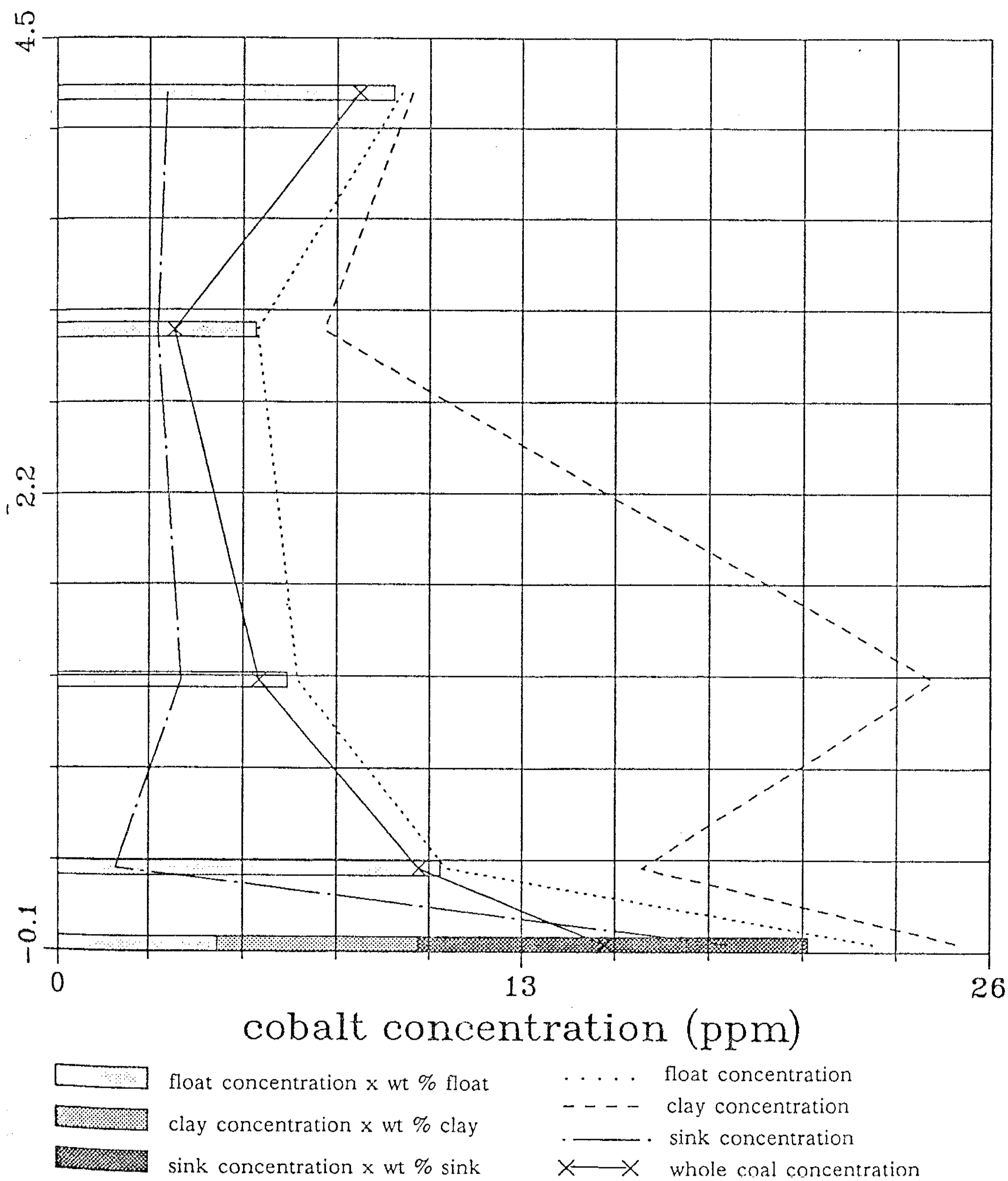


Figure D-91. Cobalt float-clay-sink distributions in the LRA2 seam.

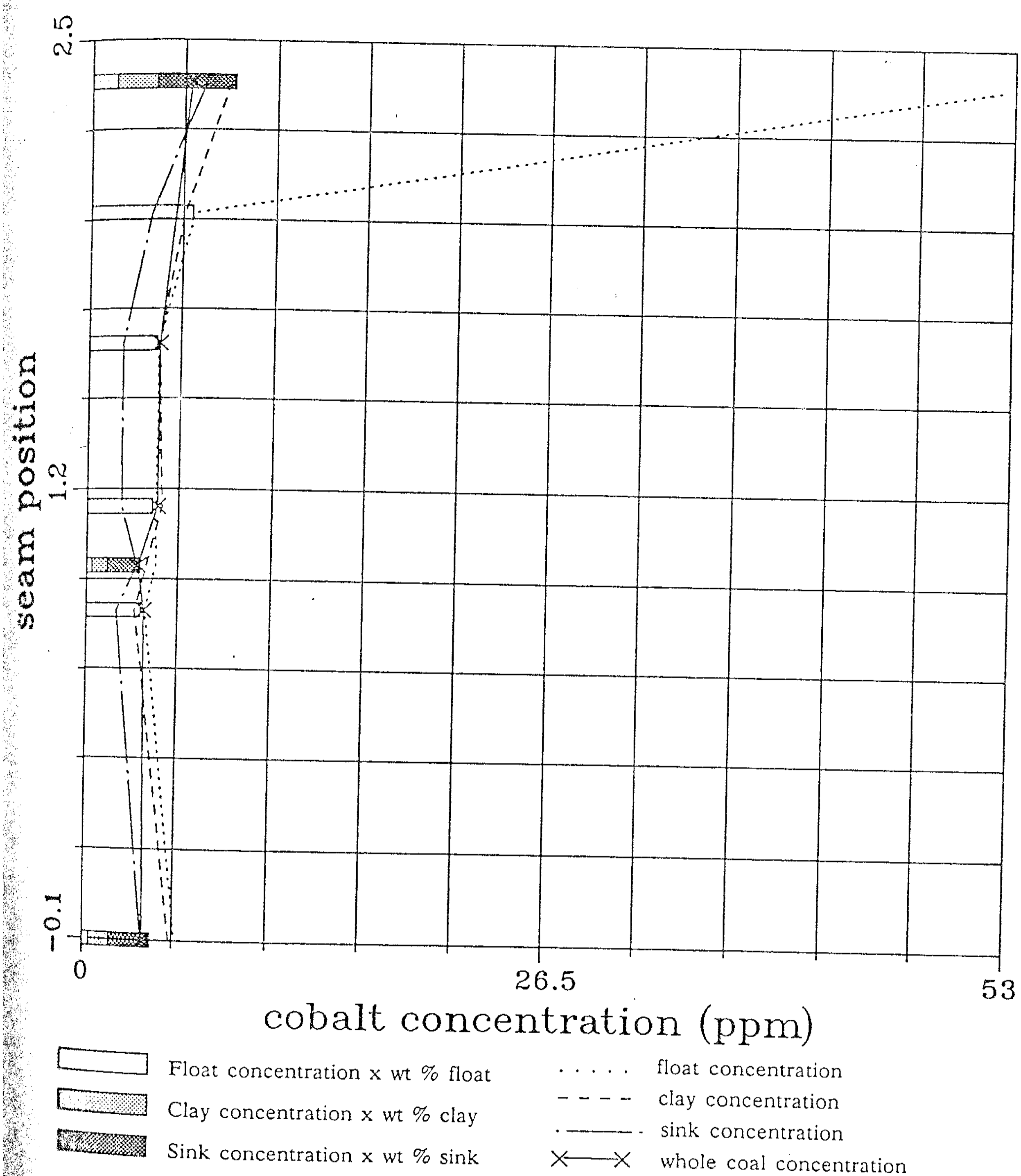


Figure D-92. Cobalt float-clay-sink distributions in the YA seam.

IRON DISTRIBUTION
IN THE LEE RANCH P1 DRILL CORE

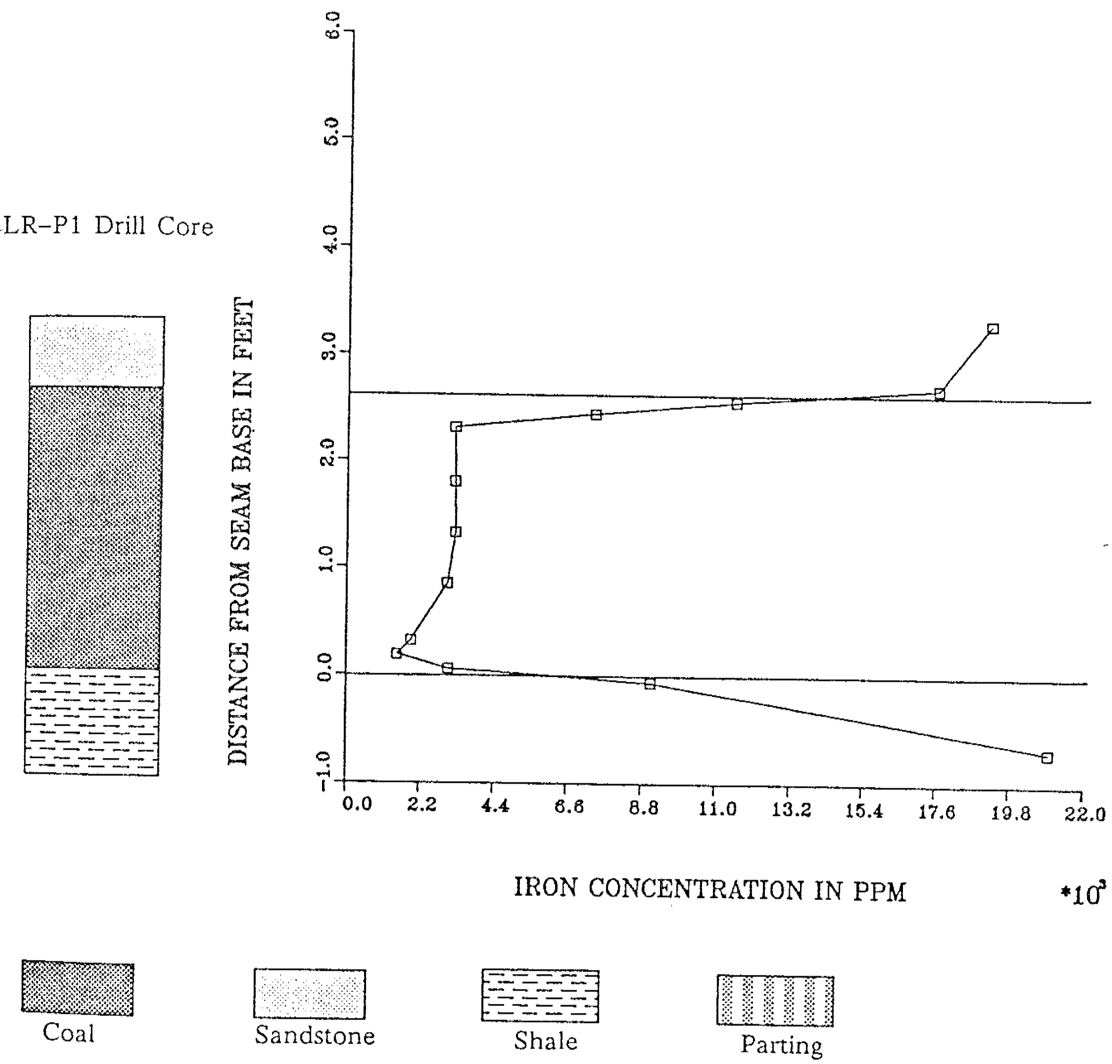


Figure D-93.

IRON DISTRIBUTION
IN THE LEE RANCH P2 DRILL CORE

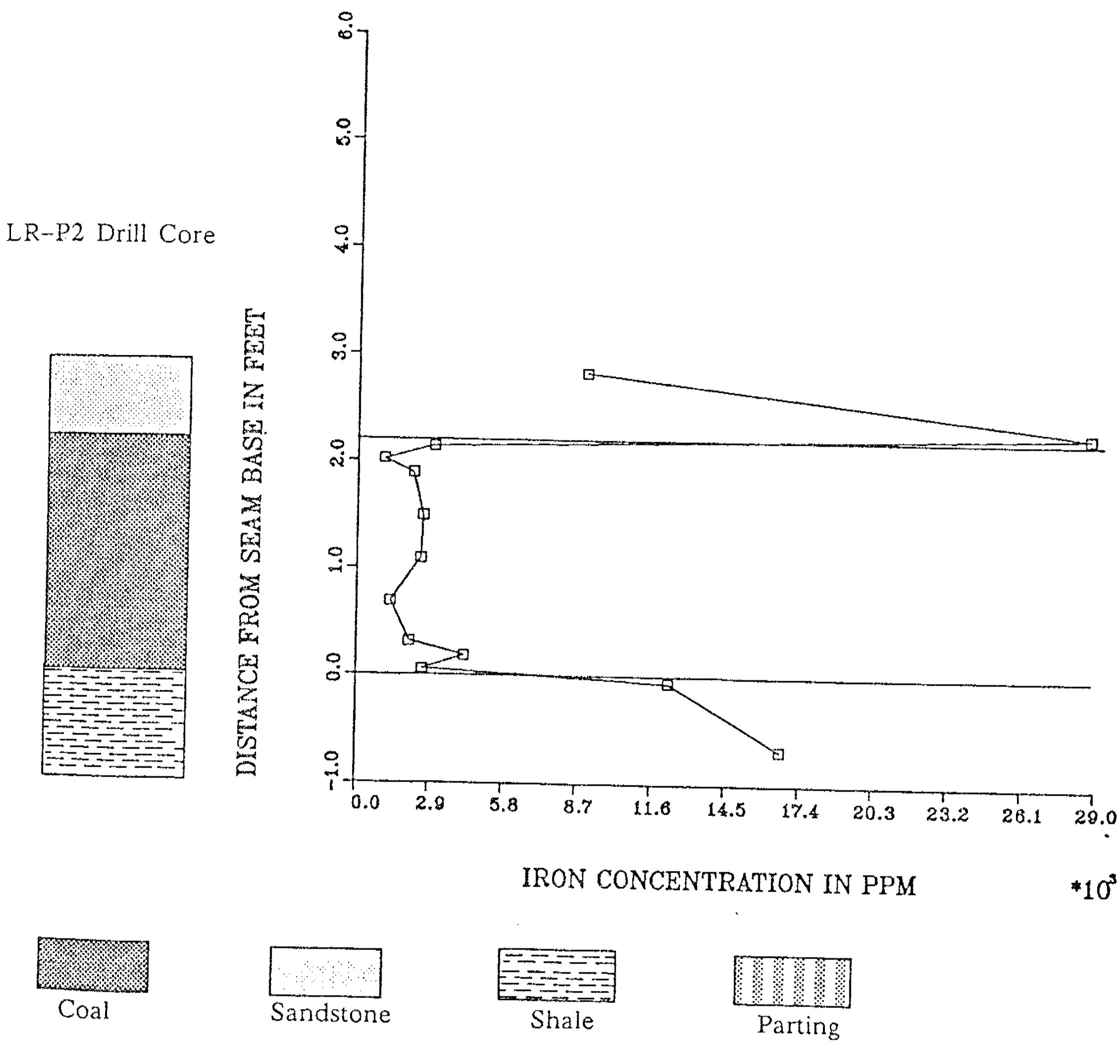


Figure D-94.

IRON DISTRIBUTION
IN THE LEE RANCH A2 DRILL CORE

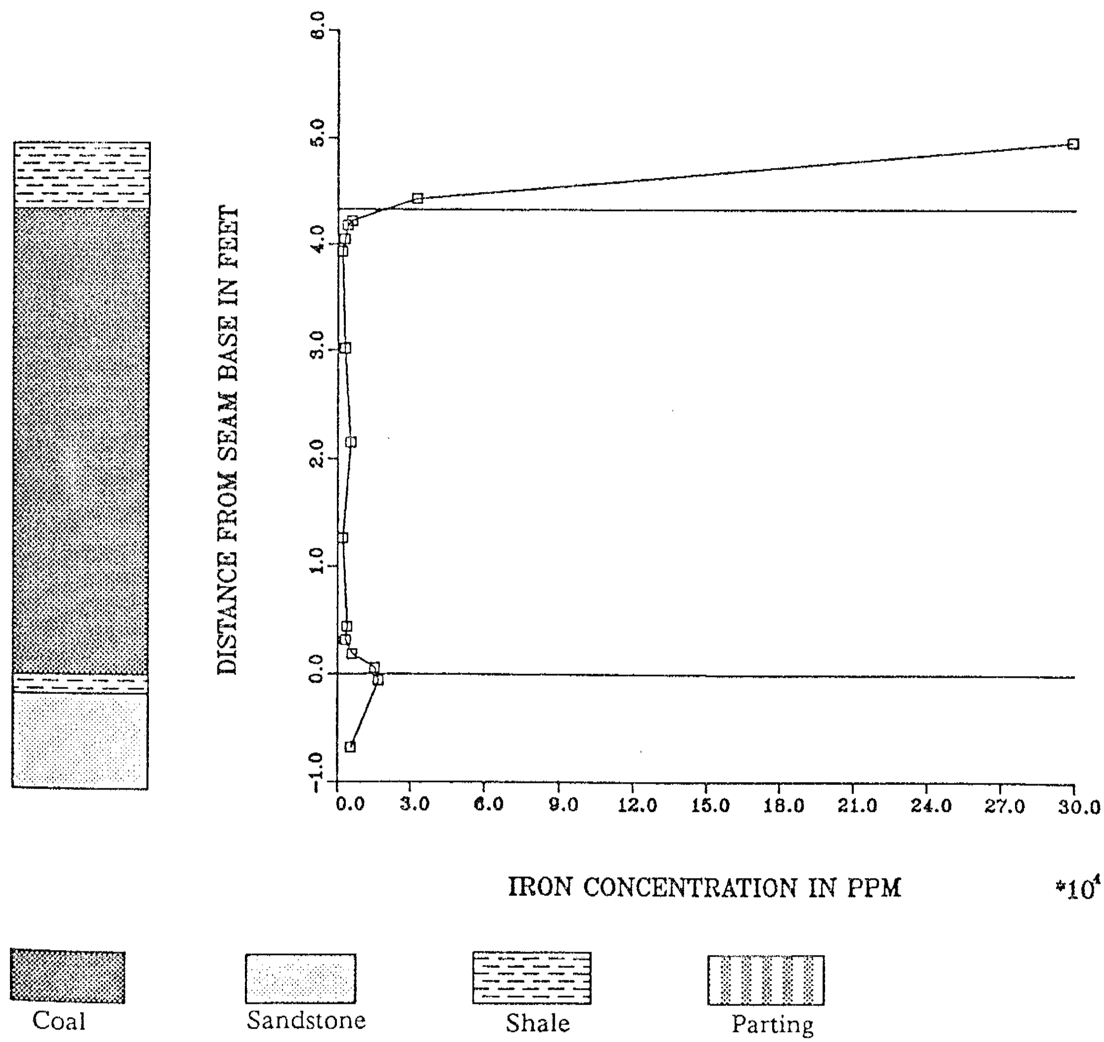


Figure D-95.

IRON DISTRIBUTION
IN THE LEE RANCH A3 DRILL CORE

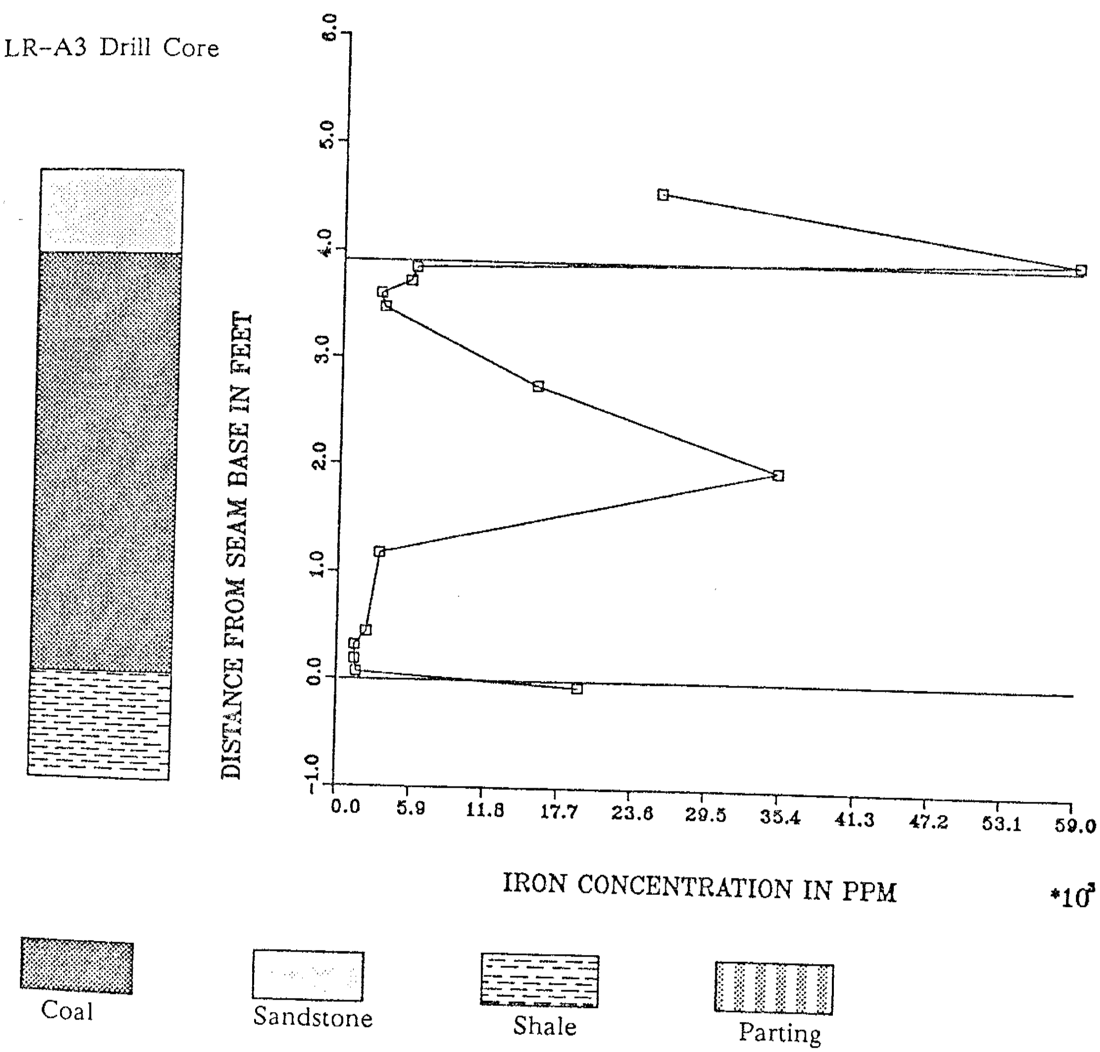


Figure D-96.

IRON DISTRIBUTION
IN THE LEE RANCH B2 DRILL CORE

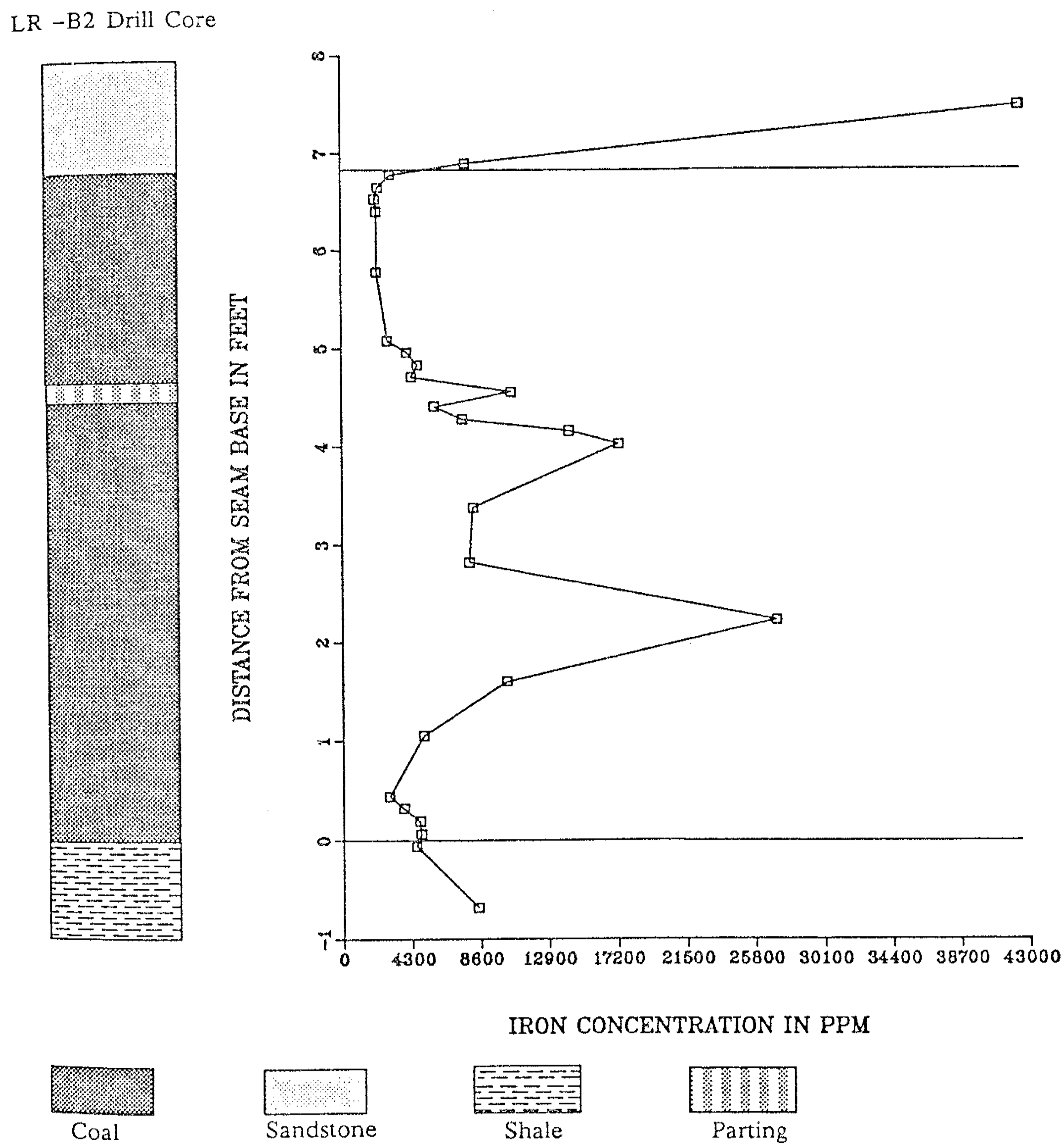


Figure D-97.

IRON DISTRIBUTION
IN THE LEE RANCH B3 DRILL CORE

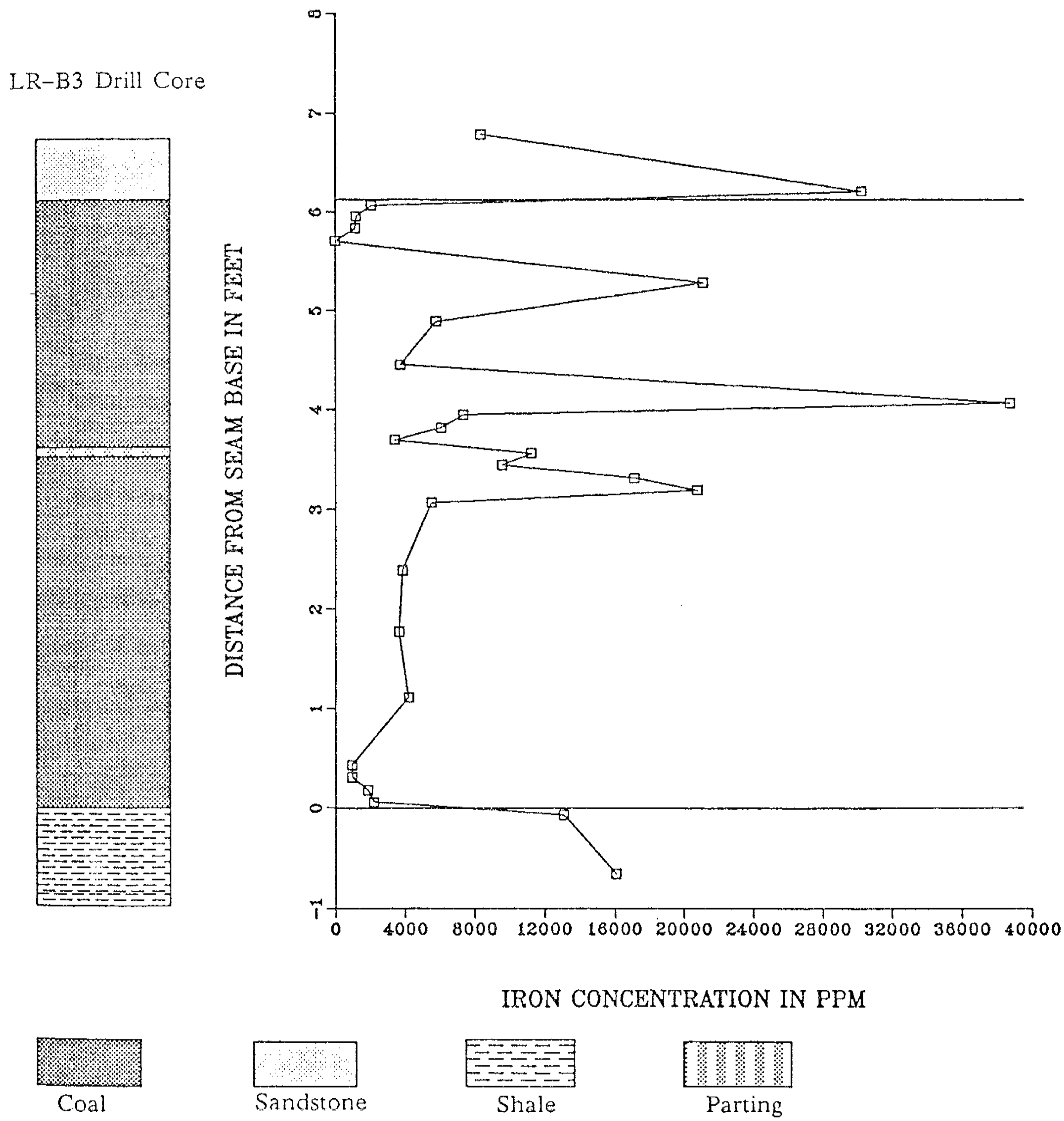


Figure D–98.

IRON DISTRIBUTION
IN THE YORK CANYON "A" AND "MAIN" SEAMS

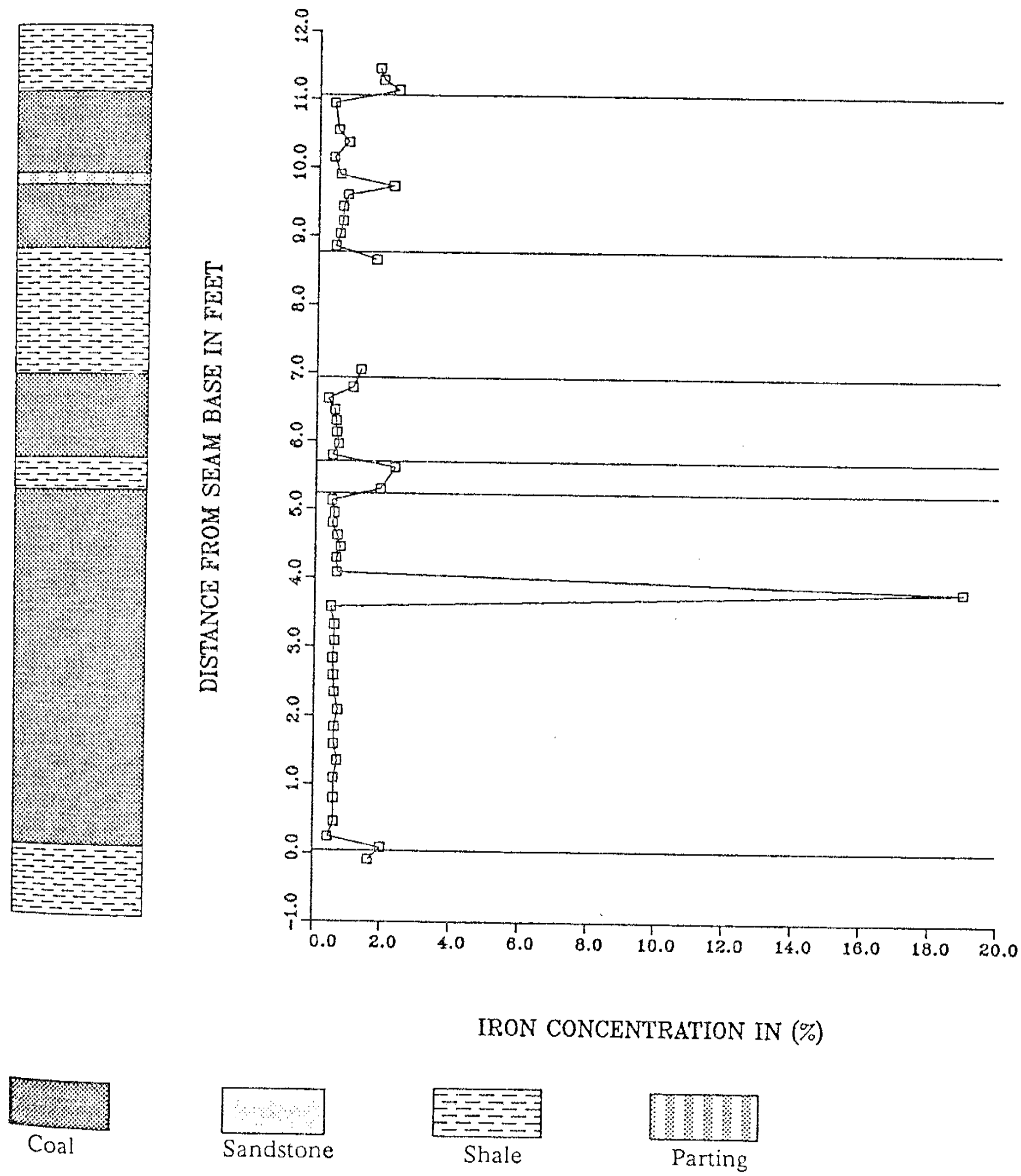


Figure D-99.

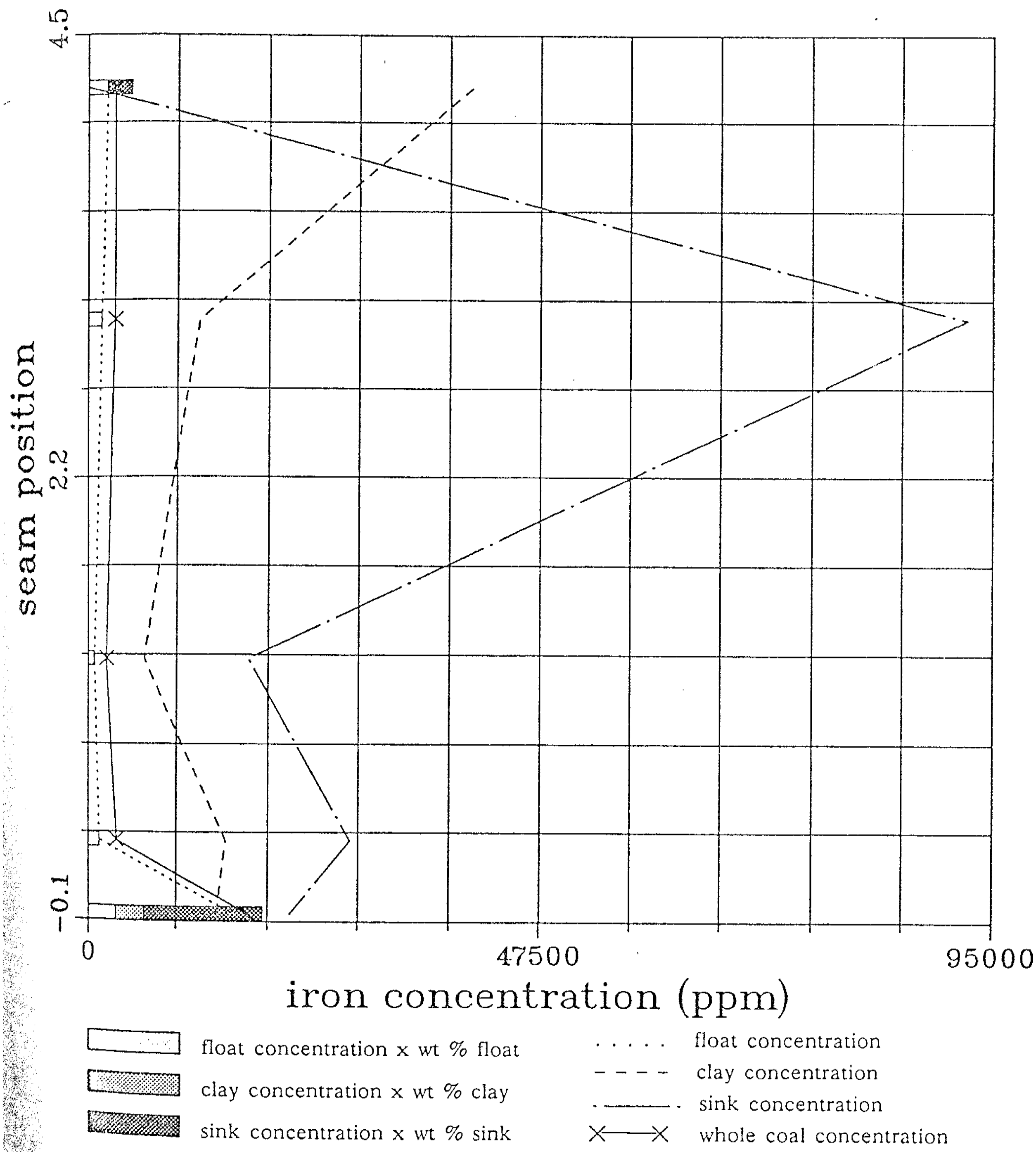


Figure 100. Iron float–clay–sink distributions in the LRA2 seam.

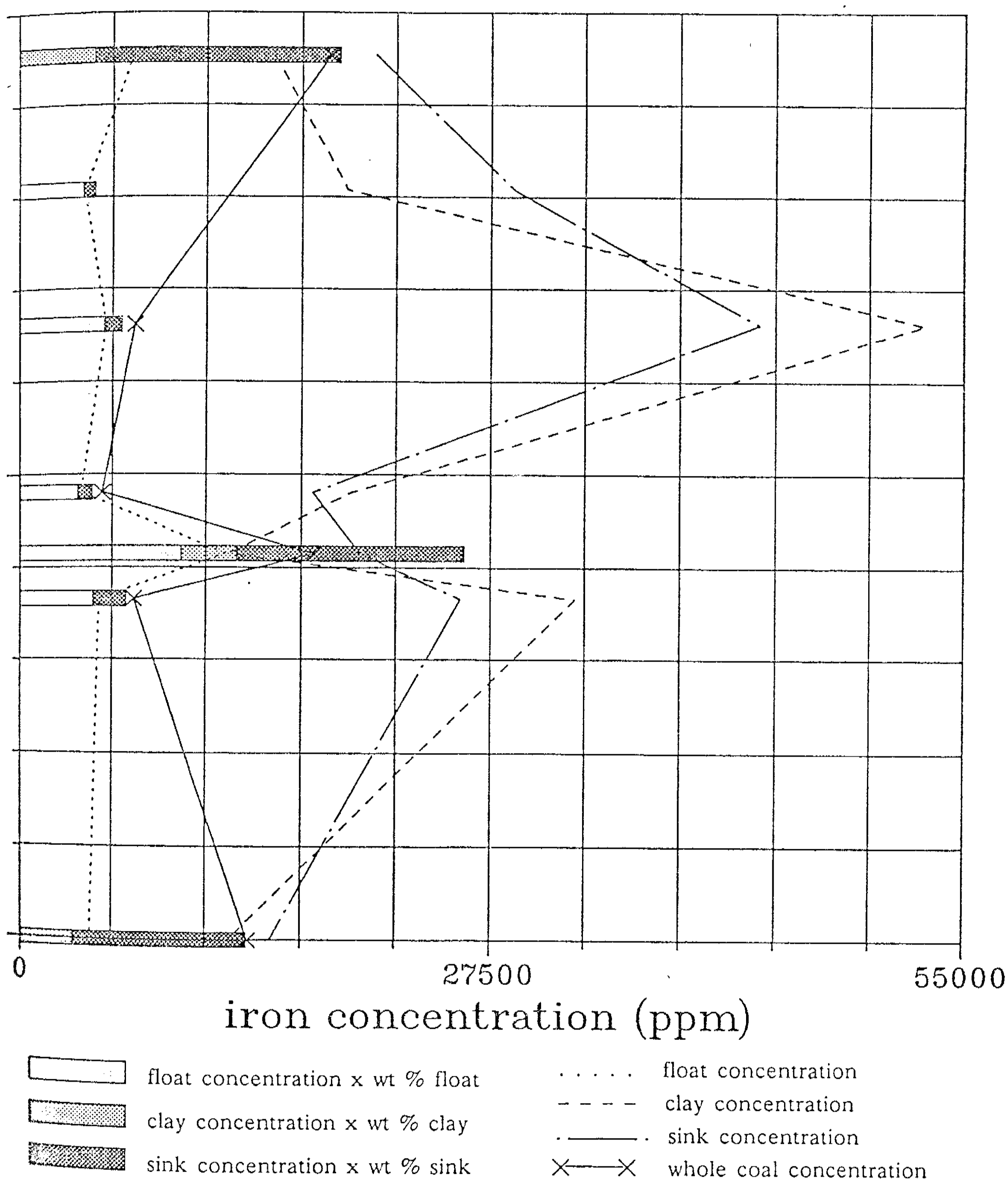


Figure D-101. Iron float-clay-sink distributions in the YA seam.

ZINC DISTRIBUTION
IN THE LEE RANCH P1 DRILL CORE

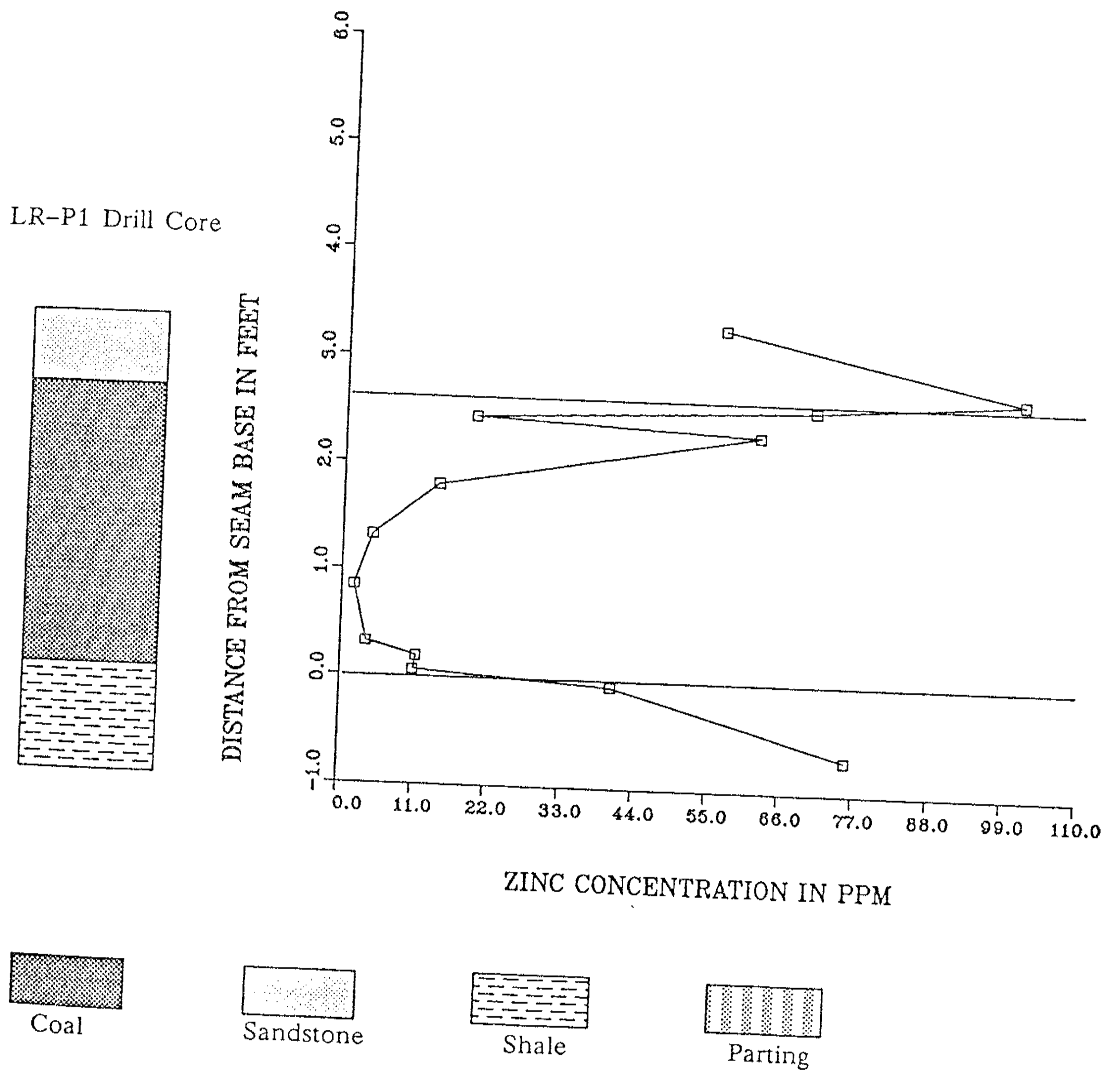


Figure D-102.

ZINC DISTRIBUTION
IN THE LEE RANCH P2 DRILL CORE

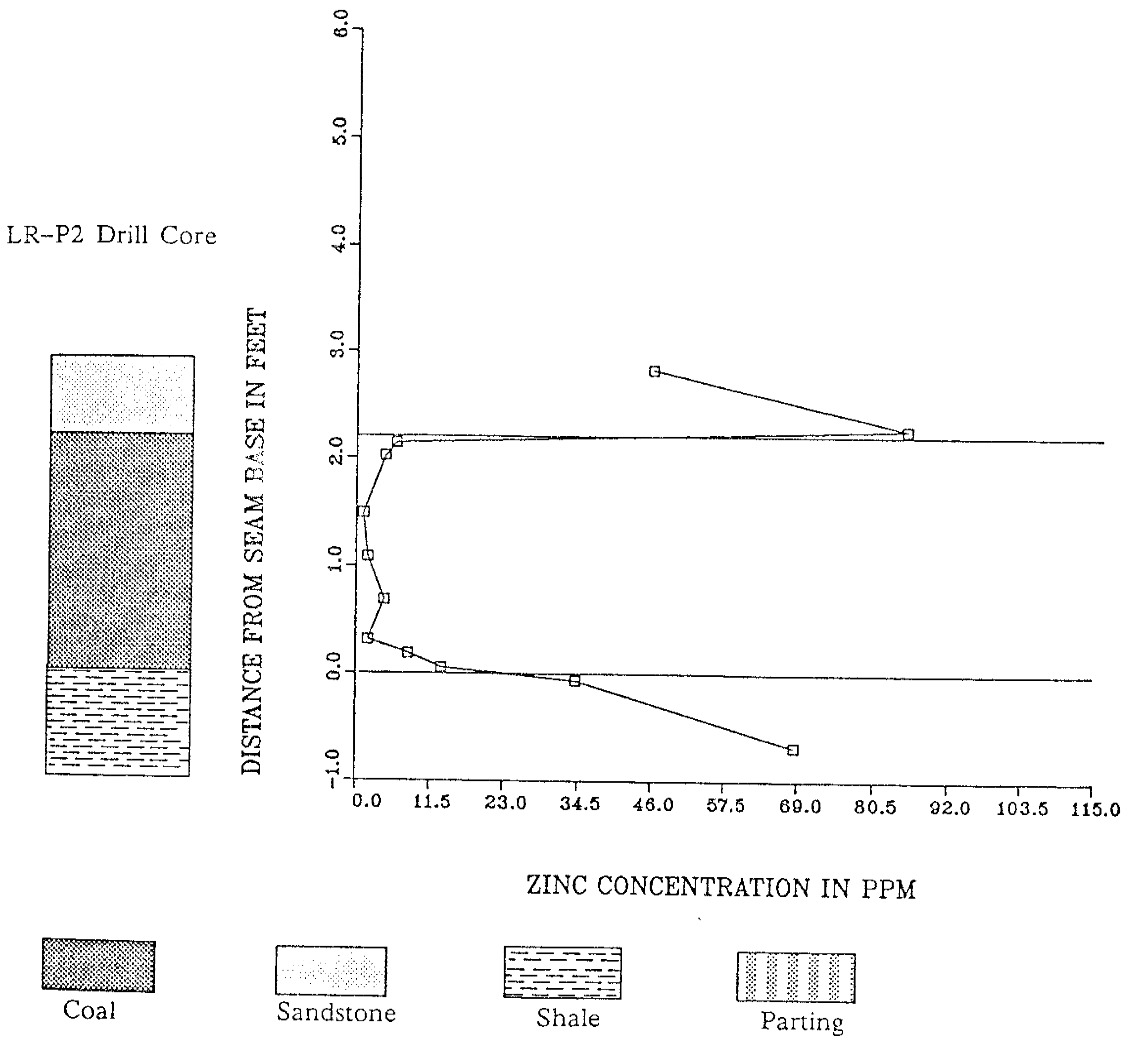


Figure D-103.

ZINC DISTRIBUTION
IN THE LEE RANCH A2 DRILL CORE

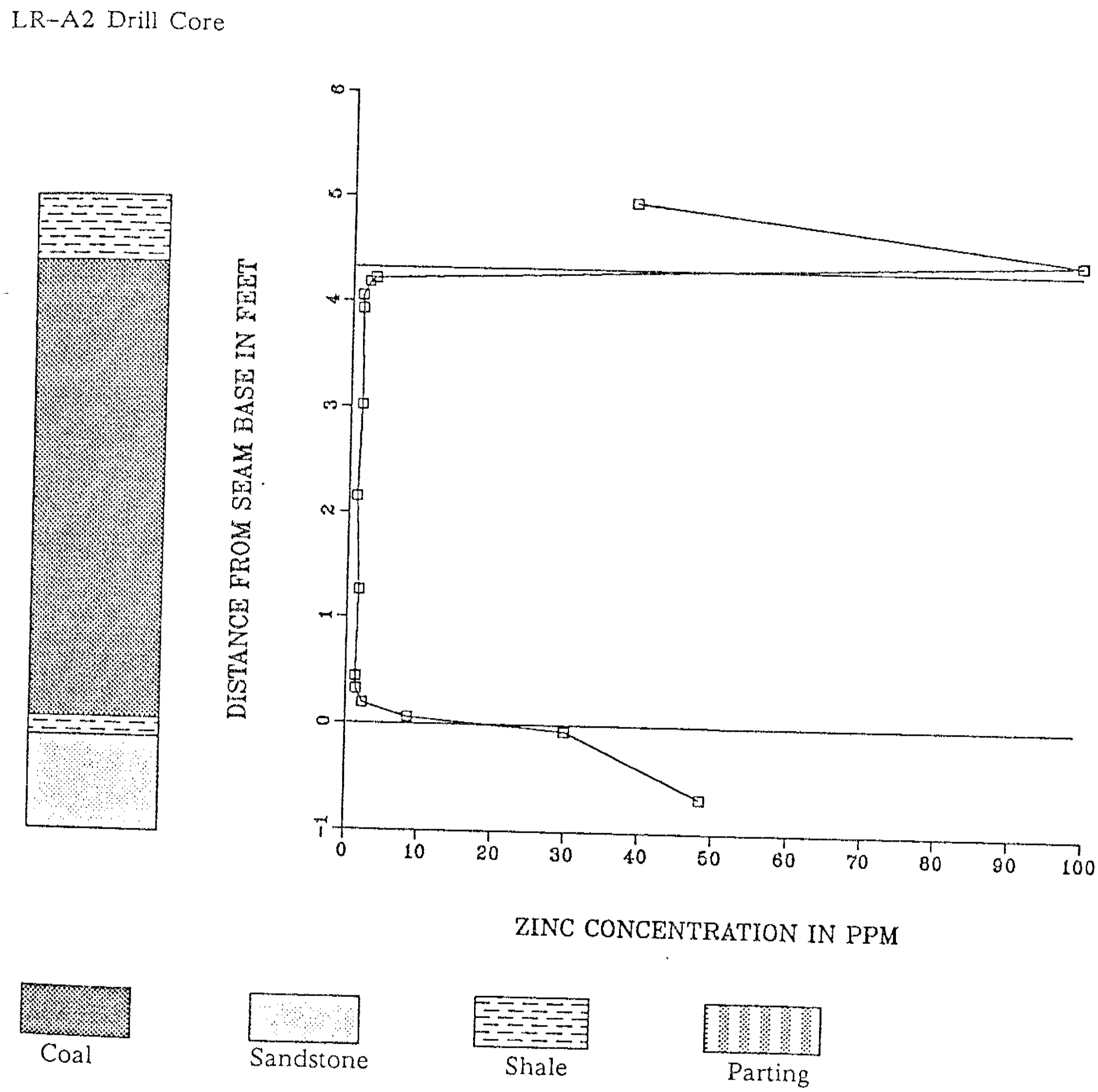


Figure D-104.

ZINC DISTRIBUTION
IN THE LEE RANCH A3 DRILL CORE

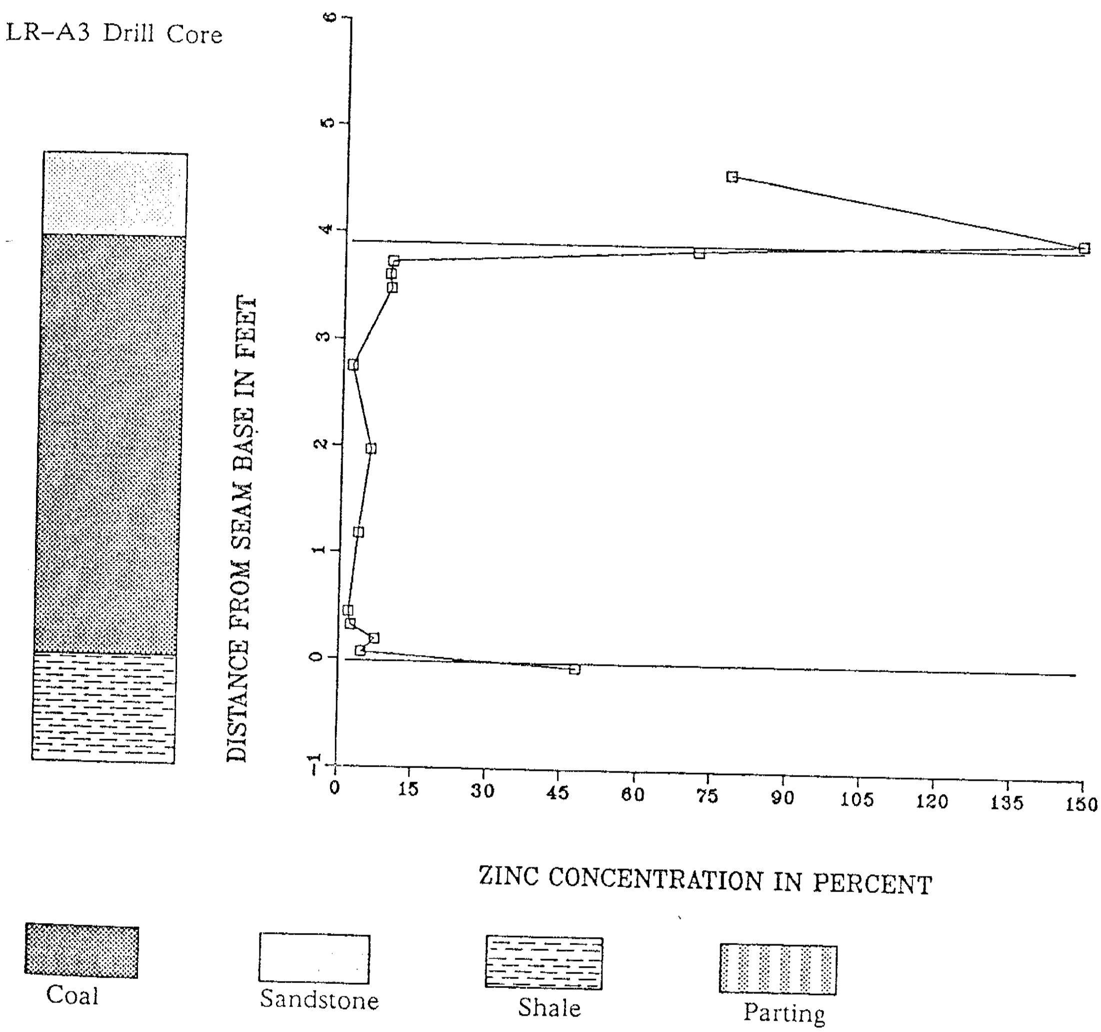


Figure D-105.

ZINC DISTRIBUTION IN THE LEE RANCH B2 DRILL CORE

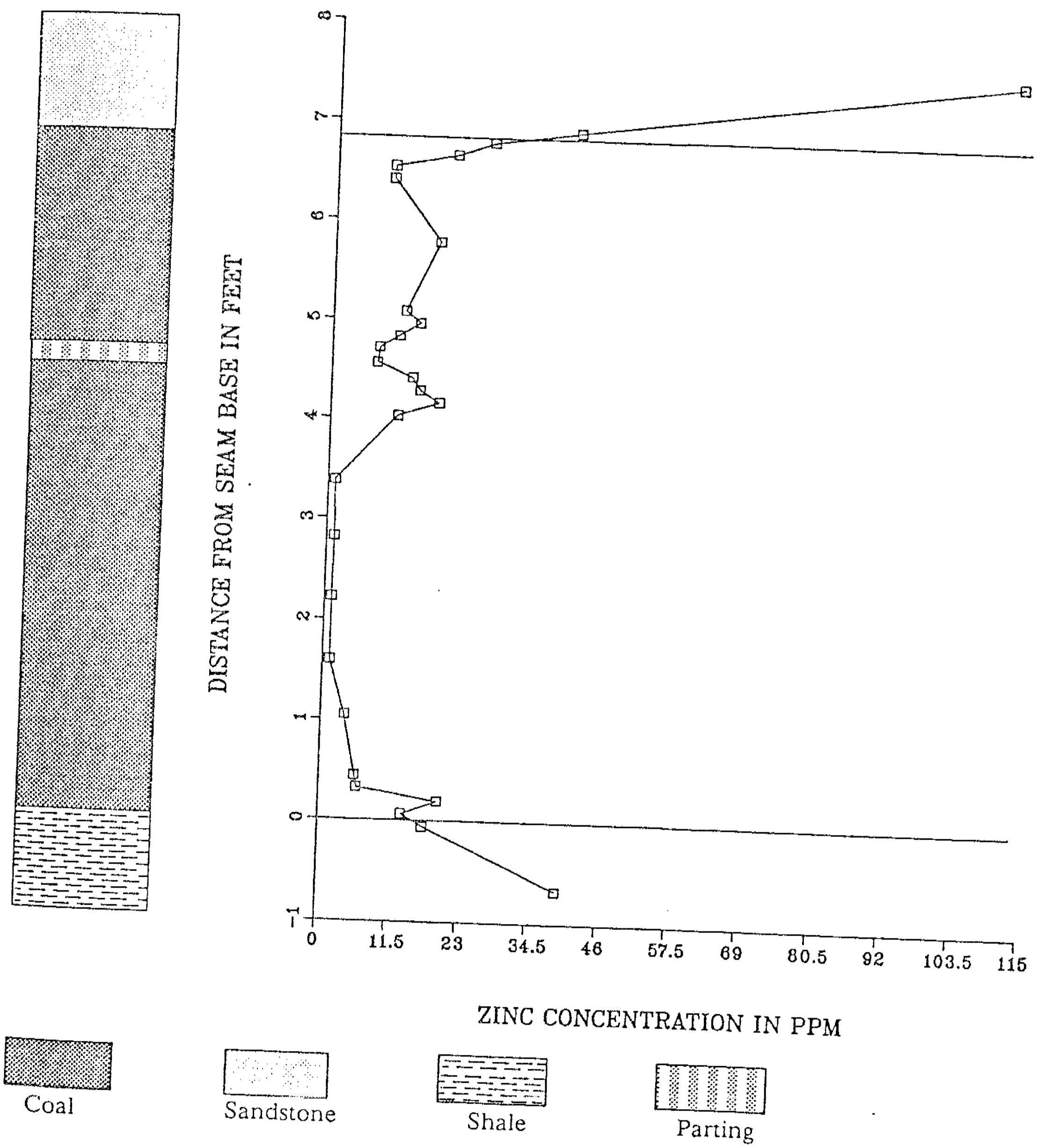


Figure D-106.

ZINC DISTRIBUTION
IN THE LEE RANCH B3 DRILL CORE

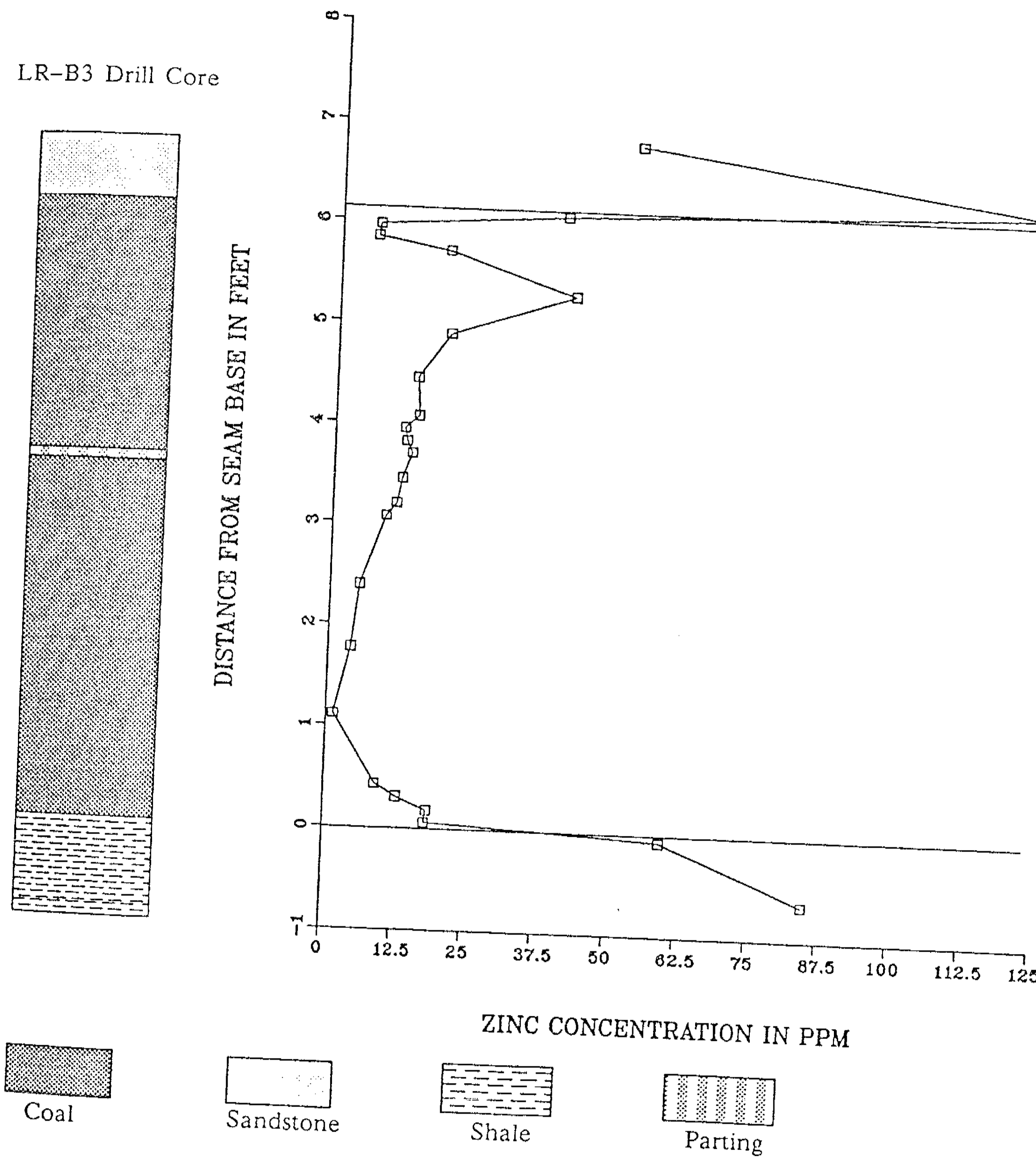


Figure D-107.

ZINC DISTRIBUTION
IN THE YORK CANYON "A" AND "MAIN" SEAMS

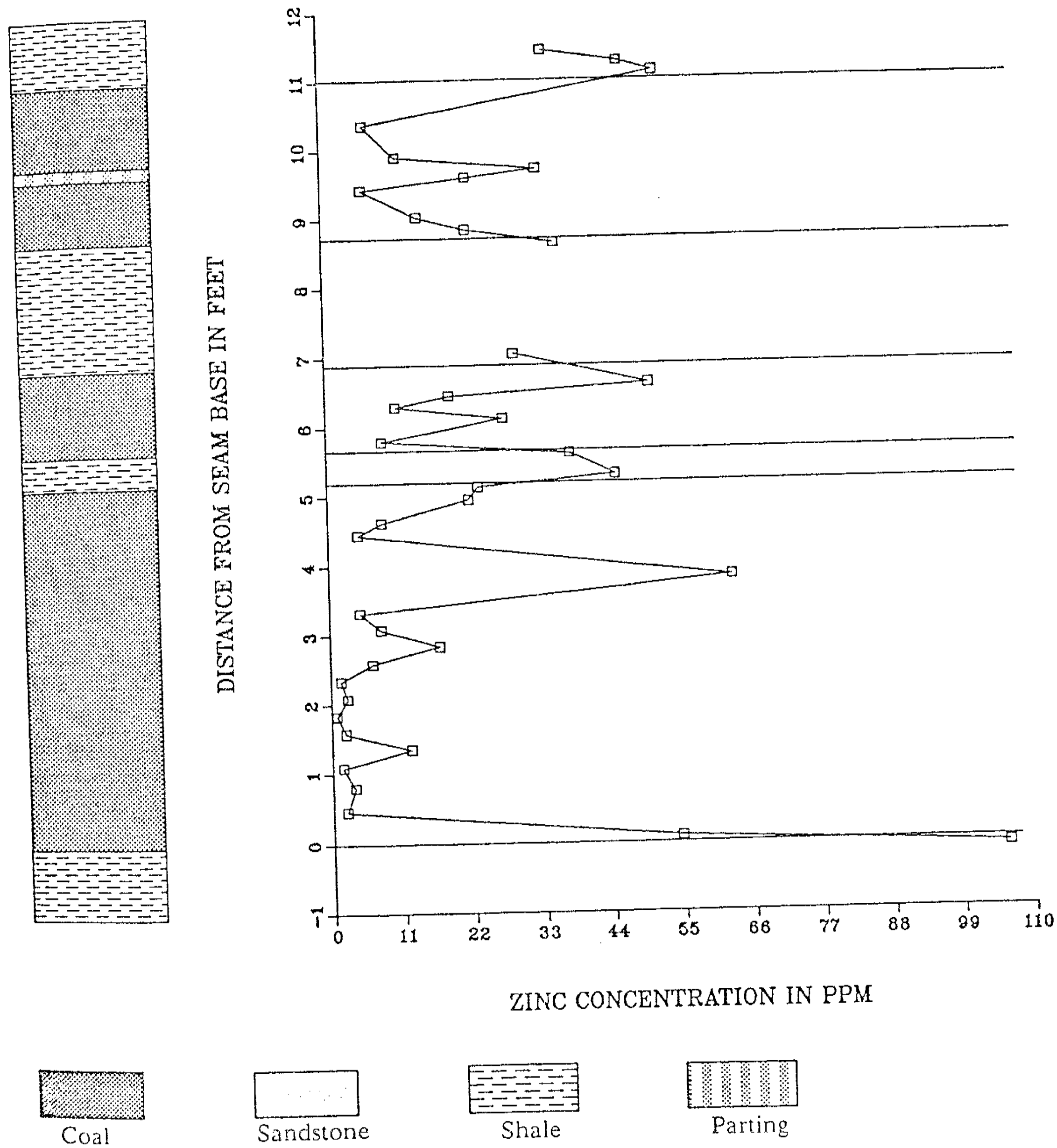


Figure D-108.

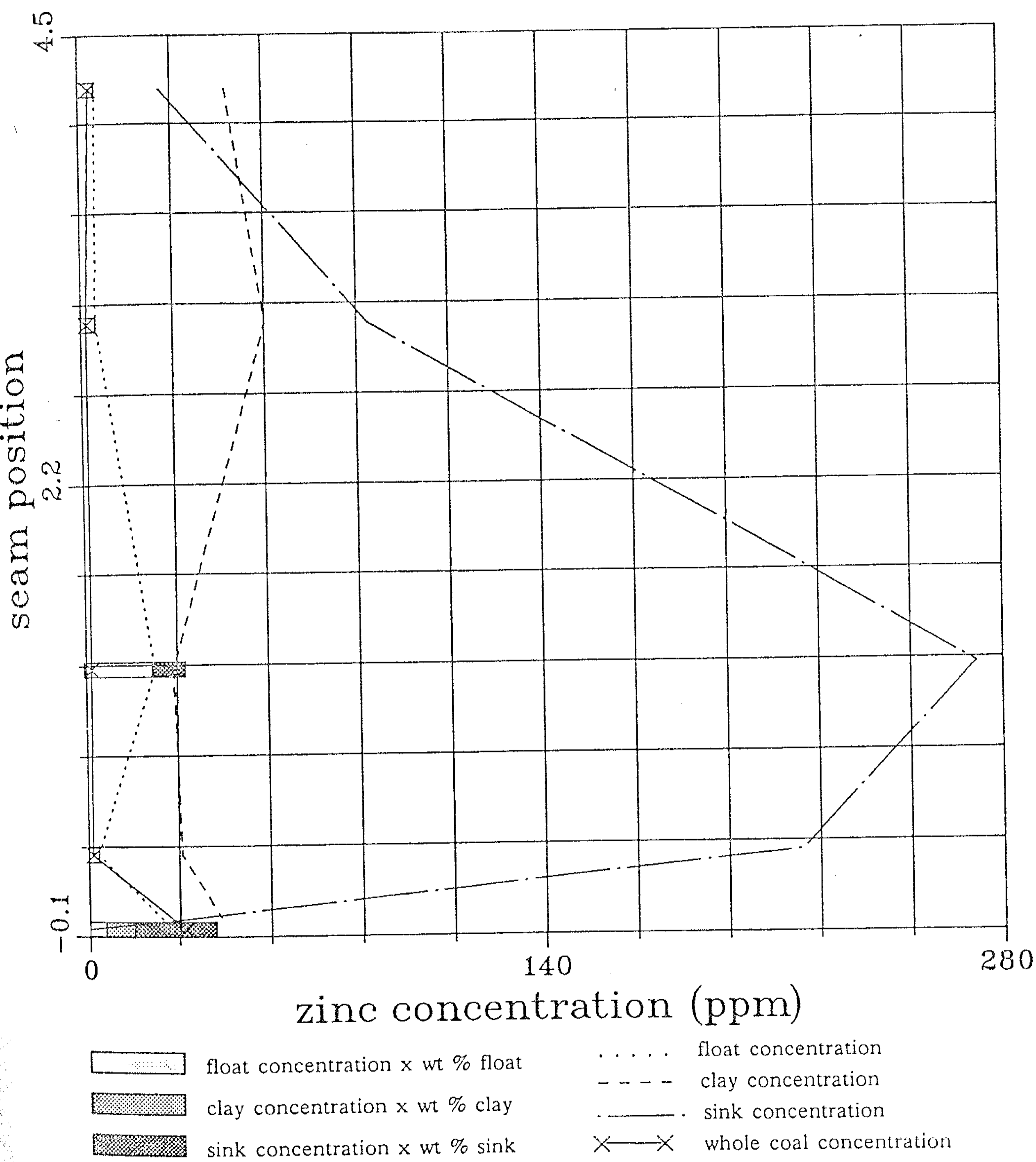


Figure D-109. Zinc float-clay-sink distributions in the LRA2 seam.

ARSENIC DISTRIBUTION
IN THE LEE RANCH P1 DRILL CORE

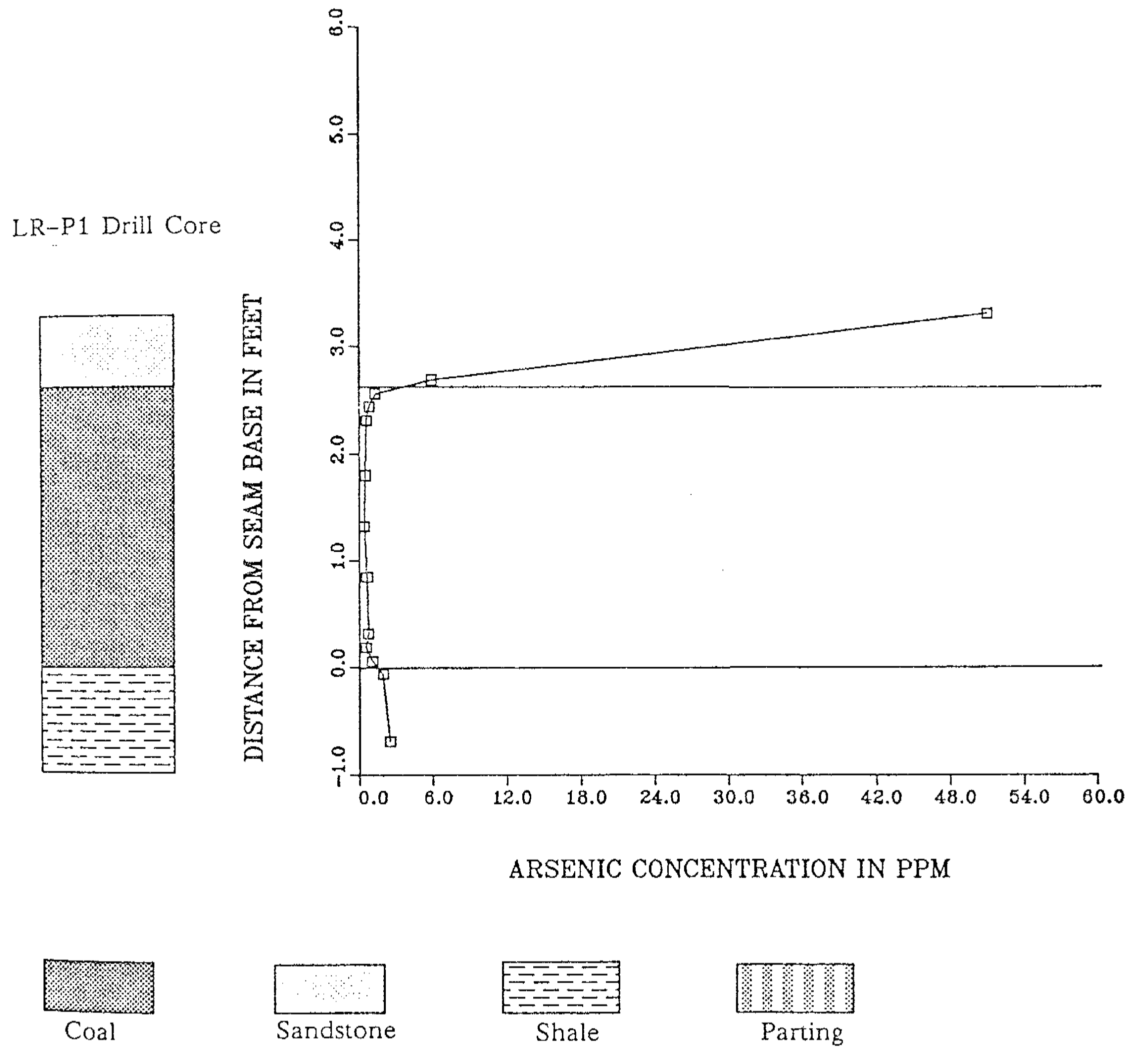


Figure D-111.

ARSENIC DISTRIBUTION
IN THE LEE RANCH P2 DRILL CORE

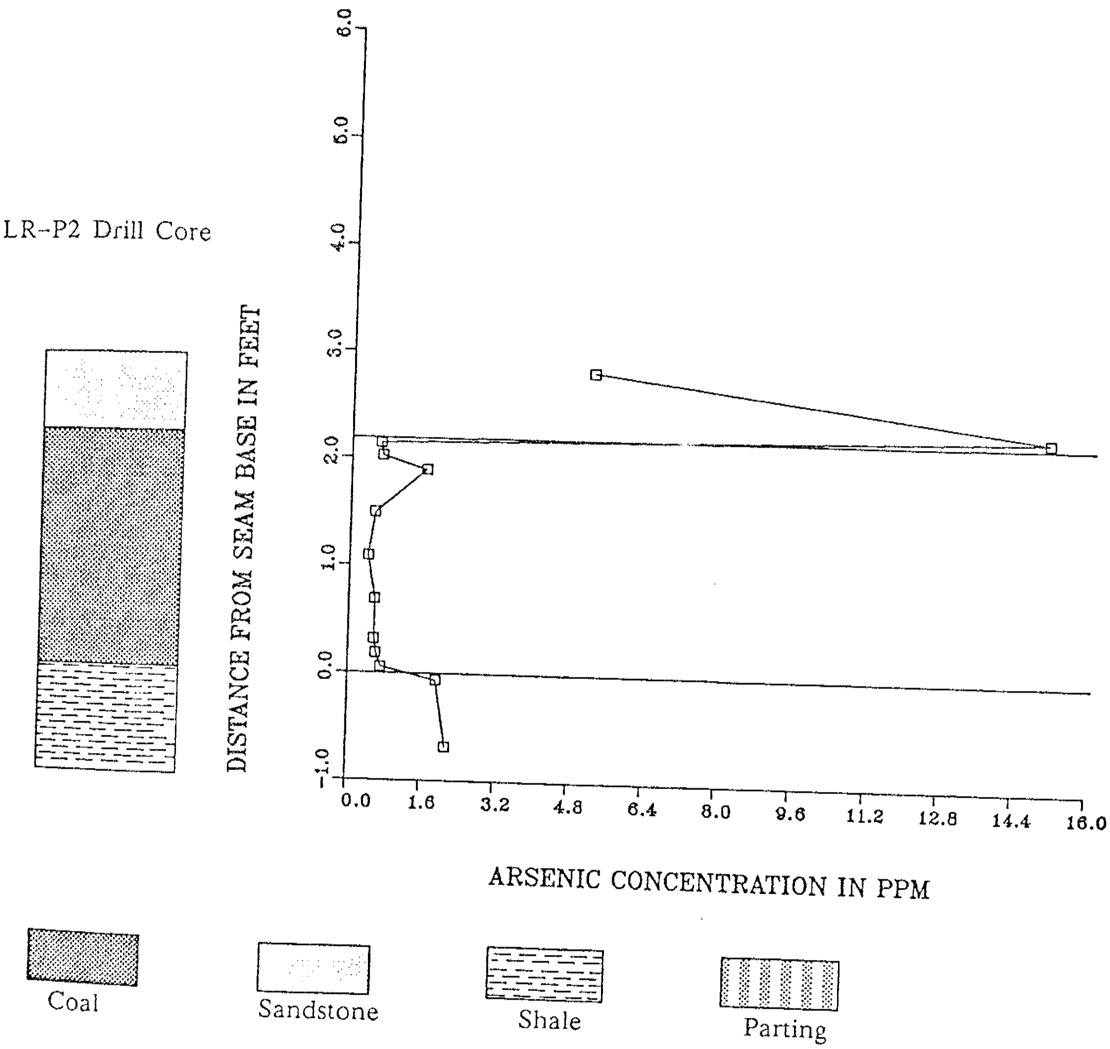


Figure D-112.

ARSENIC DISTRIBUTION
IN THE LEE RANCH A2 DRILL CORE

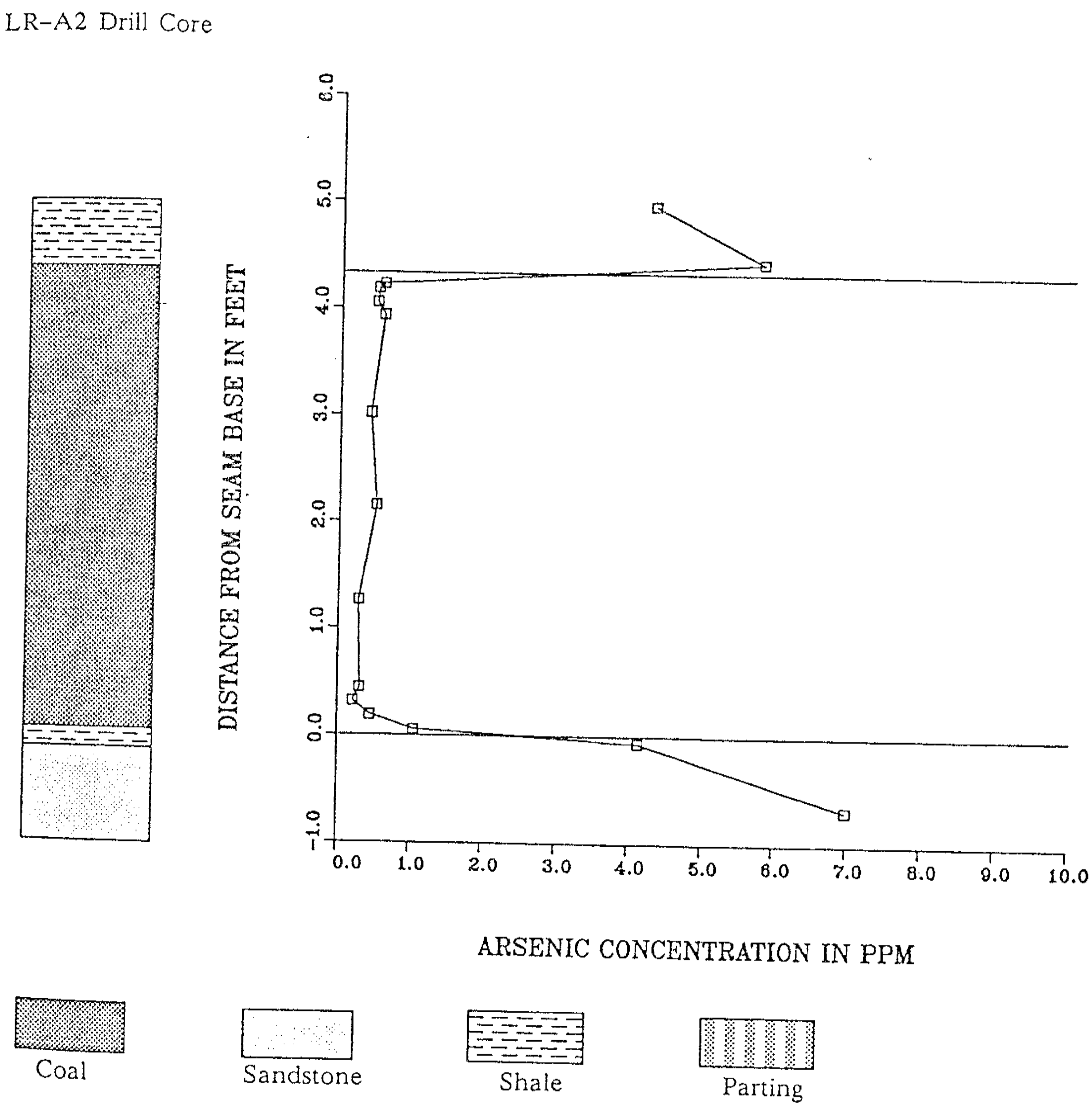


Figure D-113.

ARSENIC DISTRIBUTION
IN THE LEE RANCH B2 DRILL CORE

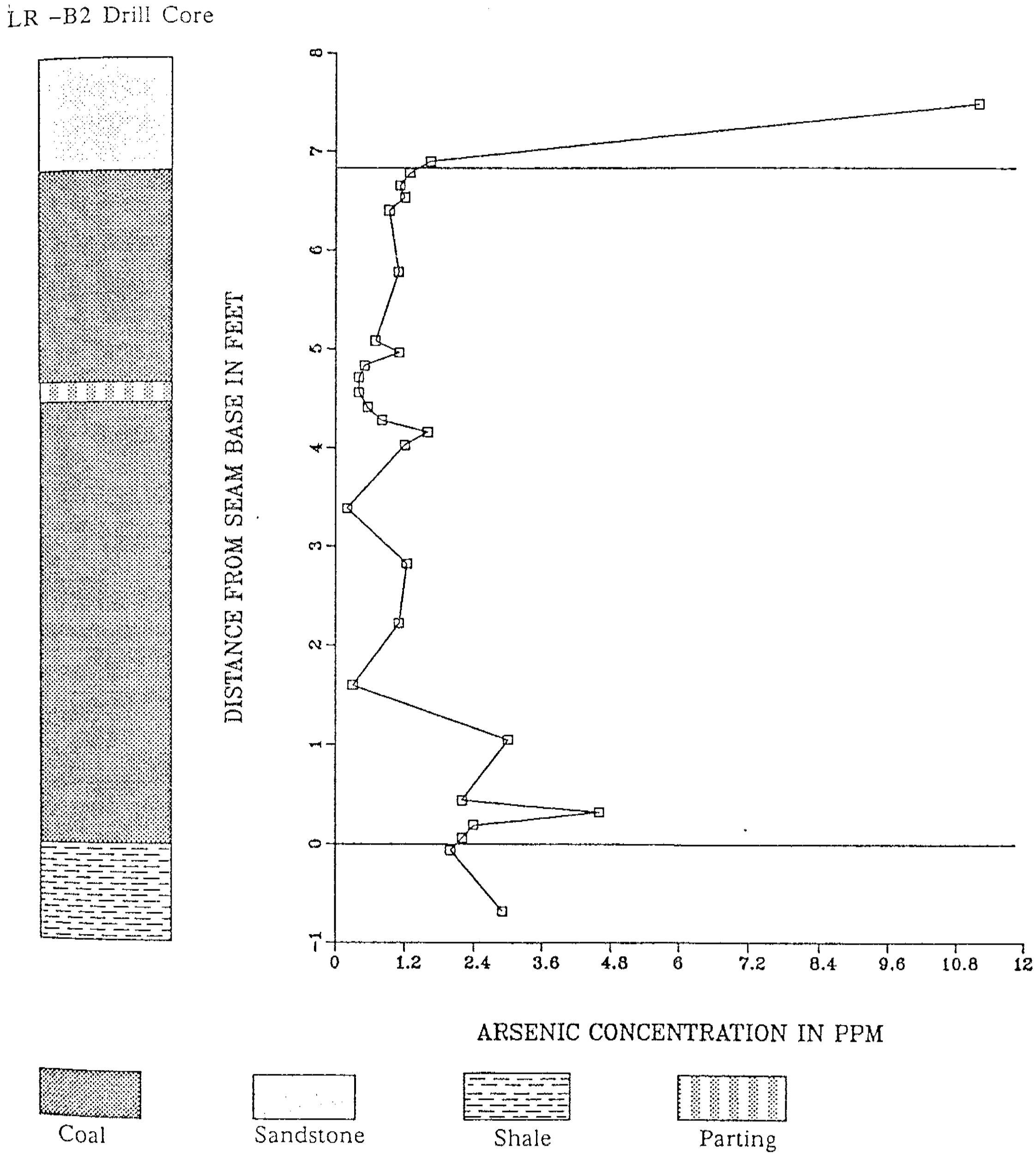


Figure D-114.

ARSENIC DISTRIBUTION IN THE LEE RANCH B3 DRILL CORE

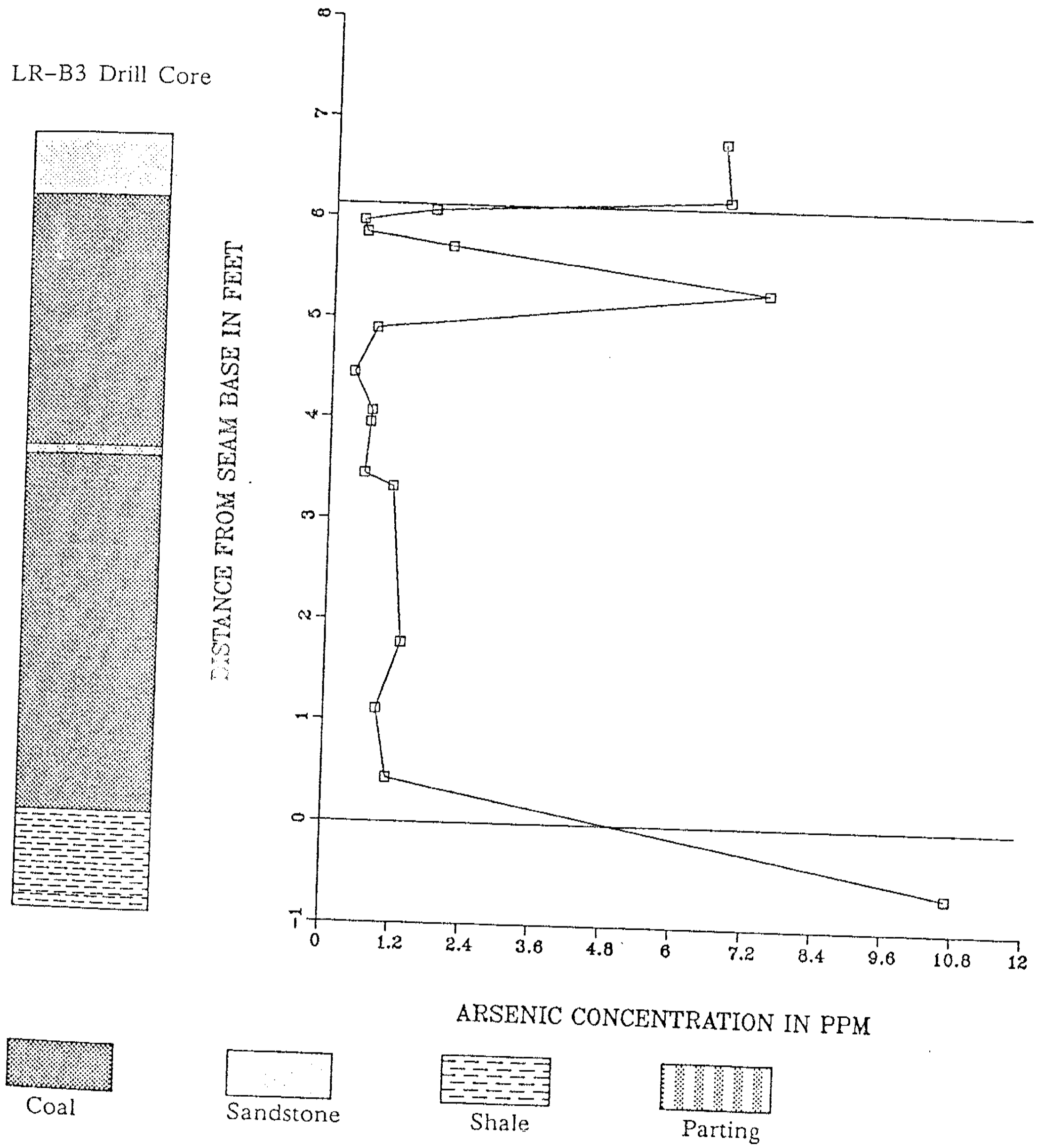


Figure D-115.

ARSENIC DISTRIBUTION

IN THE YORK CANYON "A" AND "MAIN" SEAMS

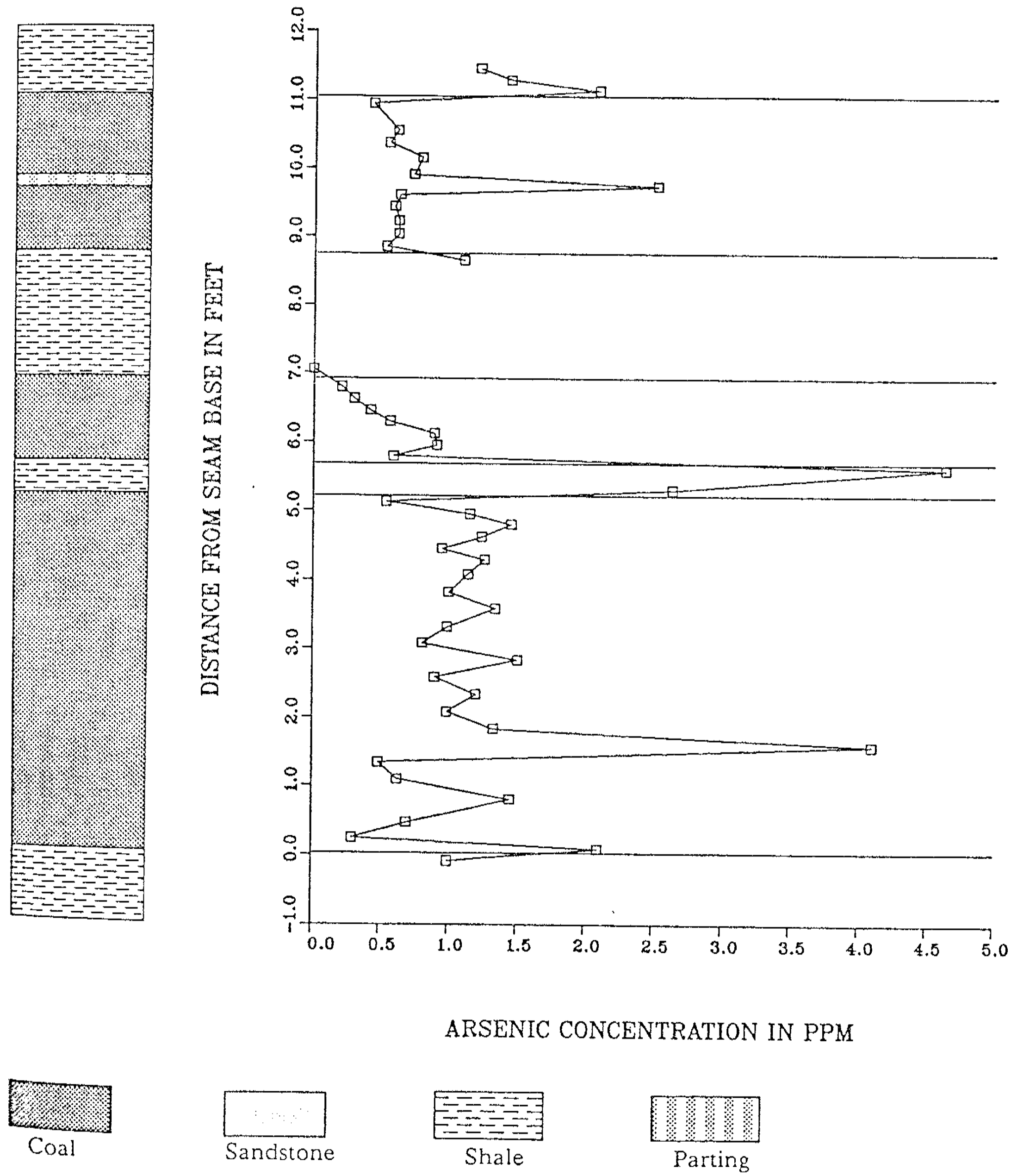


Figure D-116.

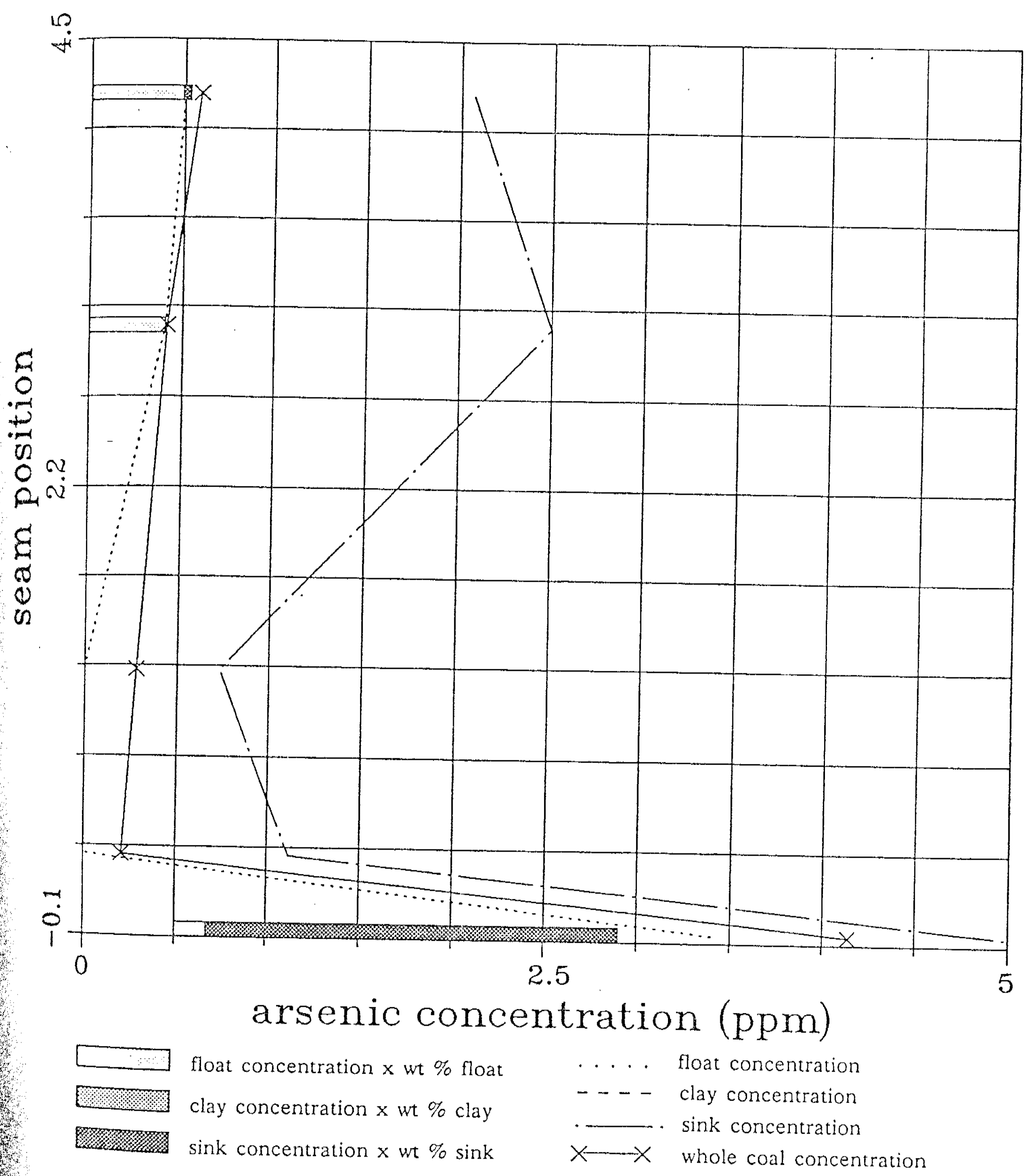


Figure D-117. Arsenic float-clay-sink distributions in the LRA2 seam.

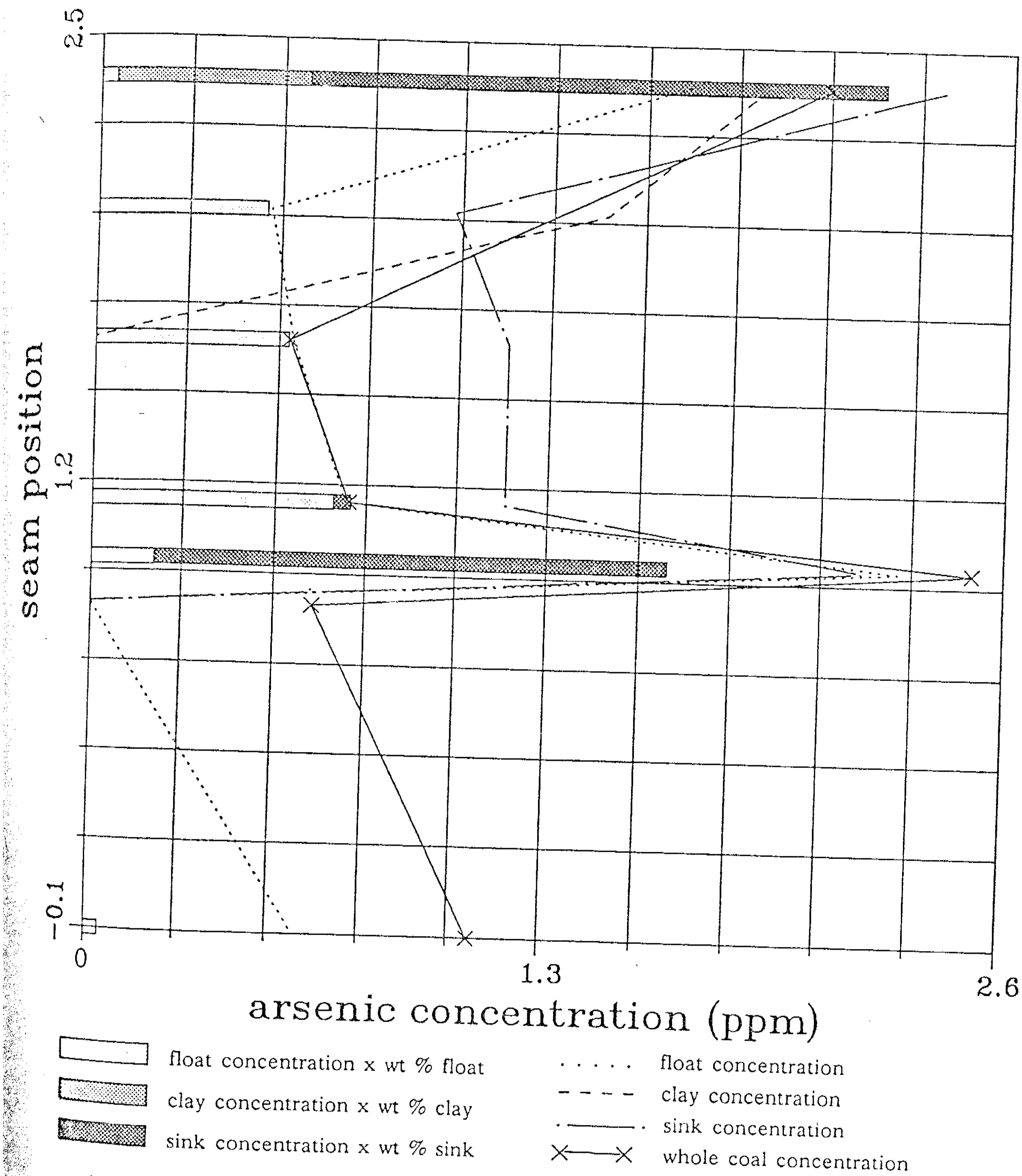


Figure D-118. Arsenic float-clay-sink distributions in the YA seam.

ANTIMONY DISTRIBUTION IN THE LEE RANCH P1 DRILL CORE

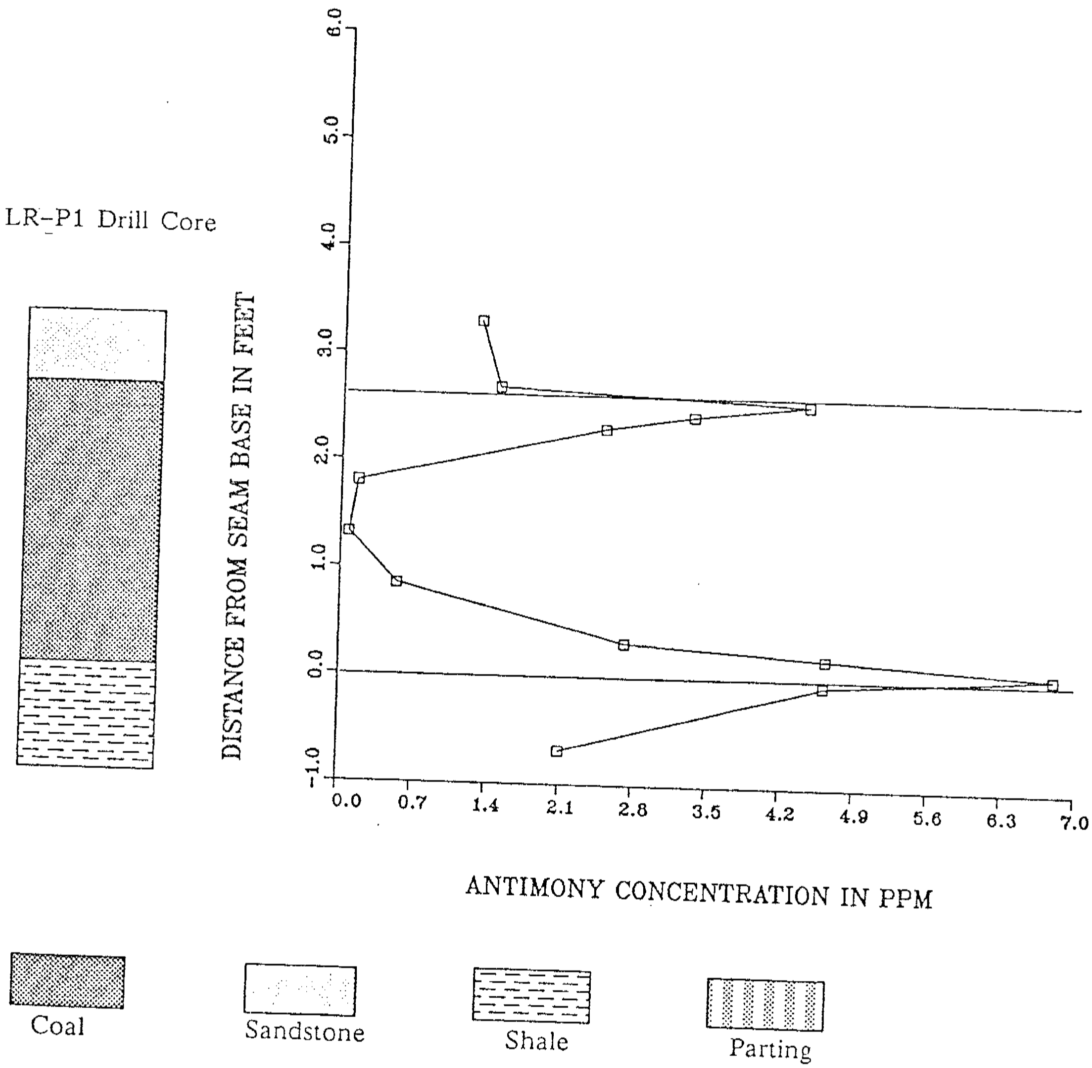


Figure D-119.

ANTIMONY DISTRIBUTION
IN THE LEE RANCH P2 DRILL CORE

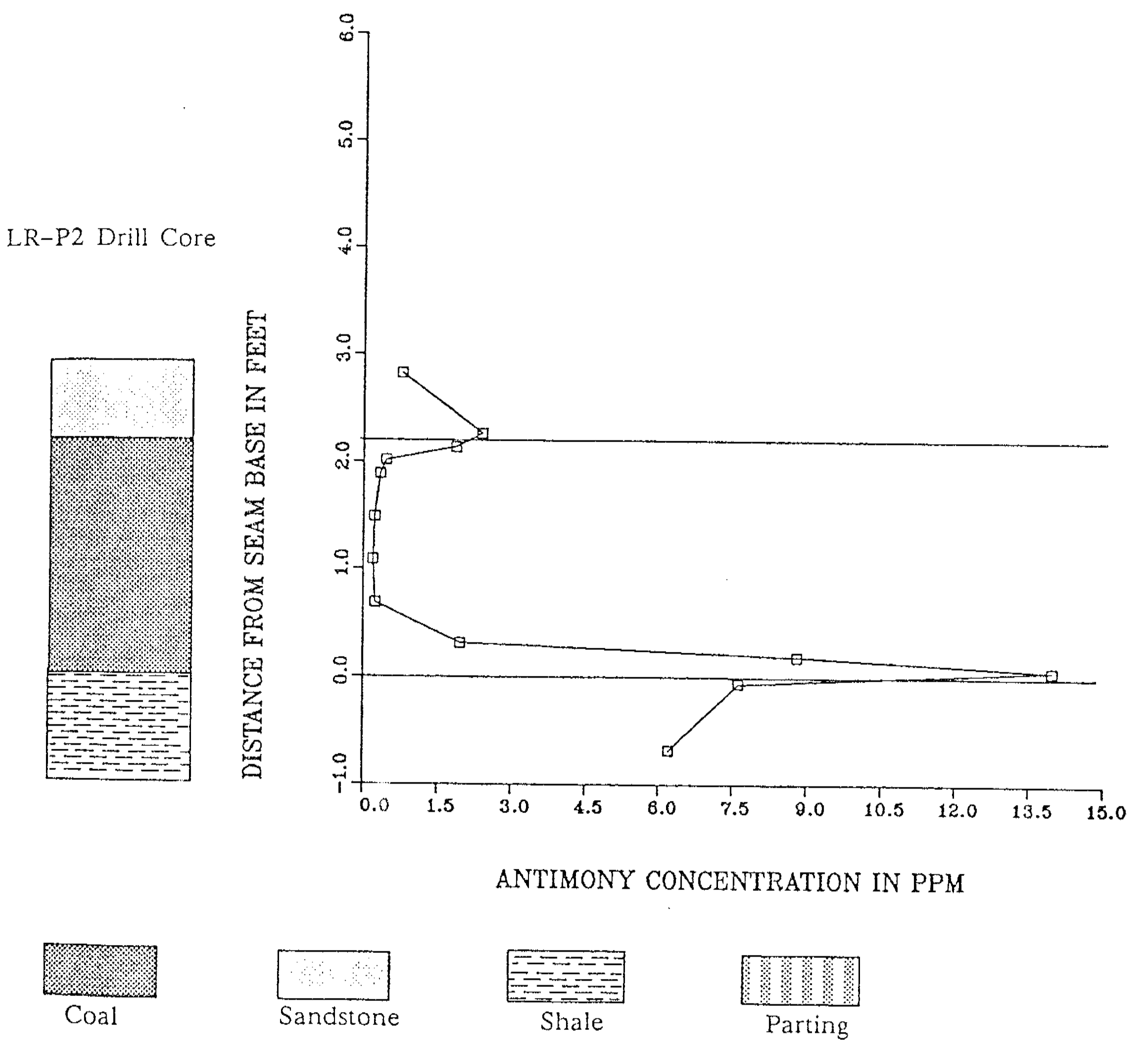


Figure D-120.

ANTIMONY DISTRIBUTION
IN THE LEE RANCH A2 DRILL CORE

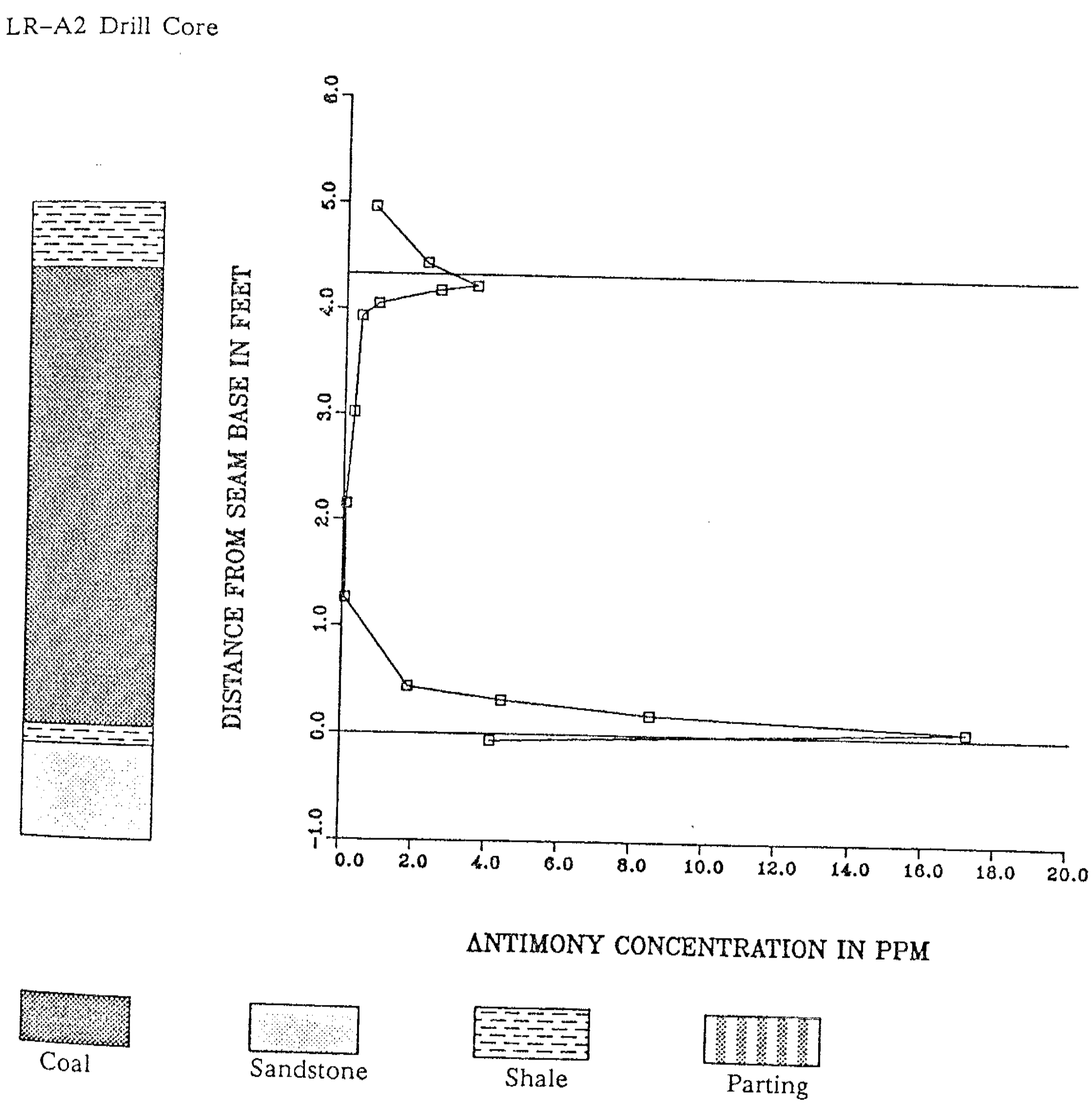


Figure D-121.

ANTIMONY DISTRIBUTION
IN THE LEE RANCH A3 DRILL CORE

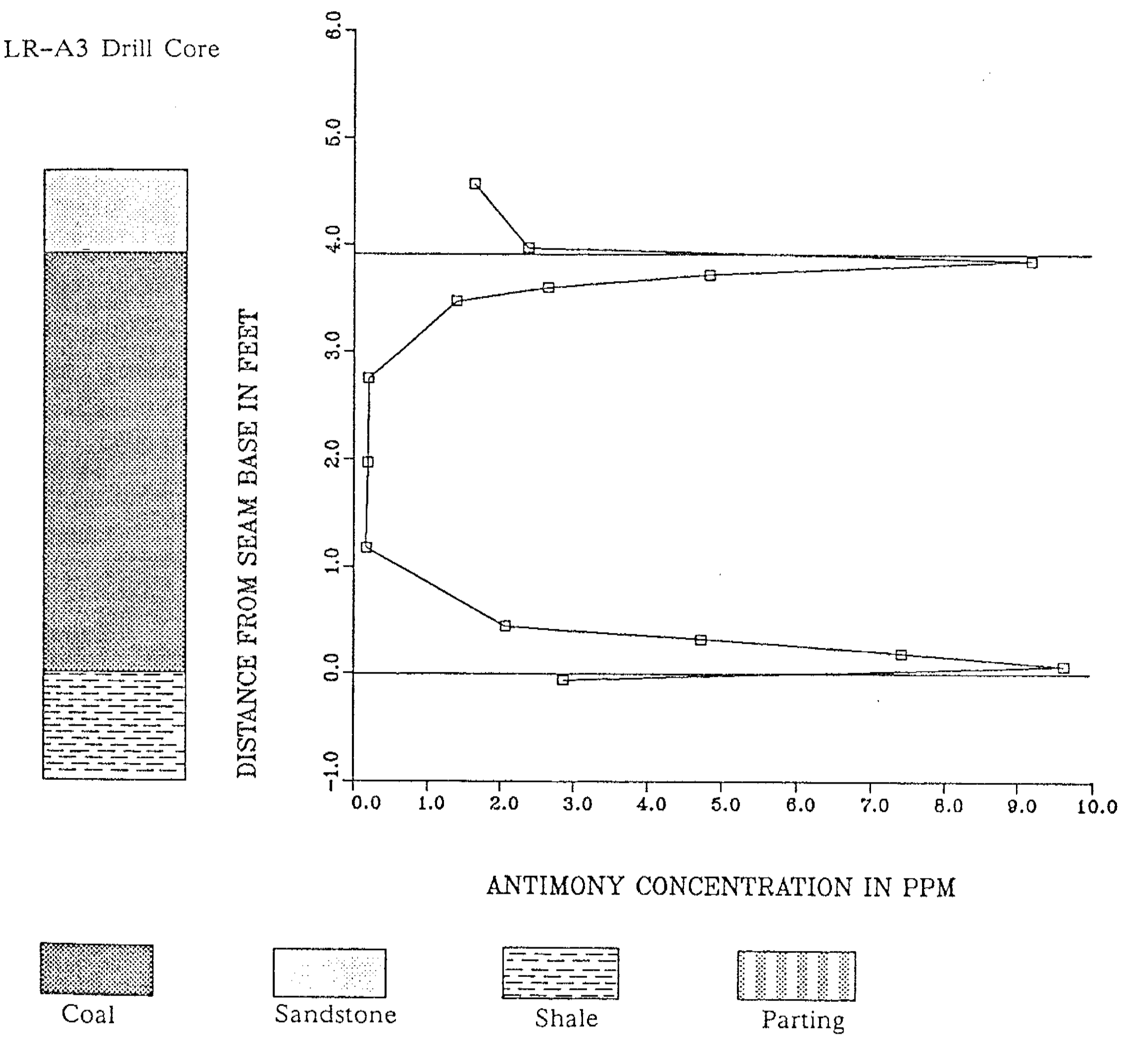


Figure D-122.

ANTIMONY DISTRIBUTION IN THE LEE RANCH B2 DRILL CORE

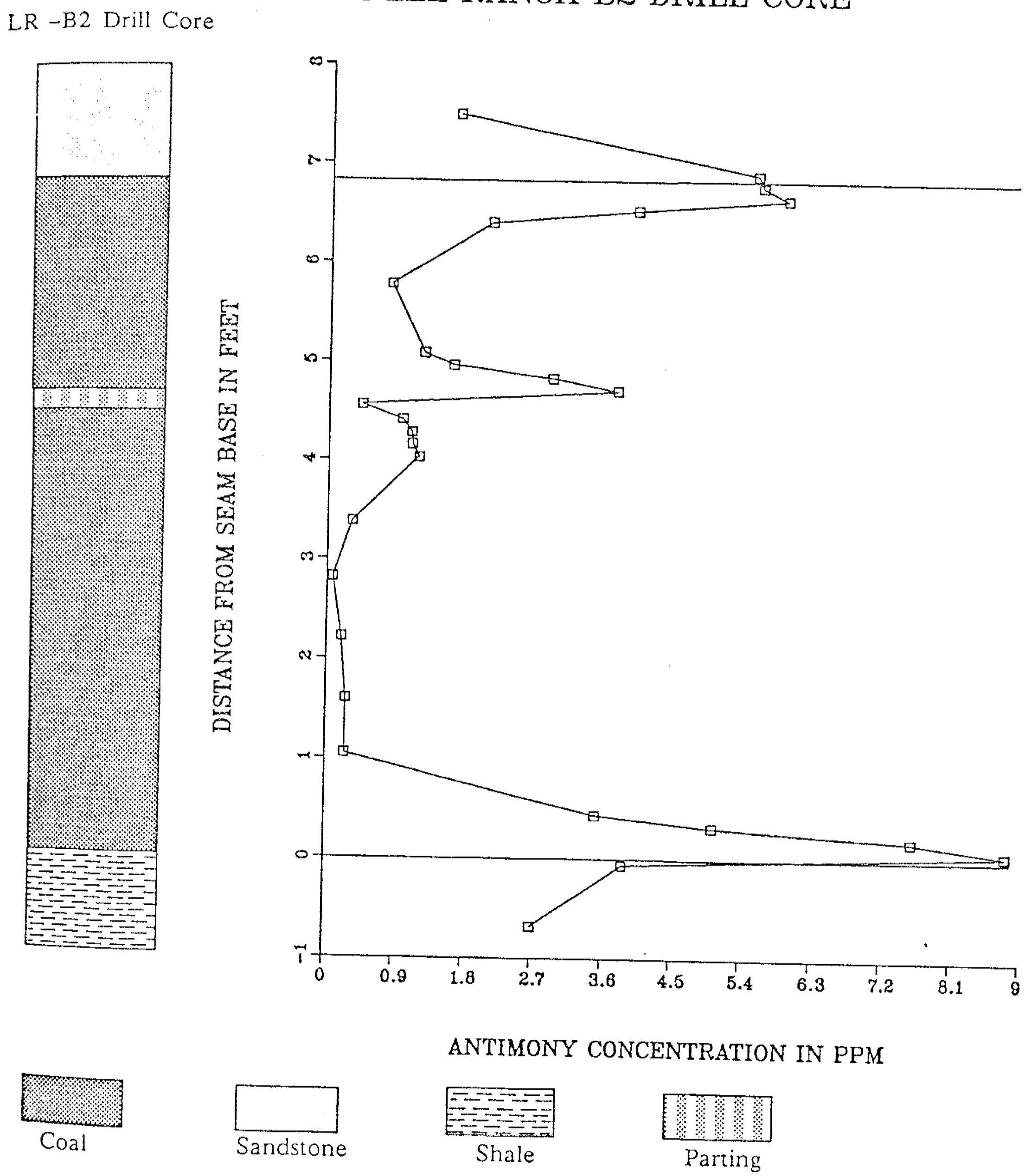


Figure D-123.

ANTIMONY DISTRIBUTION IN THE LEE RANCH B3 DRILL CORE

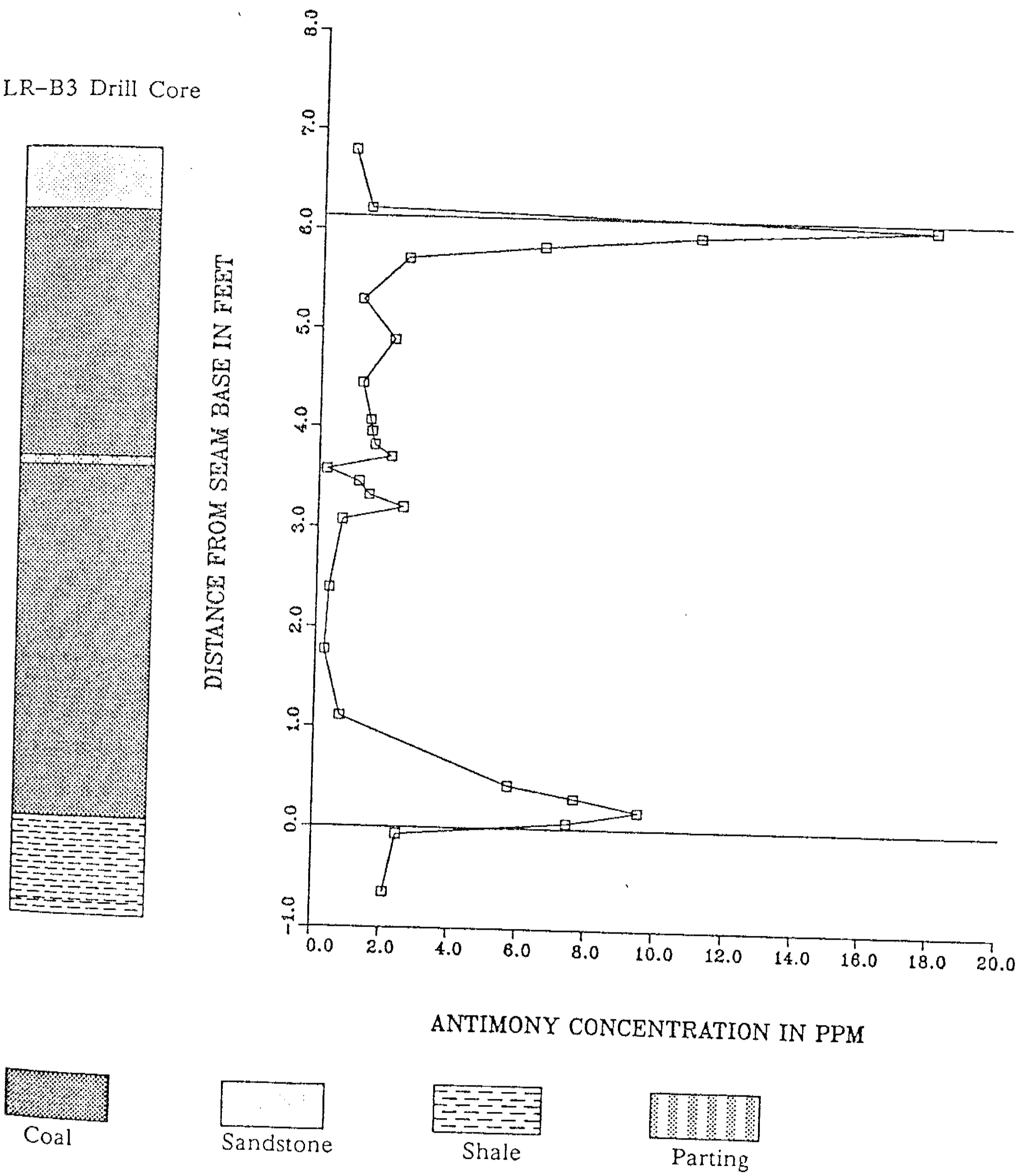


Figure D-124.

ANTIMONY DISTRIBUTION
IN THE YORK CANYON "A" AND "MAIN" SEAMS

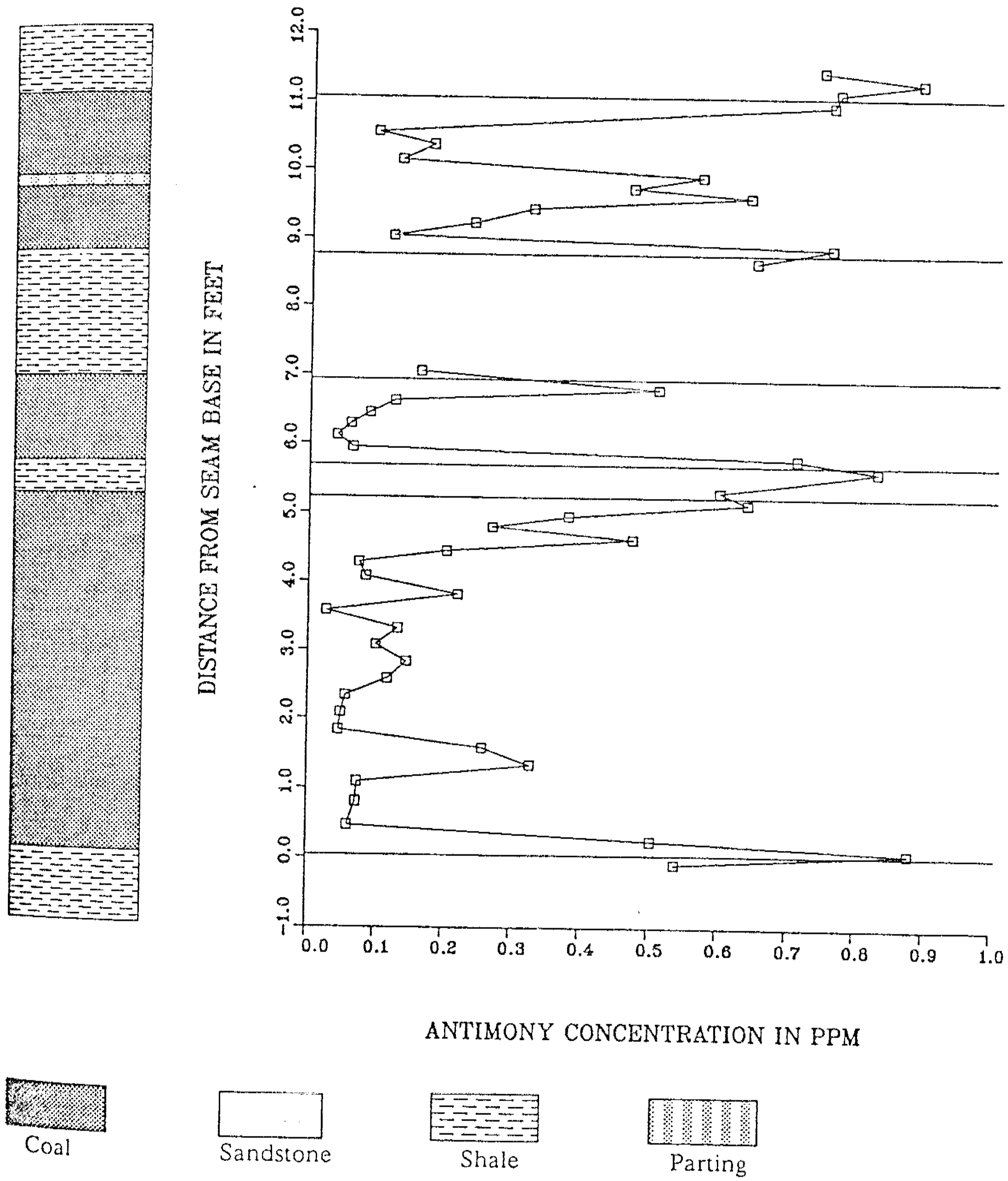


Figure D-125.

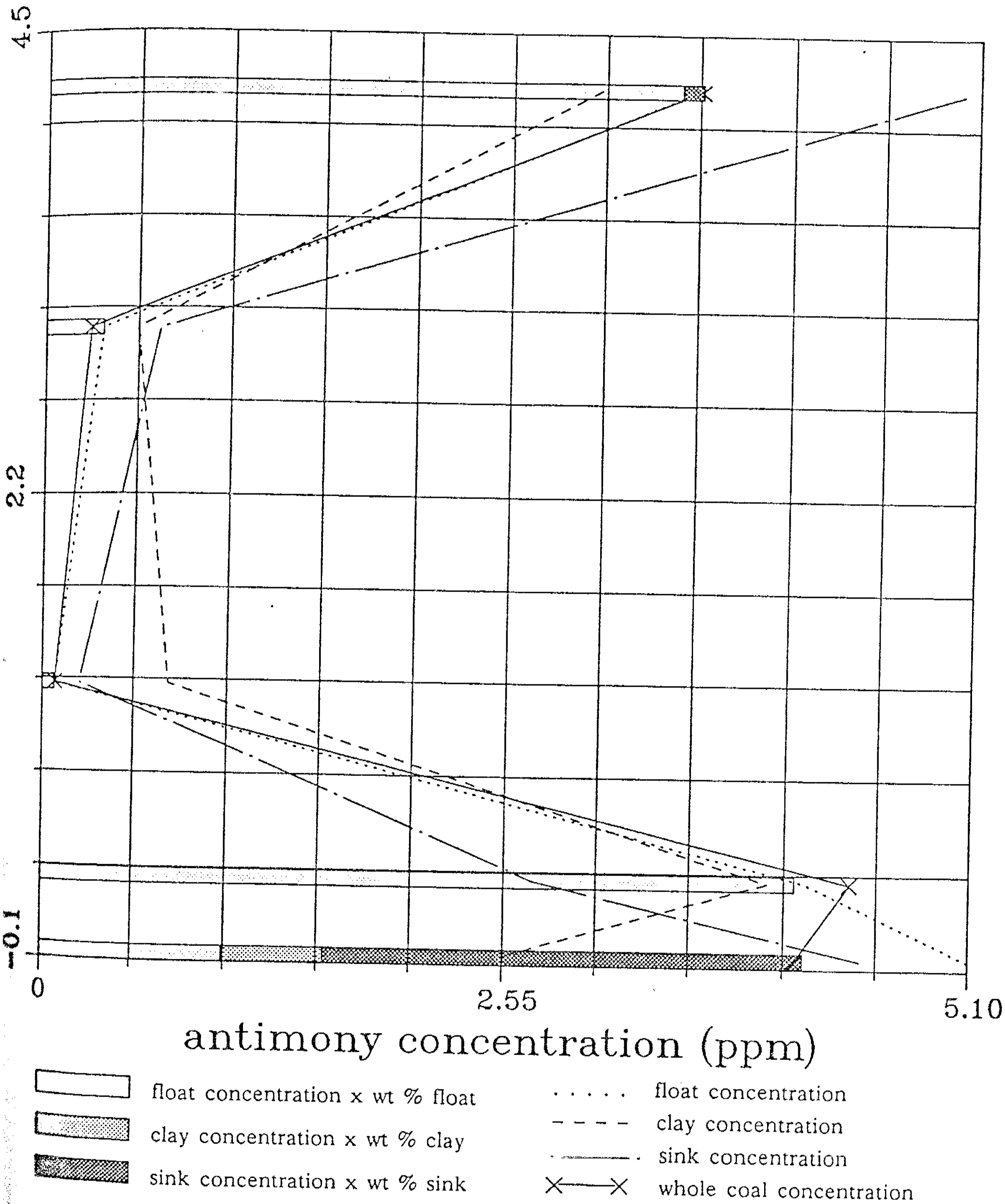
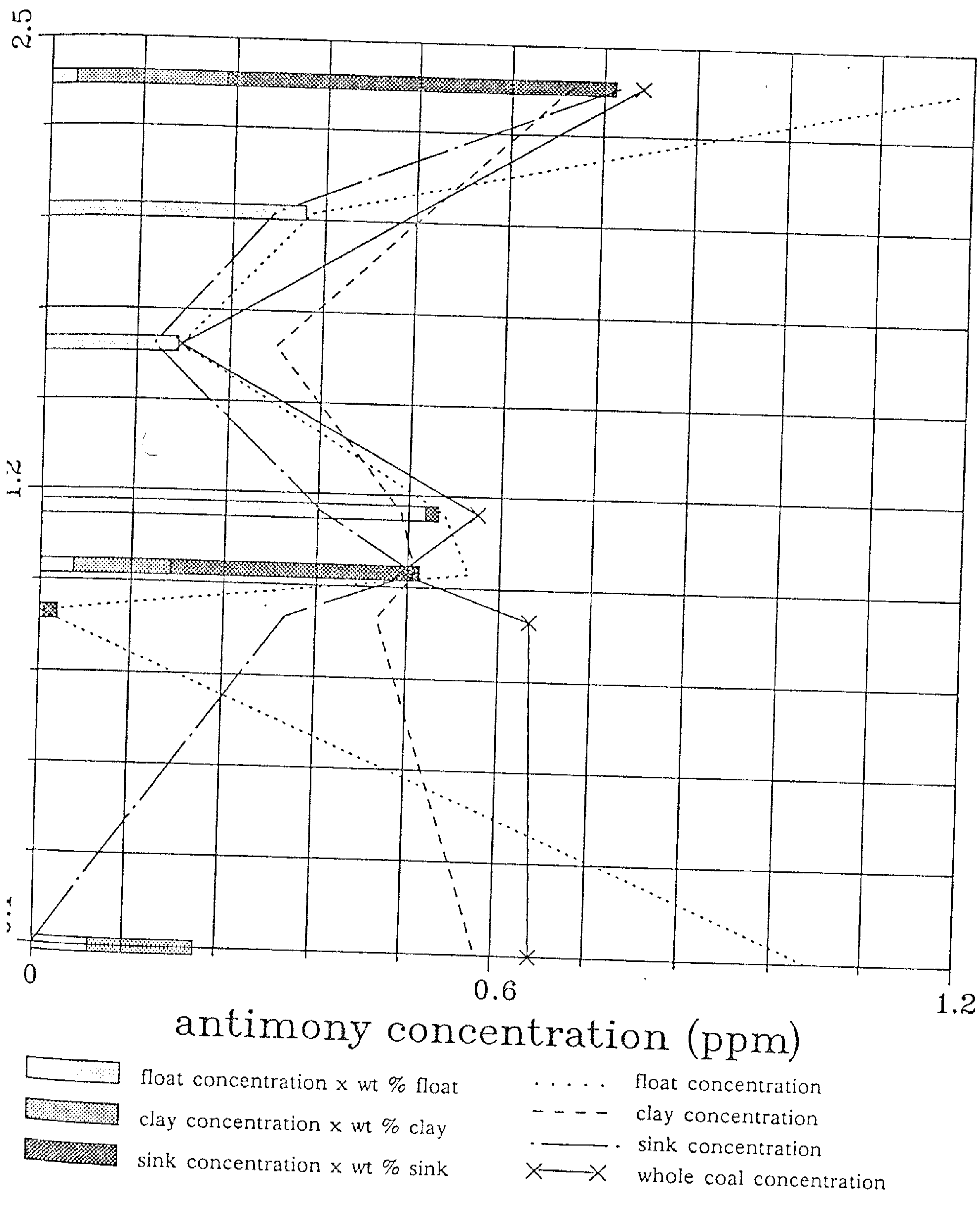


Figure D-126. Antimony float-clay-sink distributions in the LRA2 seam.



ure D-127. Antimony float-caly-sink diatributions in the YA seam.

CHROMIUM DISTRIBUTION
IN THE LEE RANCH P1 DRILL CORE

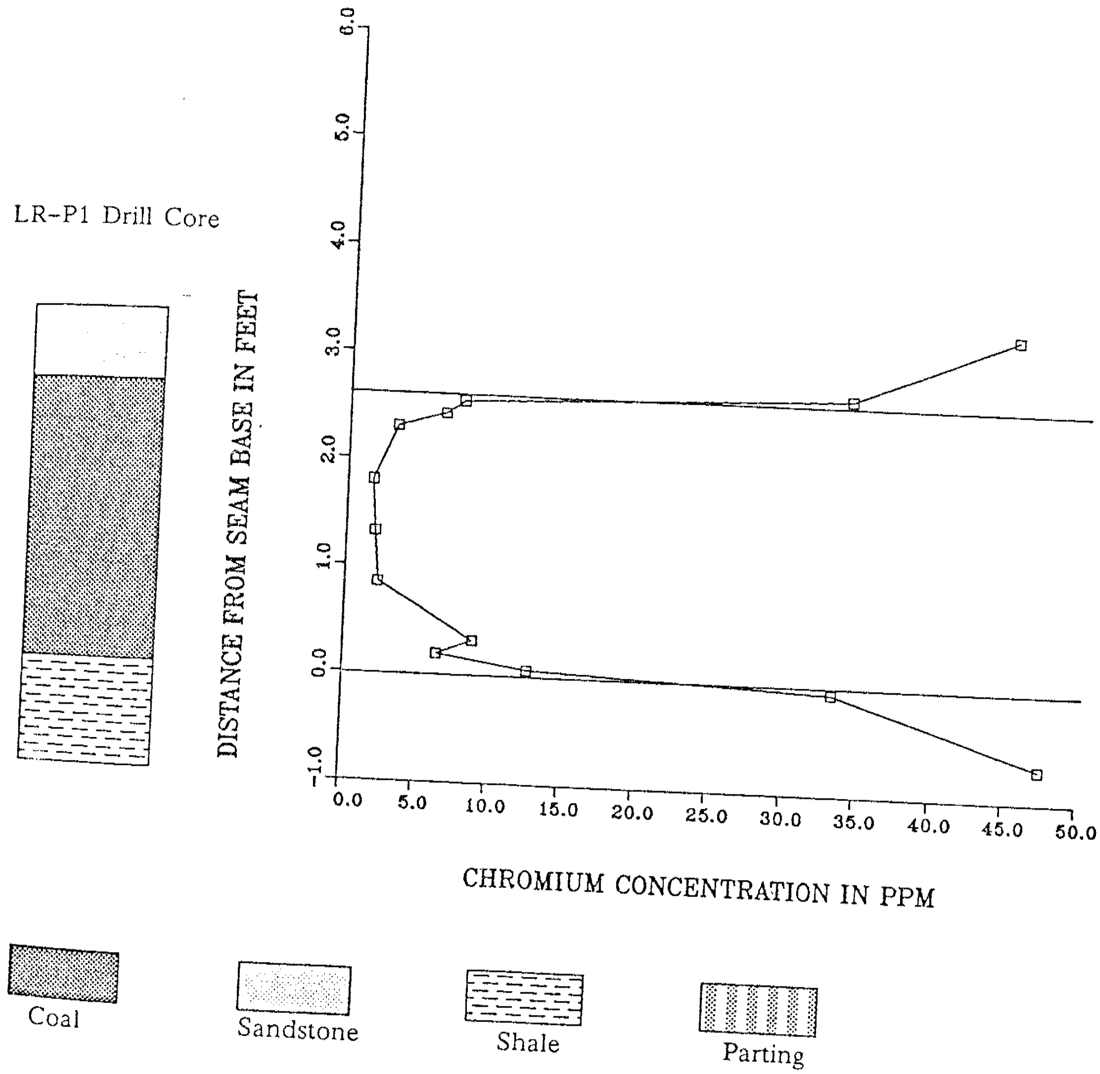


Figure D-128.

CHROMIUM DISTRIBUTION IN THE LEE RANCH P2 DRILL CORE

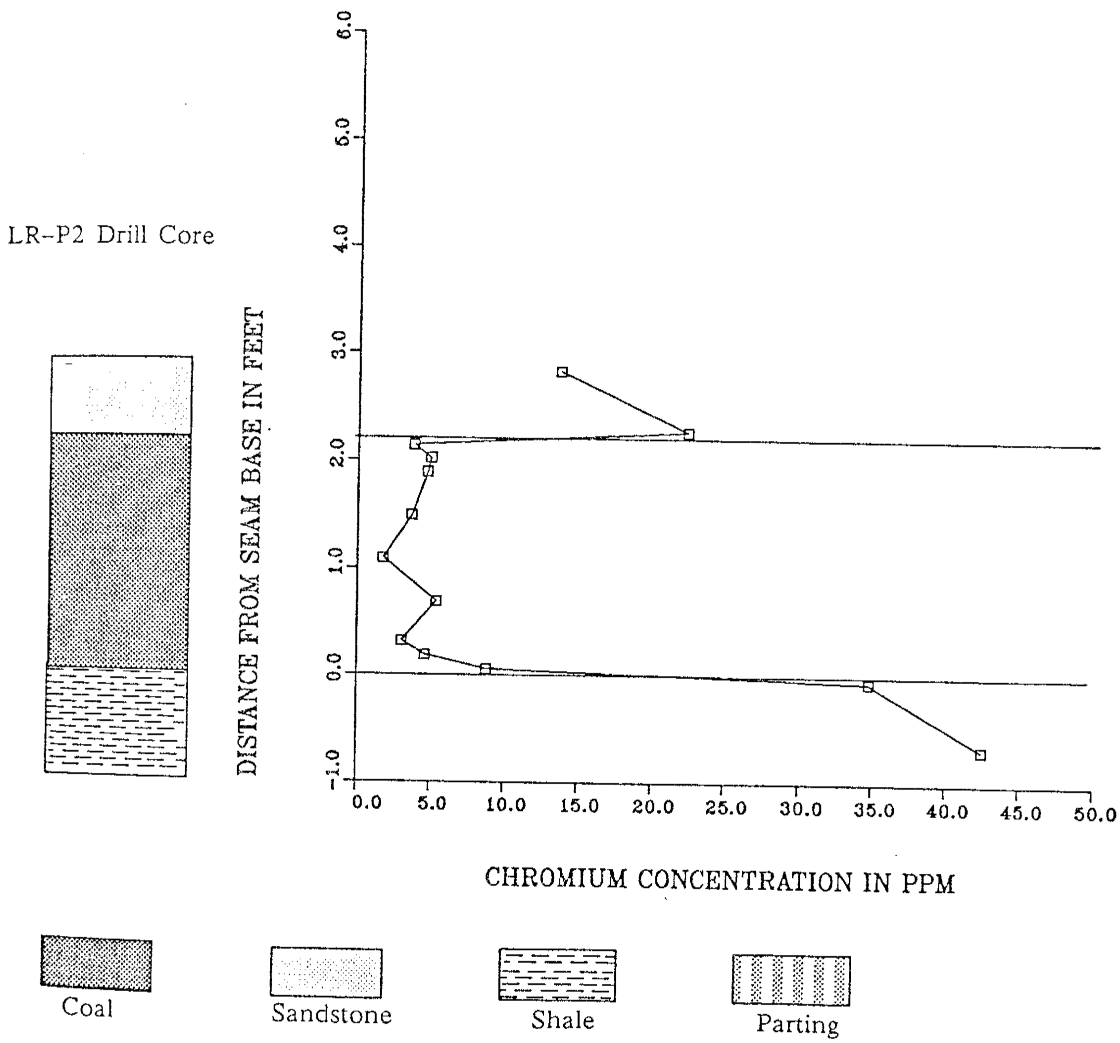


Figure D-129.

CHROMIUM DISTRIBUTION
IN THE LEE RANCH A2 DRILL CORE

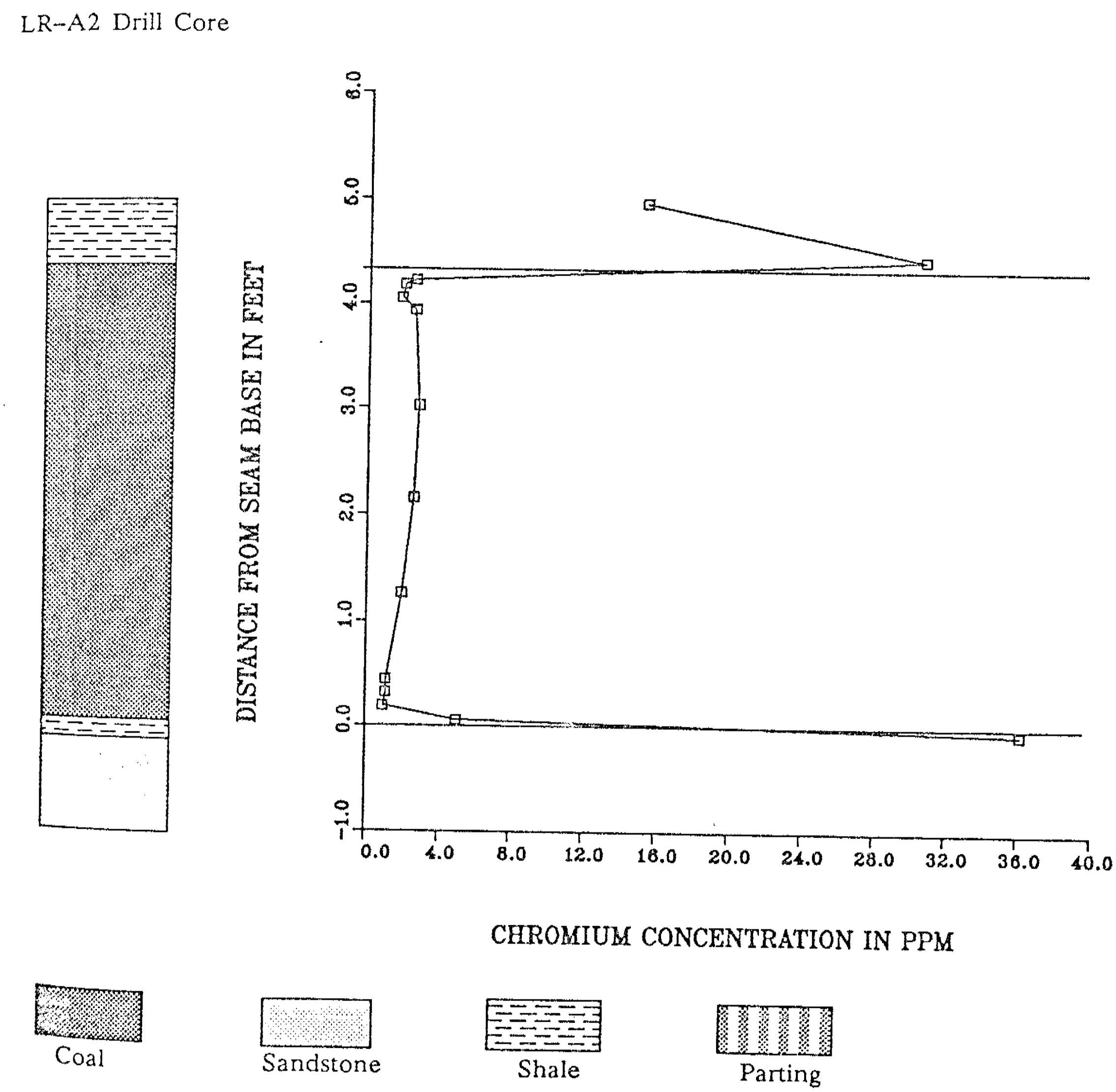


Figure D–130.

CHROMIUM DISTRIBUTION
IN THE LEE RANCH A3 DRILL CORE

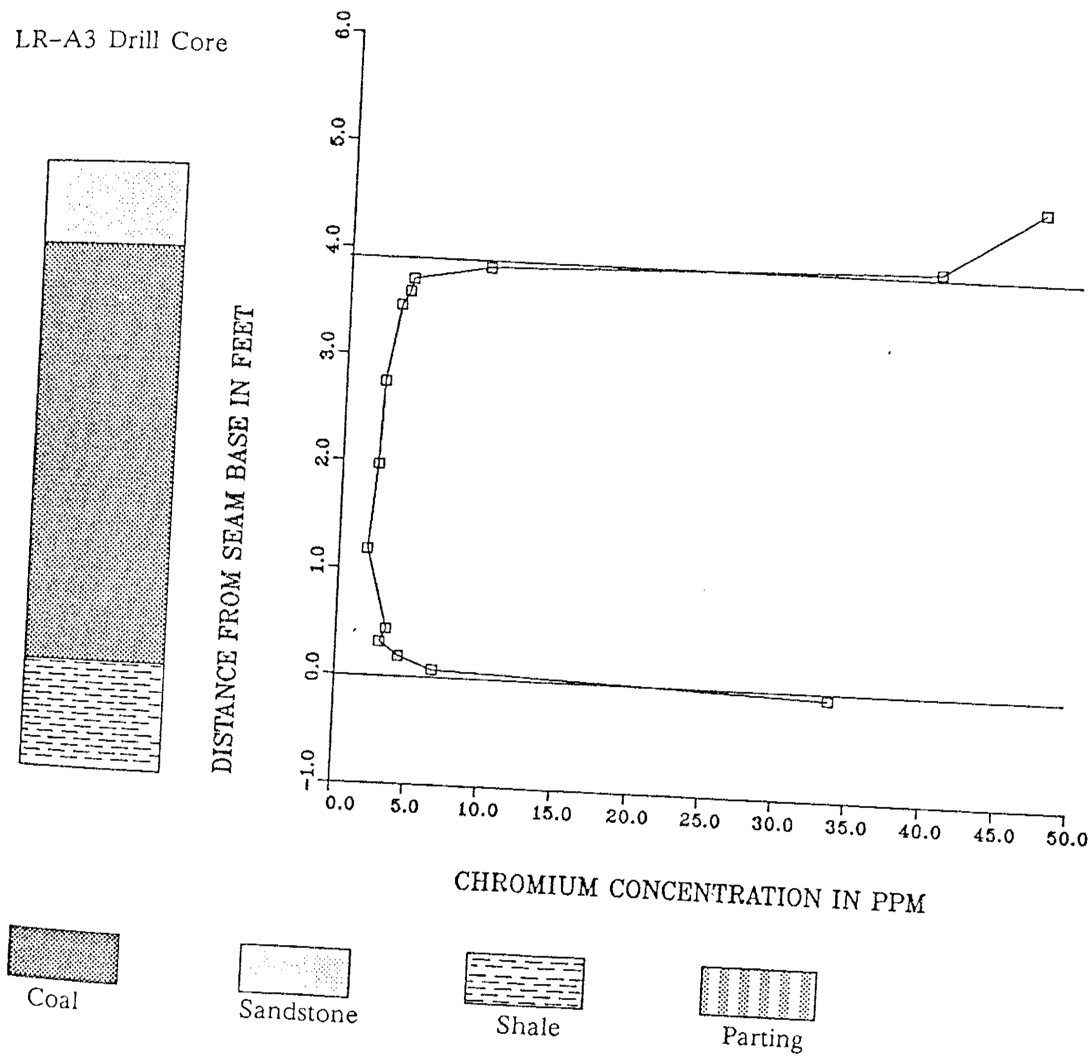


Figure D-131.

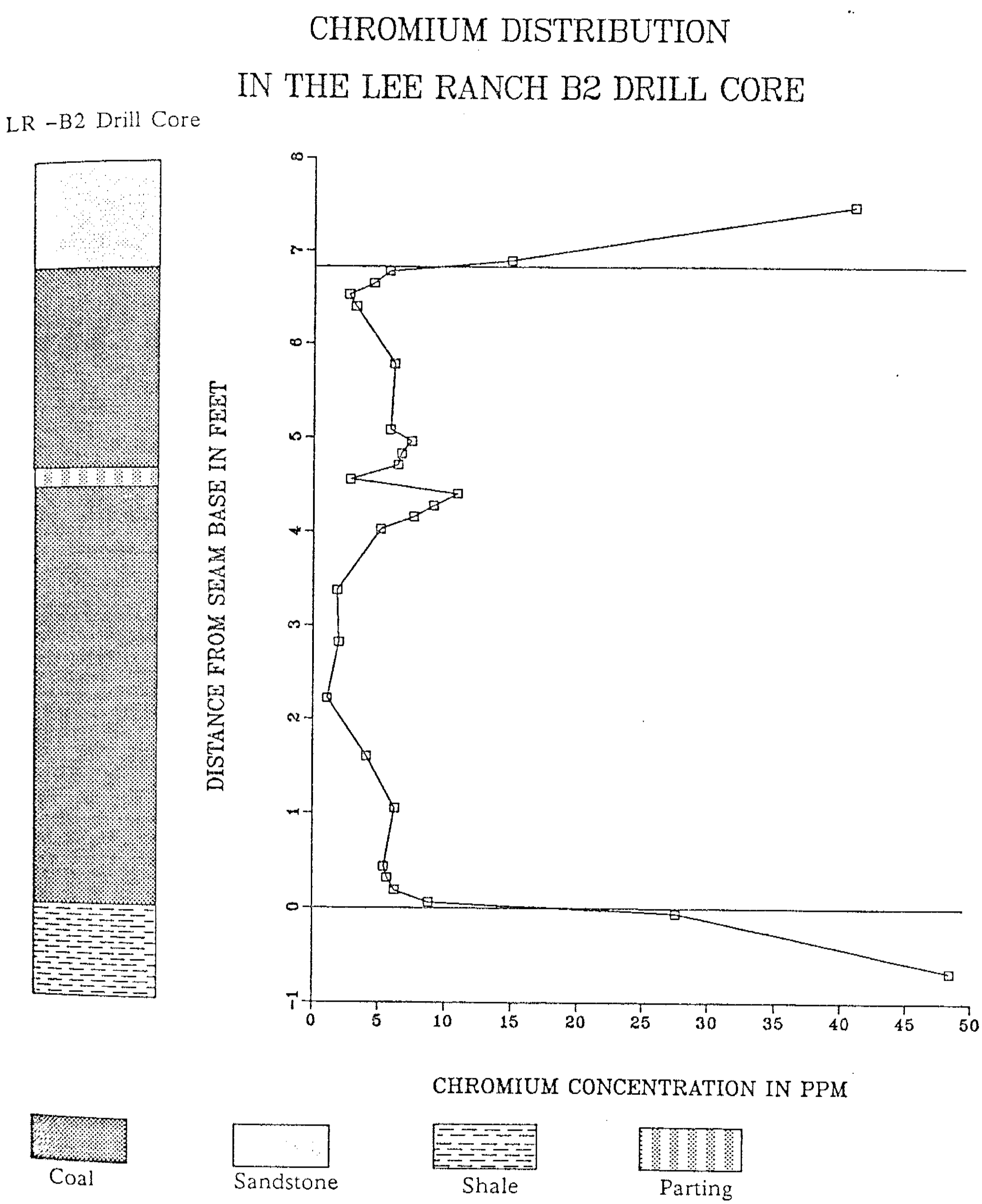

CHROMIUM DISTRIBUTION
IN THE LEE RANCH B2 DRILL CORE
LR -B2 Drill Core
DISTANCE FROM SEAM BASE IN FEET
CHROMIUM CONCENTRATION IN PPM
Coal
Sandstone
Shale
Parting

Figure D-132.

CHROMIUM DISTRIBUTION IN THE LEE RANCH B3 DRILL CORE

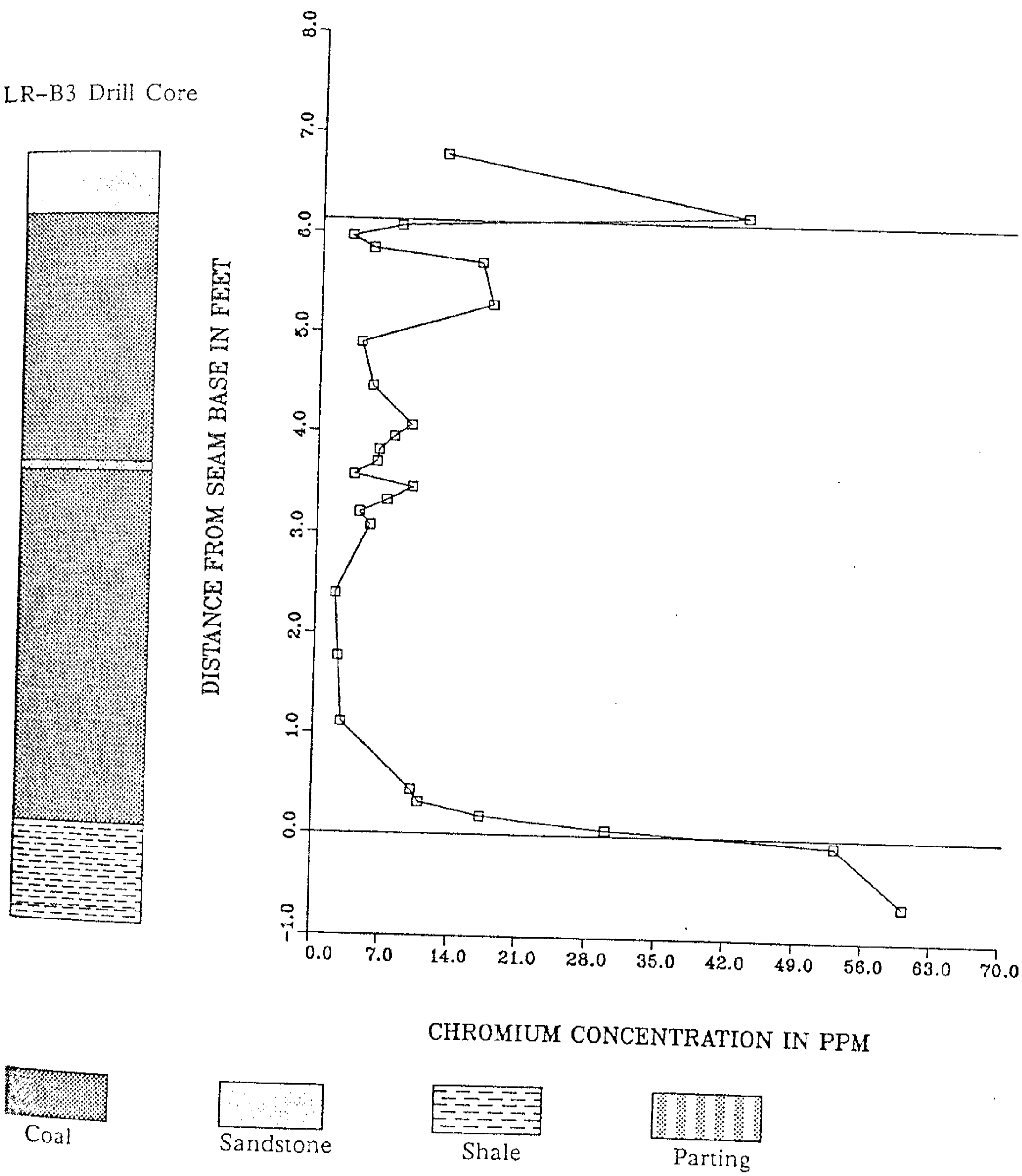


Figure D-133.

CHROMIUM DISTRIBUTION
IN THE YORK CANYON "A" AND "MAIN" SEAMS

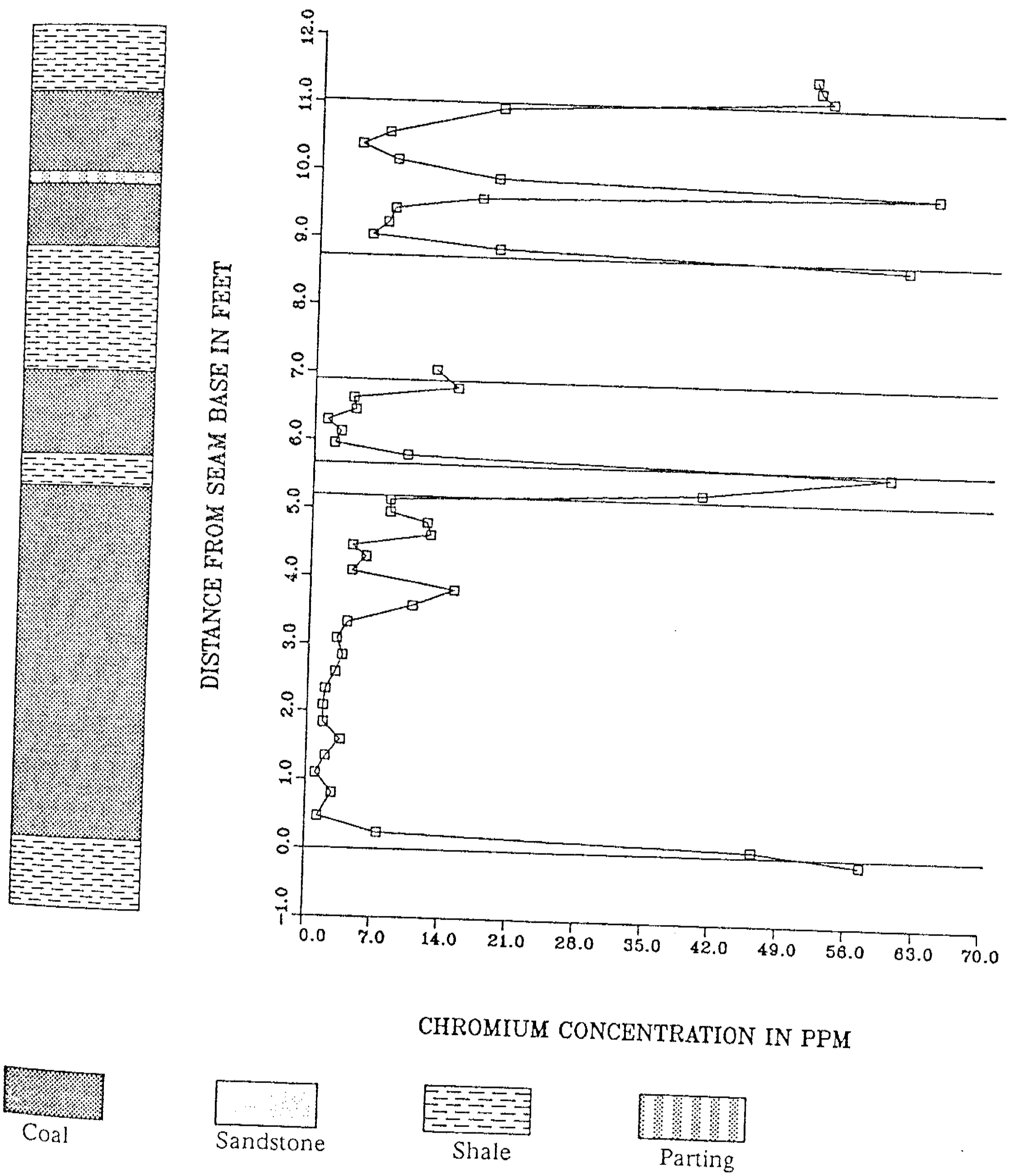


Figure D-134.

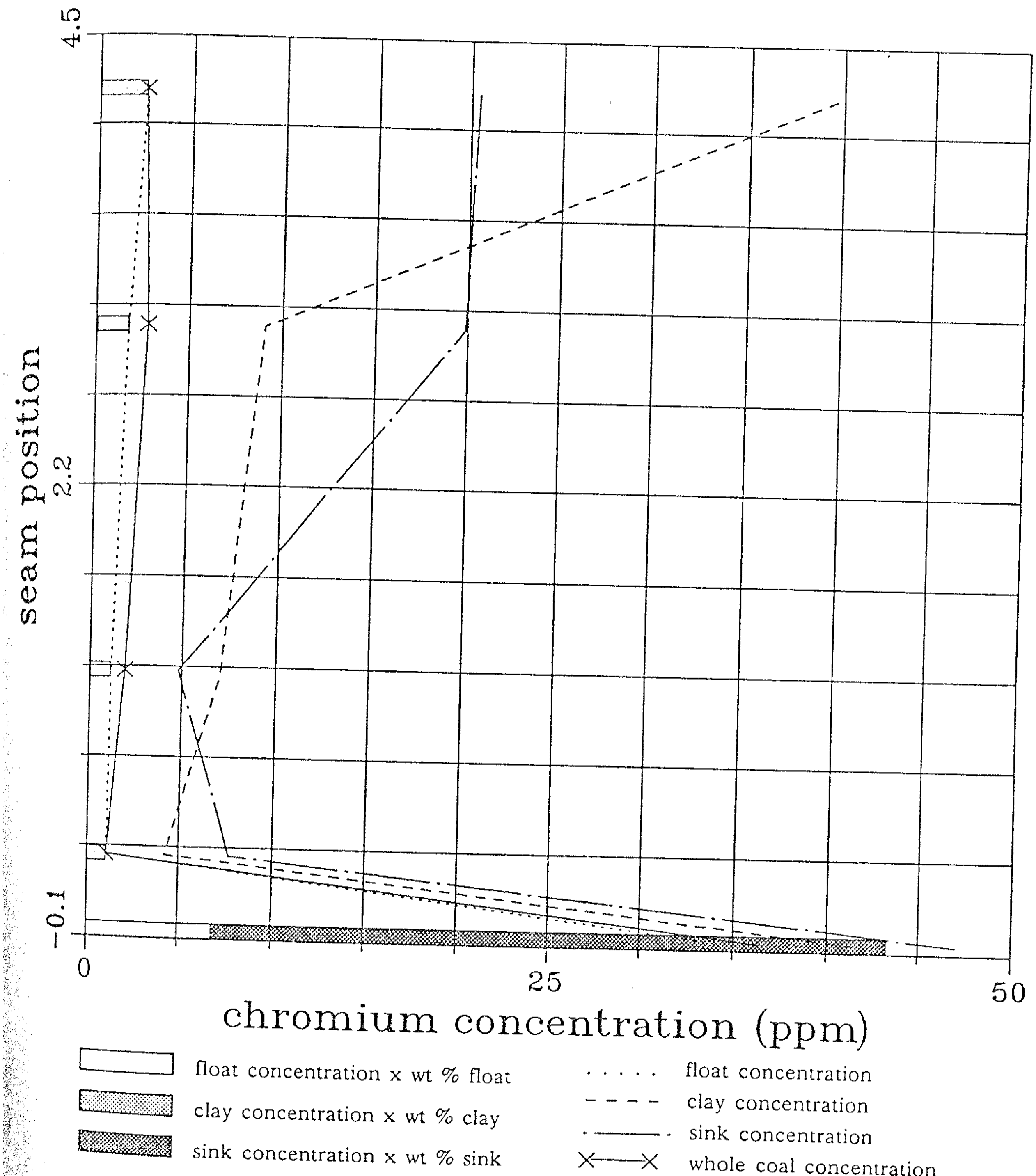


Figure D-135. Chronium float-clay-sink distributions in the LRA2 seam.

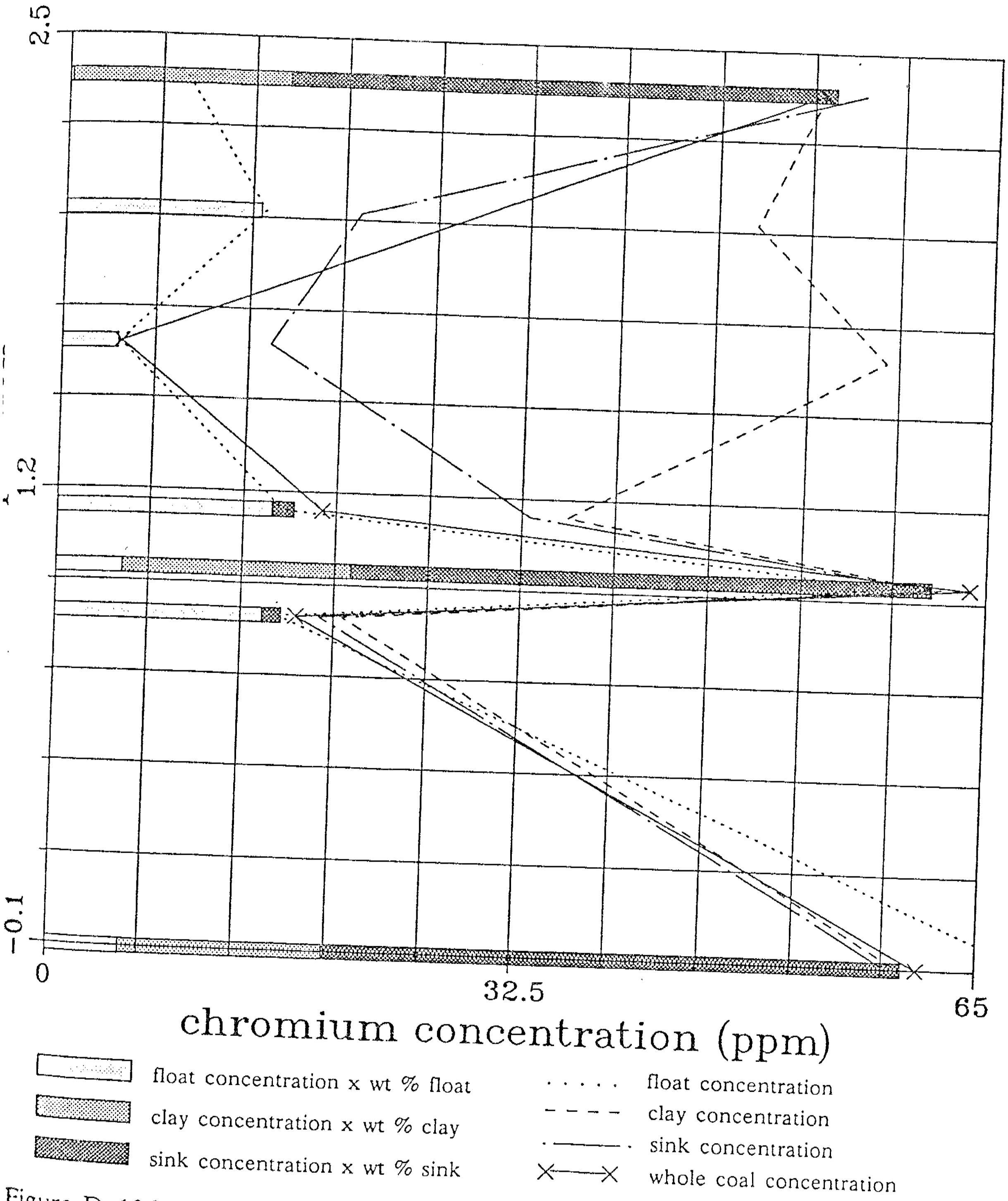


Figure D-136. Chromium float-clay-sink distributions in the YA seam.

SCANDIUM DISTRIBUTION IN THE LEE RANCH P1 DRILL CORE

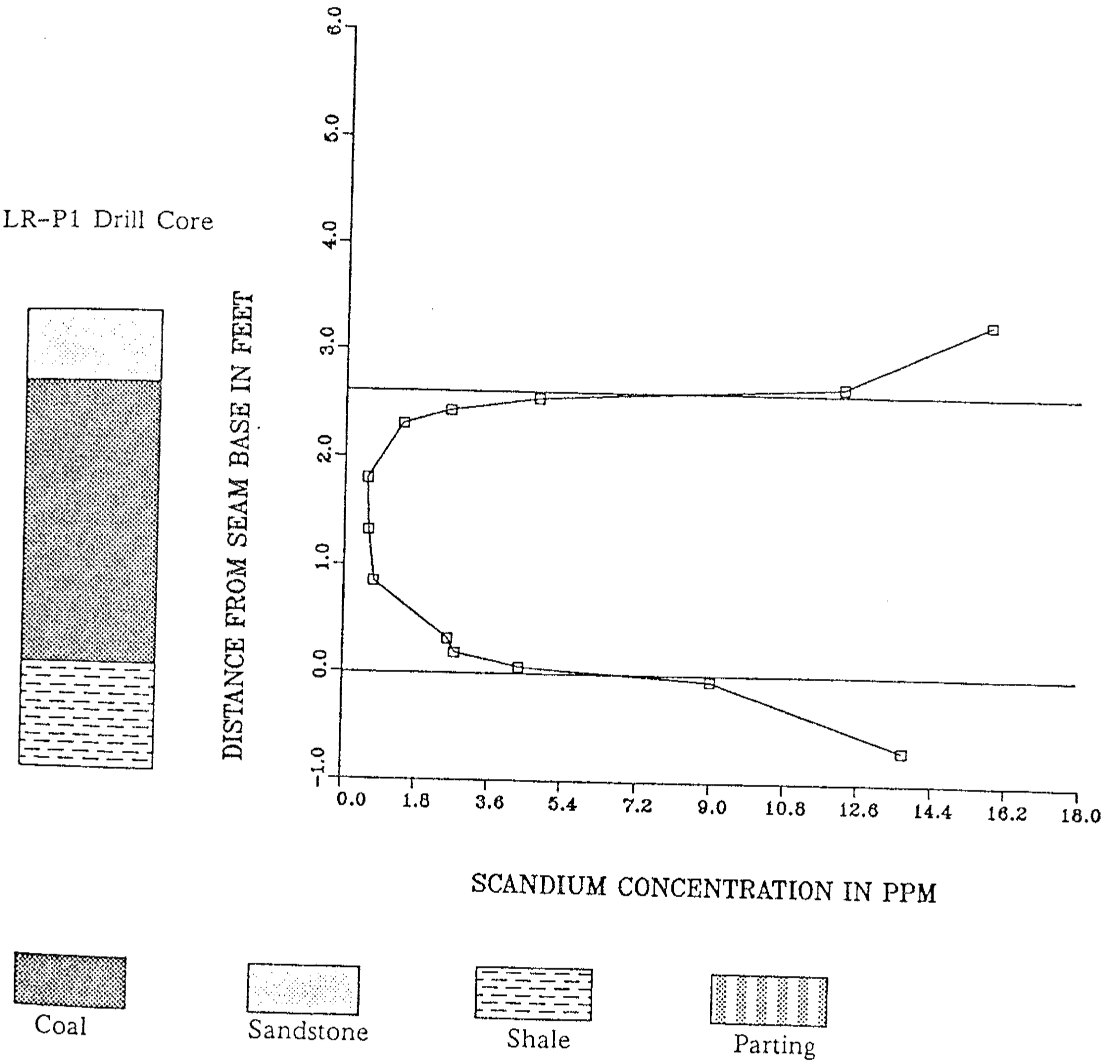


Figure D-137.

SCANDIUM DISTRIBUTION
IN THE LEE RANCH P2 DRILL CORE

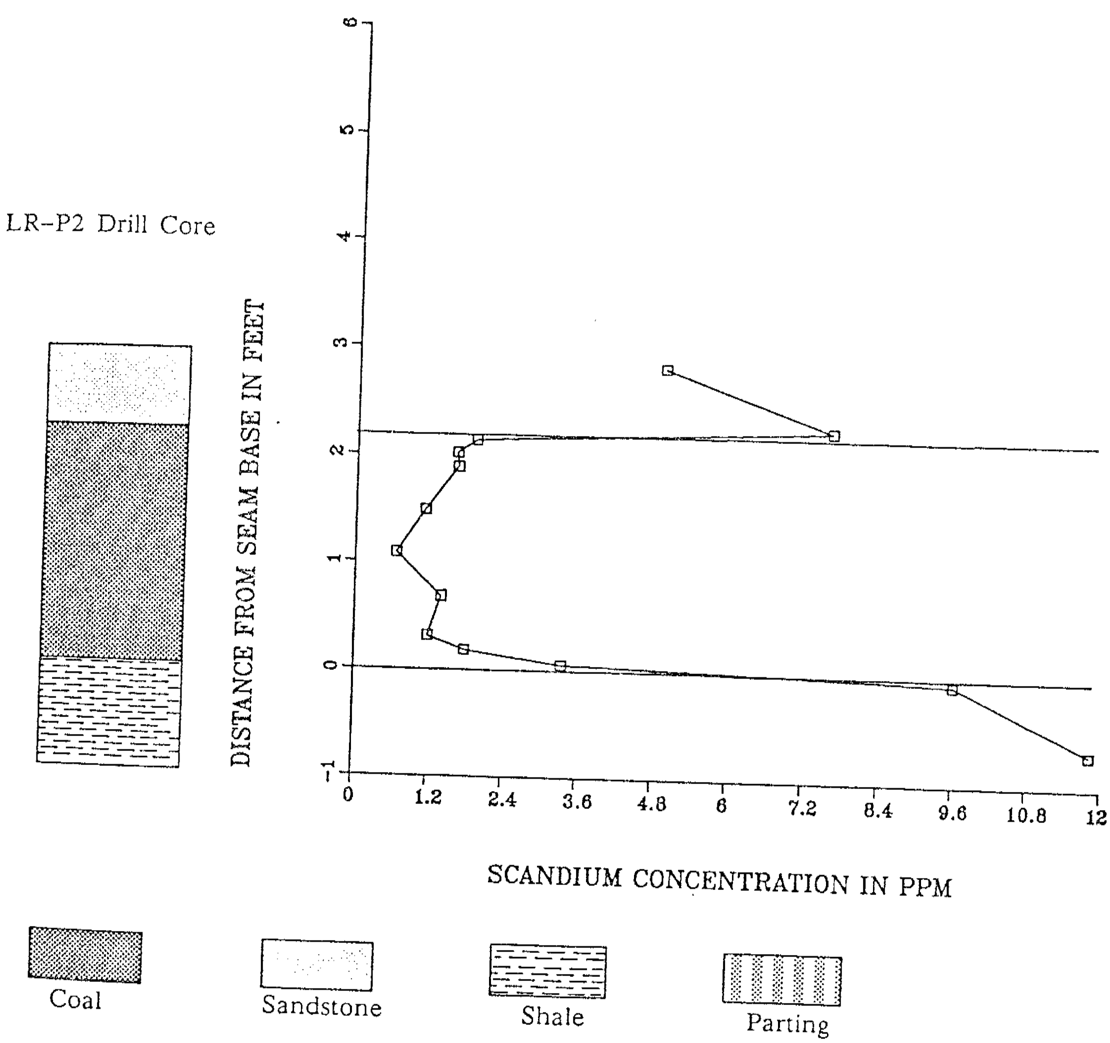


Figure D-138.

SCANDIUM DISTRIBUTION IN THE LEE RANCH A2 DRILL CORE

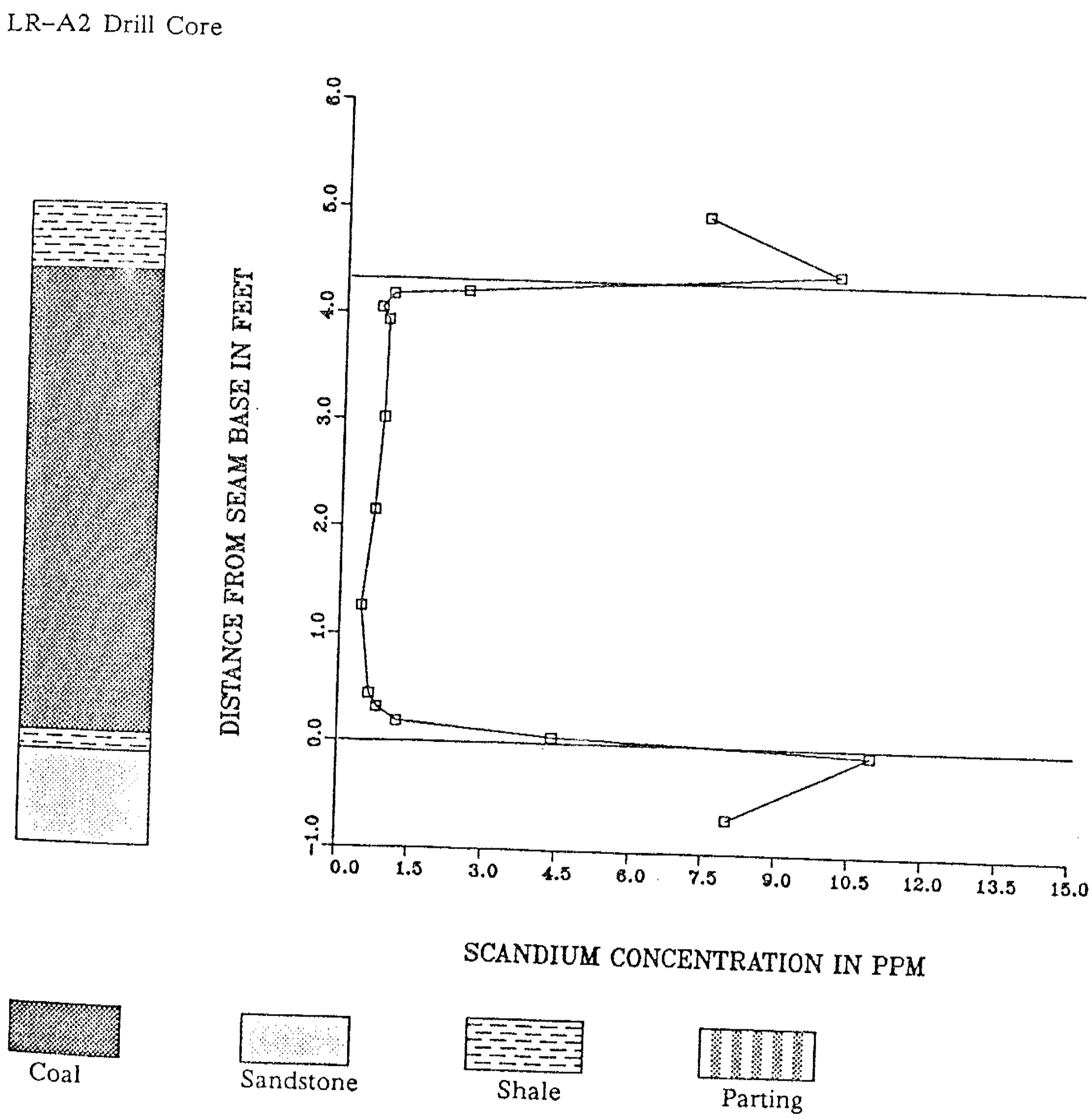


Figure D-139.

SCANDIUM DISTRIBUTION IN THE LEE RANCH A3 DRILL CORE

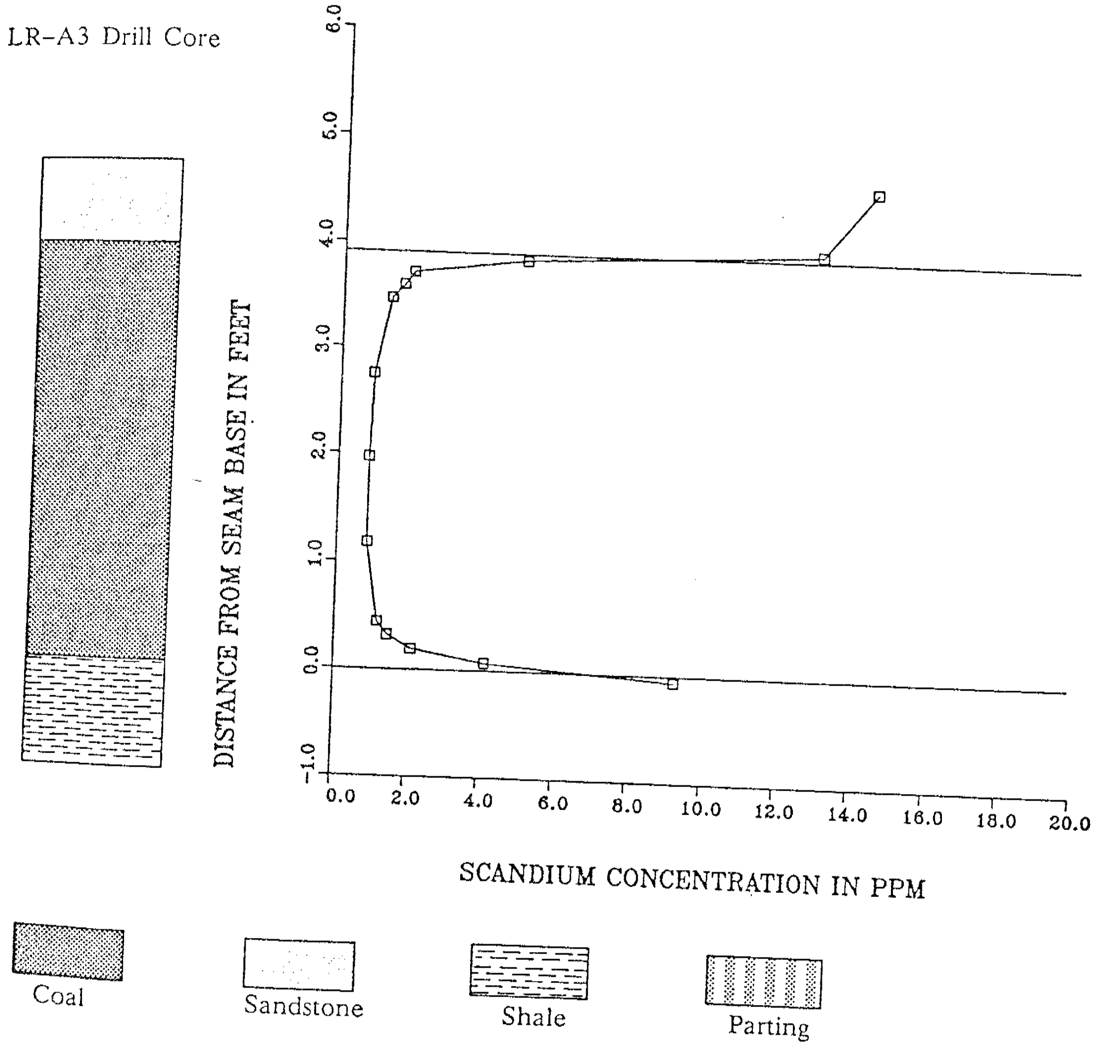


Figure D-140.

SCANDIUM DISTRIBUTION IN THE LEE RANCH B2 DRILL CORE

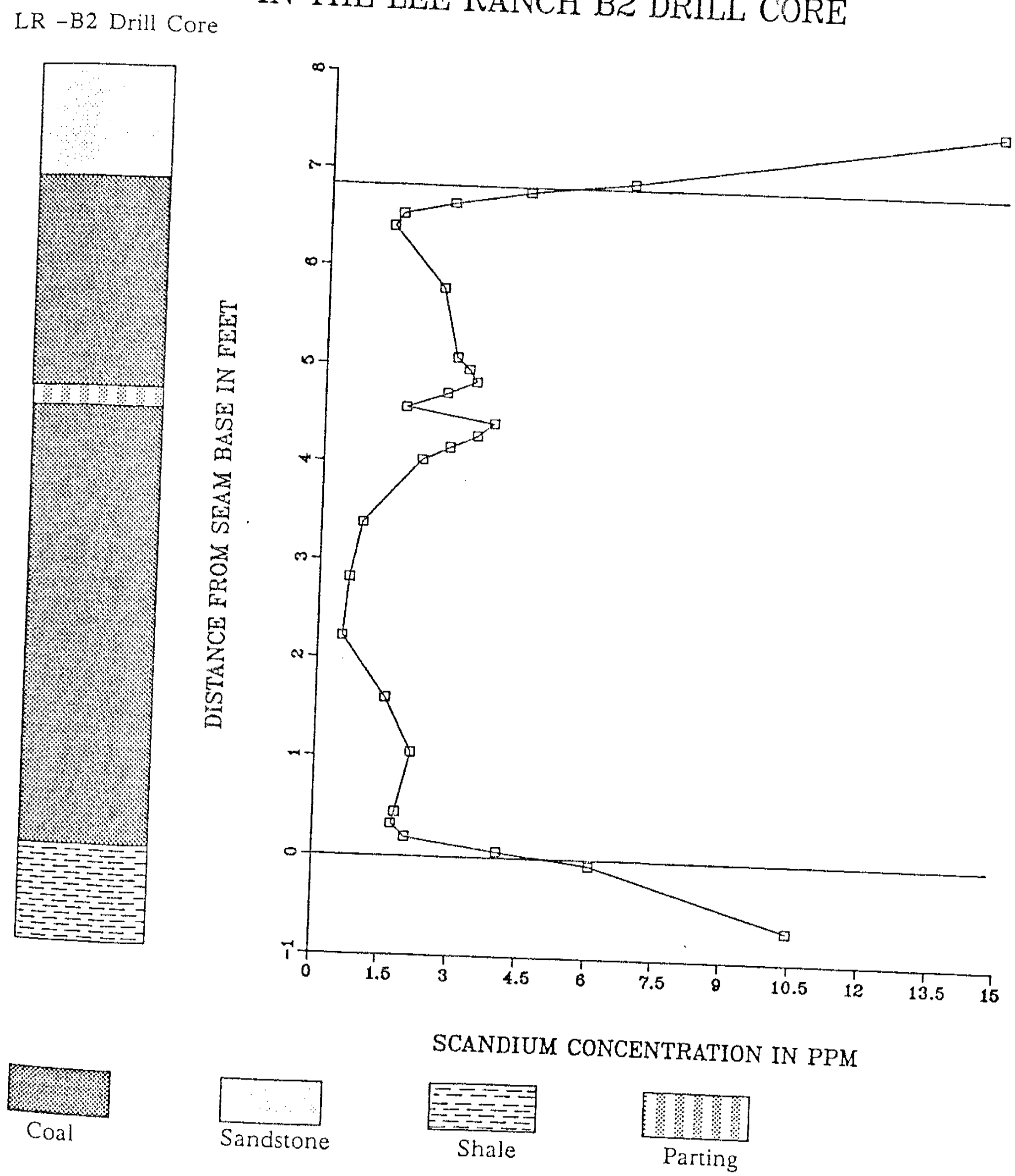


Figure D-141.

SCANDIUM DISTRIBUTION IN THE LEE RANCH B3 DRILL CORE

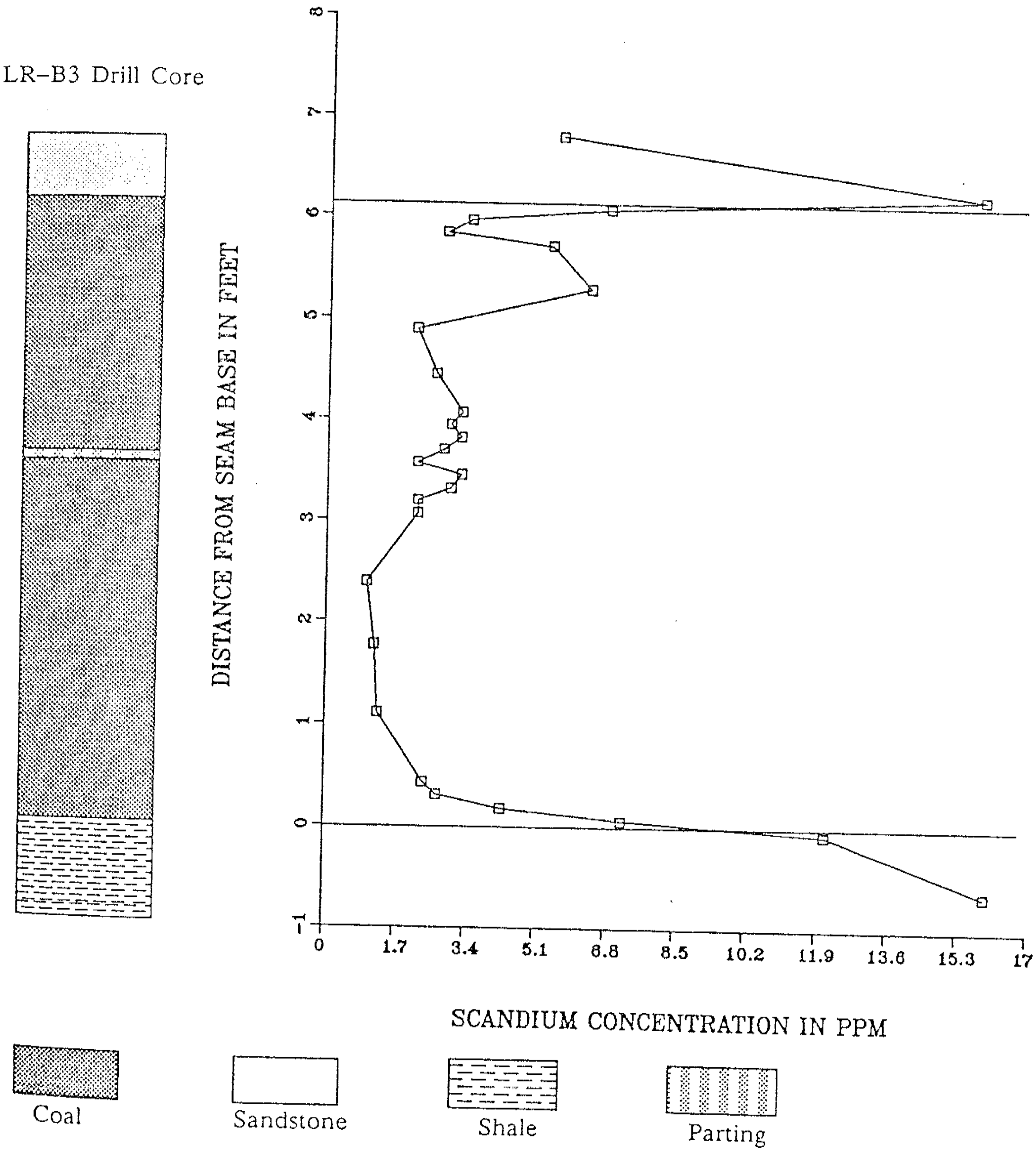


Figure D-142.

SCANDIUM DISTRIBUTION
IN THE YORK CANYON "A" AND "MAIN" SEAMS

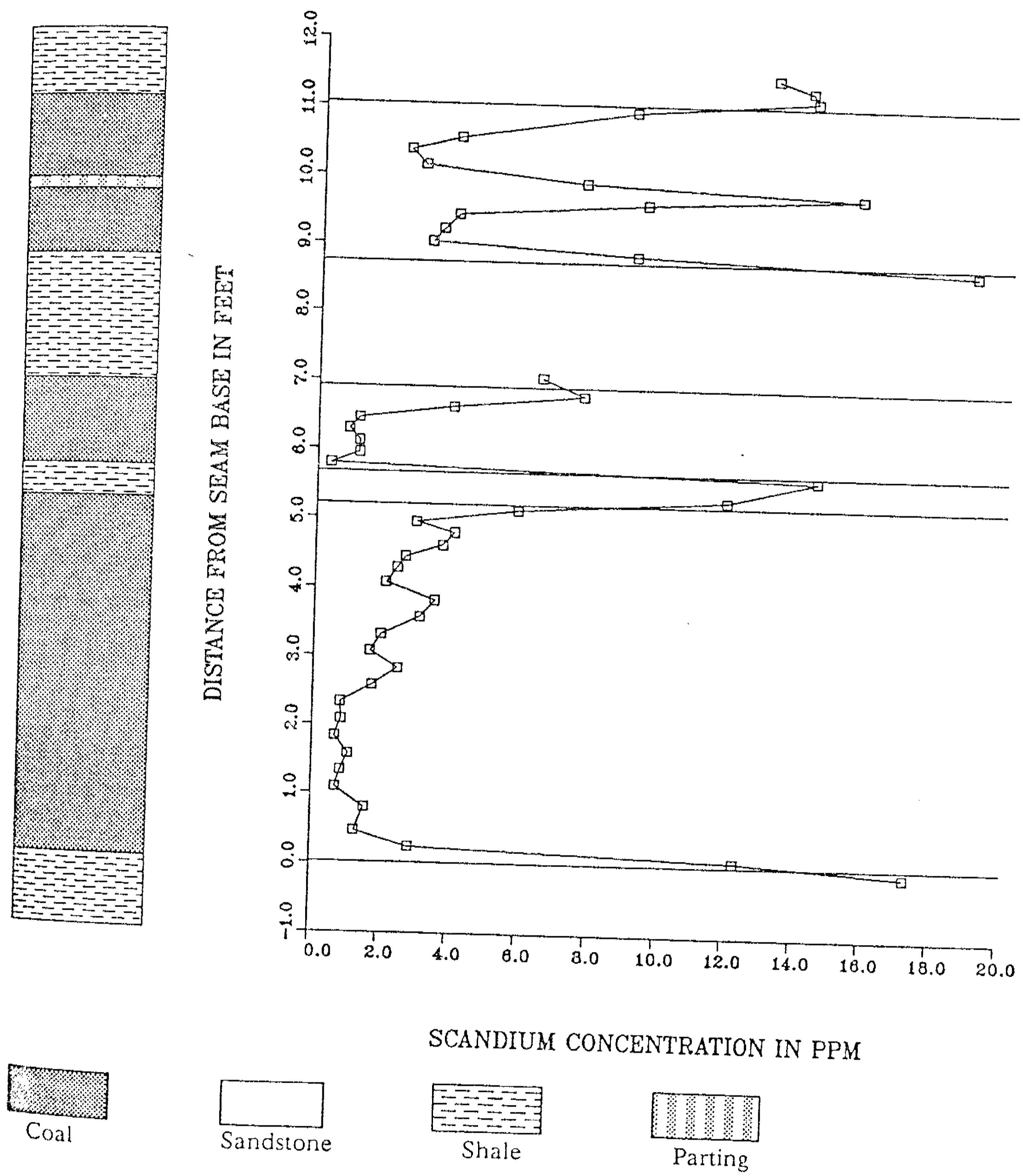


Figure D-143.

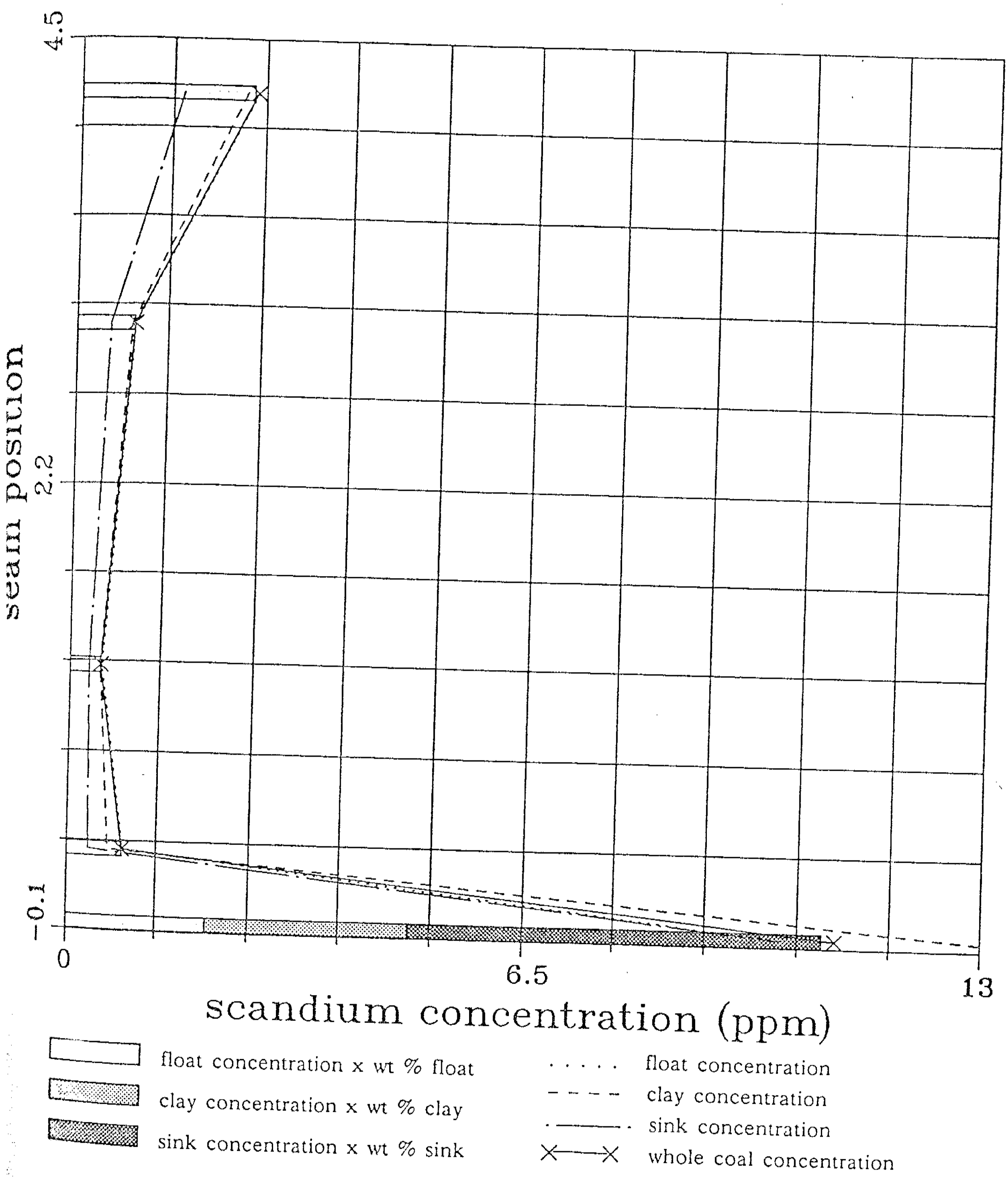


Figure D-144. Scandium float-clay-sink distributions in the LRA2 seam.

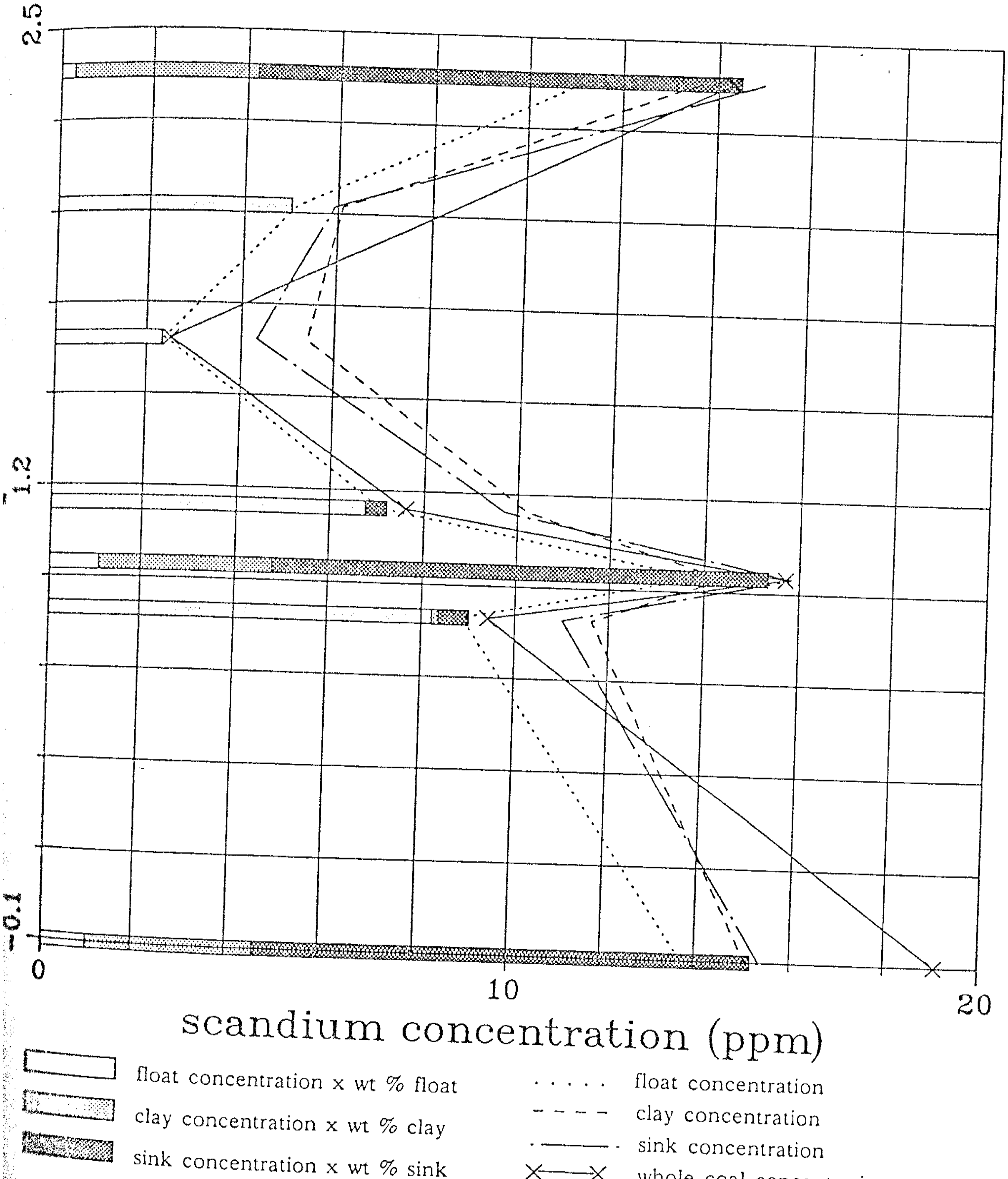


Figure D-145. Scandium float-clay-sink distributions in the Ya seam.

HAFNIUM DISTRIBUTION
IN THE LEE RANCH P1 DRILL CORE

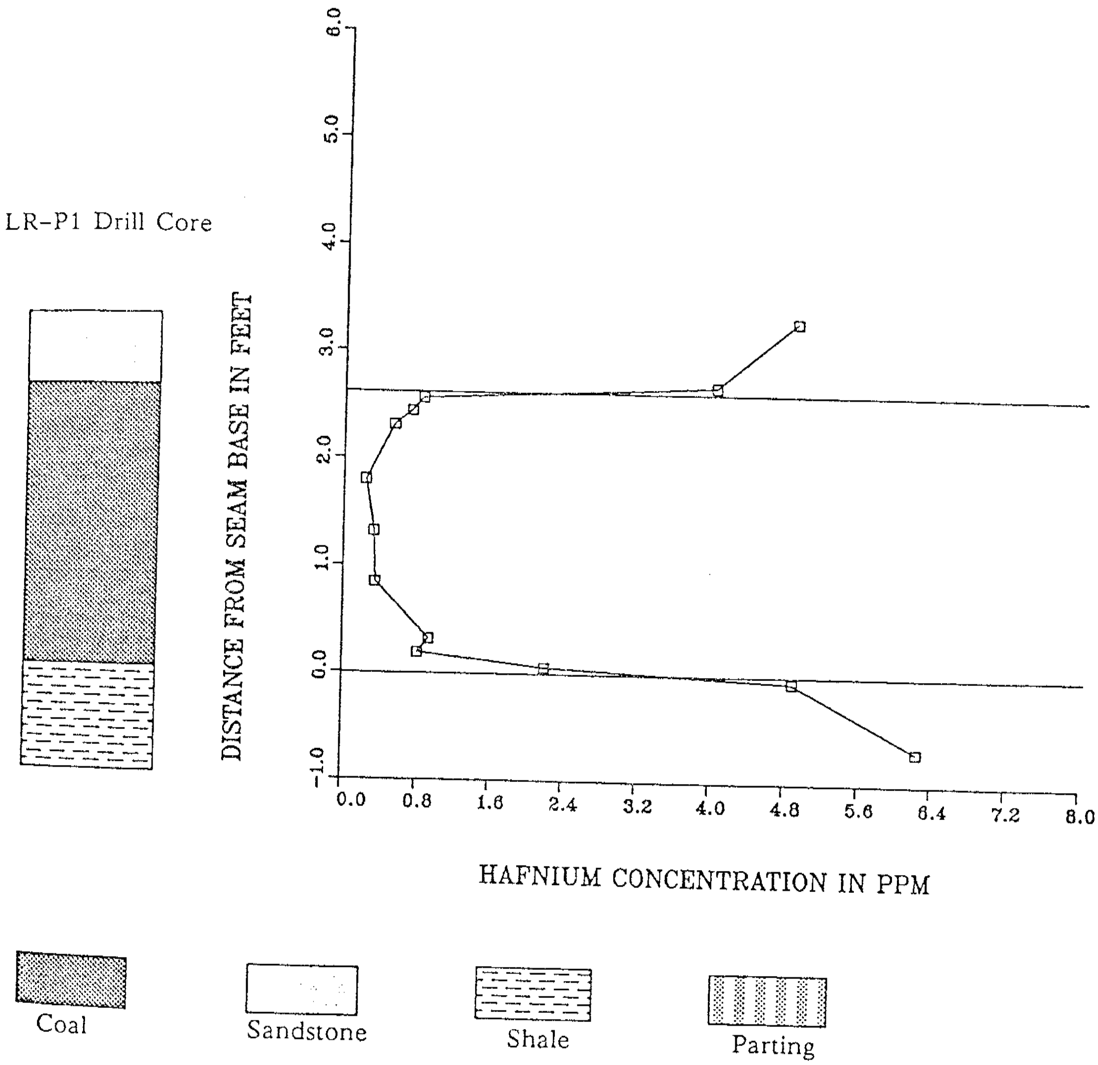


Figure D-146.

HAFNIUM DISTRIBUTION IN THE LEE RANCH P2 DRILL CORE

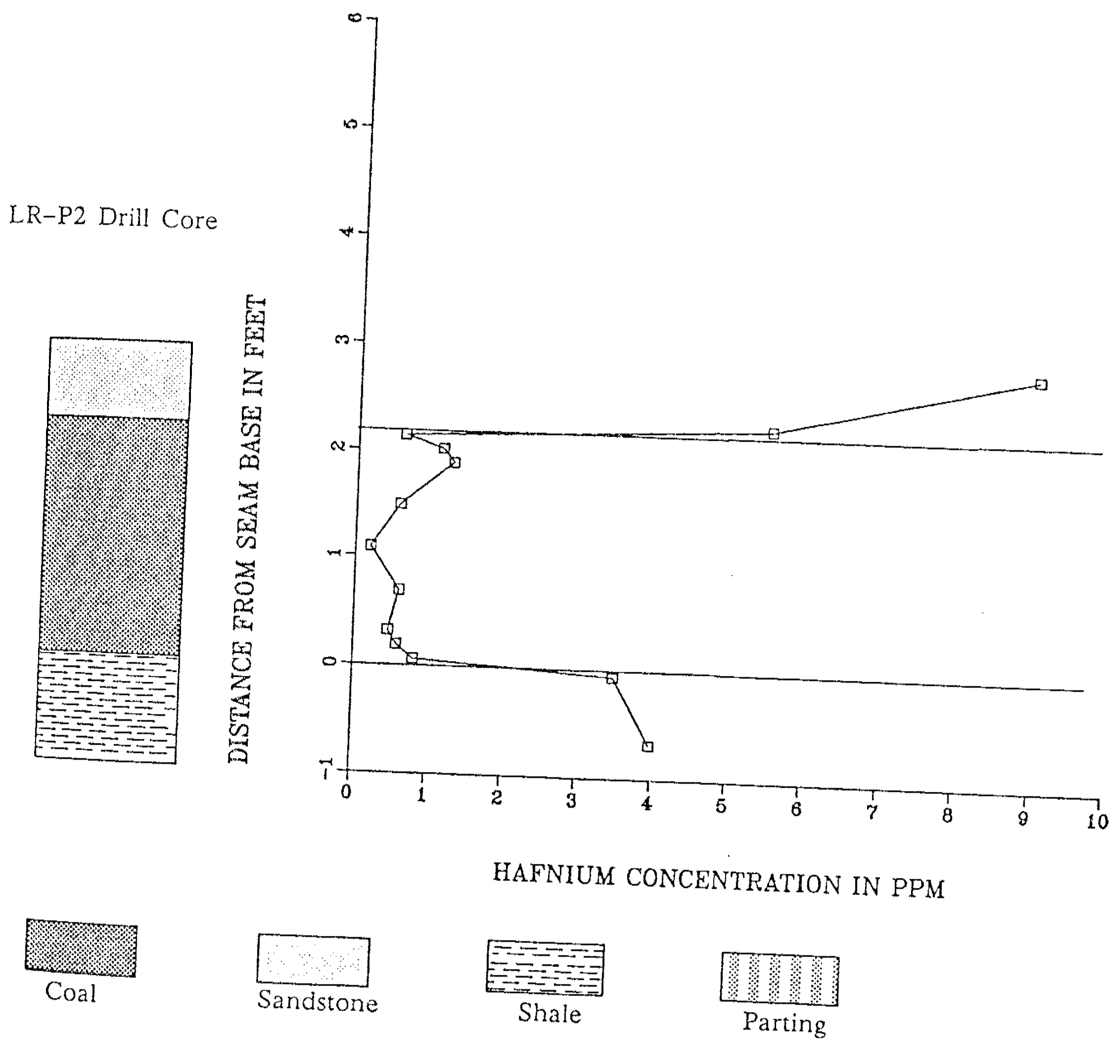


Figure D-147.

HAFNIUM DISTRIBUTION
IN THE LEE RANCH A2 DRILL CORE

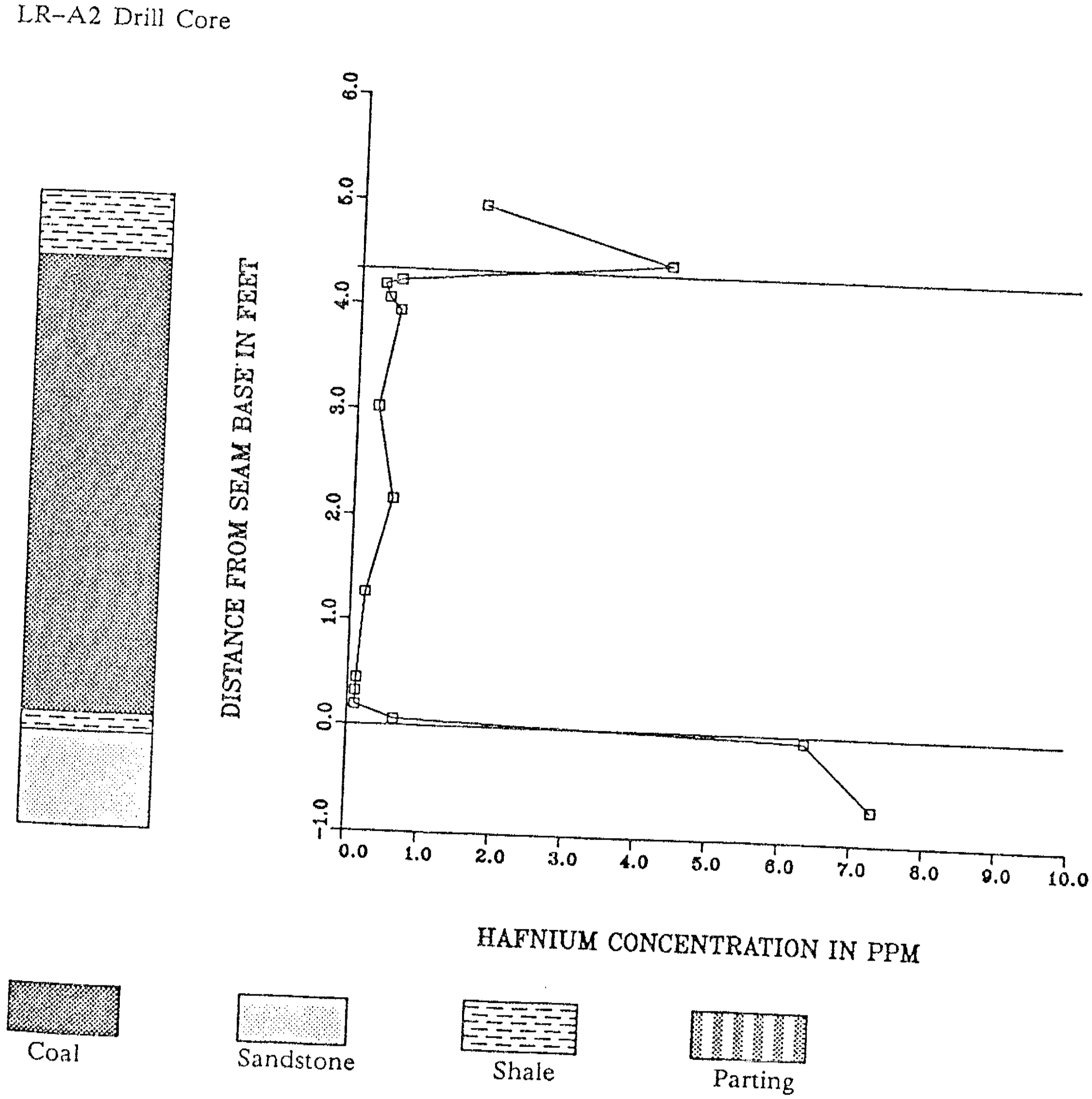


Figure D-148.

HAFNIUM DISTRIBUTION IN THE LEE RANCH A3 DRILL CORE

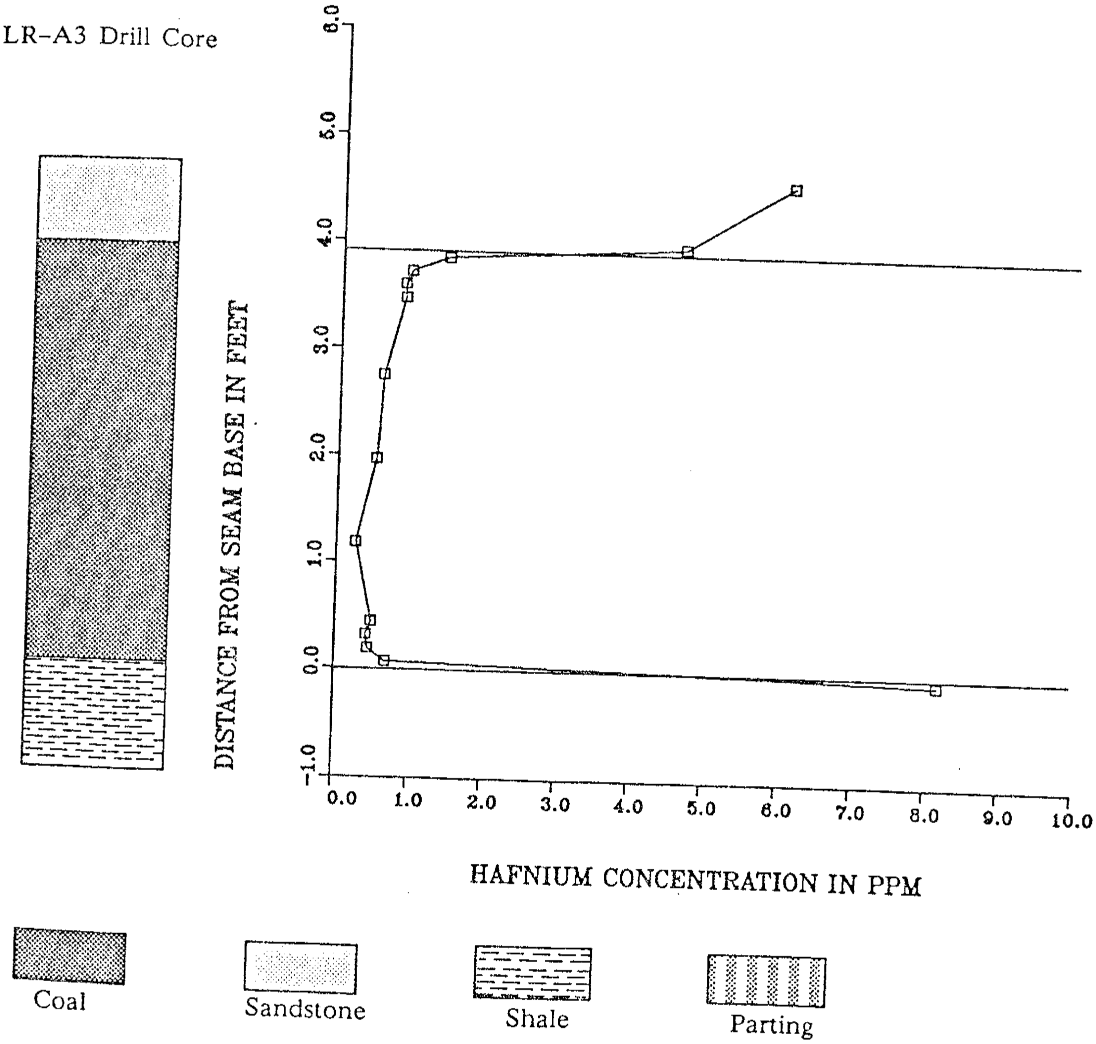


Figure D-149.

HAFNIUM DISTRIBUTION IN THE LEE RANCH B2 DRILL CORE

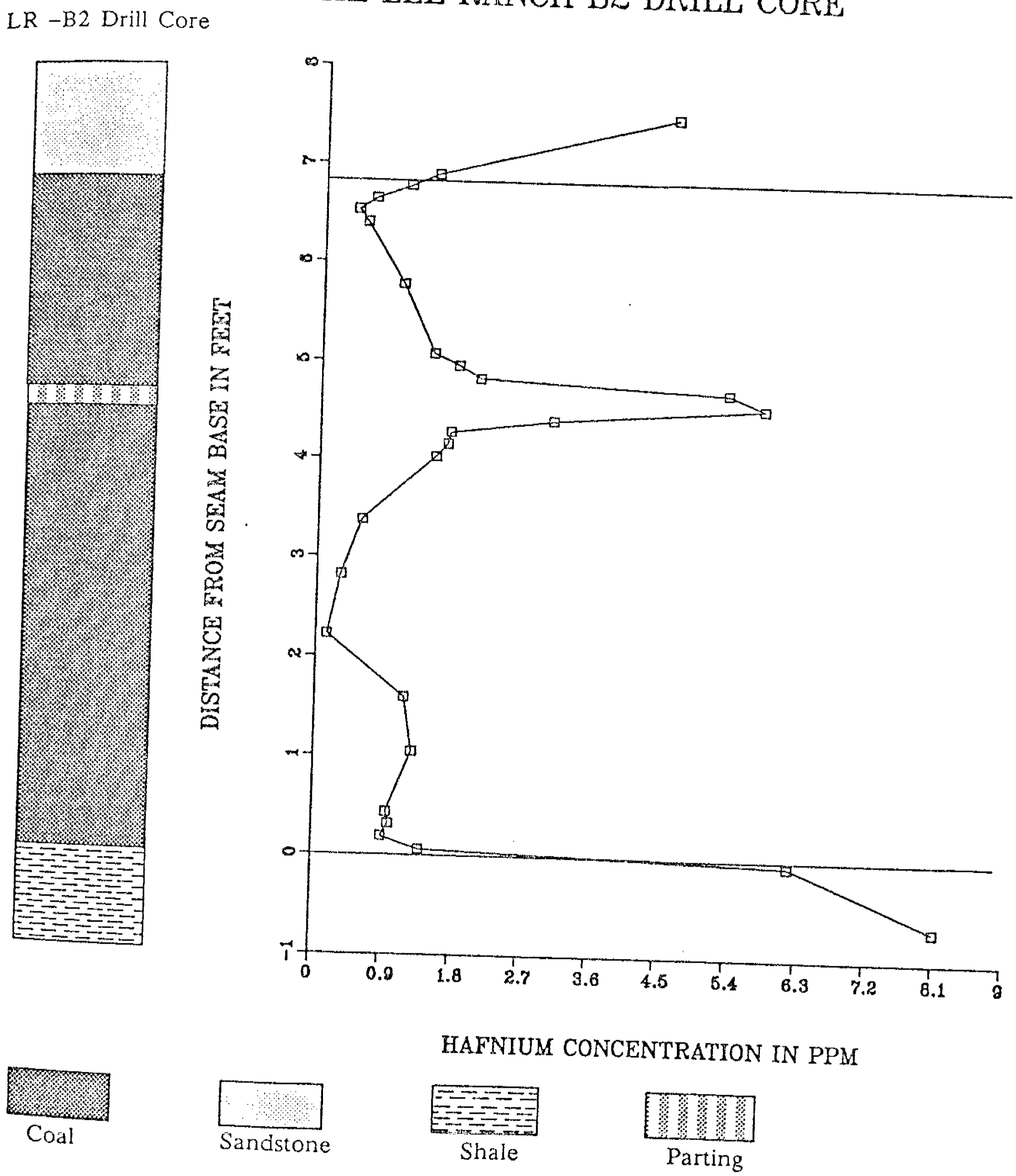


Figure D-150.

HAFNIUM DISTRIBUTION
IN THE LEE RANCH B3 DRILL CORE

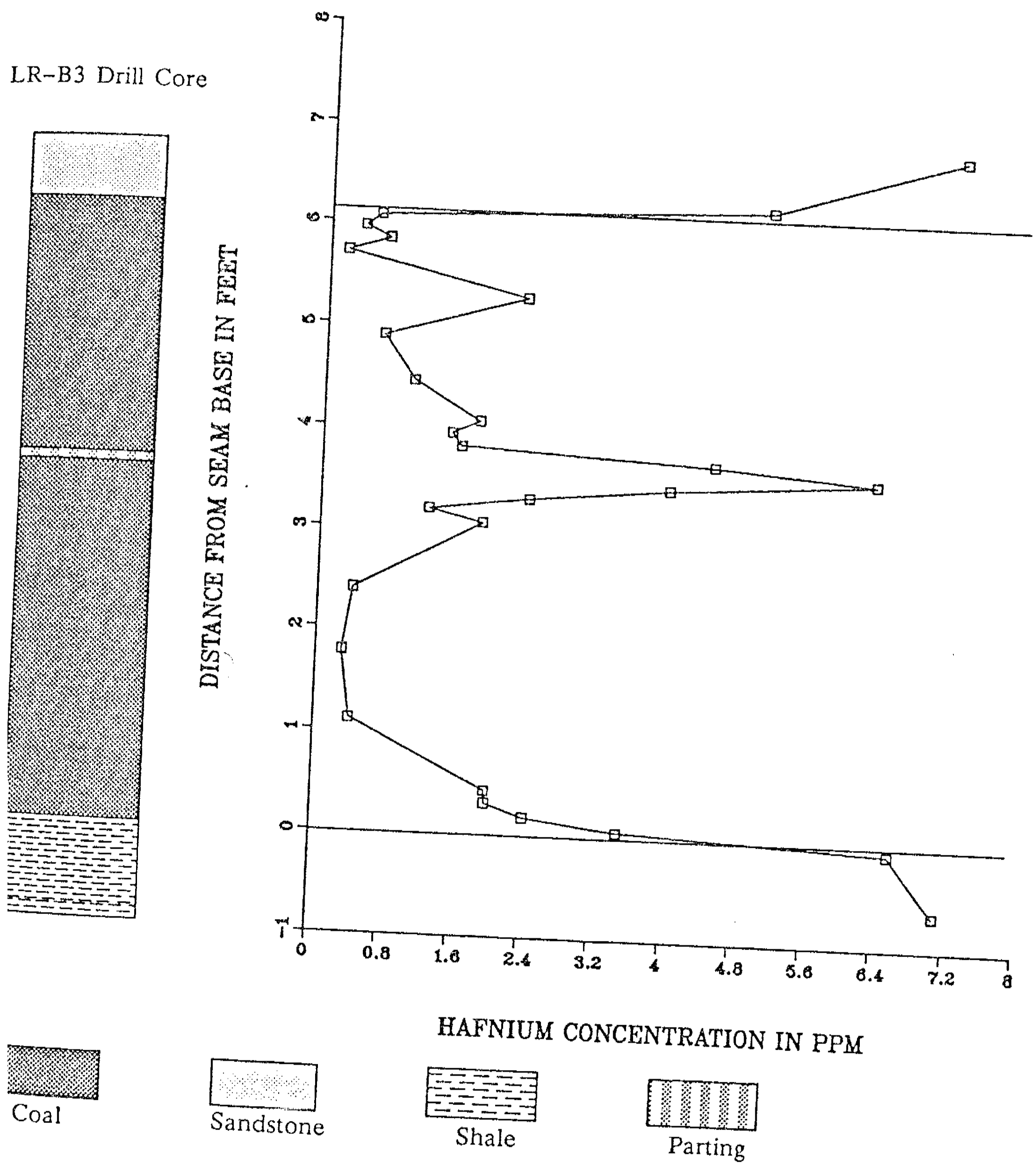


Figure D-151.

HAFNIUM DISTRIBUTION
IN THE YORK CANYON "A" AND "MAIN" SEAMS

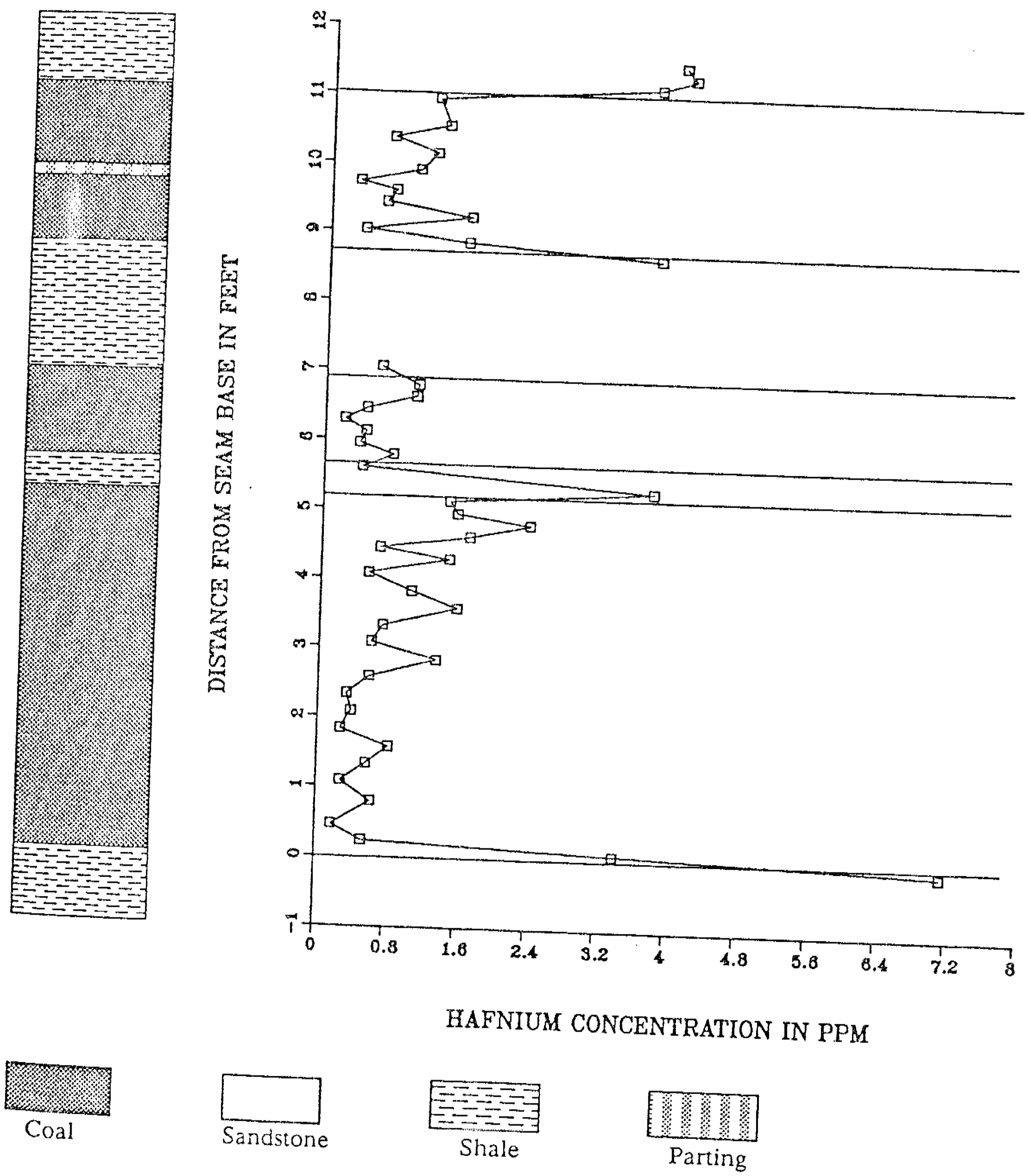


Figure D-152.

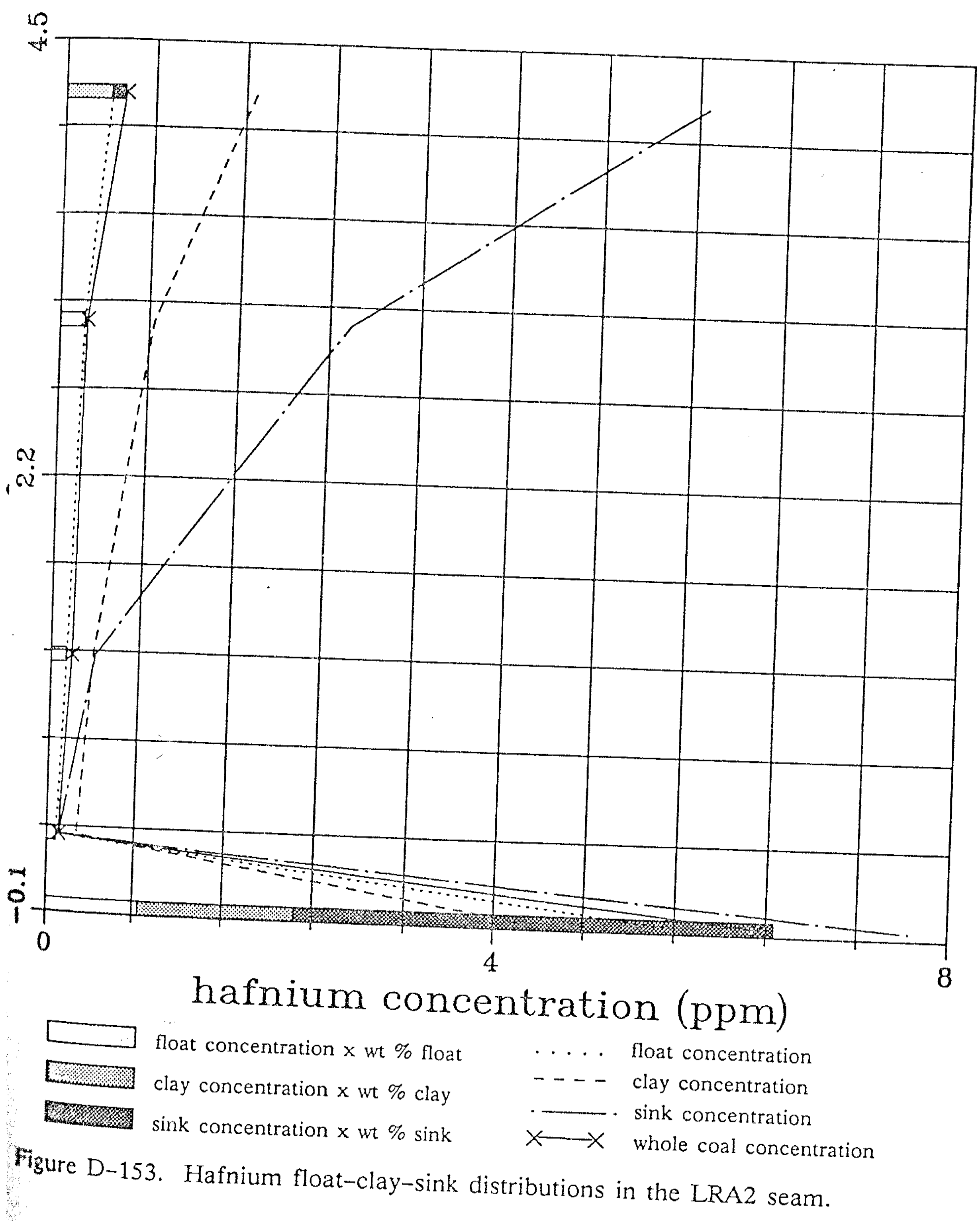


Figure D-153. Hafnium float–clay–sink distributions in the LRA2 seam.

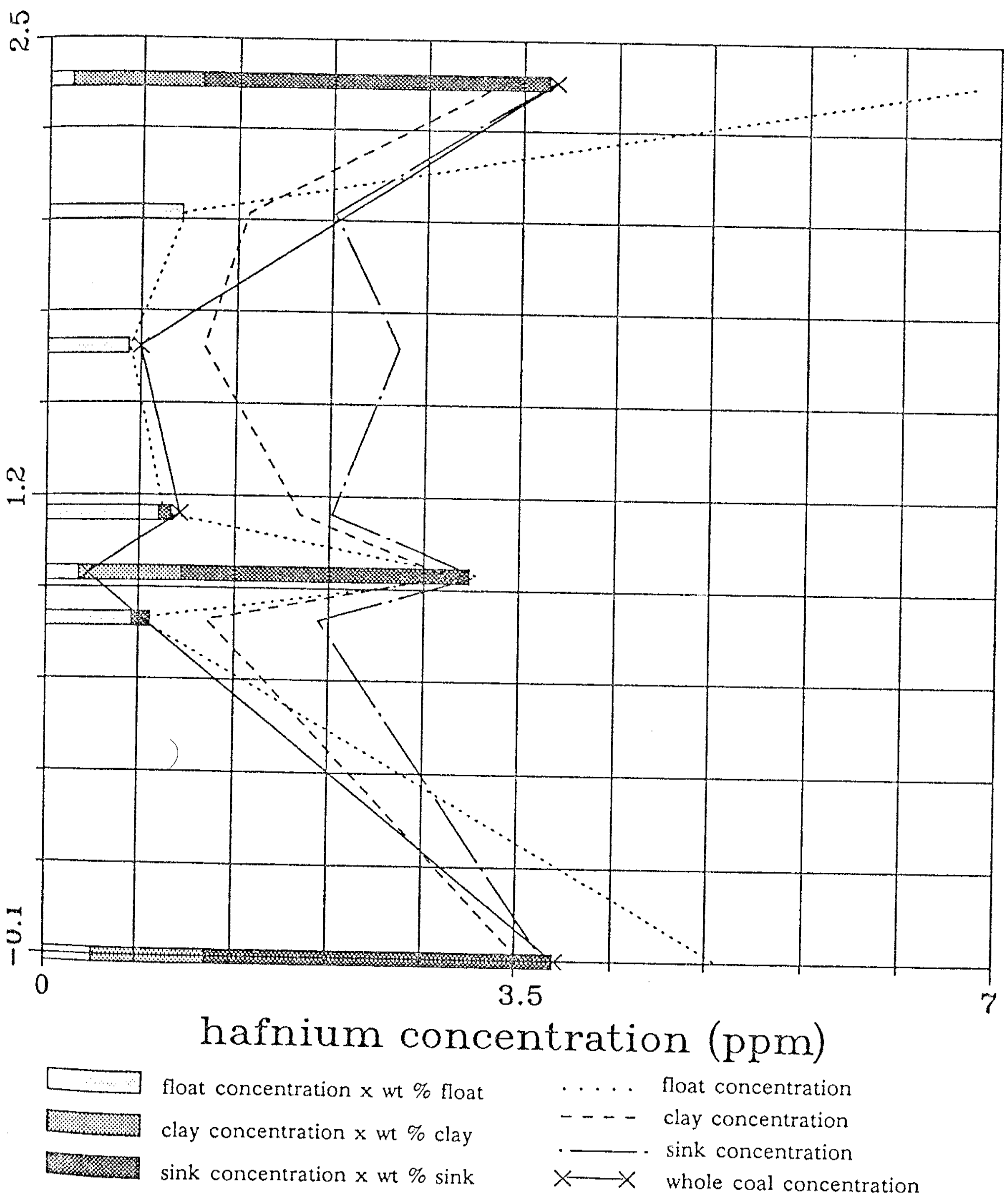


Figure D-154. Hafnium float-clay-sink distributions in the YA seam.

TANTALUM DISTRIBUTION
IN THE LEE RANCH P1 DRILL CORE

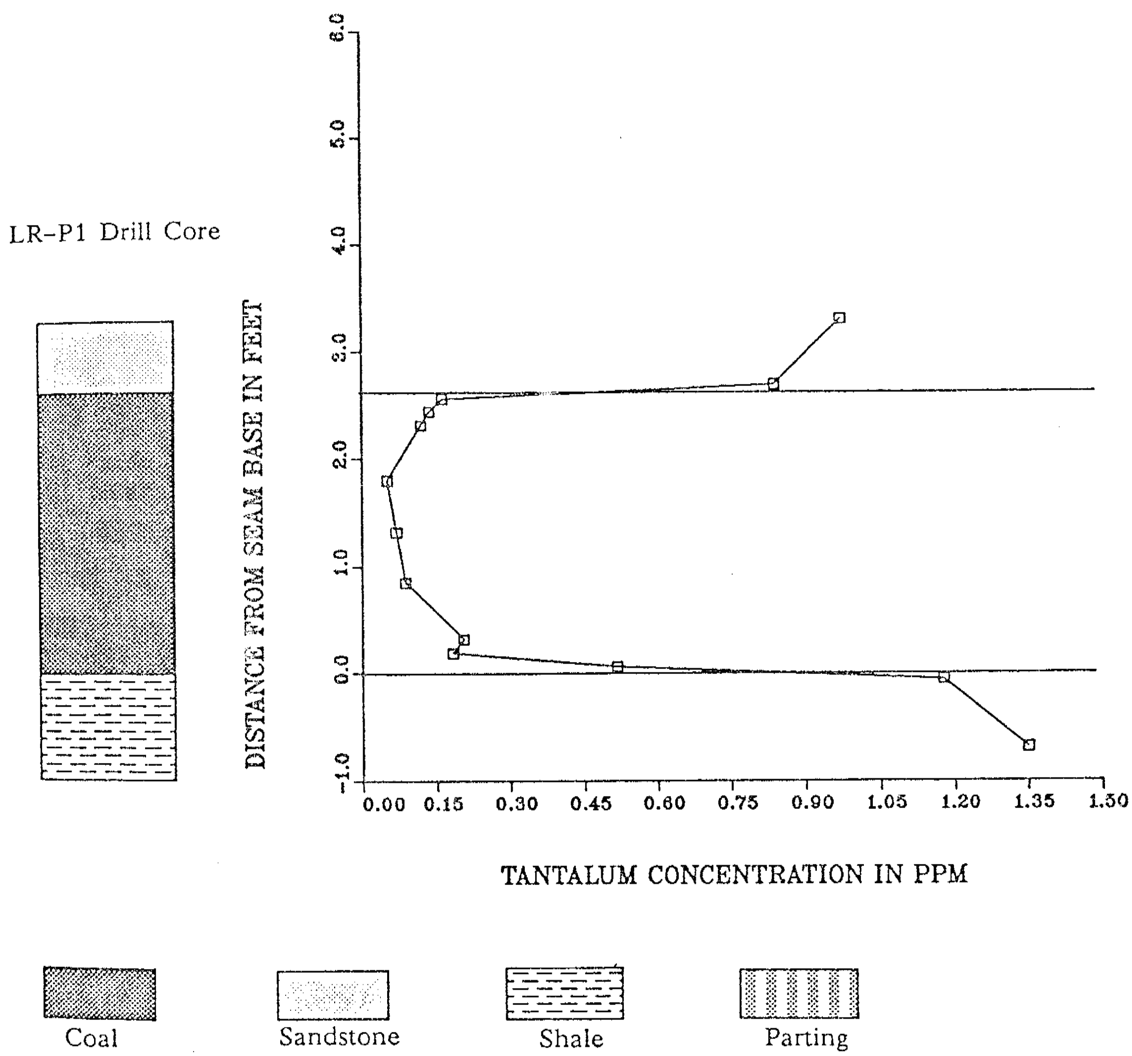


Figure D-155.

TANTALUM DISTRIBUTION
IN THE LEE RANCH P2 DRILL CORE

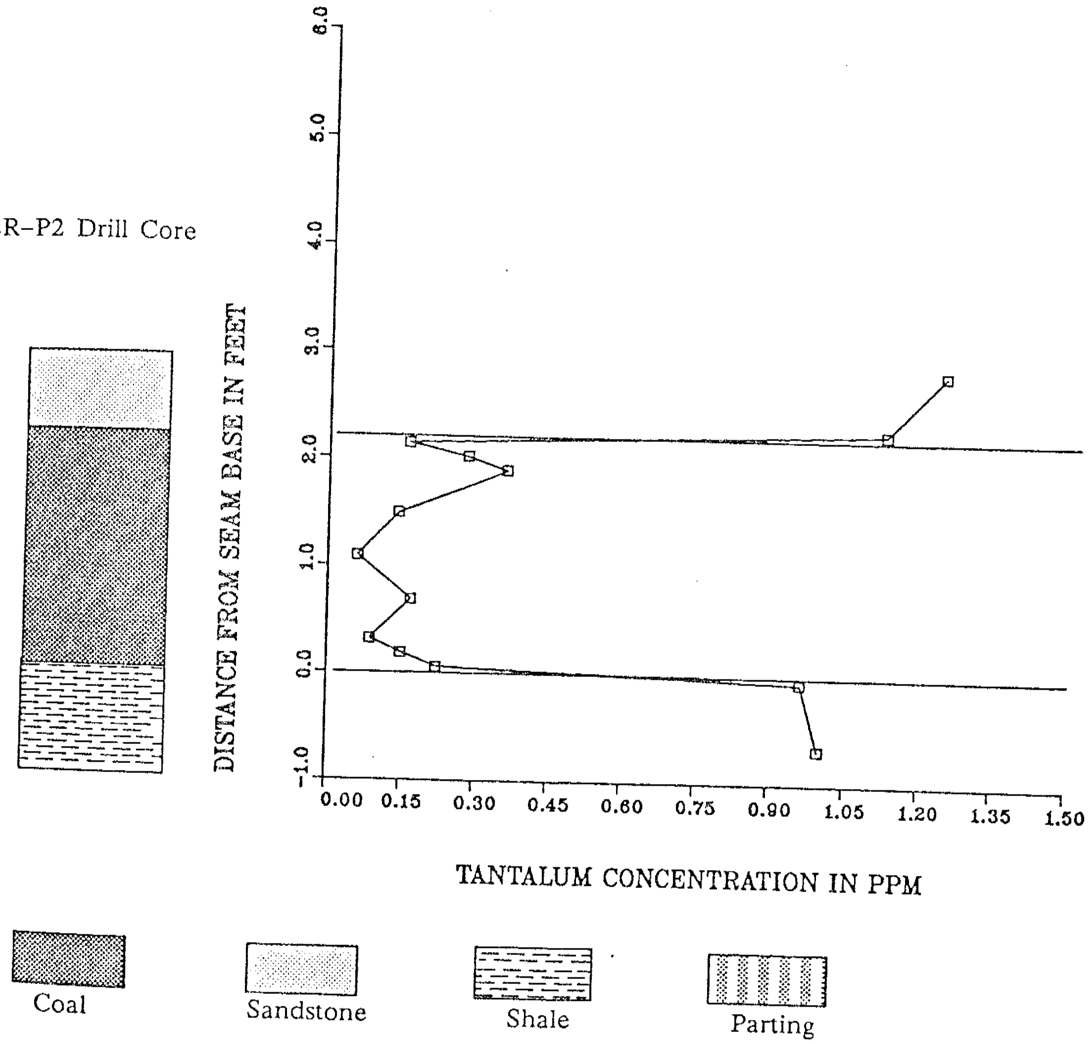


Figure D-156.

TANTALUM DISTRIBUTION IN THE LEE RANCH A2 DRILL CORE

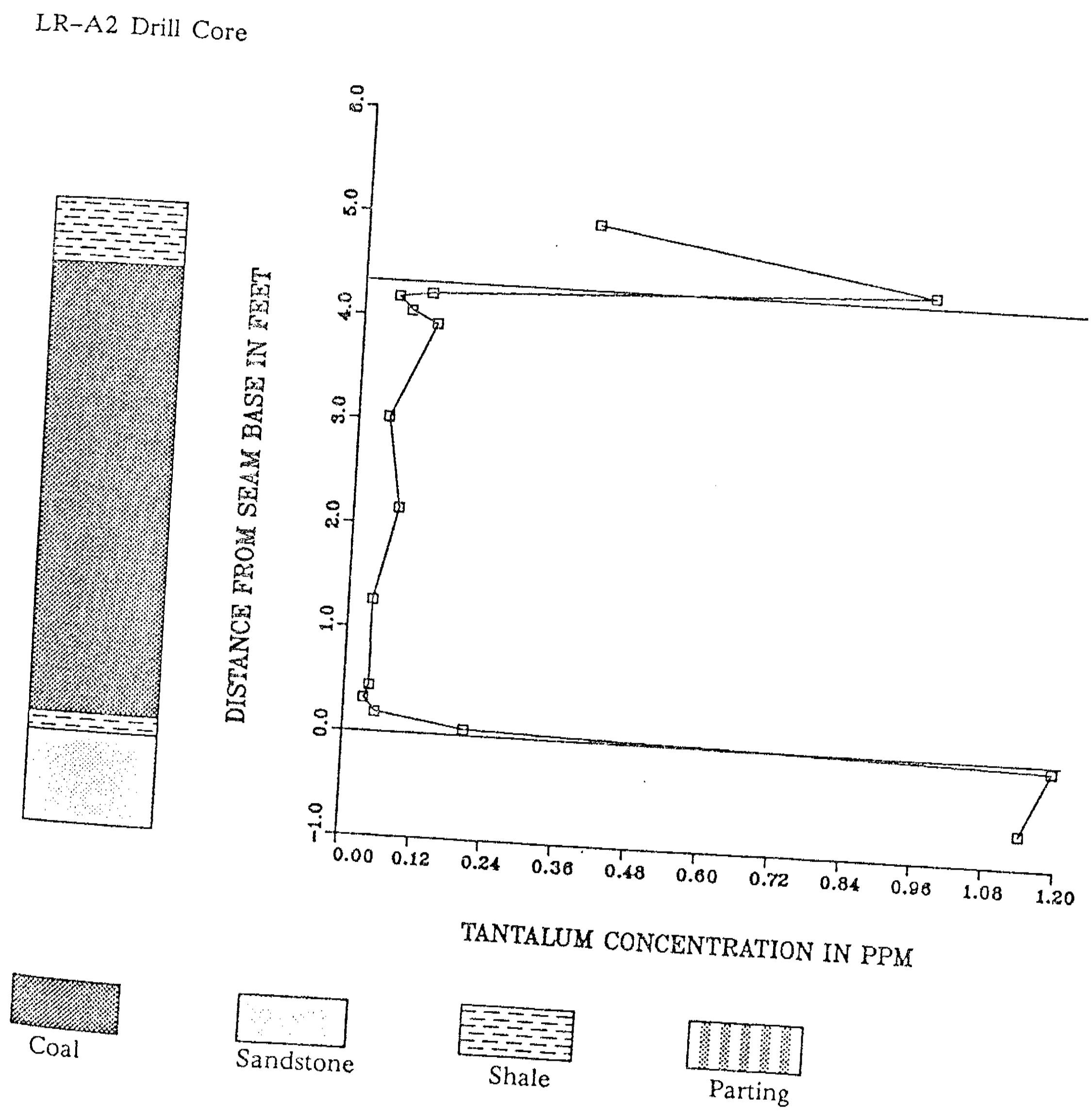


Figure D-157.

TANTALUM DISTRIBUTION IN THE LEE RANCH A3 DRILL CORE

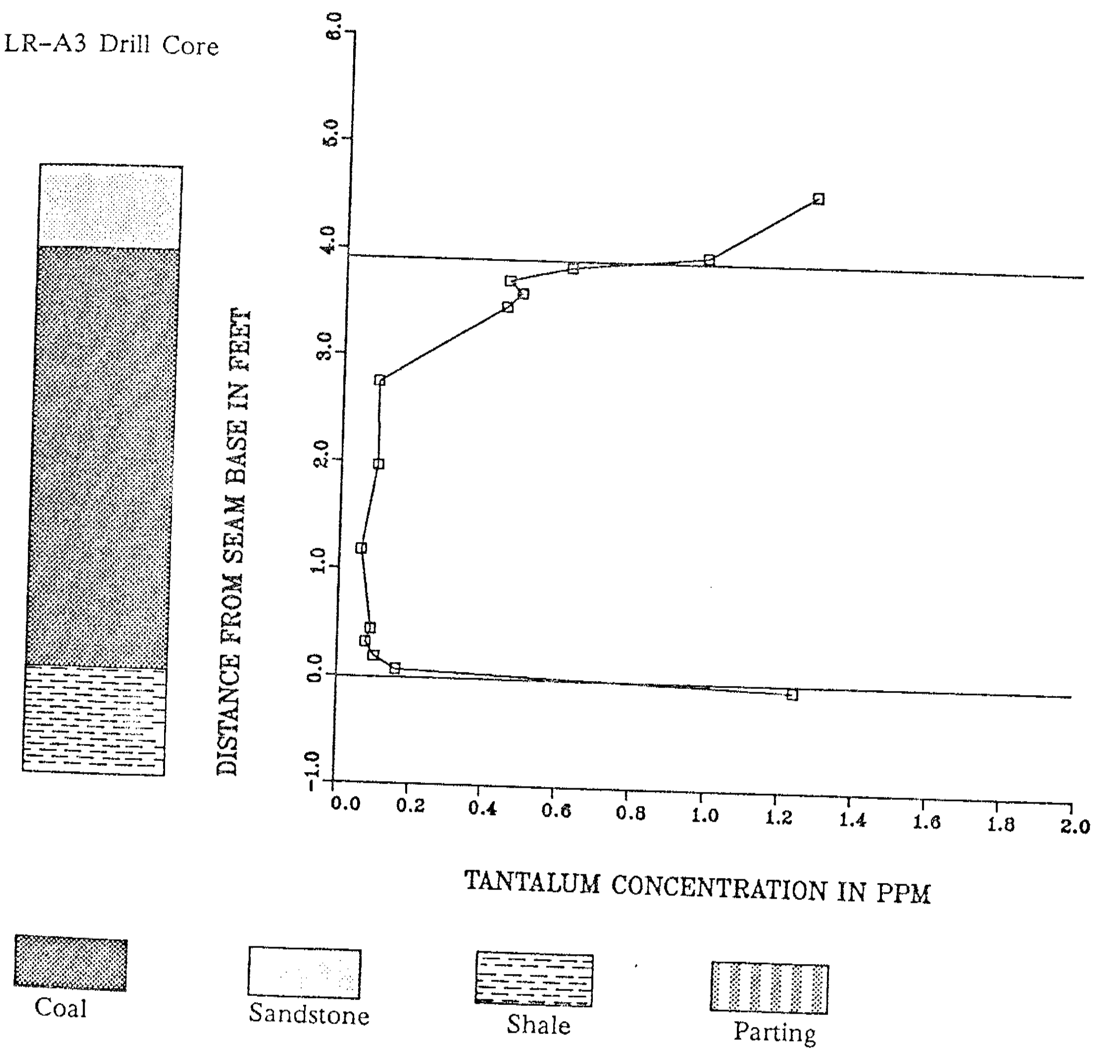


Figure D-158.

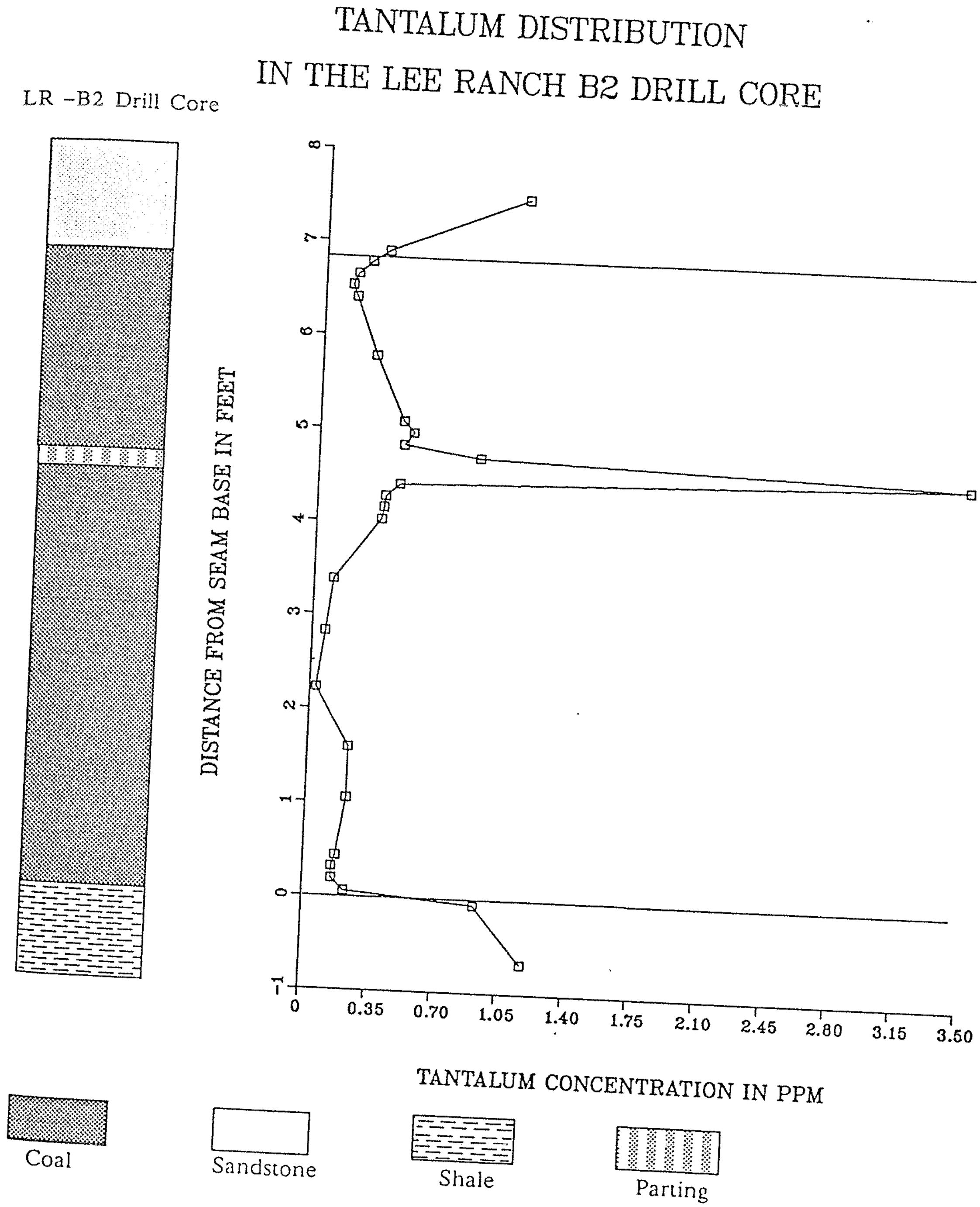

TANTALUM DISTRIBUTION
IN THE LEE RANCH B2 DRILL CORE
LR -B2 Drill Core
DISTANCE FROM SEAM BASE IN FEET
-1
0
1
2
3
4
5
6
7
8
0
0.35
0.70
1.05
1.40
1.75
2.10
2.45
2.80
3.15
3.50
TANTALUM CONCENTRATION IN PPM
Coal
Sandstone
Shale
Parting

Figure D-159.

TANTALUM DISTRIBUTION
IN THE LEE RANCH B3 DRILL CORE

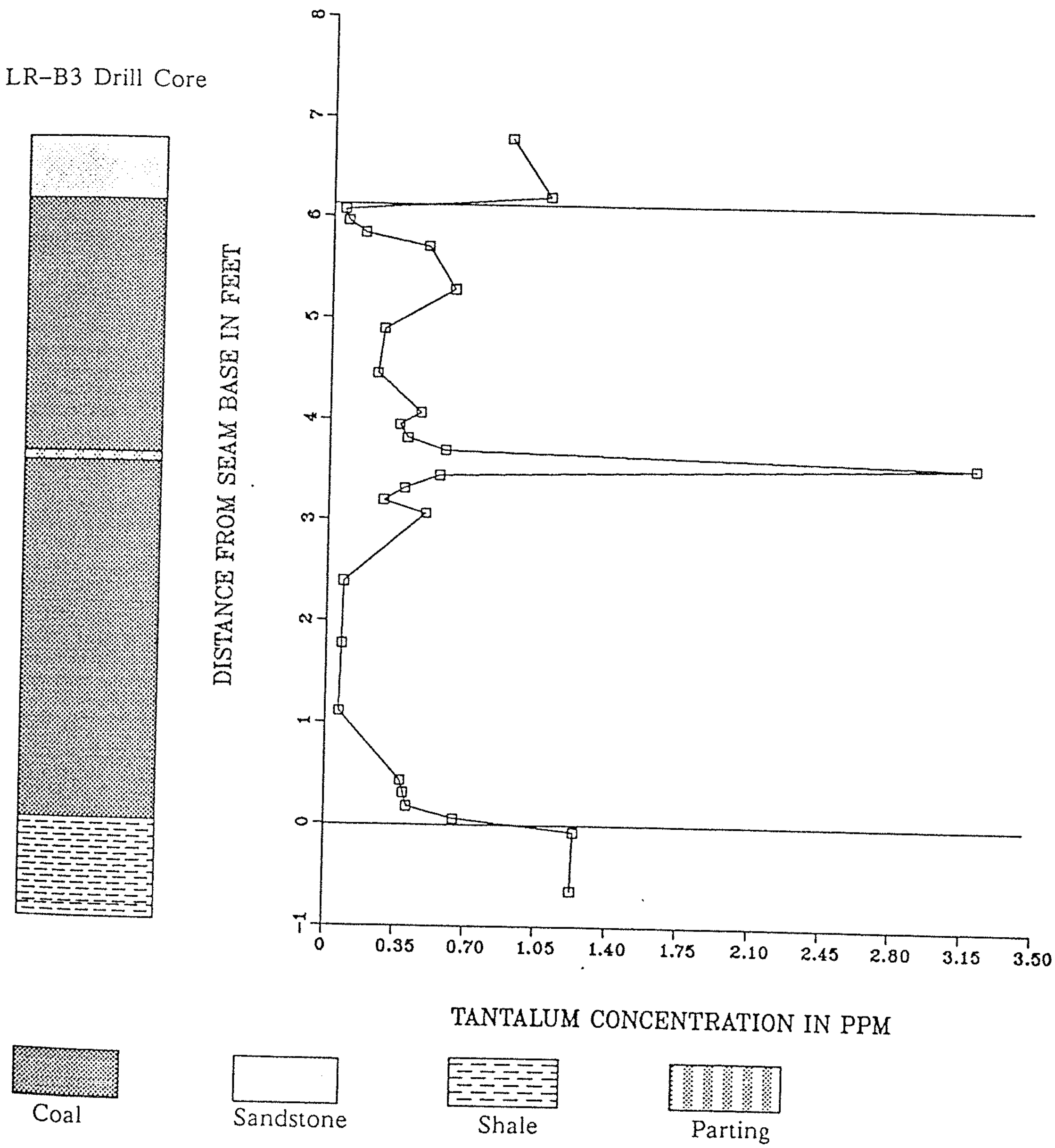


Figure D-160.

TANTALUM DISTRIBUTION
IN THE YORK CANYON "A" AND "MAIN" SEAMS

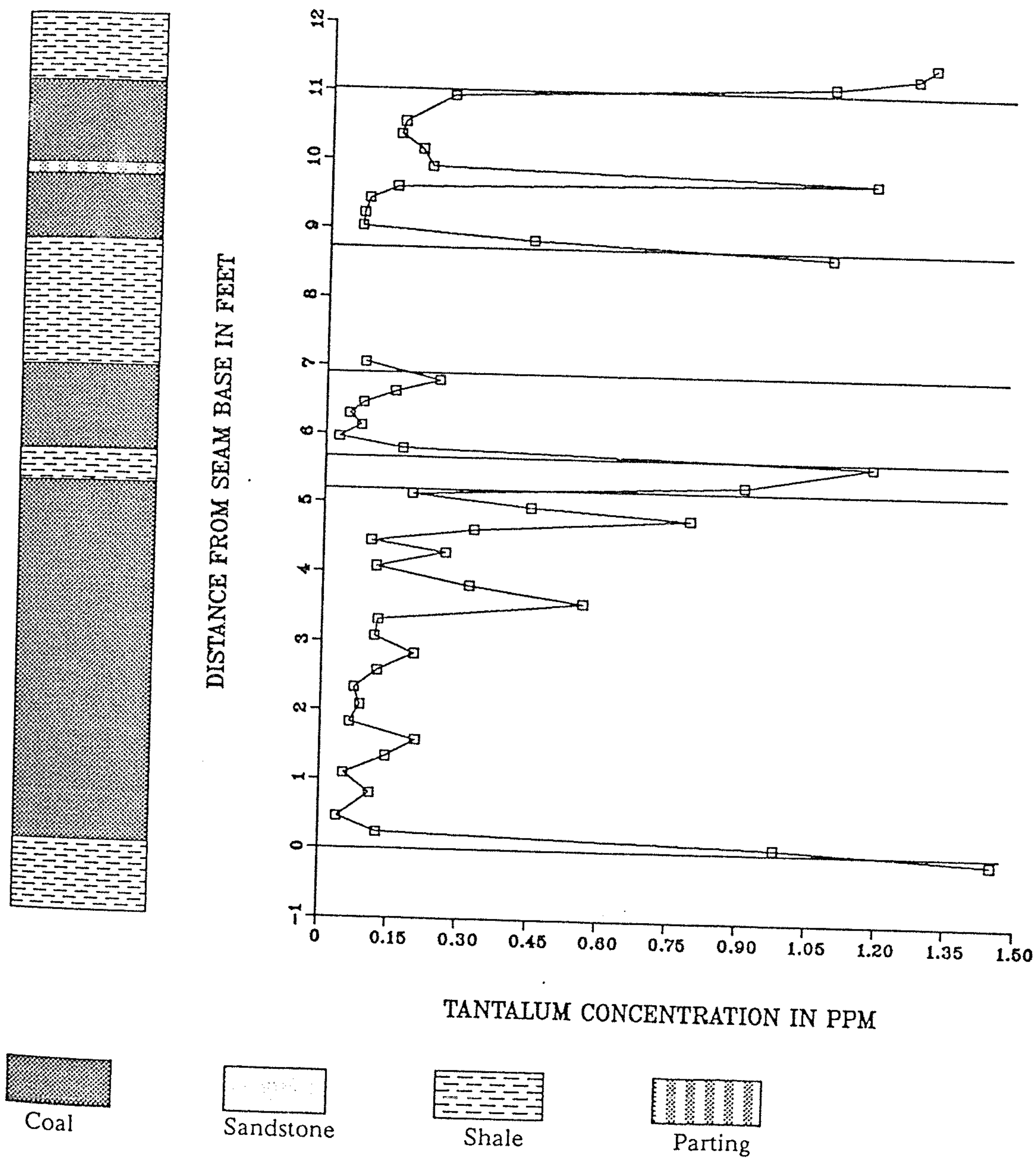


Figure D-161.

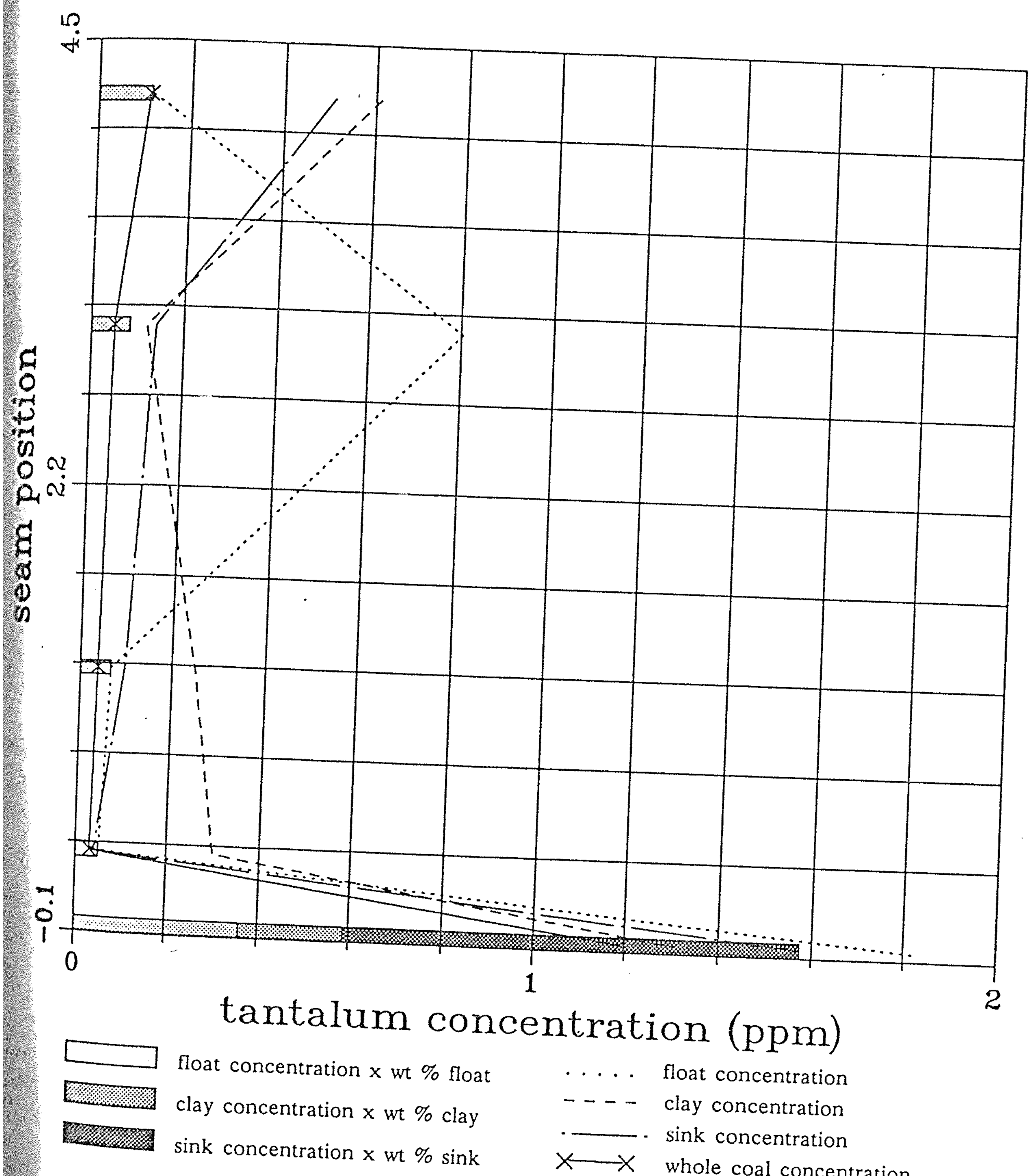


Figure D-162 Tantalum float-clay-sink distribution in the LRA2 seam.

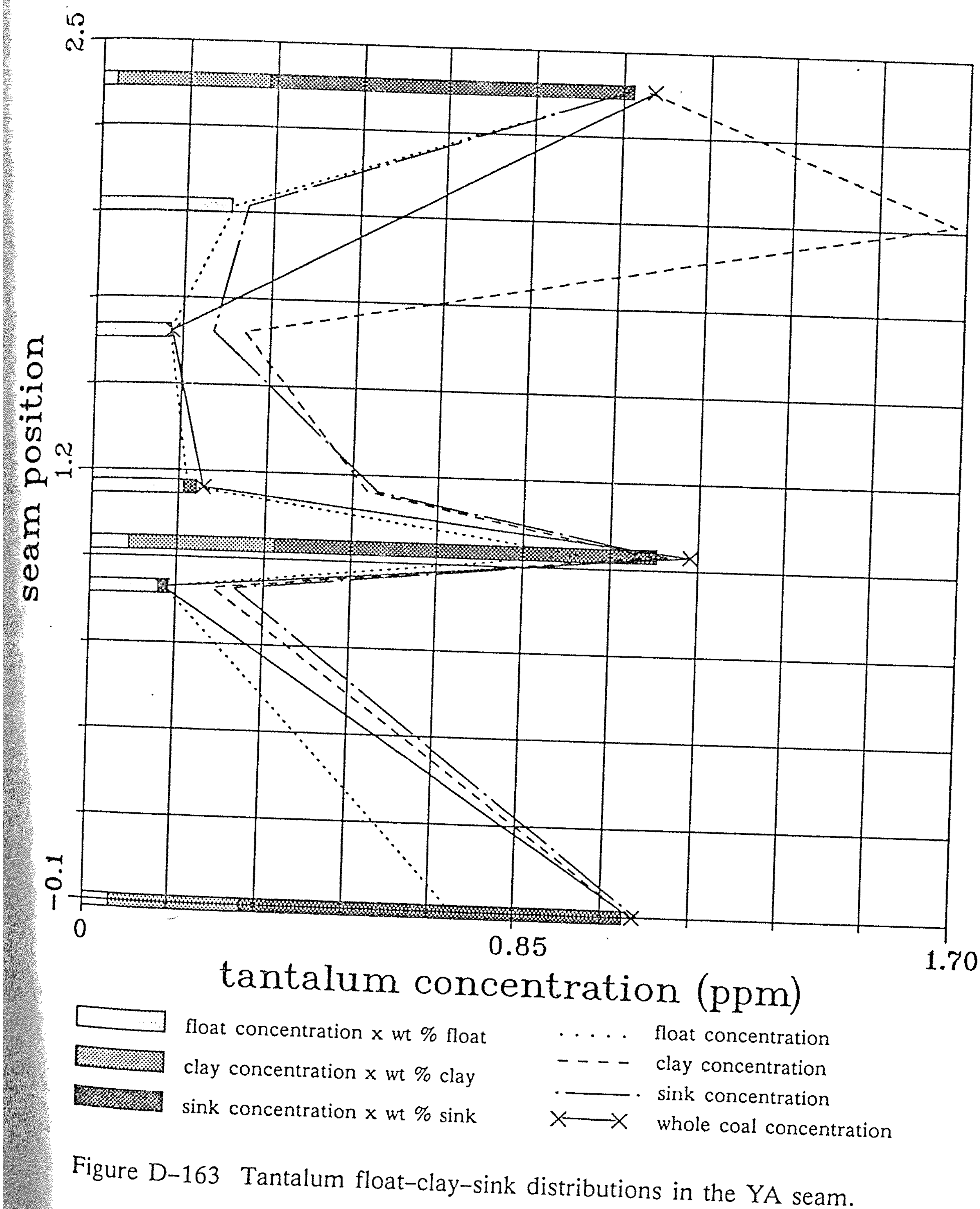


Figure D-163 Tantalum float-clay-sink distributions in the YA seam.

THORIUM DISTRIBUTION
IN THE LEE RANCH P1 DRILL CORE

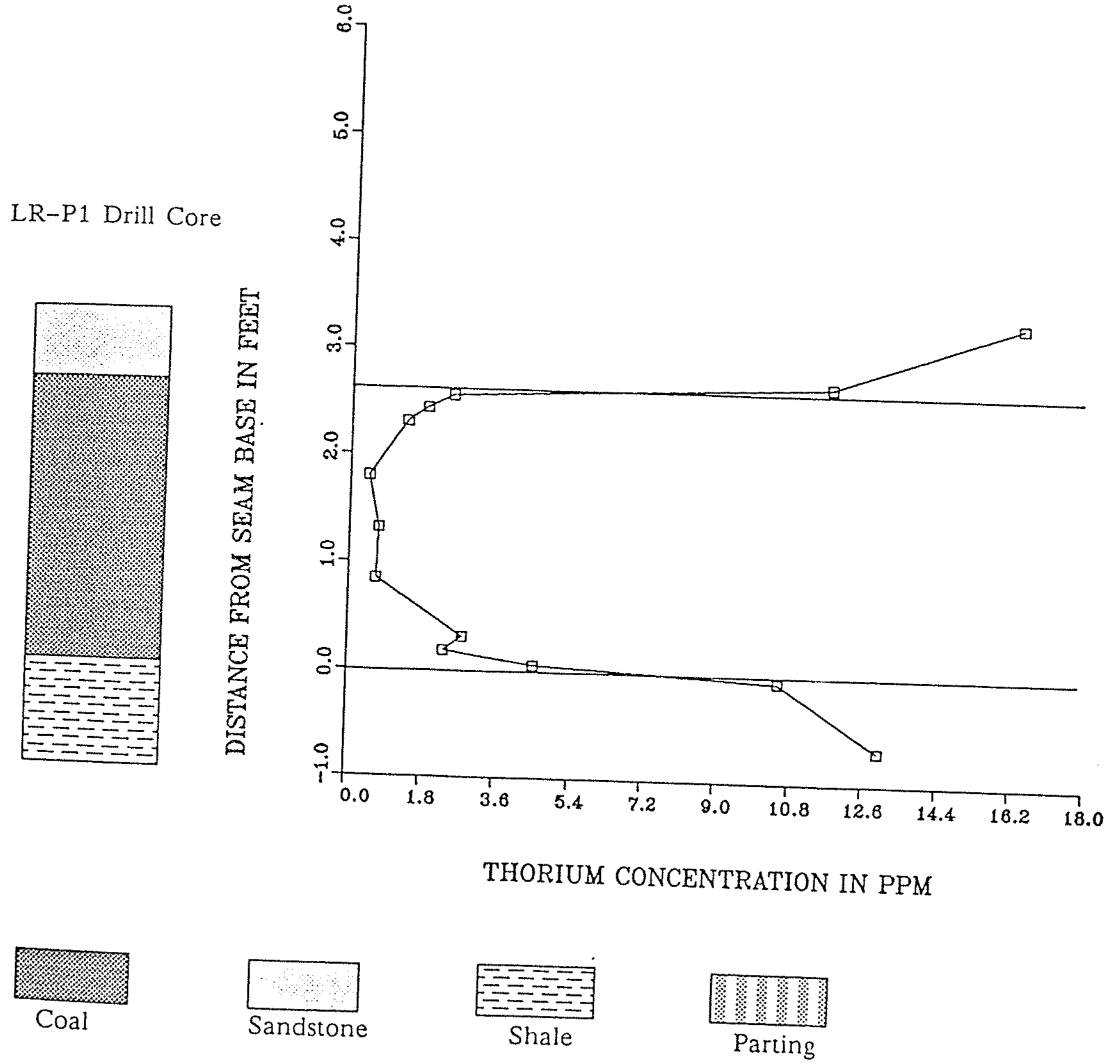


Figure D–164.

THORIUM DISTRIBUTION IN THE LEE RANCH P2 DRILL CORE

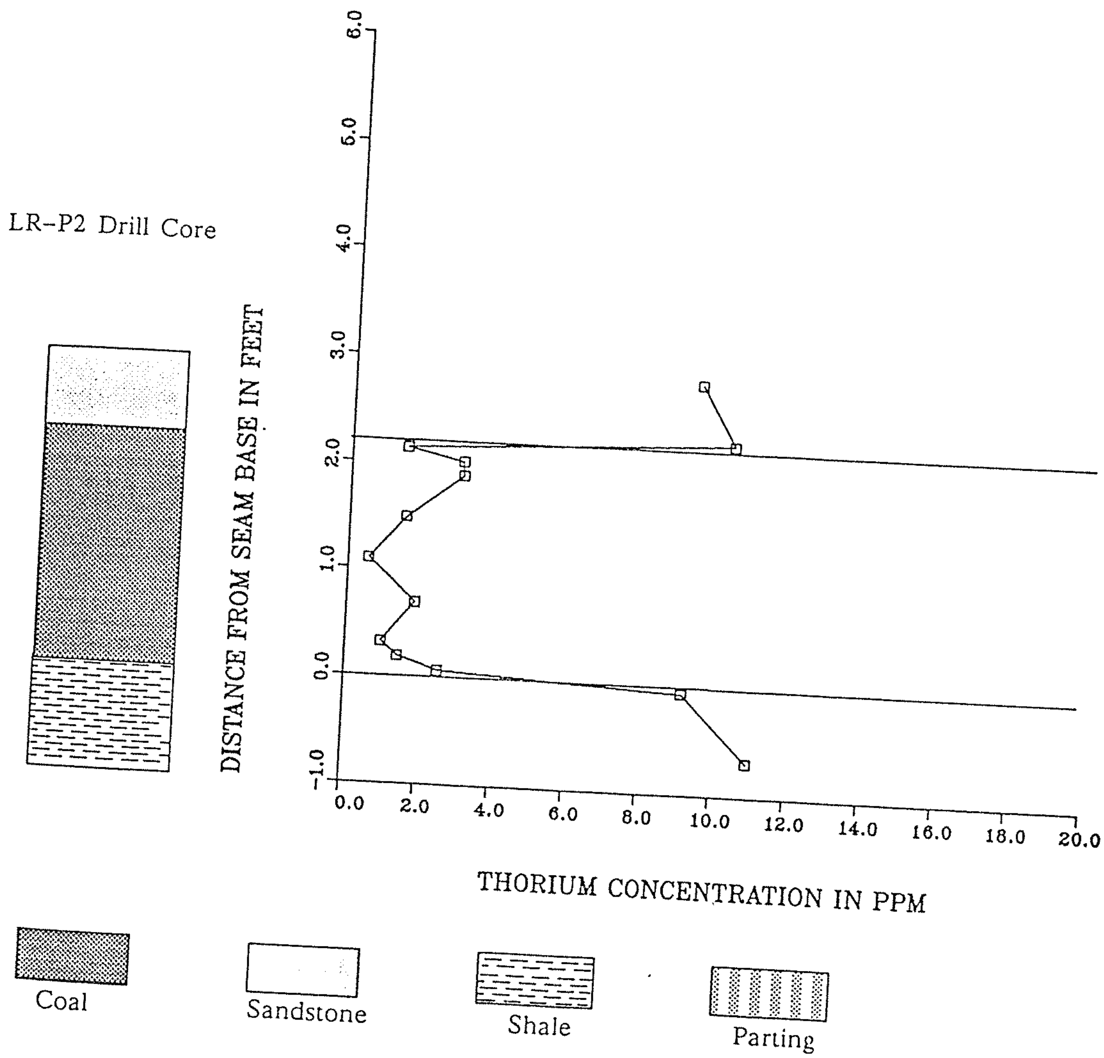


Figure D-165.

THORIUM DISTRIBUTION
IN THE LEE RANCH A2 DRILL CORE

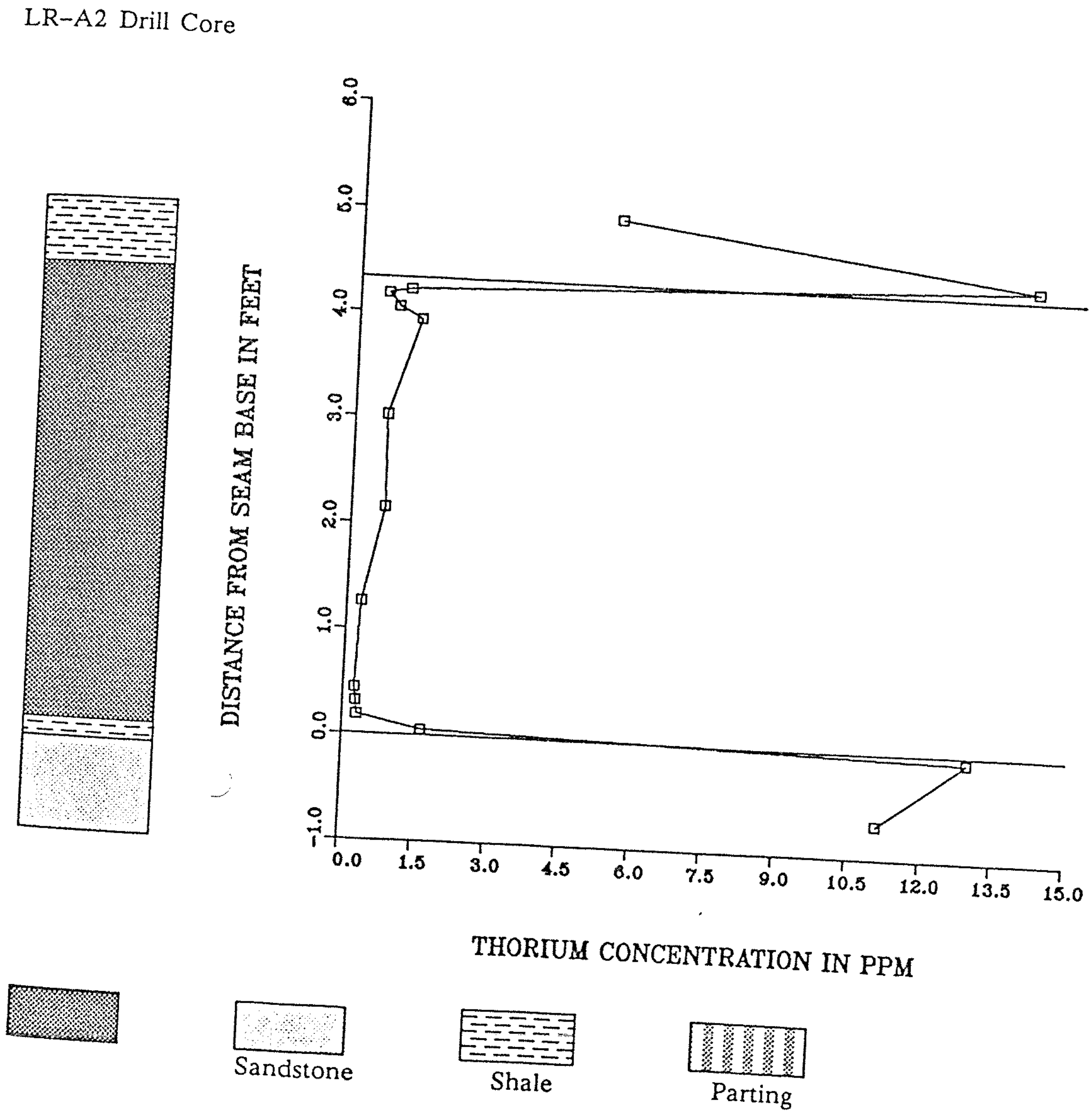


Figure D-166.

THORIUM DISTRIBUTION
IN THE LEE RANCH A3 DRILL CORE

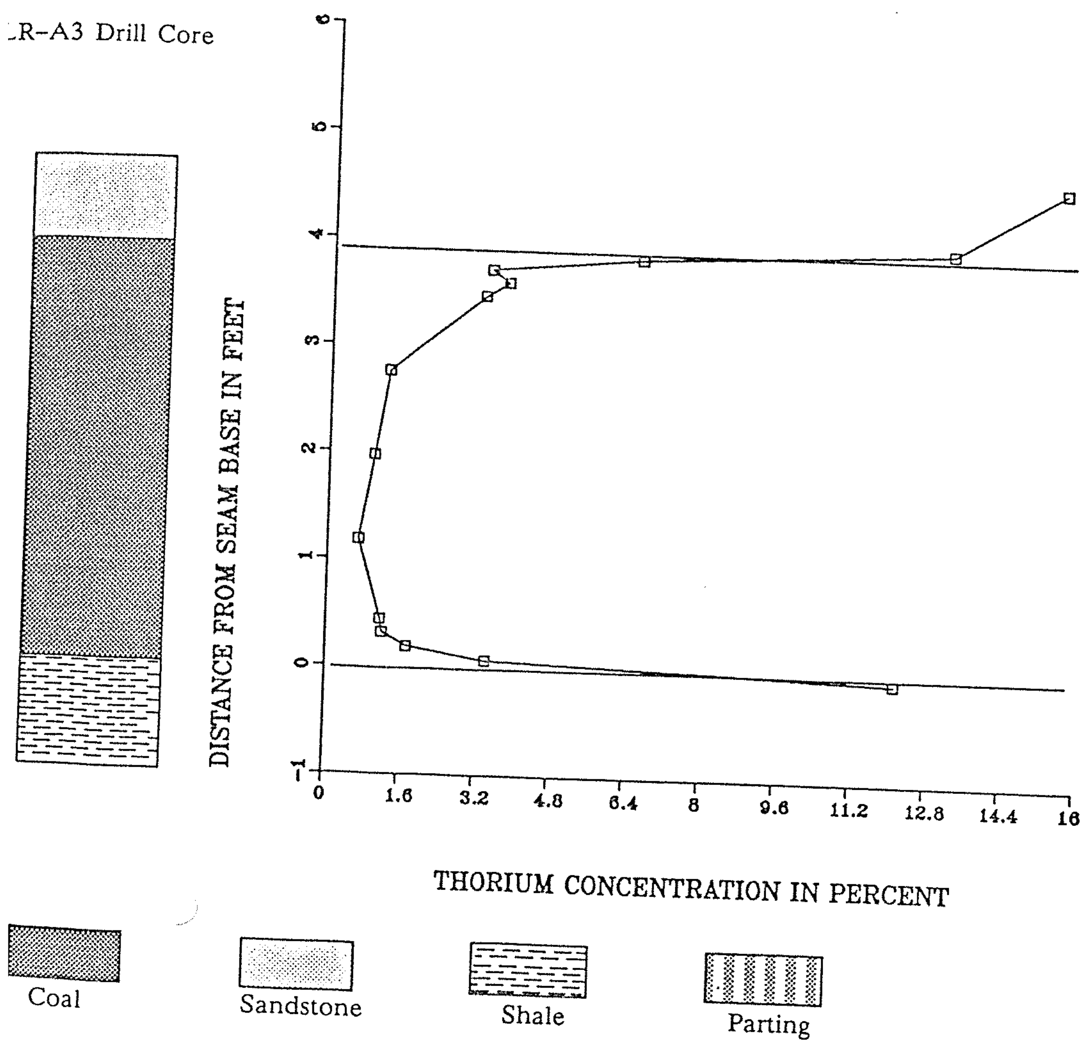


Figure D-167.

THORIUM DISTRIBUTION IN THE LEE RANCH B2 DRILL CORE

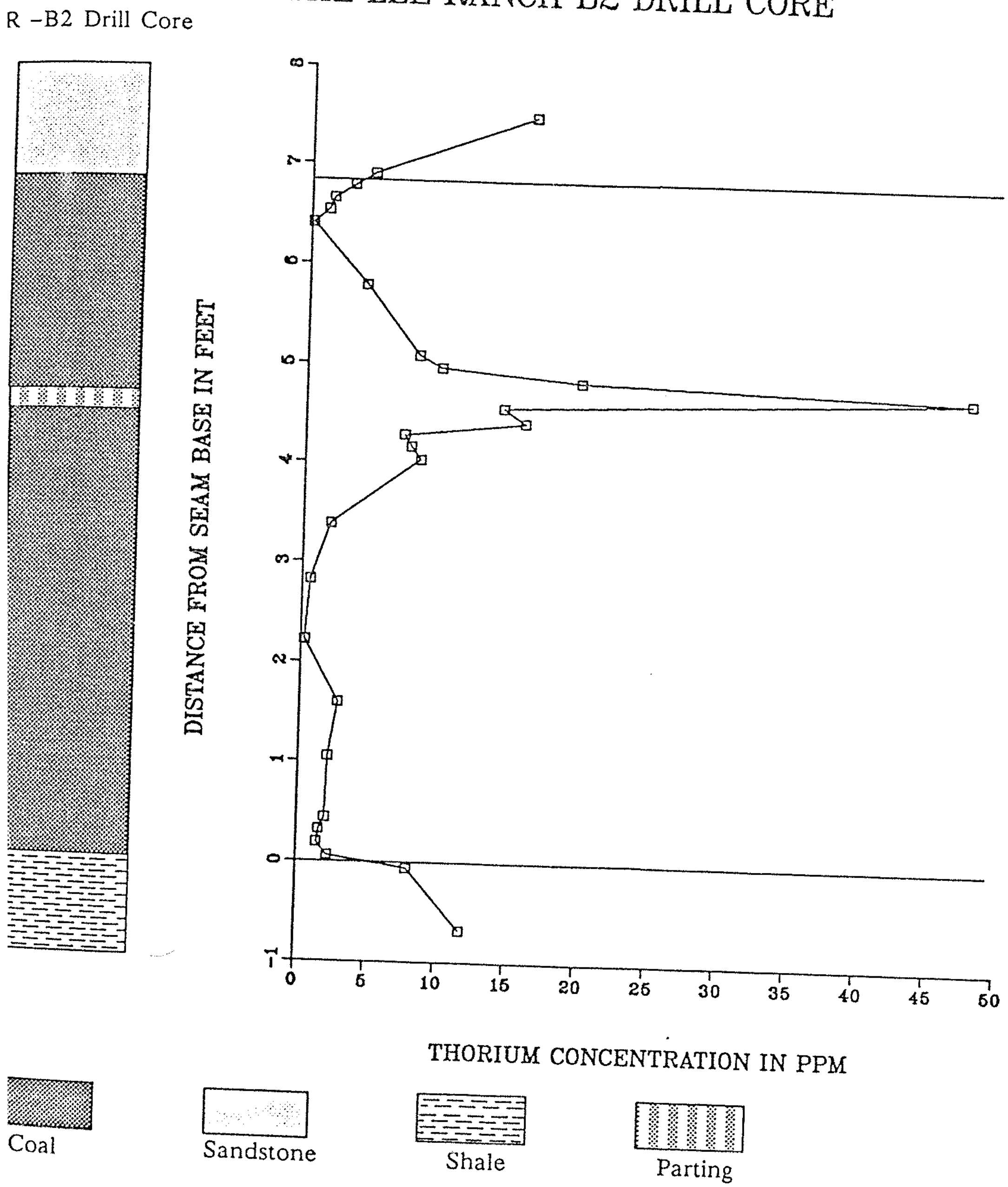


Figure D-168.

THORIUM DISTRIBUTION
IN THE LEE RANCH B3 DRILL CORE

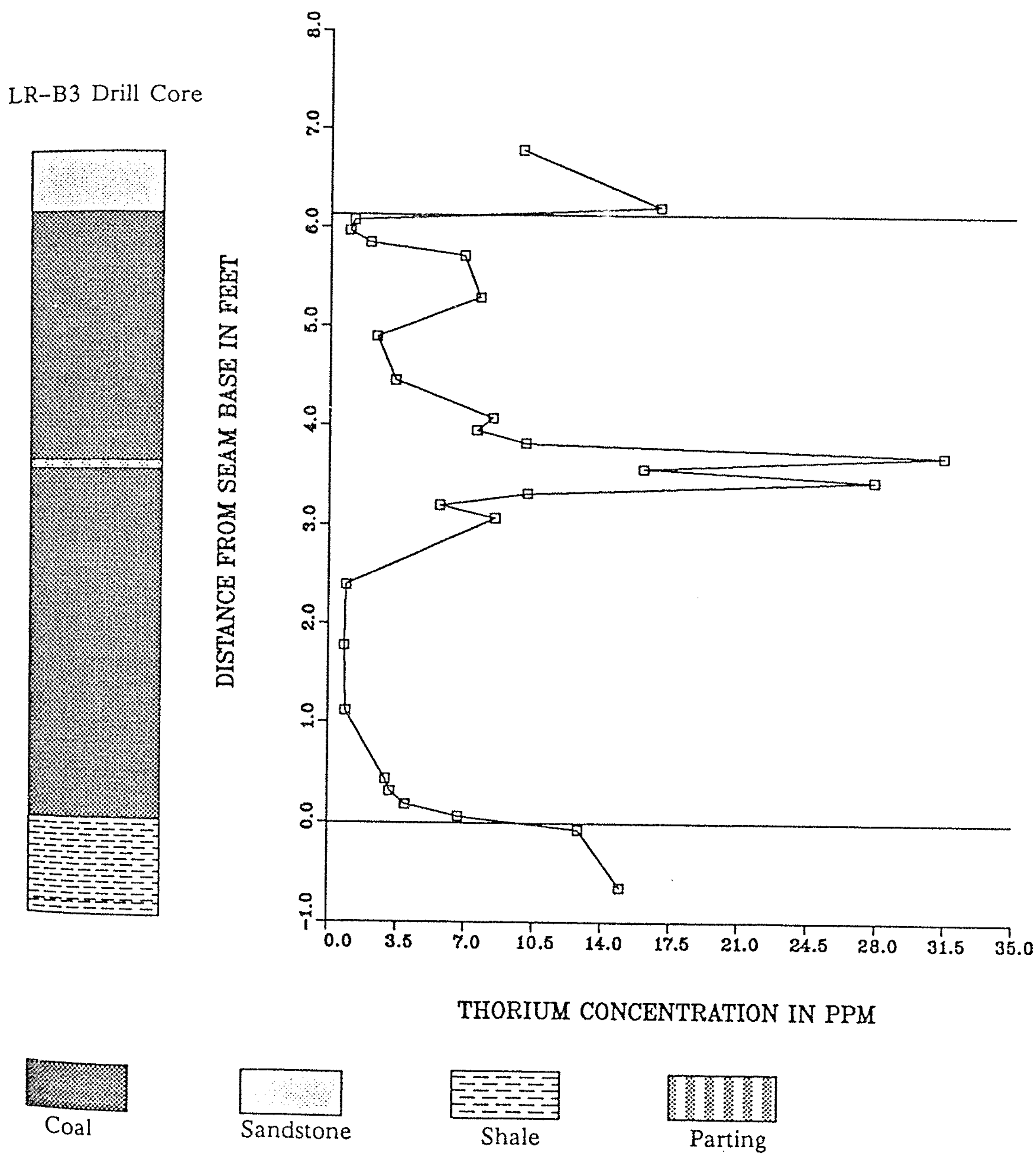


Figure D-169.

THORIUM DISTRIBUTION
IN THE YORK CANYON "A" AND "MAIN" SEAMS

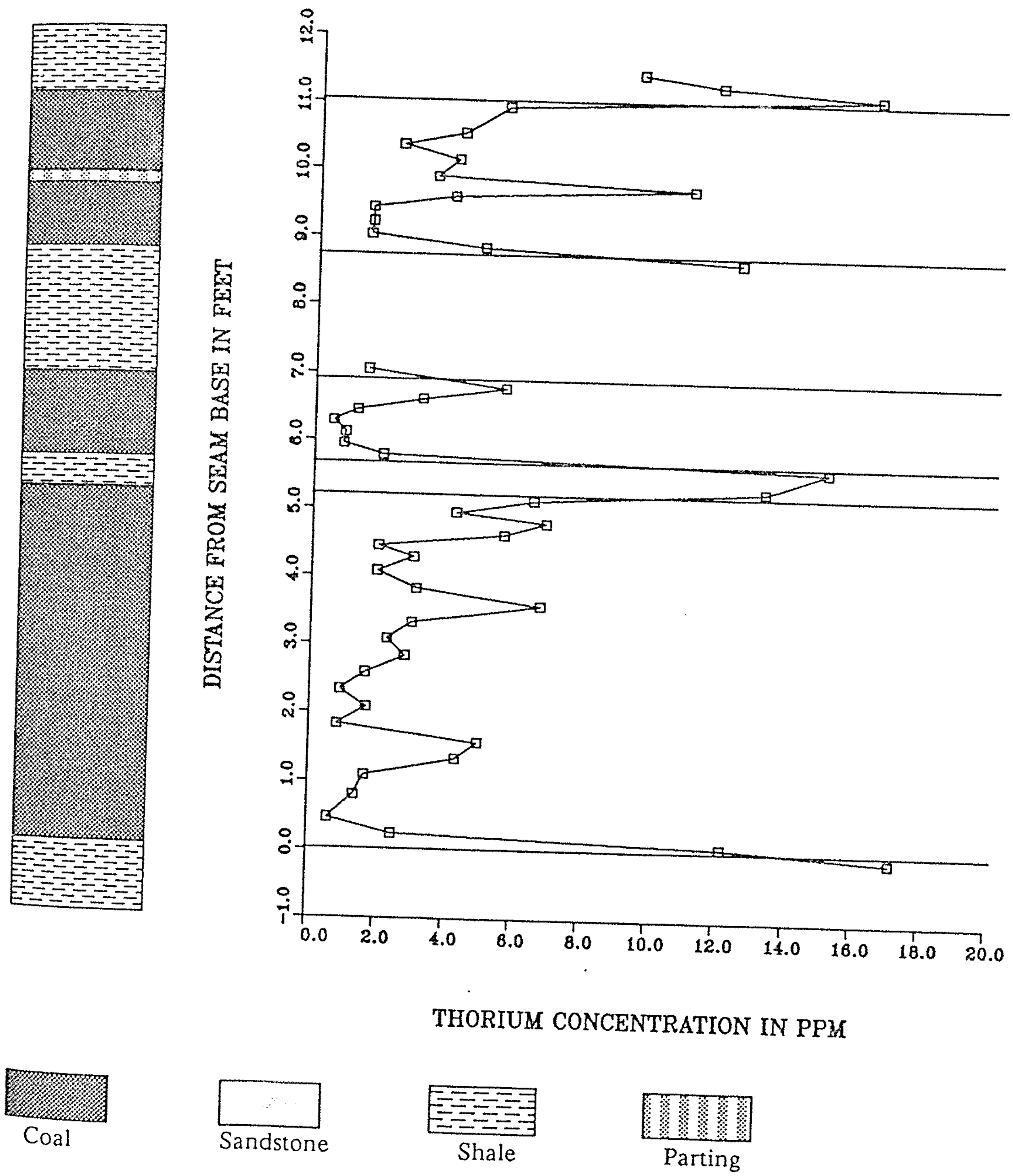


Figure D-170.

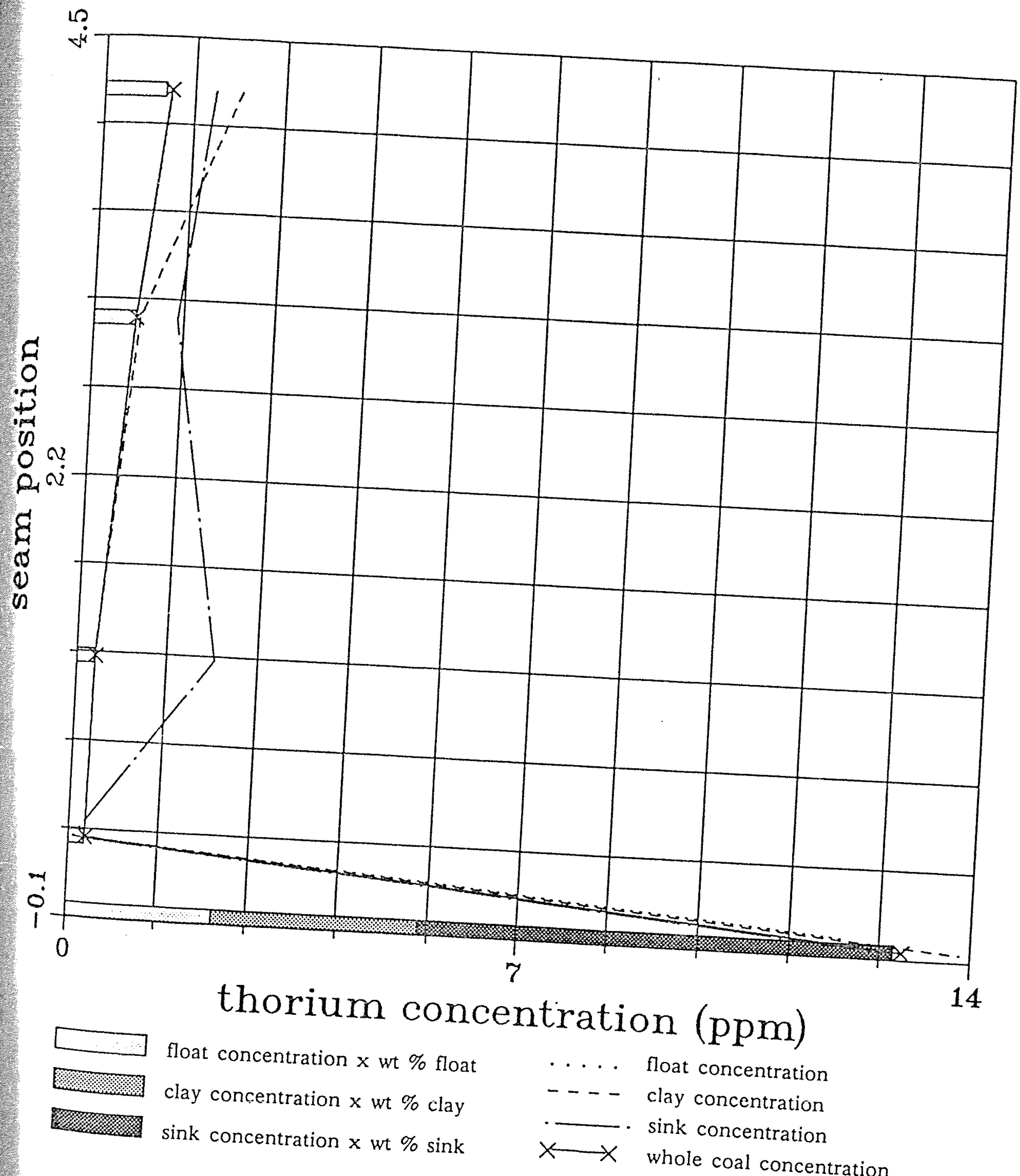


Figure D-171 Thorium float-clay-sink distributions in the LRA2 seam.

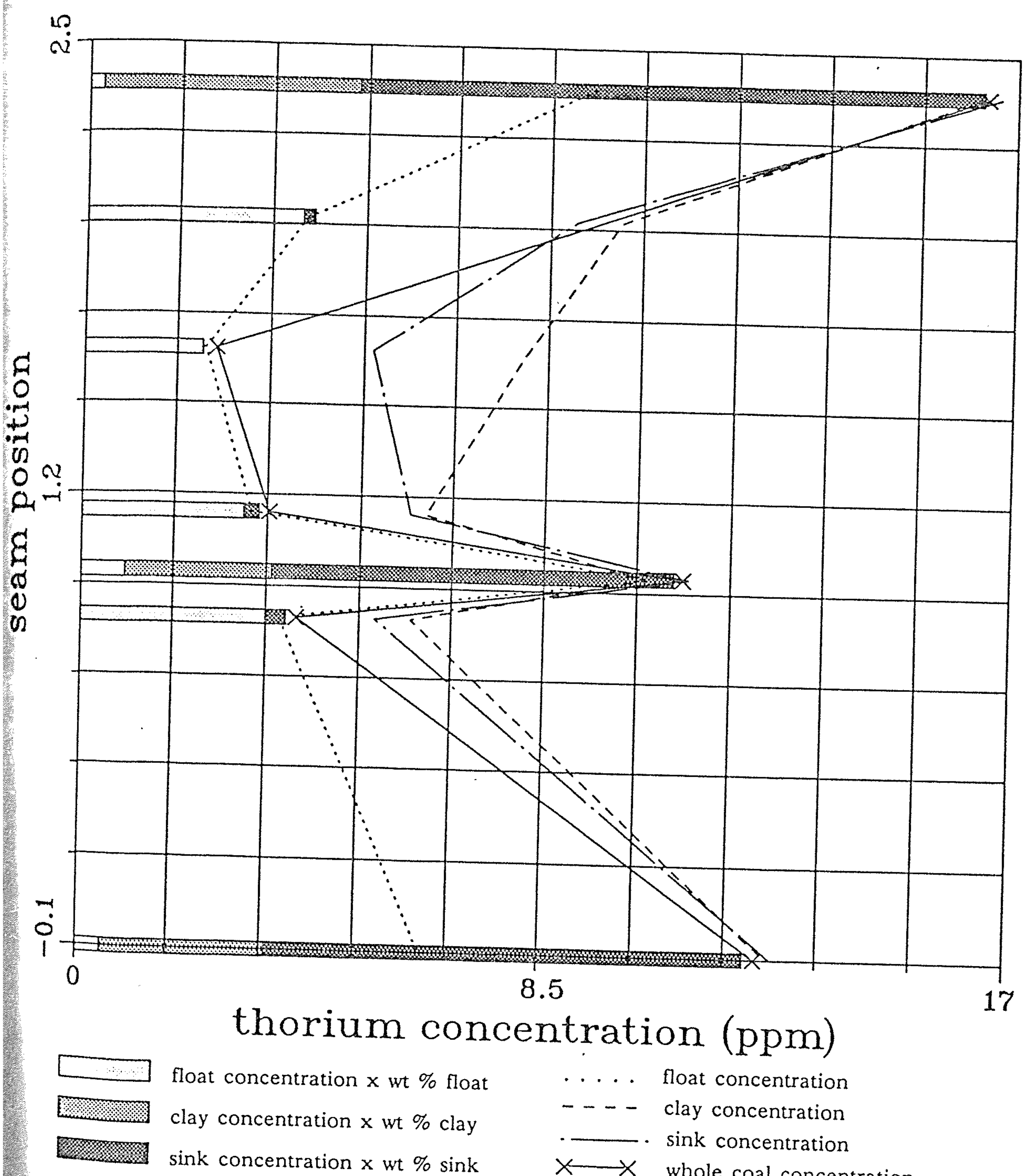


Figure D-172 Thorium float-clay-sink distributions in the YA seam.

URANIUM DISTRIBUTION
IN THE LEE RANCH P1 DRILL CORE

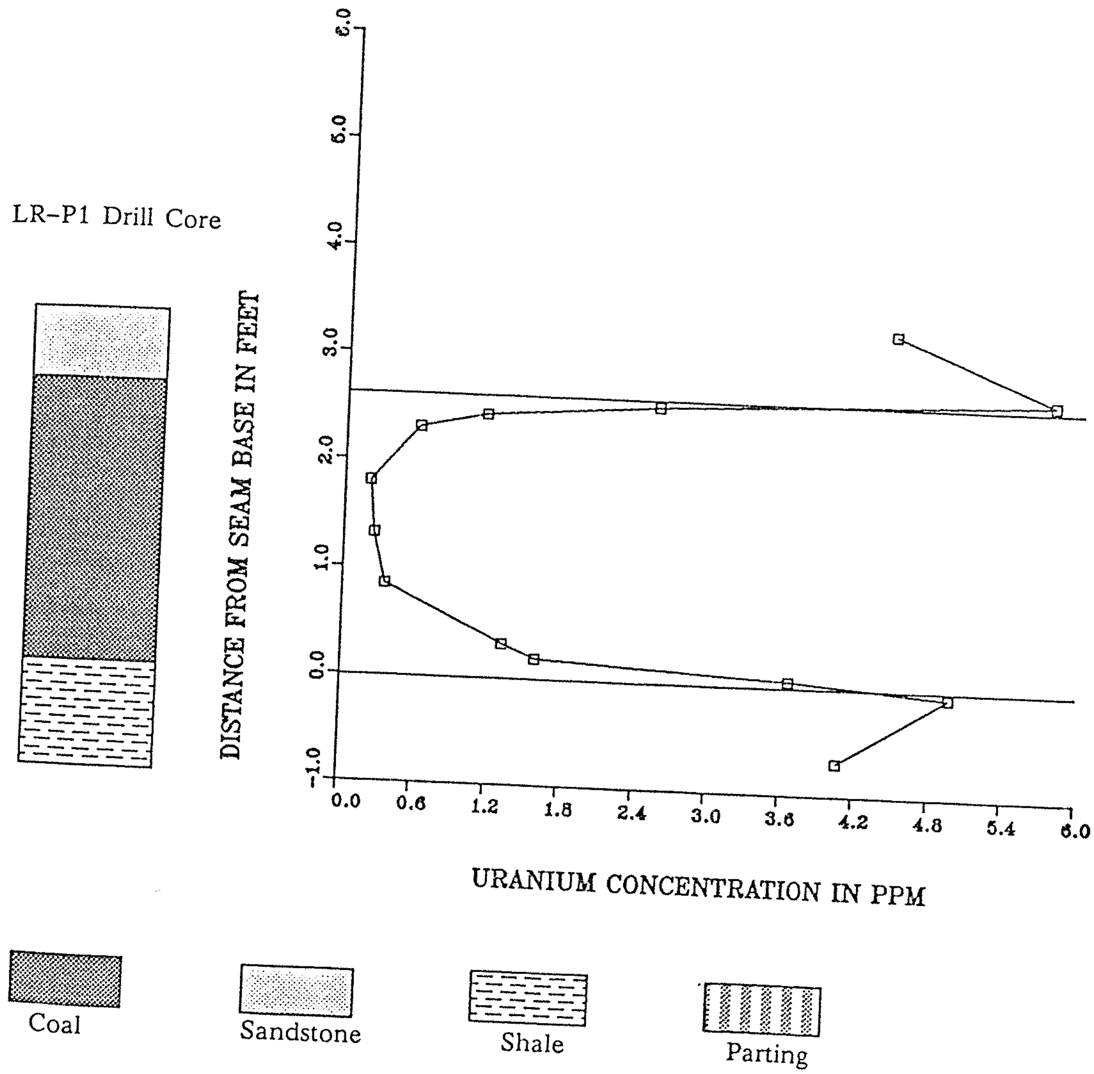


Figure D-173.

URANIUM DISTRIBUTION IN THE LEE RANCH P2 DRILL CORE

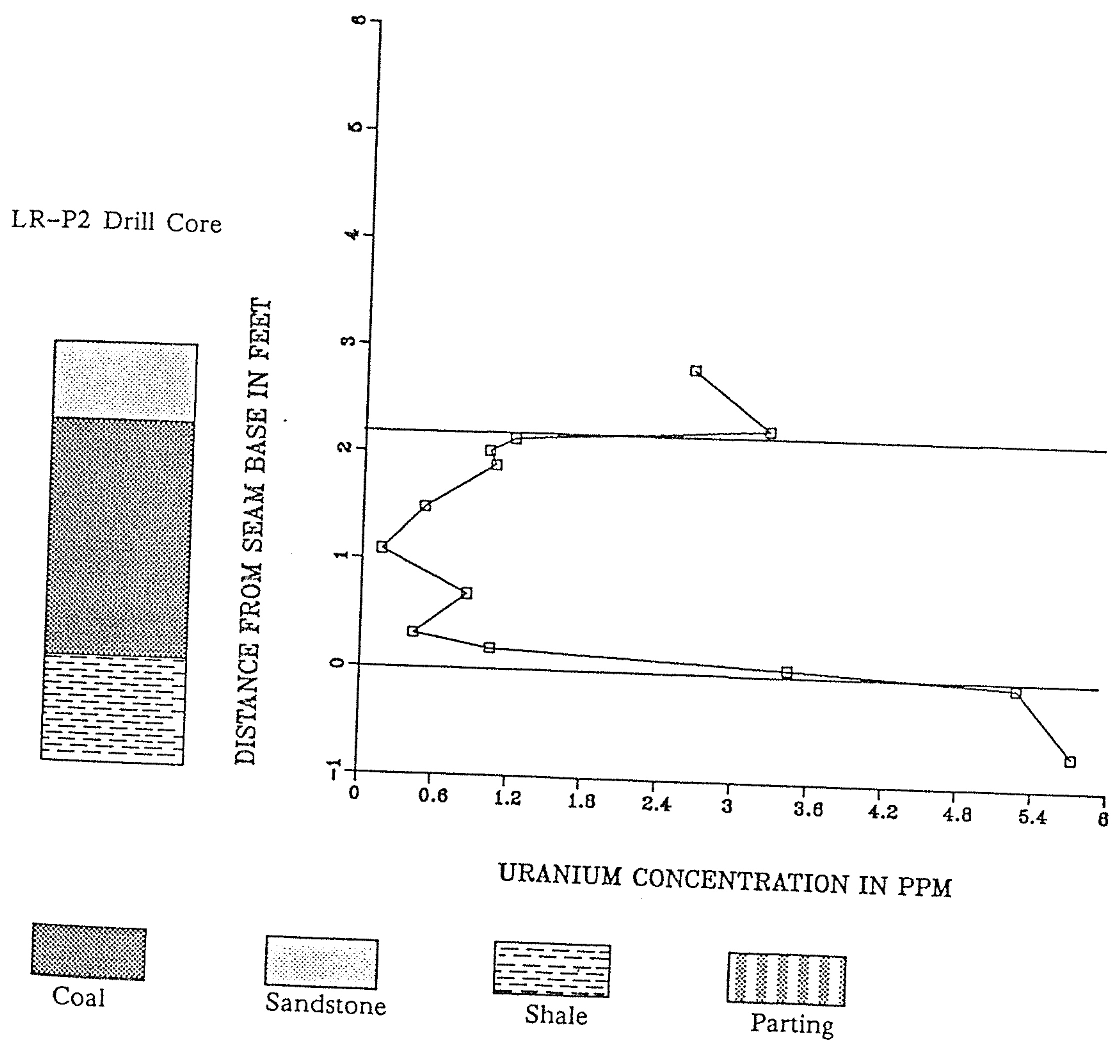


Figure D-174.

URANIUM DISTRIBUTION
IN THE LEE RANCH A2 DRILL CORE

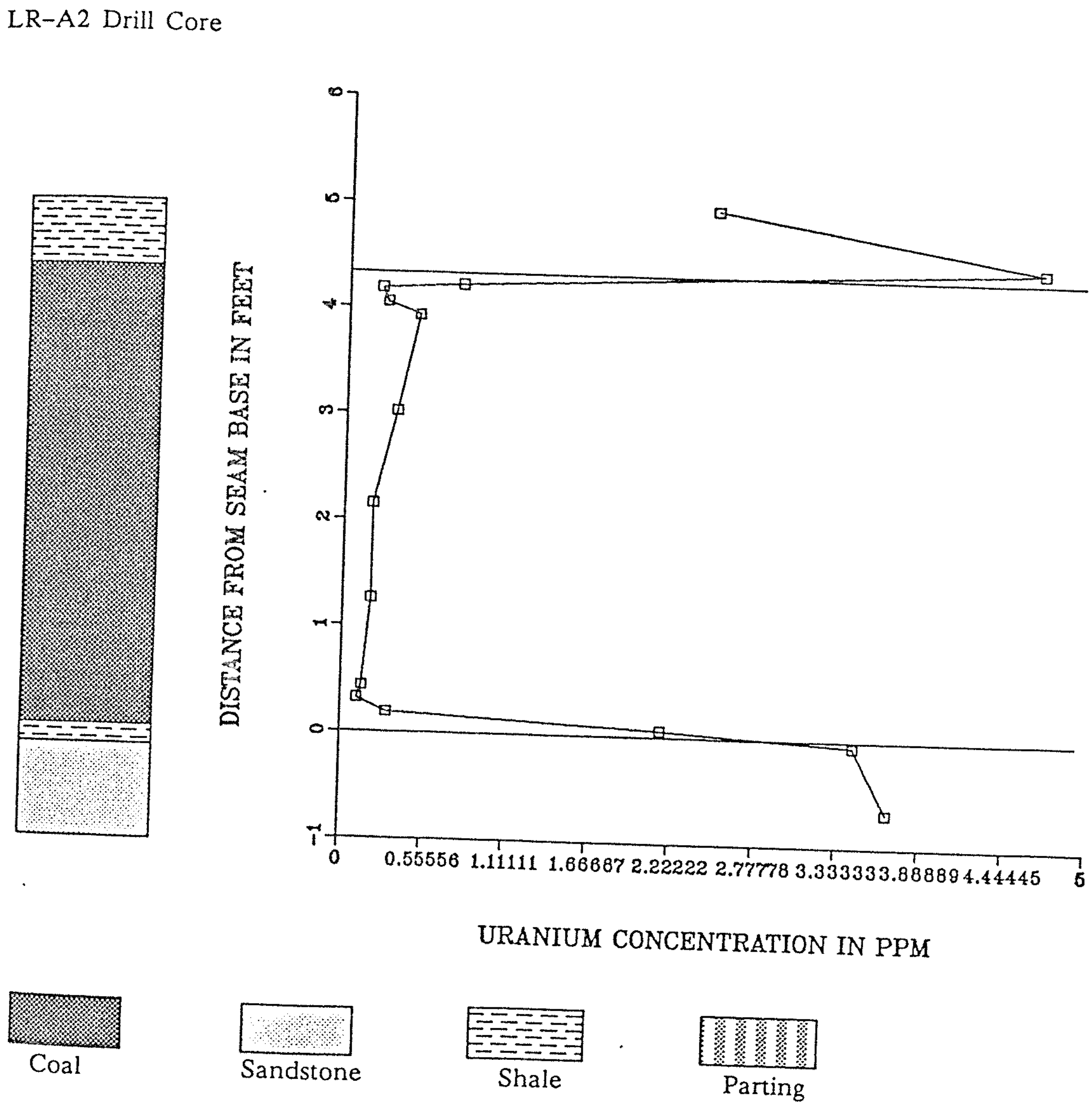


Figure D-175.

URANIUM DISTRIBUTION
IN THE LEE RANCH A3 DRILL CORE

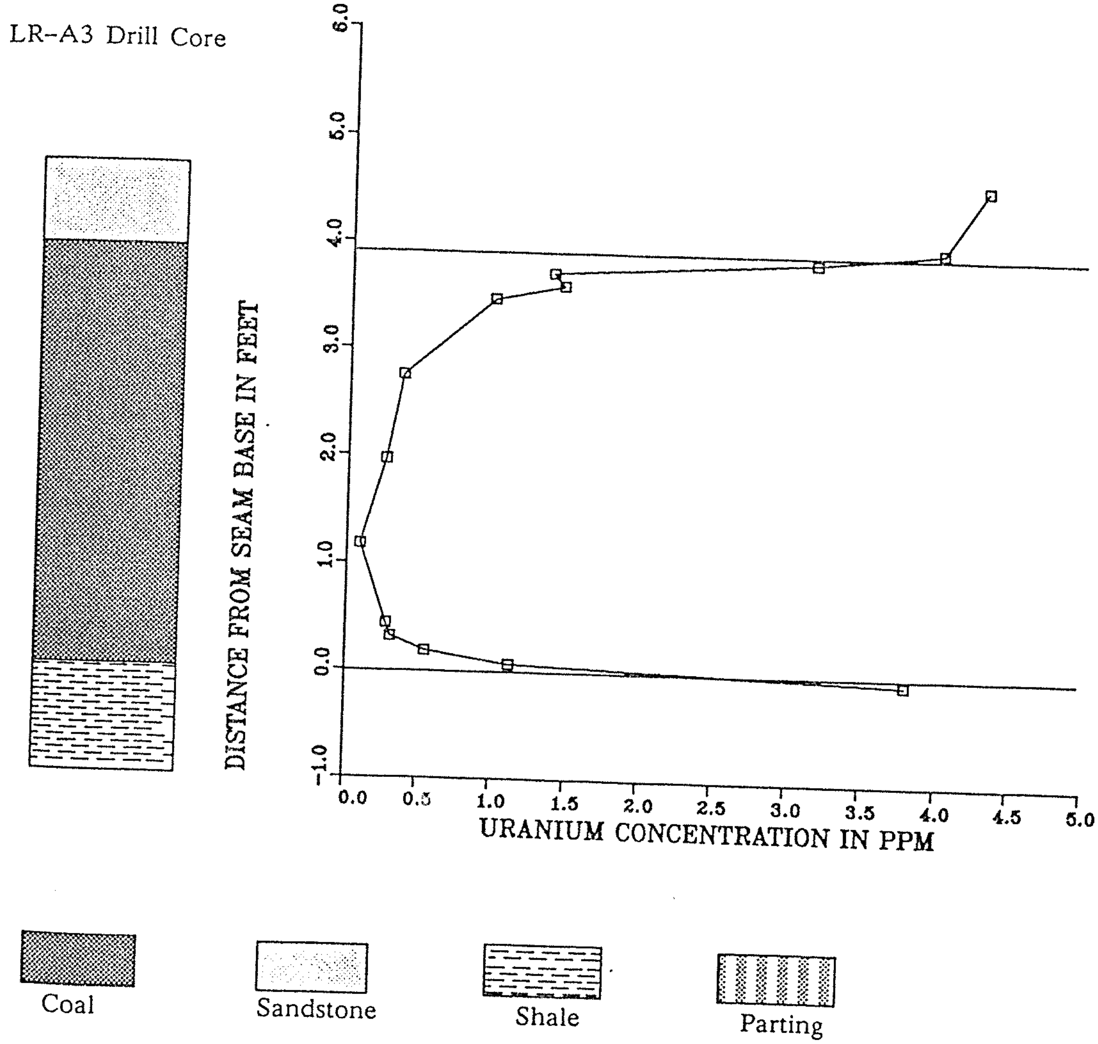


Figure D-176.

URANIUM DISTRIBUTION IN THE LEE RANCH B2 DRILL CORE

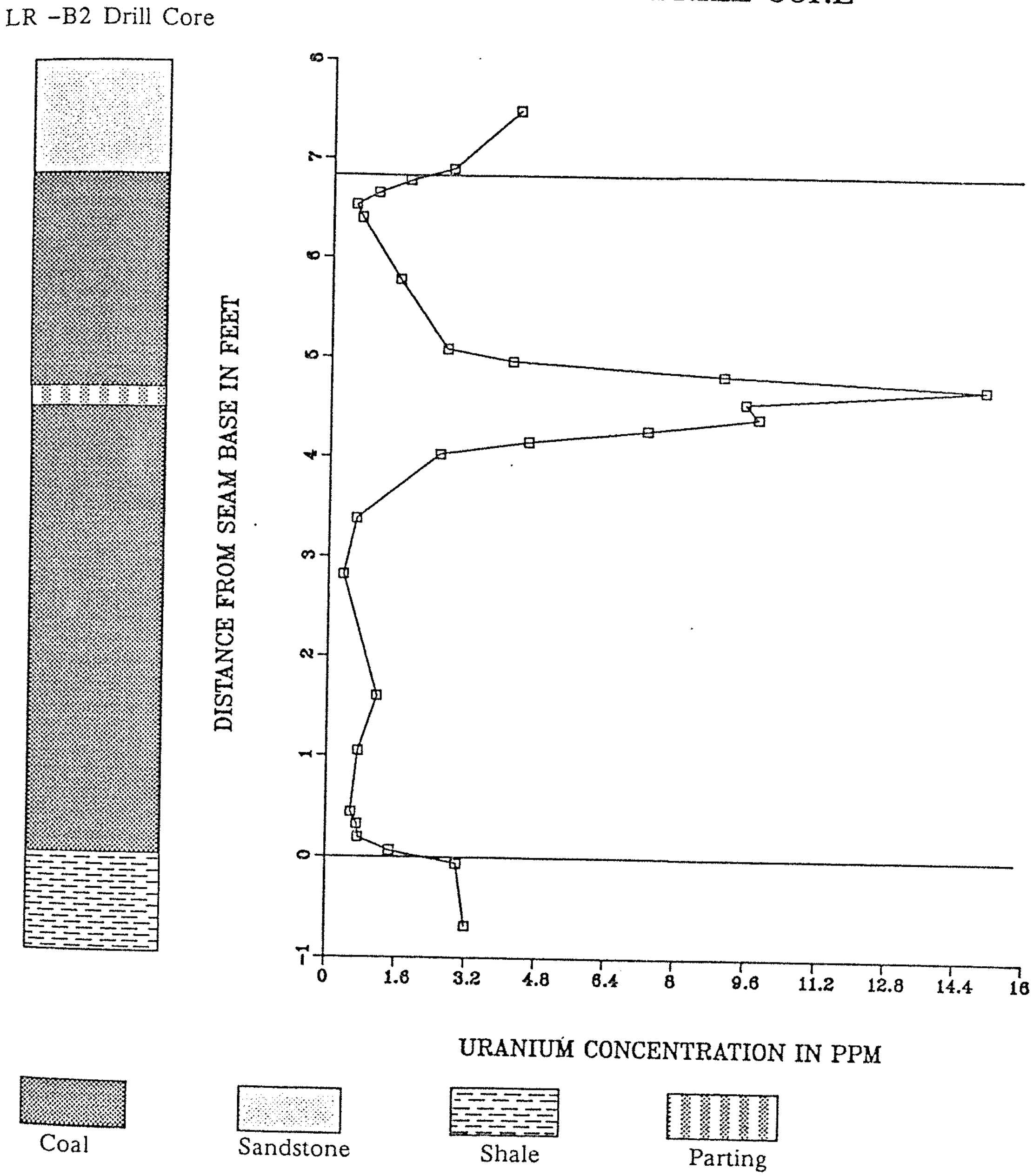


Figure D-177.

URANIUM DISTRIBUTION
IN THE LEE RANCH B3 DRILL CORE

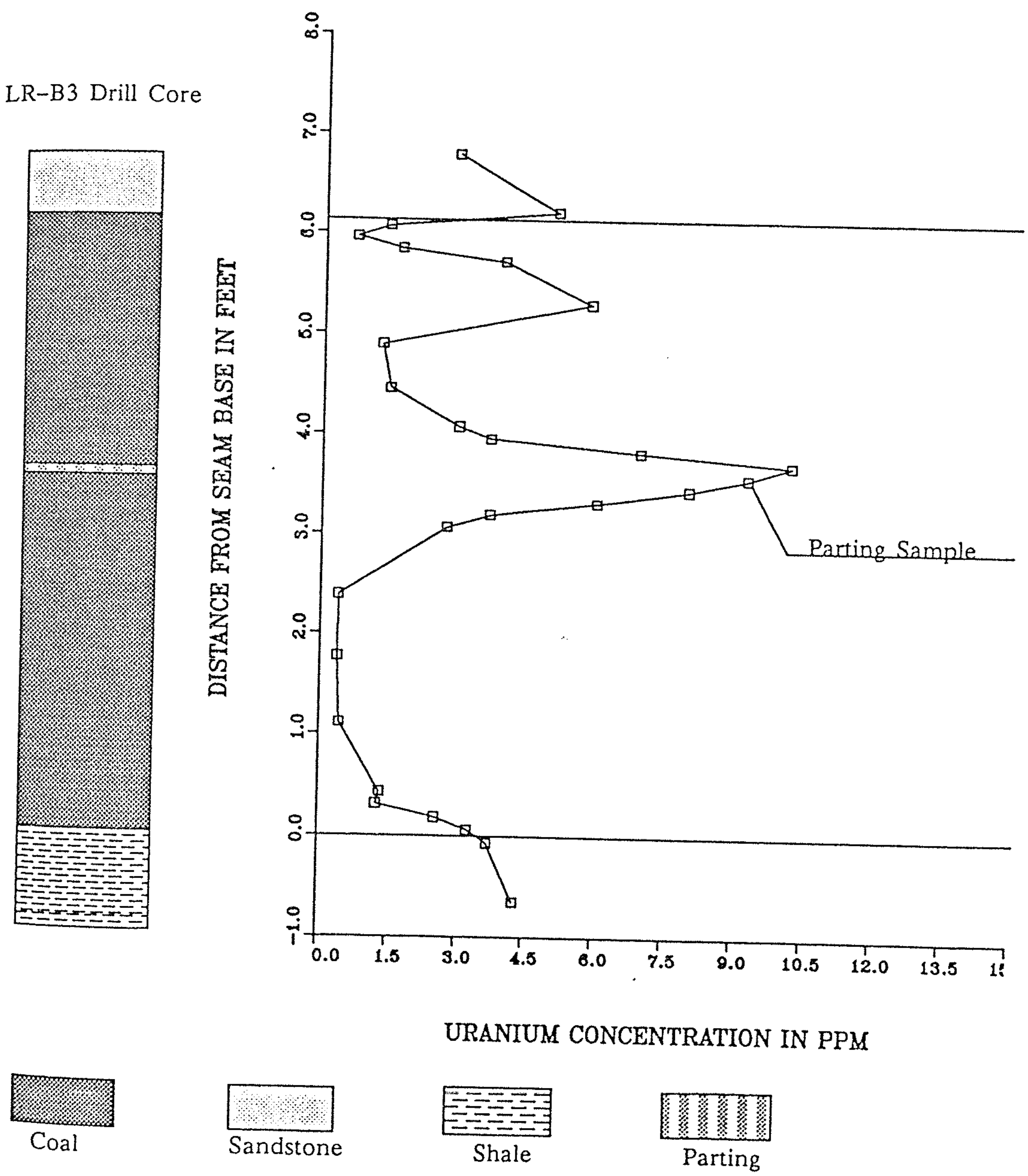


Figure D-178.

URANIUM DISTRIBUTION IN THE YORK CANYON "A" AND "MAIN" SEAMS

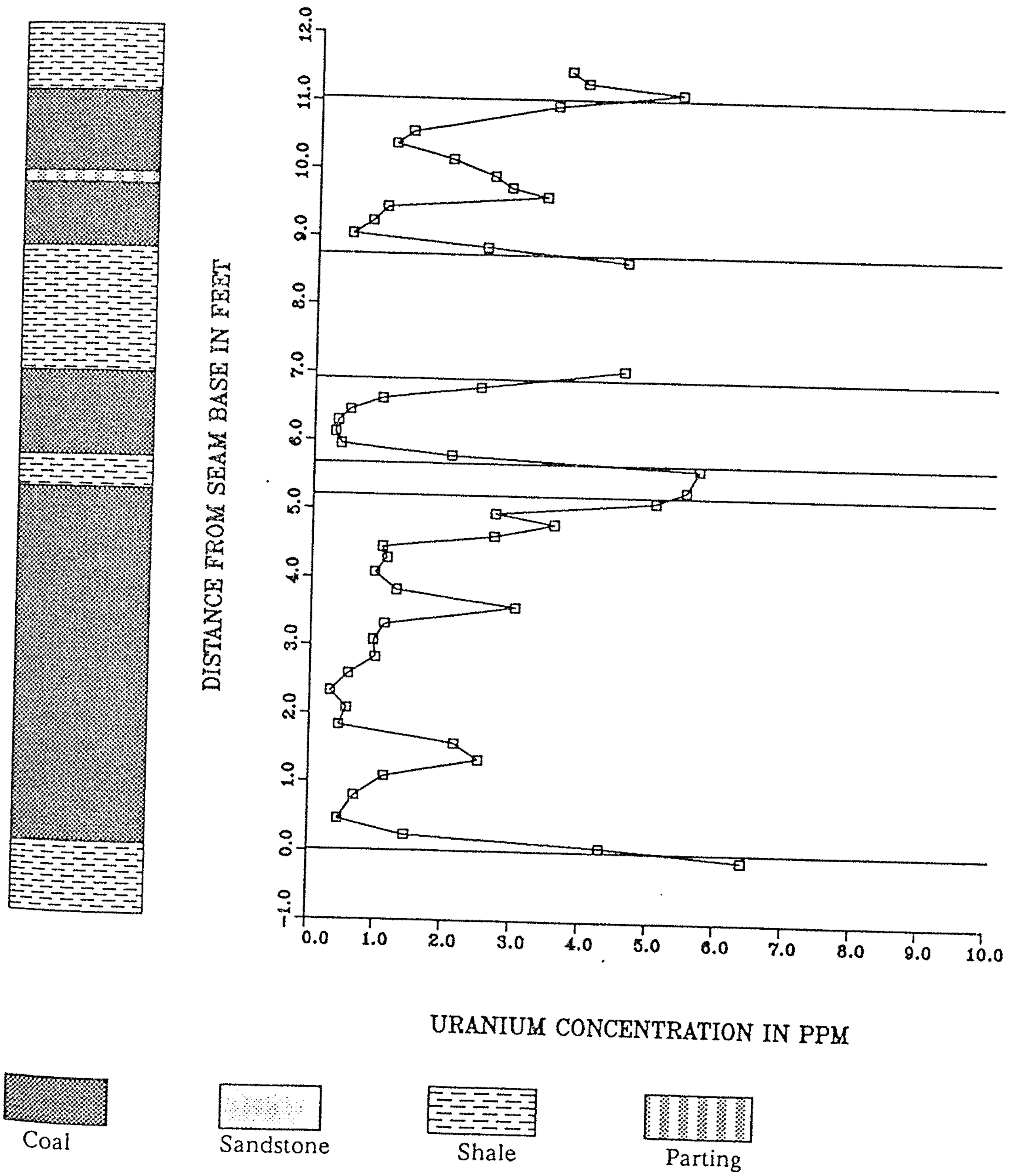


Figure D-179.

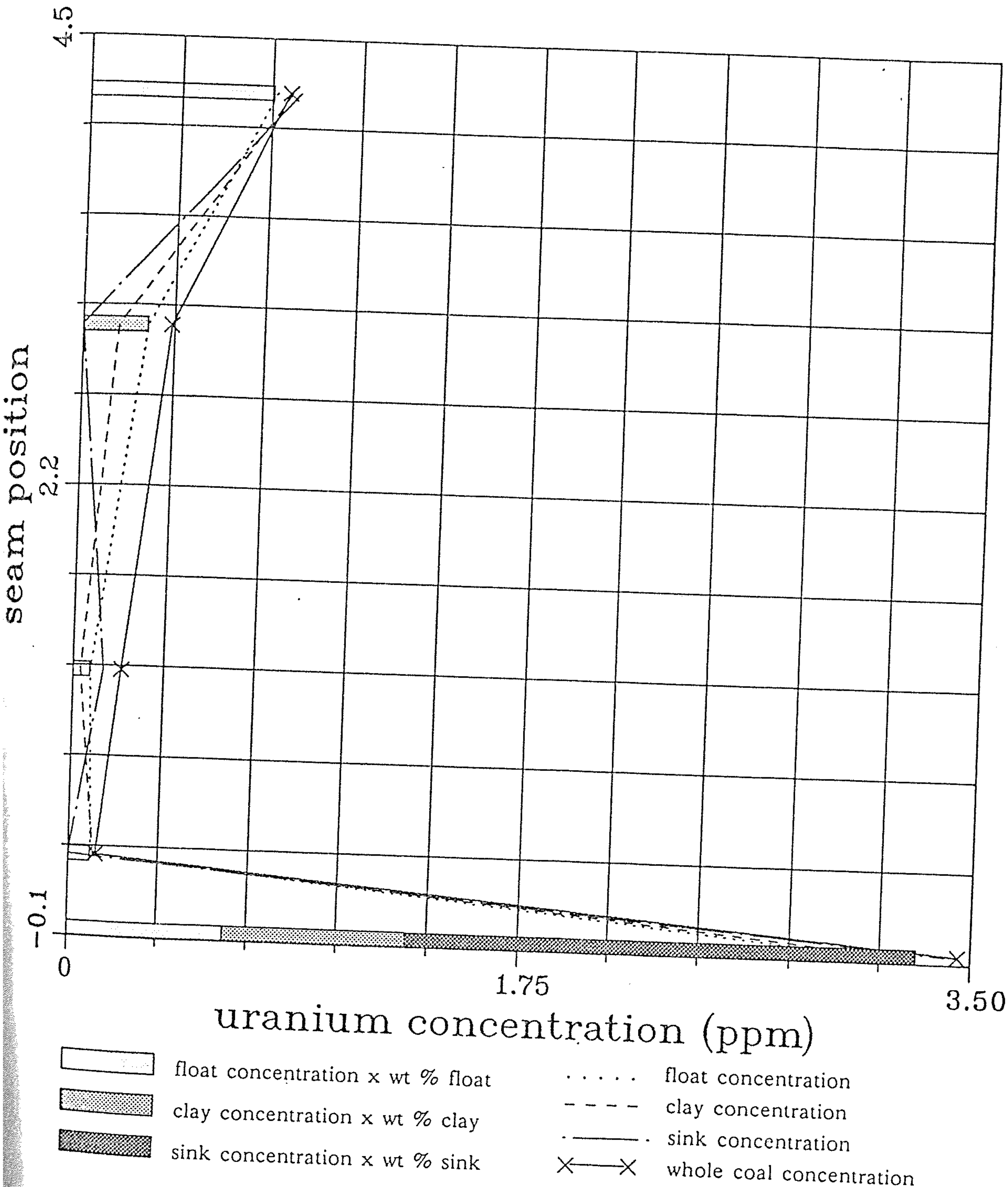


Figure D-180 Uranium float-clay-sink distribution in the LRA2 seam.

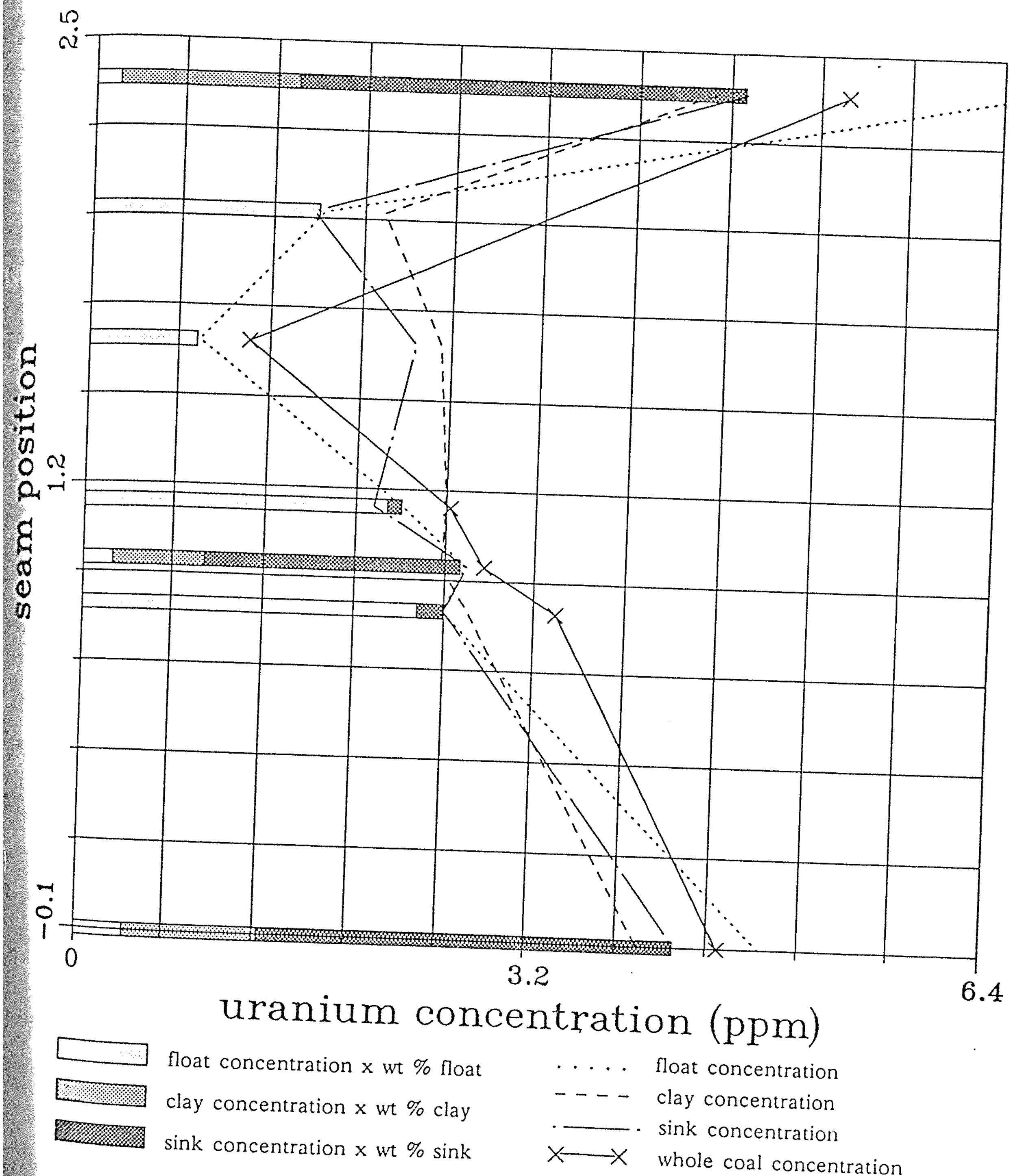


Figure D-181 Uranium float-clay-sink distributions in the YA seam.

LANTHANUM DISTRIBUTION IN THE LEE RANCH P1 DRILL CORE

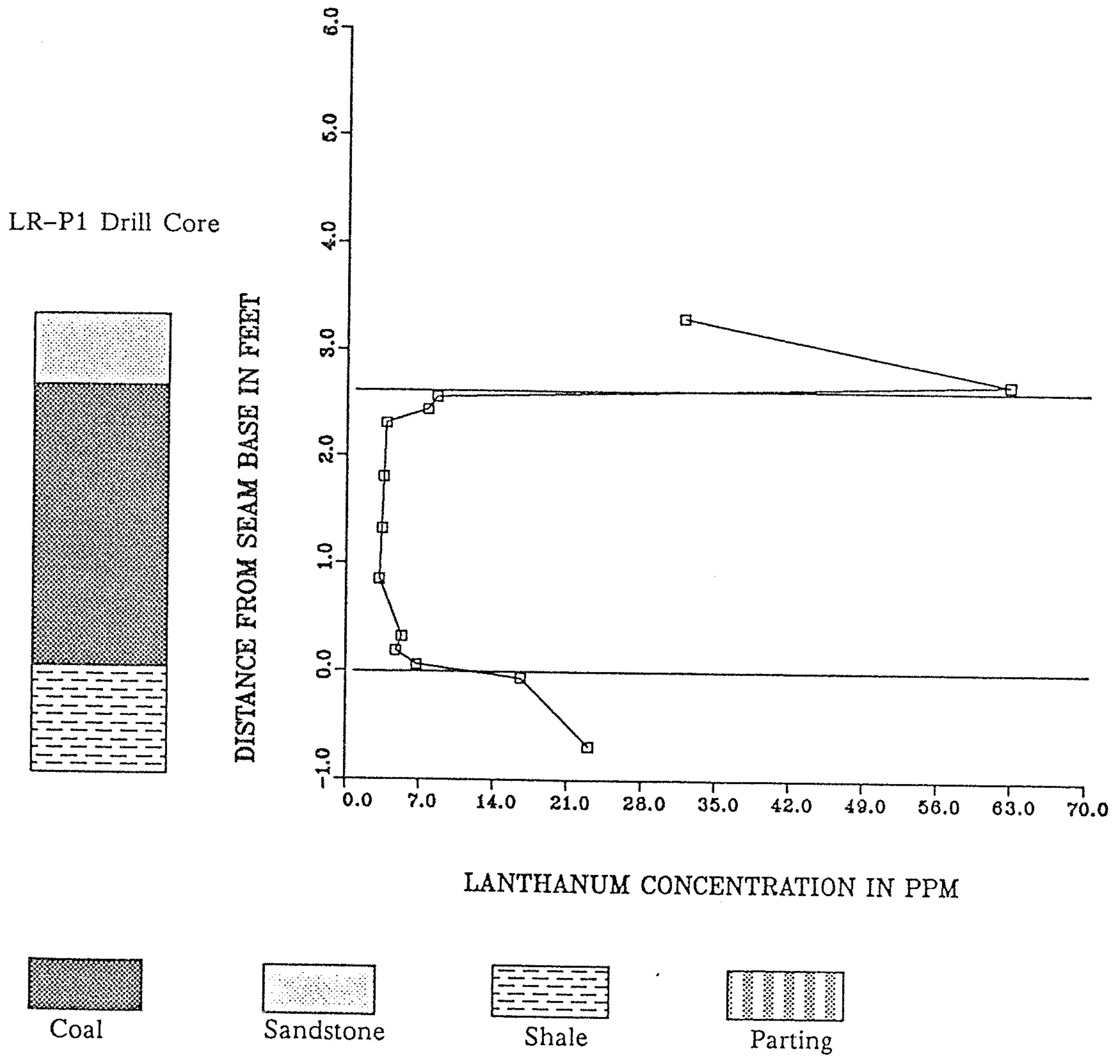


Figure D-182.

CERIUM DISTRIBUTION IN THE LEE RANCH P1 DRILL CORE

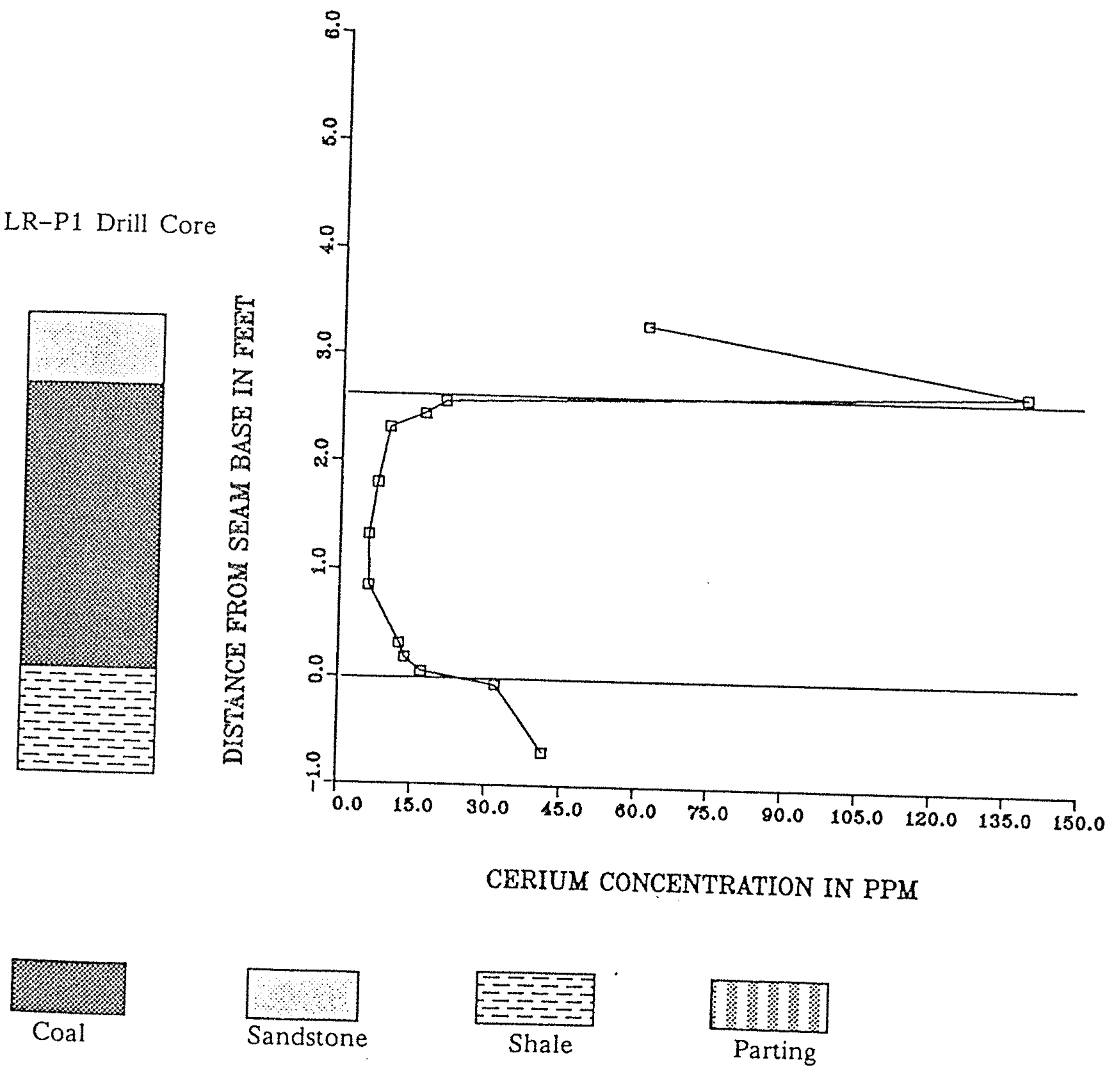


Figure D-183.

NEODYMIUM DISTRIBUTION IN THE LEE RANCH P1 DRILL CORE

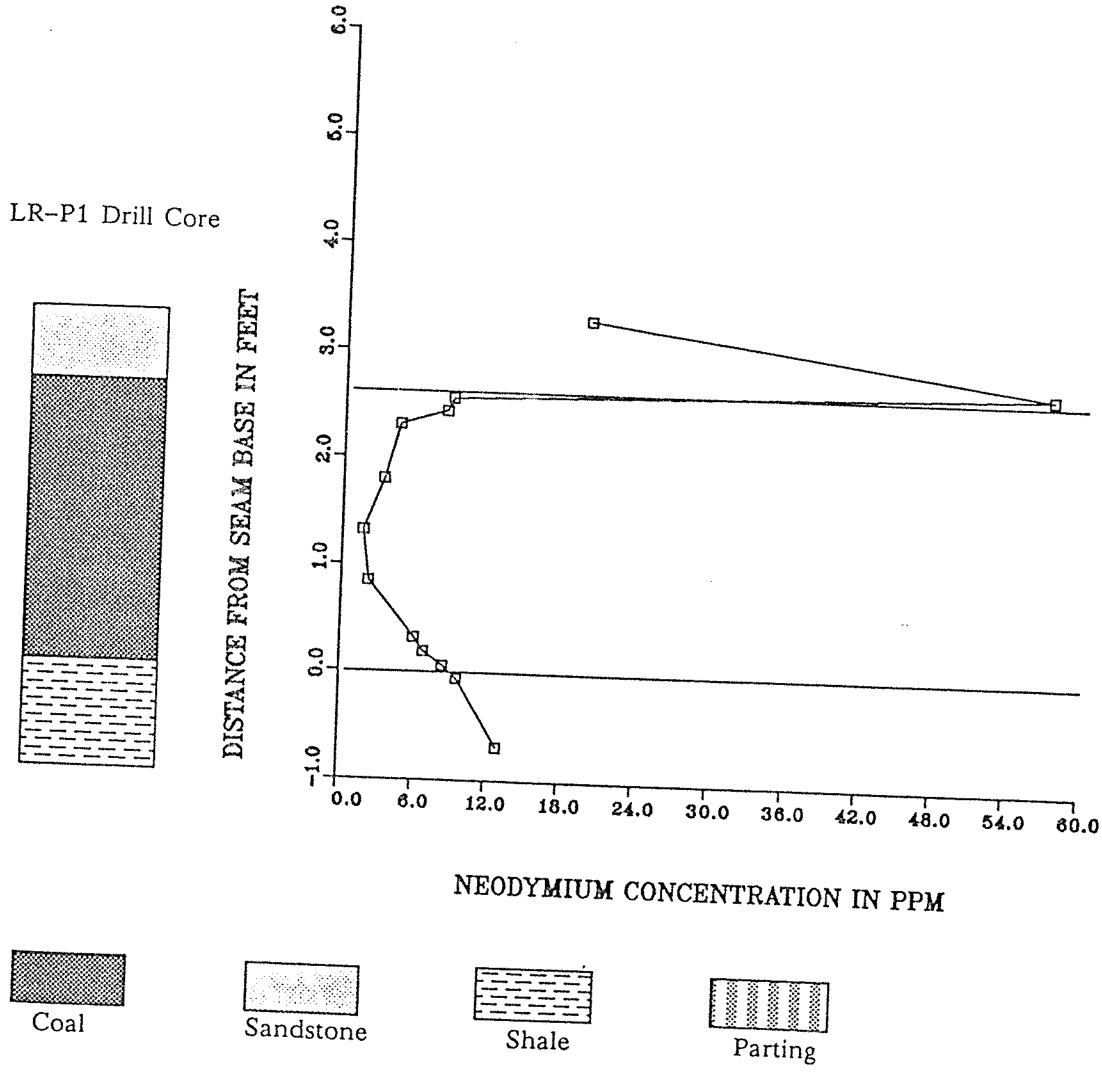


Figure D-184.

LANTHANUM DISTRIBUTION
IN THE LEE RANCH P2 DRILL CORE

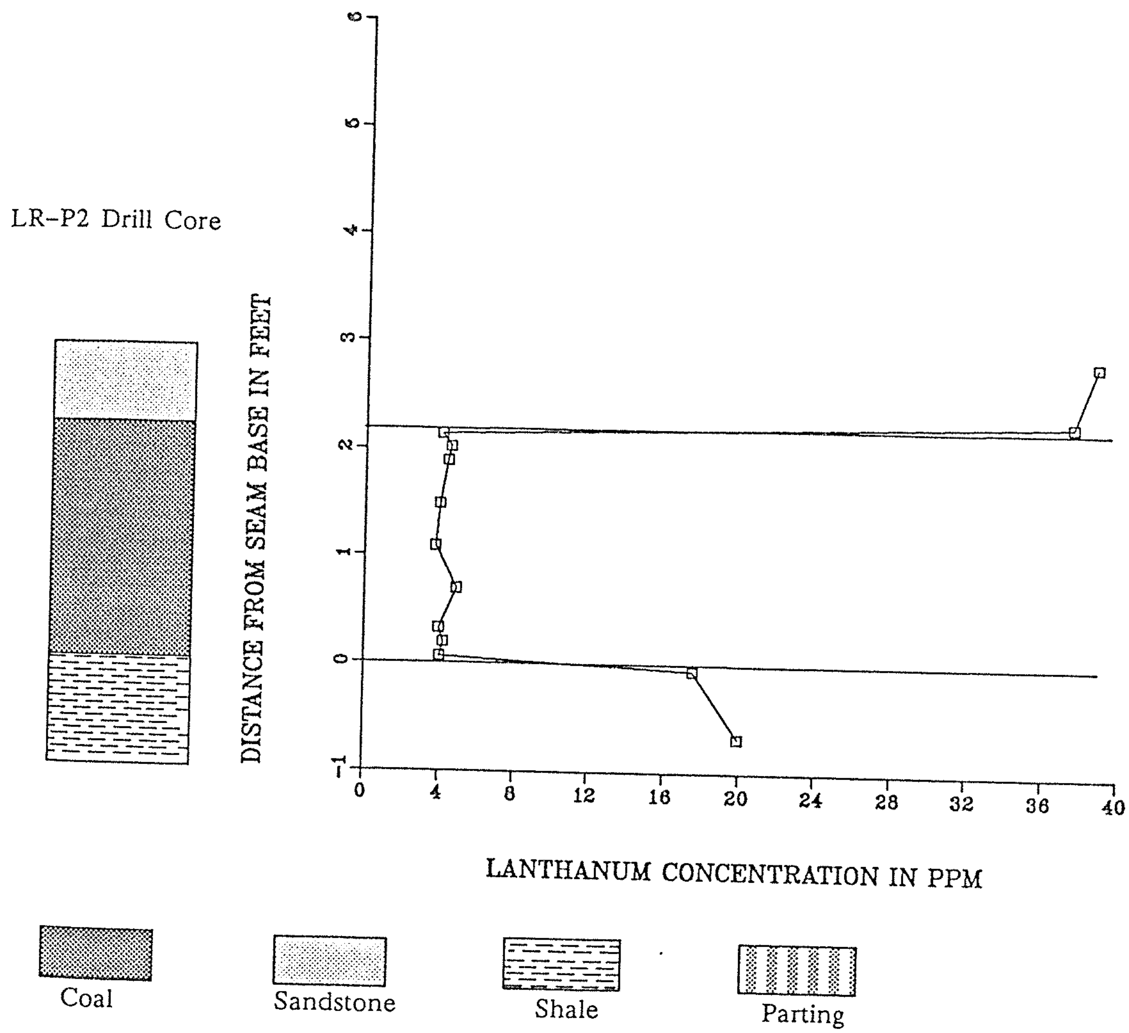


Figure D-185.

CERIUM DISTRIBUTION
IN THE LEE RANCH P2 DRILL CORE

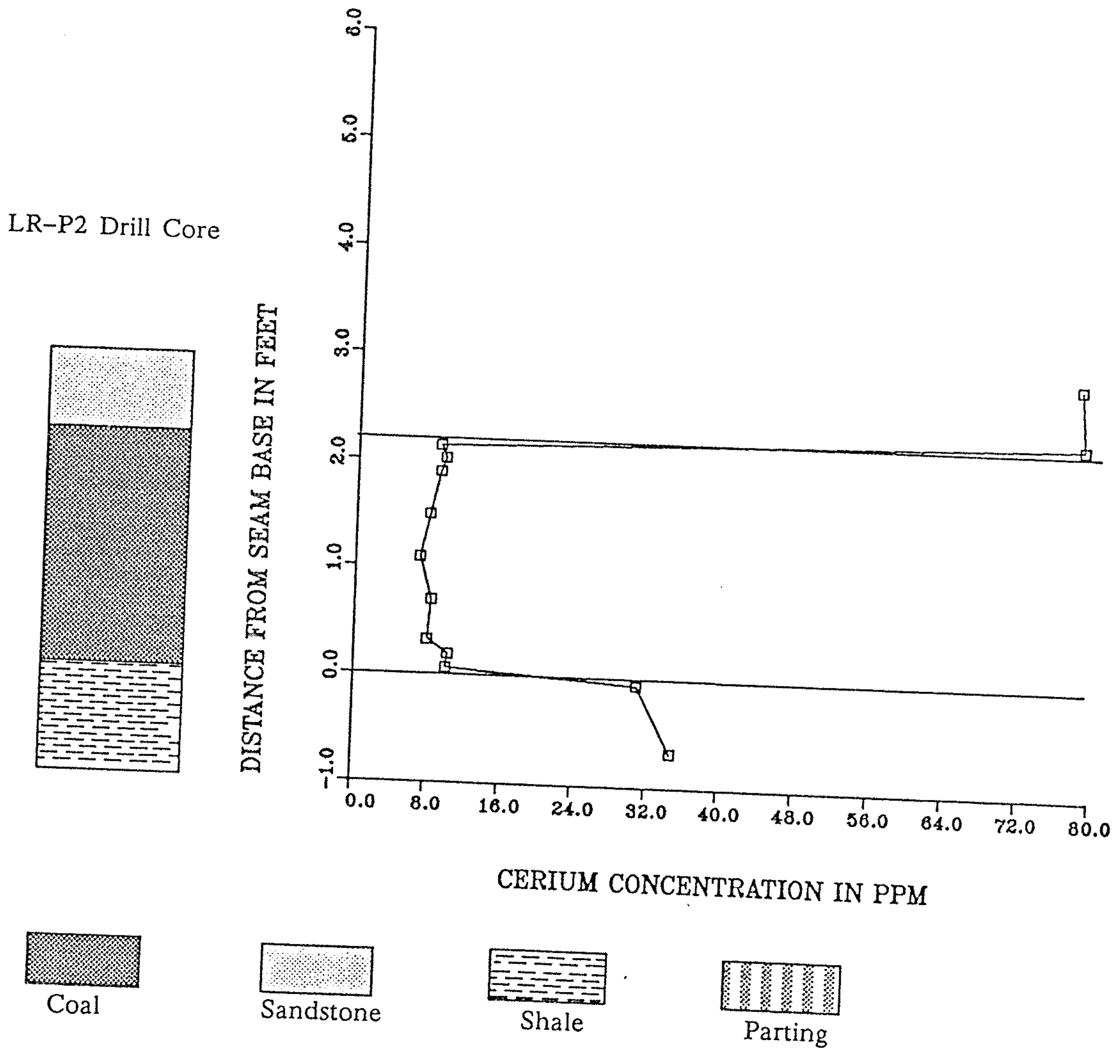


Figure D-186.

NEODYMIUM DISTRIBUTION IN THE LEE RANCH P2 DRILL CORE

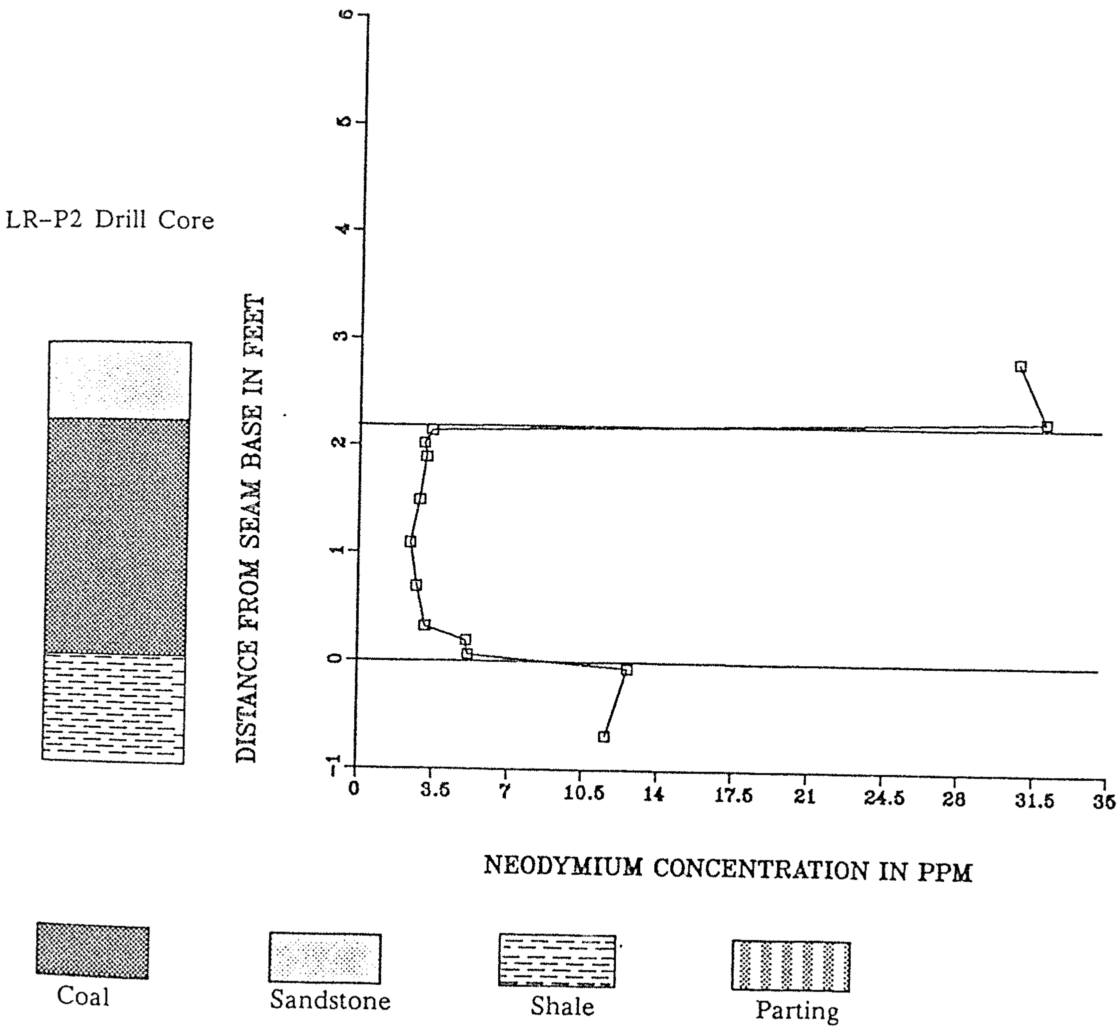


Figure D-187.

LANTHANUM DISTRIBUTION
IN THE LEE RANCH A2 DRILL CORE

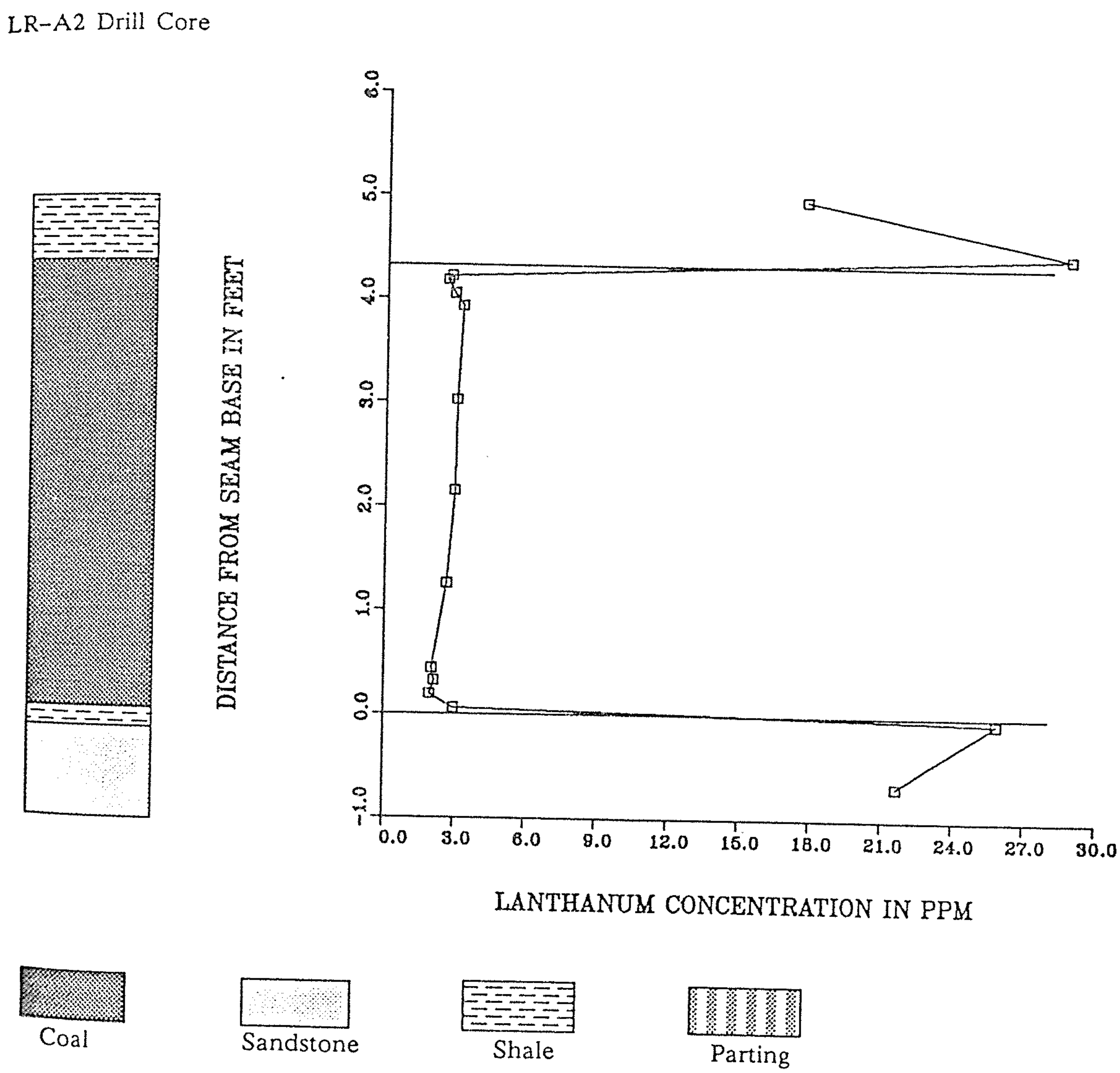


Figure D-188.

CERIUM DISTRIBUTION IN THE LEE RANCH A2 DRILL CORE

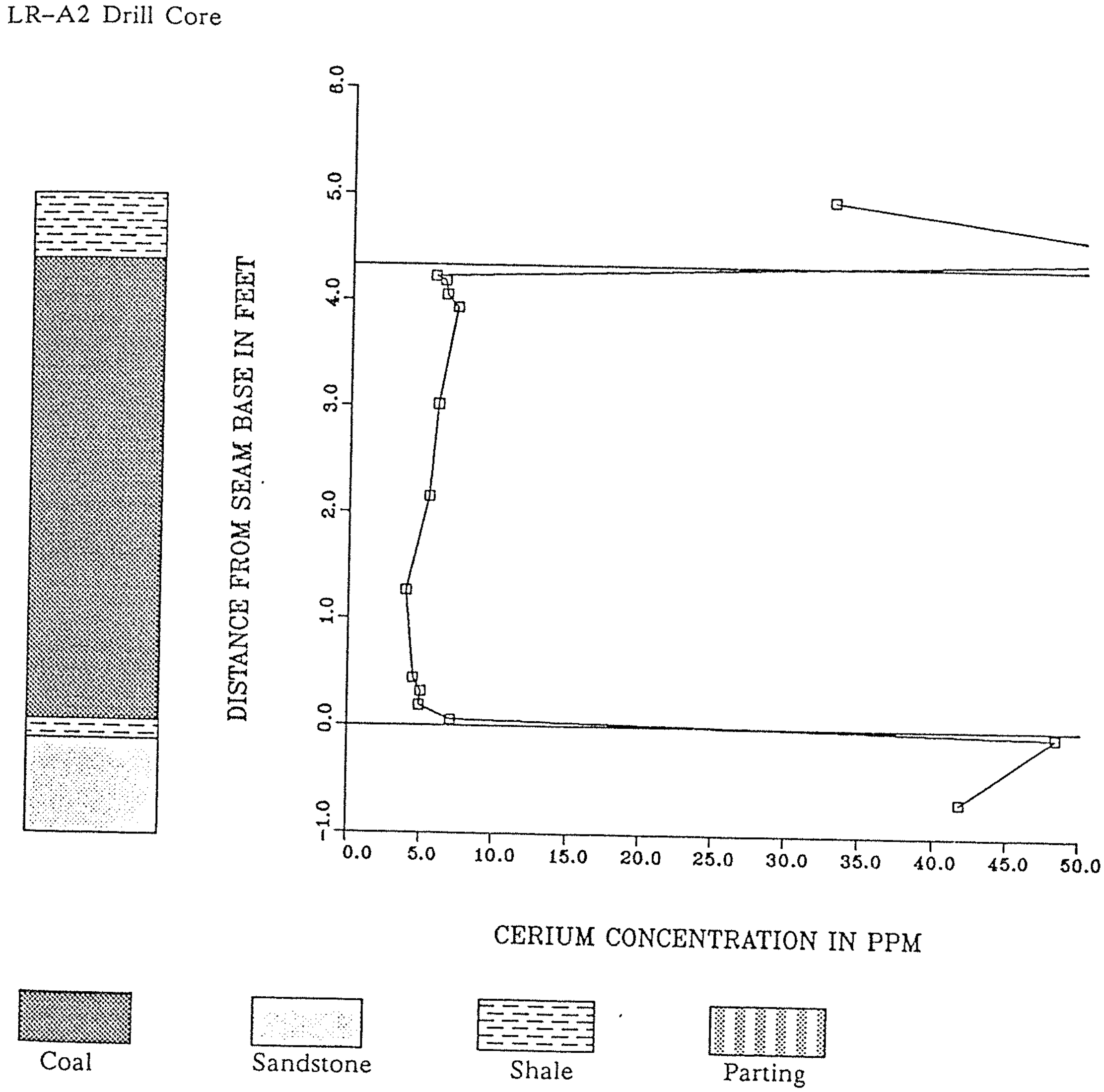


Figure D-189.

NEODYMIUM DISTRIBUTION
IN THE LEE RANCH A2 DRILL CORE

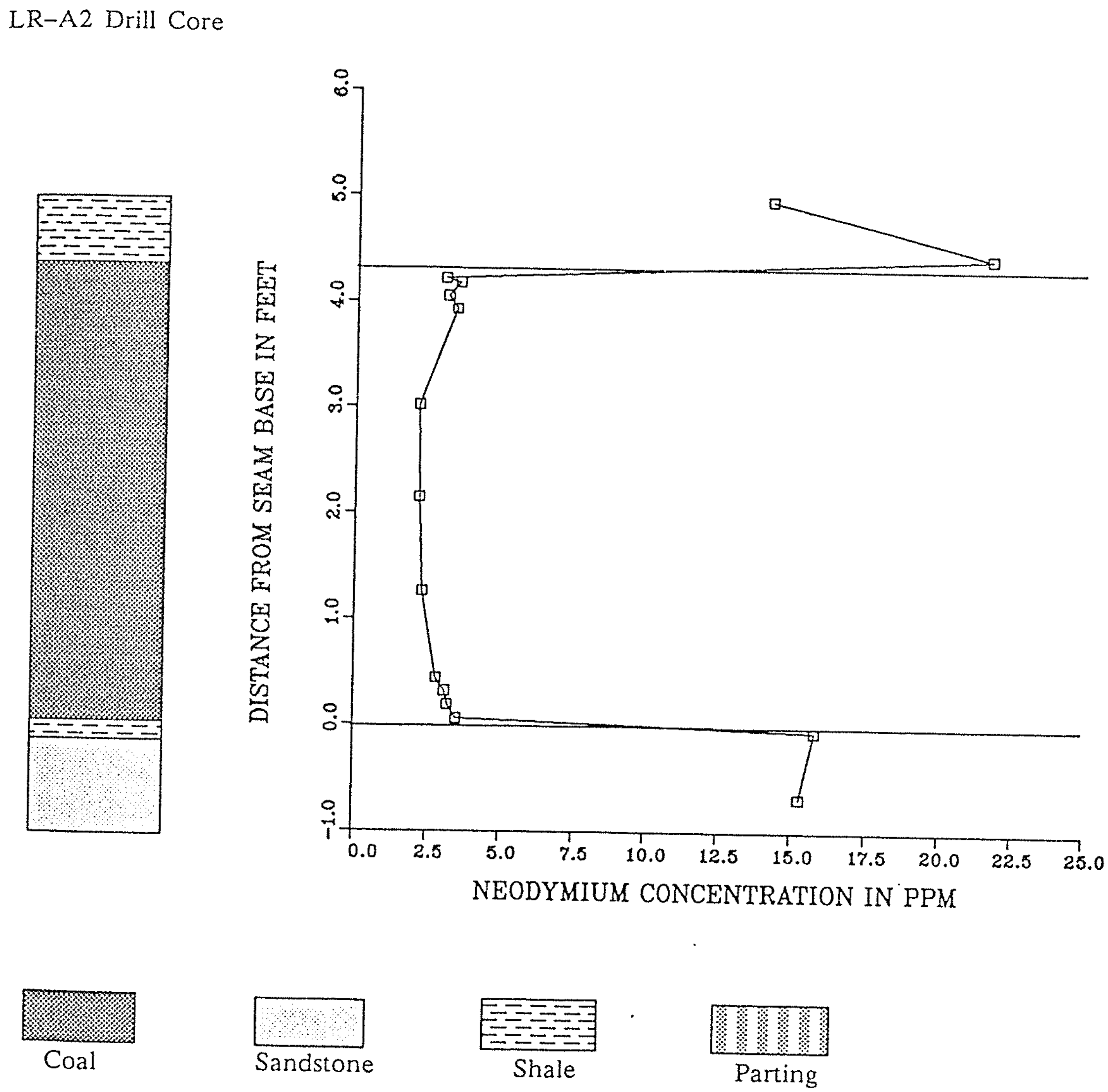


Figure D-190.

LANTHANUM DISTRIBUTION
IN THE LEE RANCH A3 DRILL CORE

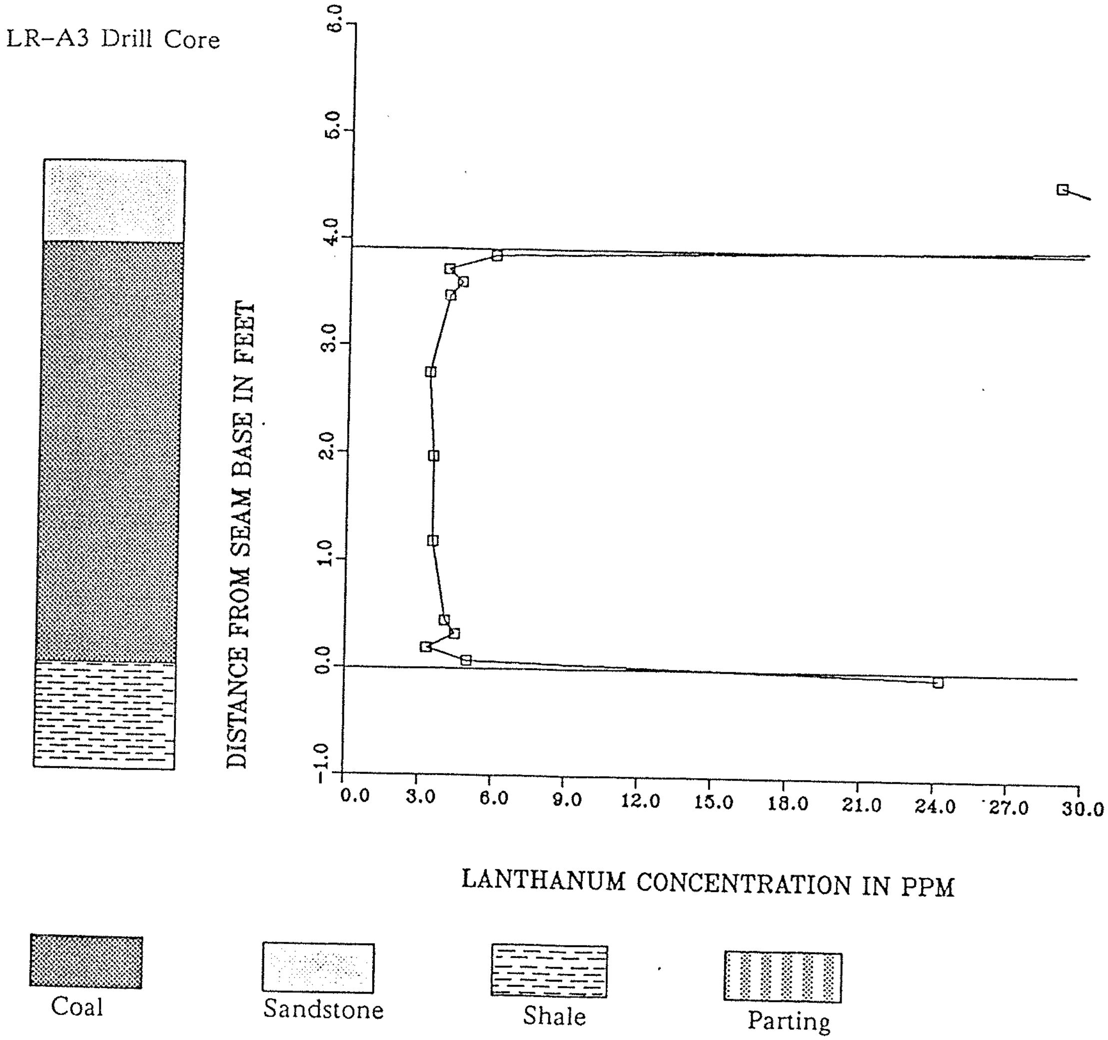


Figure D-191.

CERIUM DISTRIBUTION
IN THE LEE RANCH A3 DRILL CORE

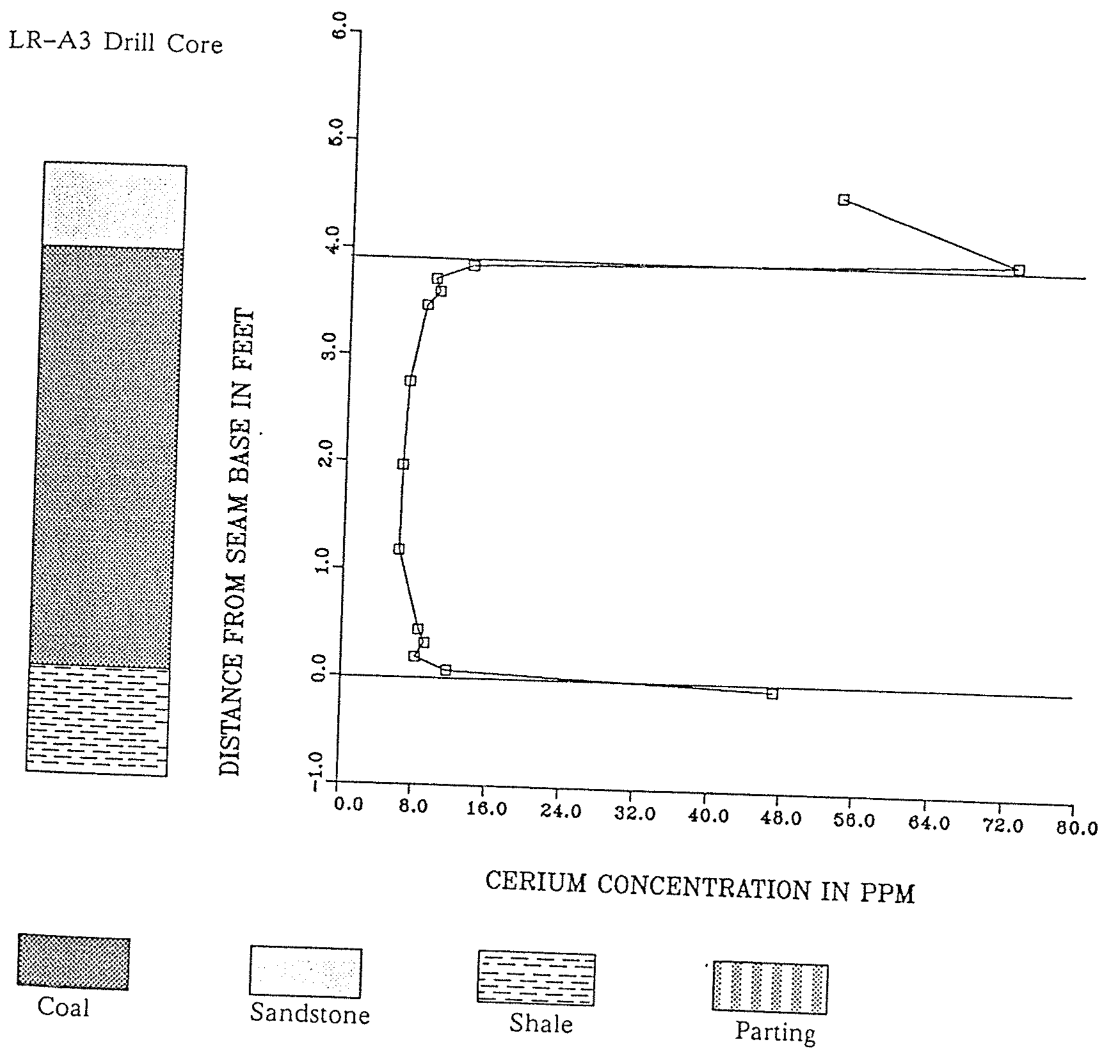


Figure D-192.

NEODYMIUM DISTRIBUTION
IN THE LEE RANCH A3 DRILL CORE

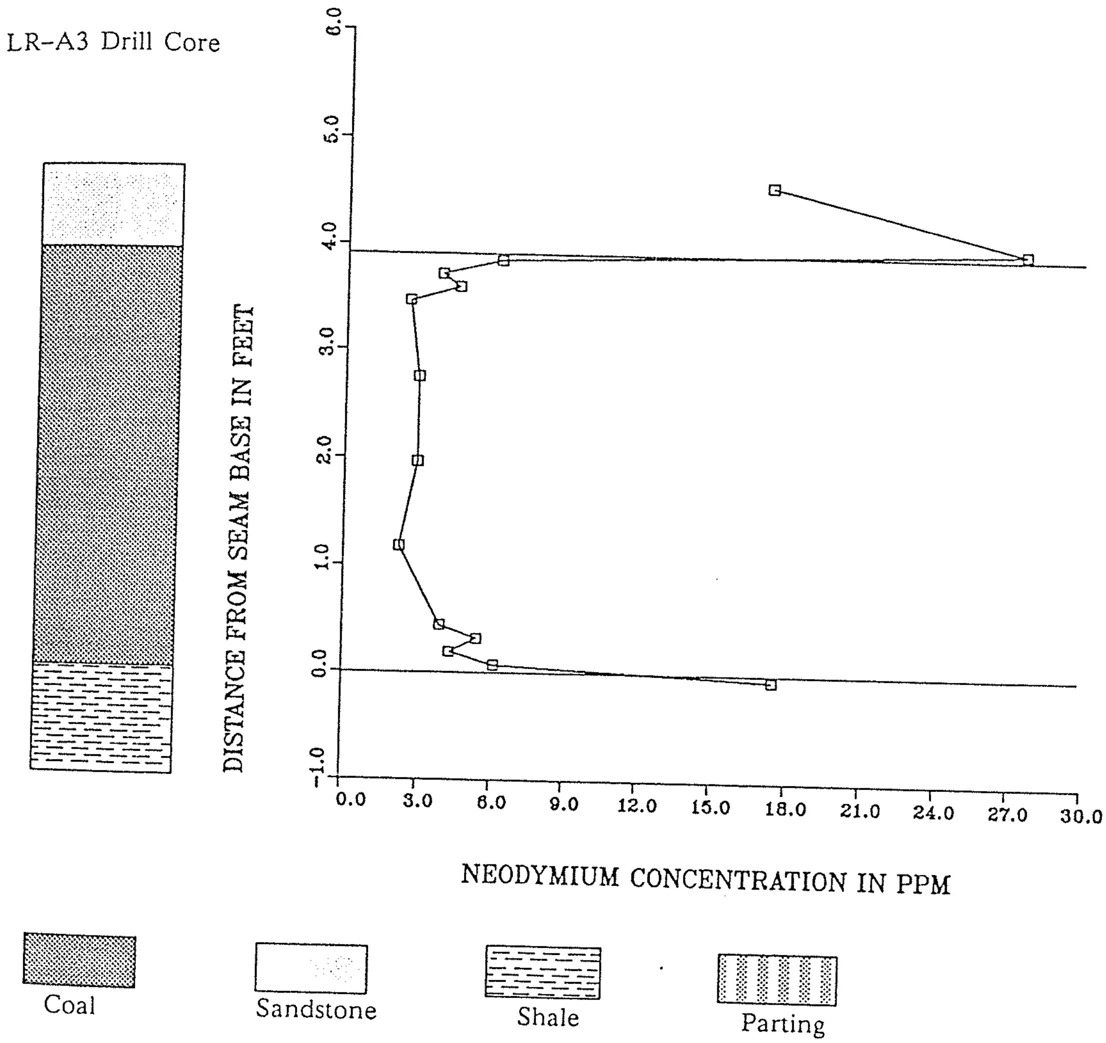


Figure D-193.

LANTHANUM DISTRIBUTION
IN THE LEE RANCH B2 DRILL CORE

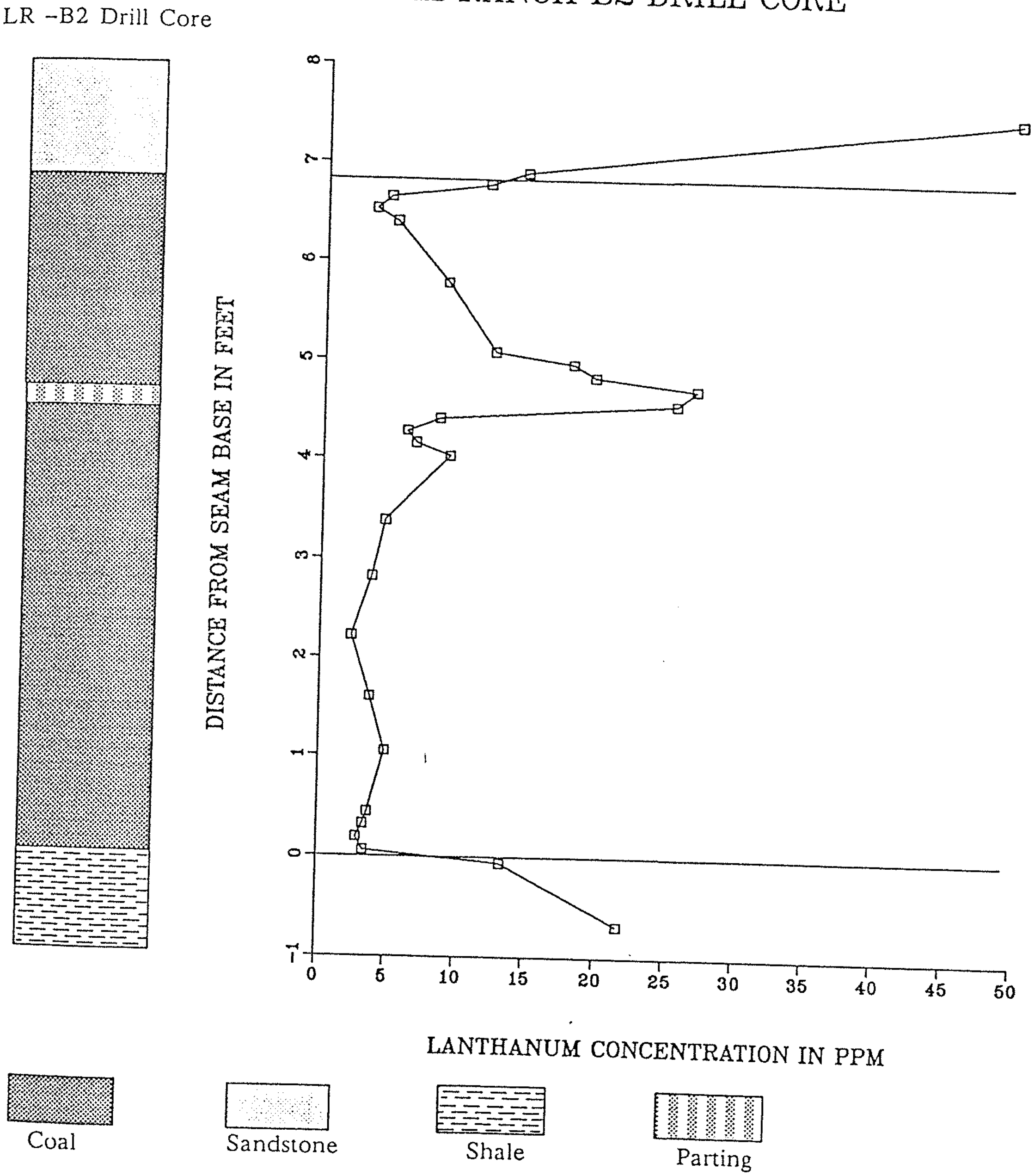


Figure D-194.

CERIUM DISTRIBUTION
IN THE LEE RANCH B2 DRILL CORE

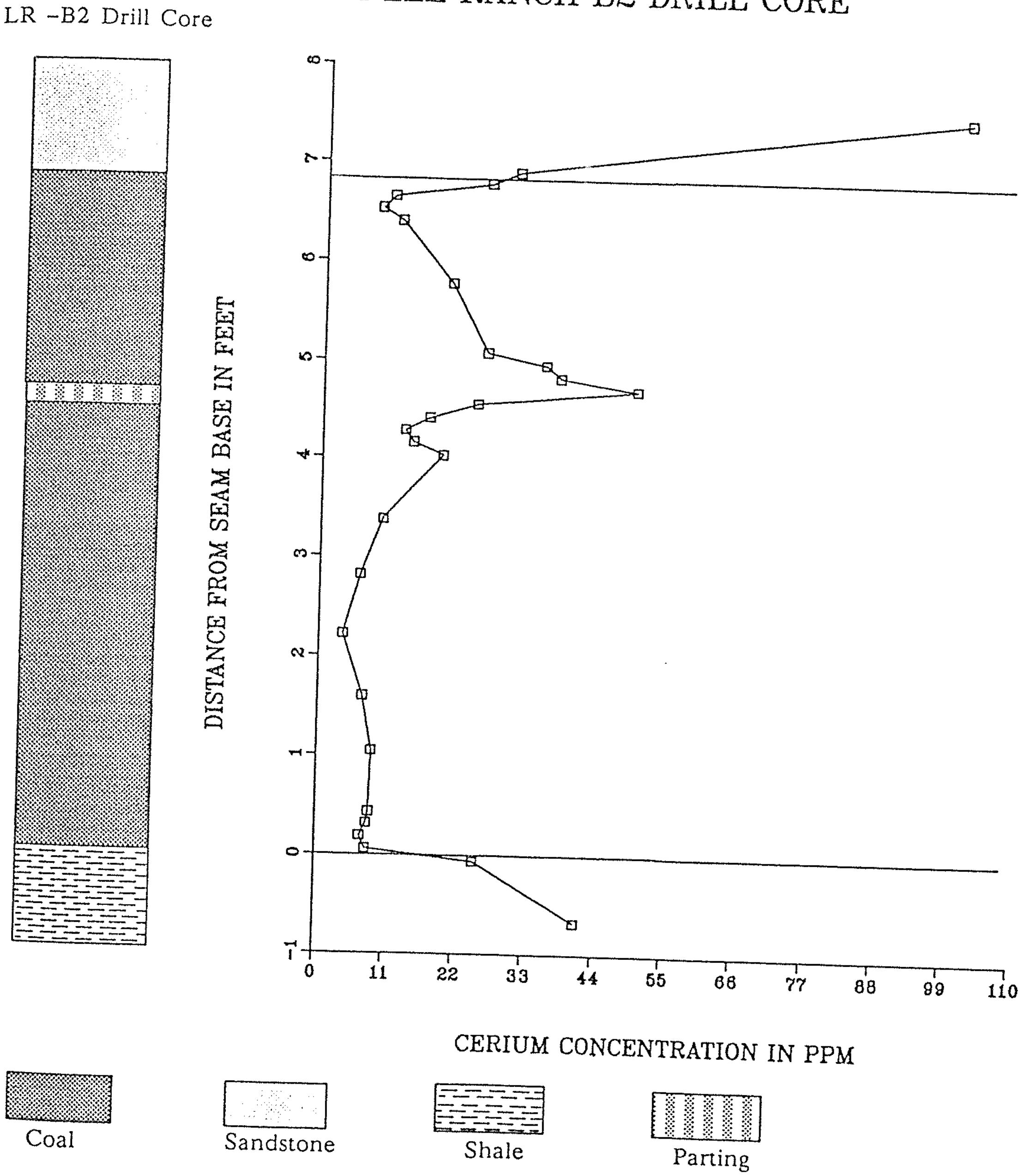


Figure D-195.

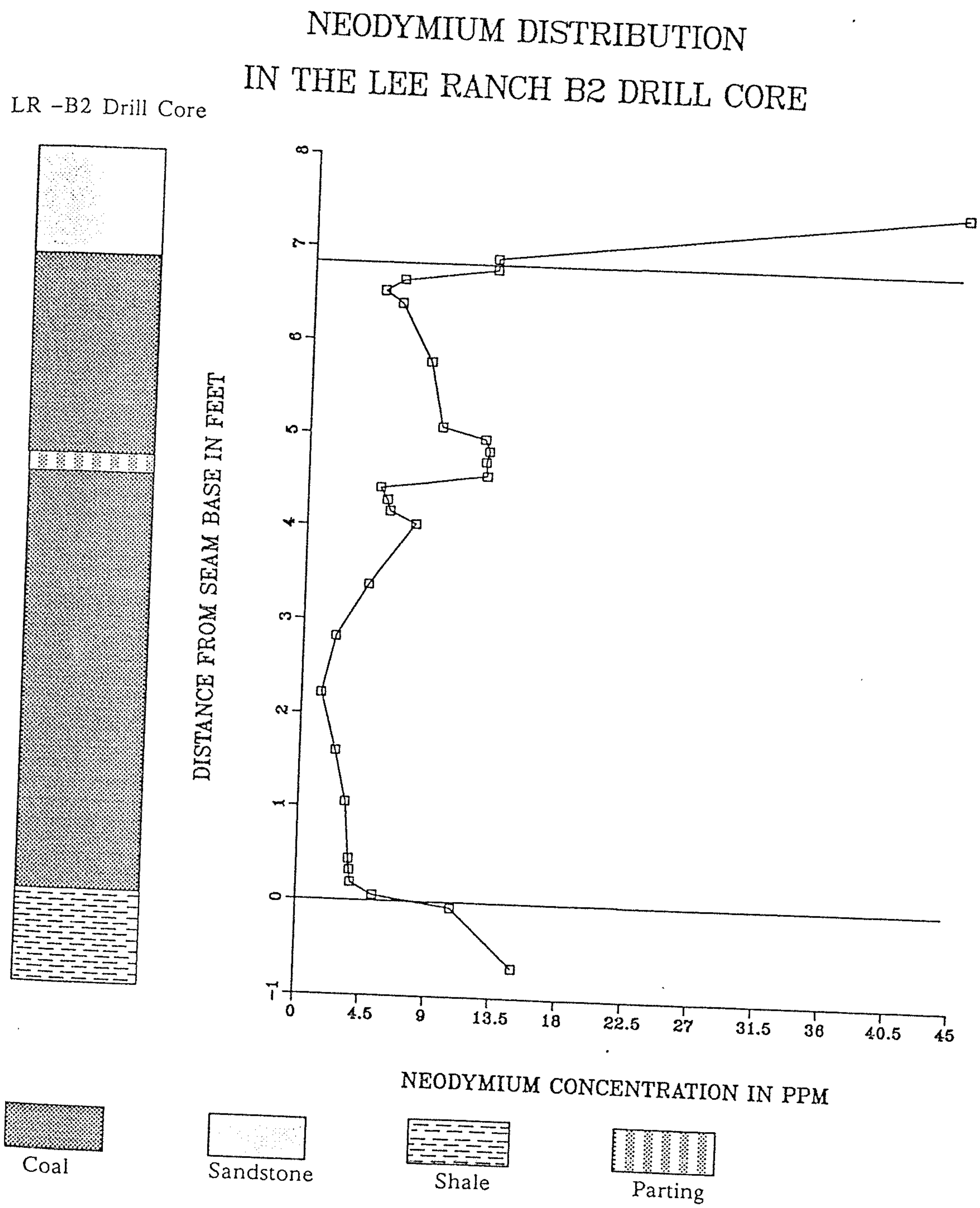

NEODYMIUM DISTRIBUTION
IN THE LEE RANCH B2 DRILL CORE
LR -B2 Drill Core
DISTANCE FROM SEAM BASE IN FEET
-1
0
1
2
3
4
5
6
7
8
0
4.5
9
13.5
18
22.5
27
31.5
36
40.5
45
NEODYMIUM CONCENTRATION IN PPM
Coal
Sandstone
Shale
Parting

Figure D-196.

LANTHANUM DISTRIBUTION IN THE LEE RANCH B3 DRILL CORE

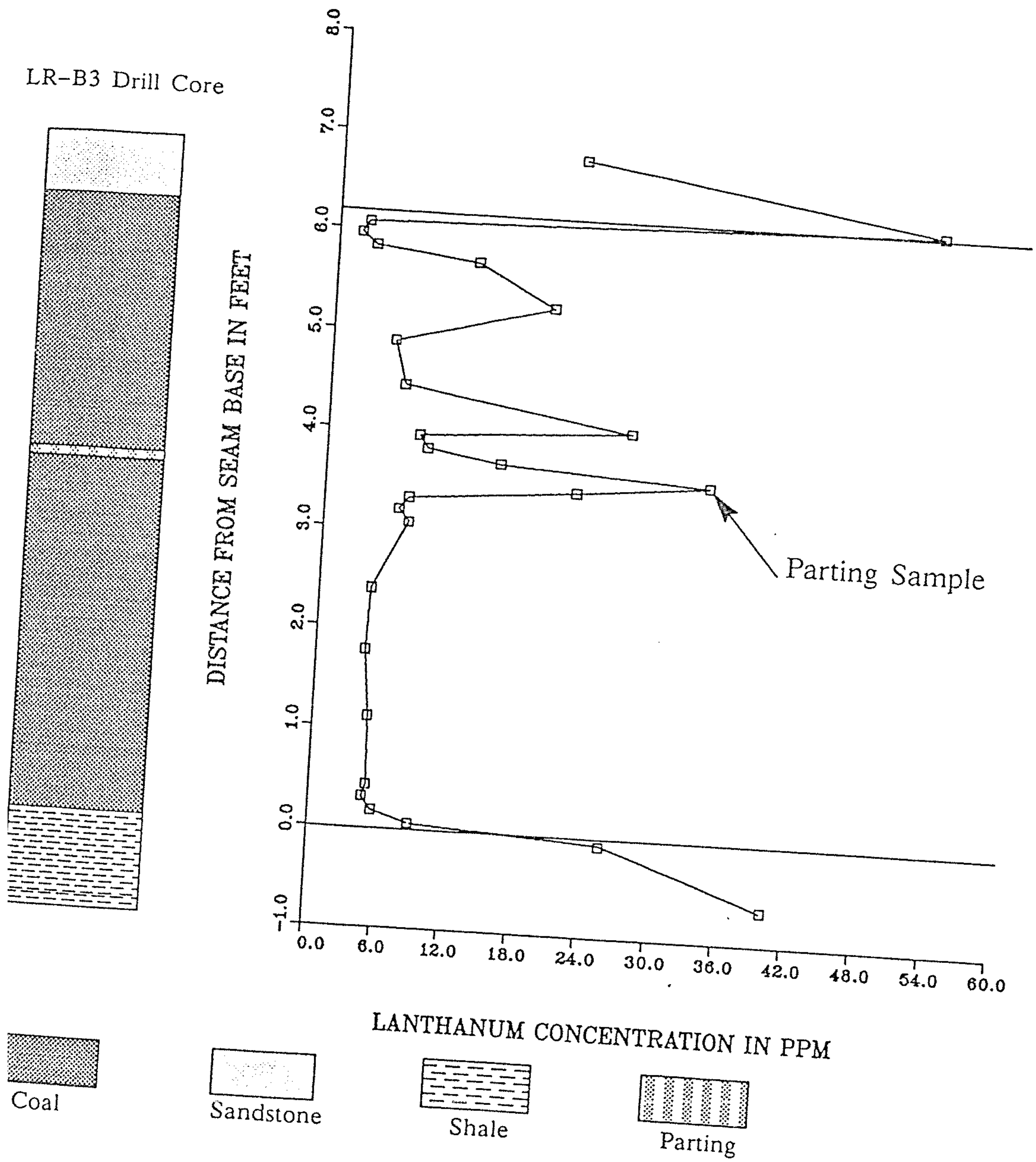


Figure D-197.

CERIUM DISTRIBUTION
IN THE LEE RANCH B3 DRILL CORE

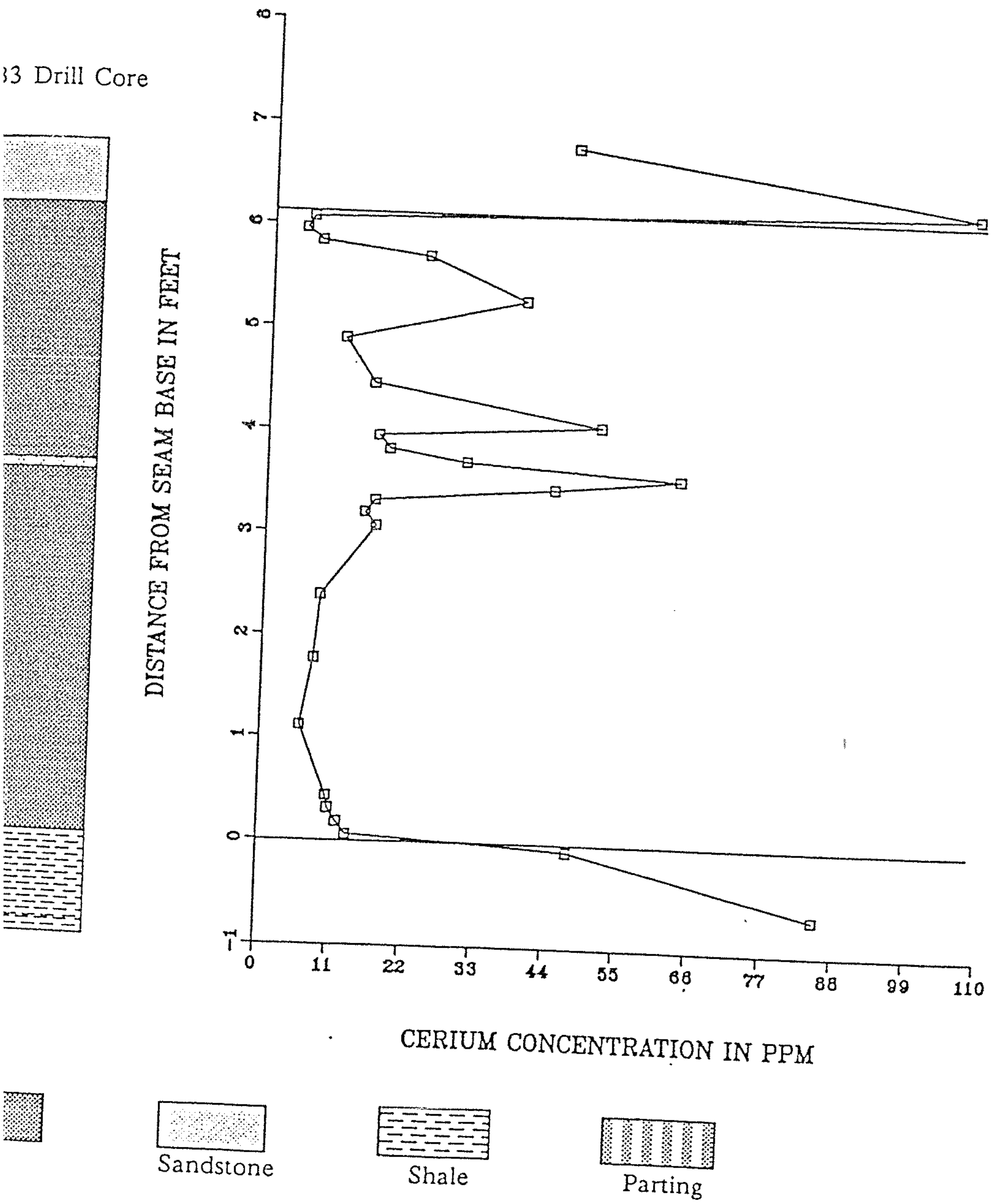


Figure D–198

NEODYMIUM DISTRIBUTION IN THE LEE RANCH B3 DRILL CORE

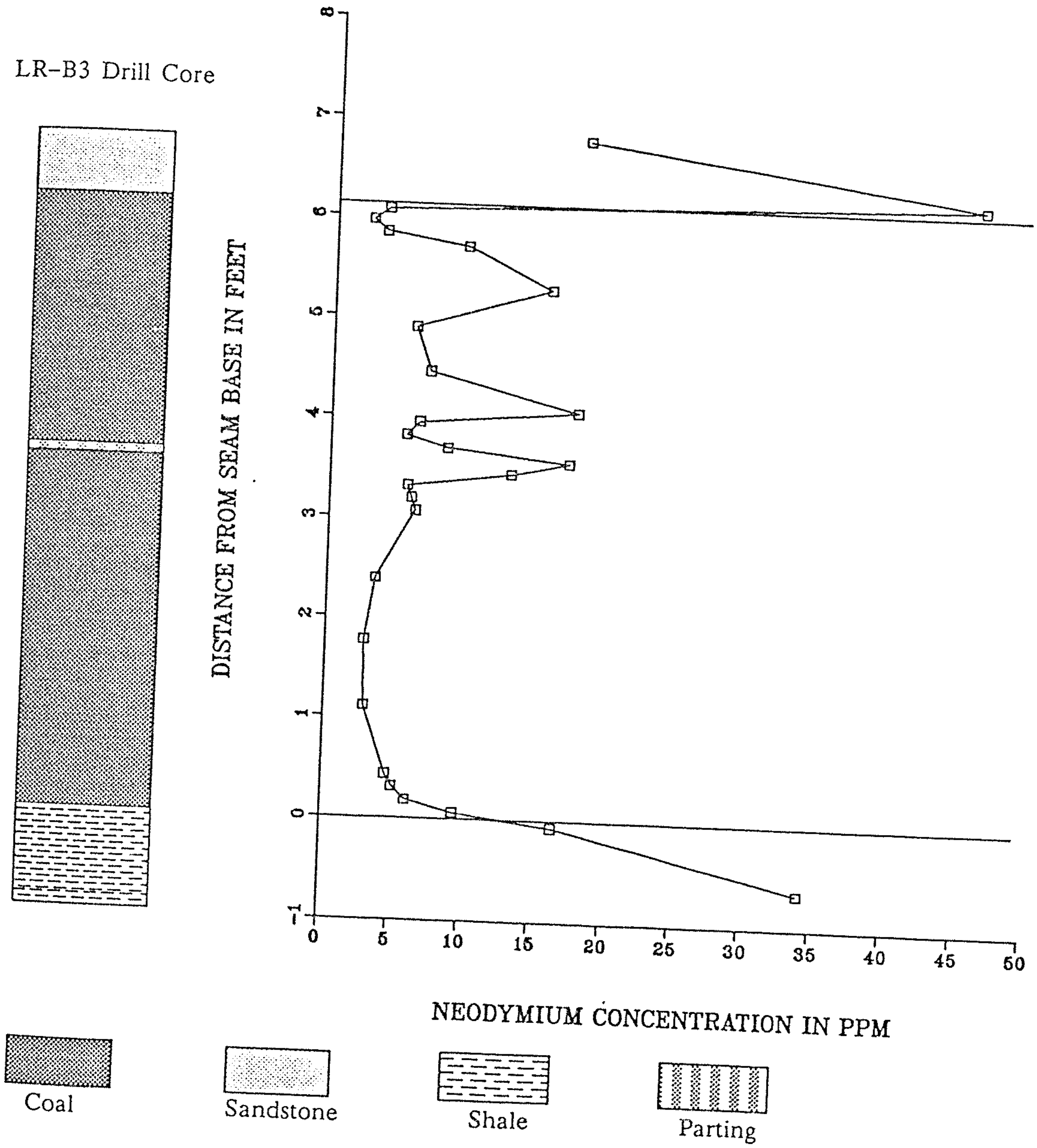


Figure D-199.

LANTHANUM DISTRIBUTION
IN THE YORK CANYON "A" AND "MAIN" SEAMS

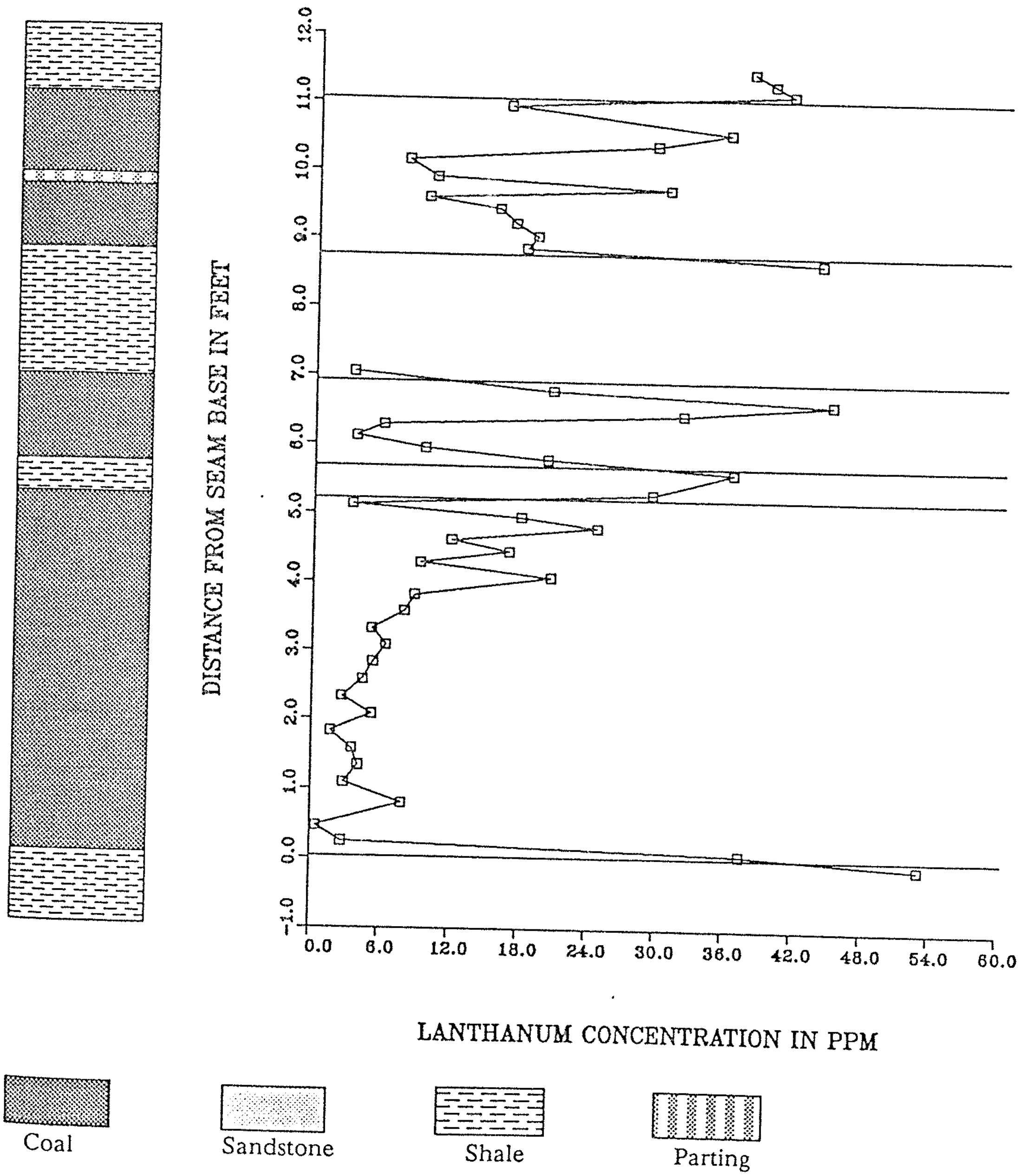


Figure D-200.

CERIUM DISTRIBUTION
IN THE YORK CANYON "A" AND "MAIN" SEAMS

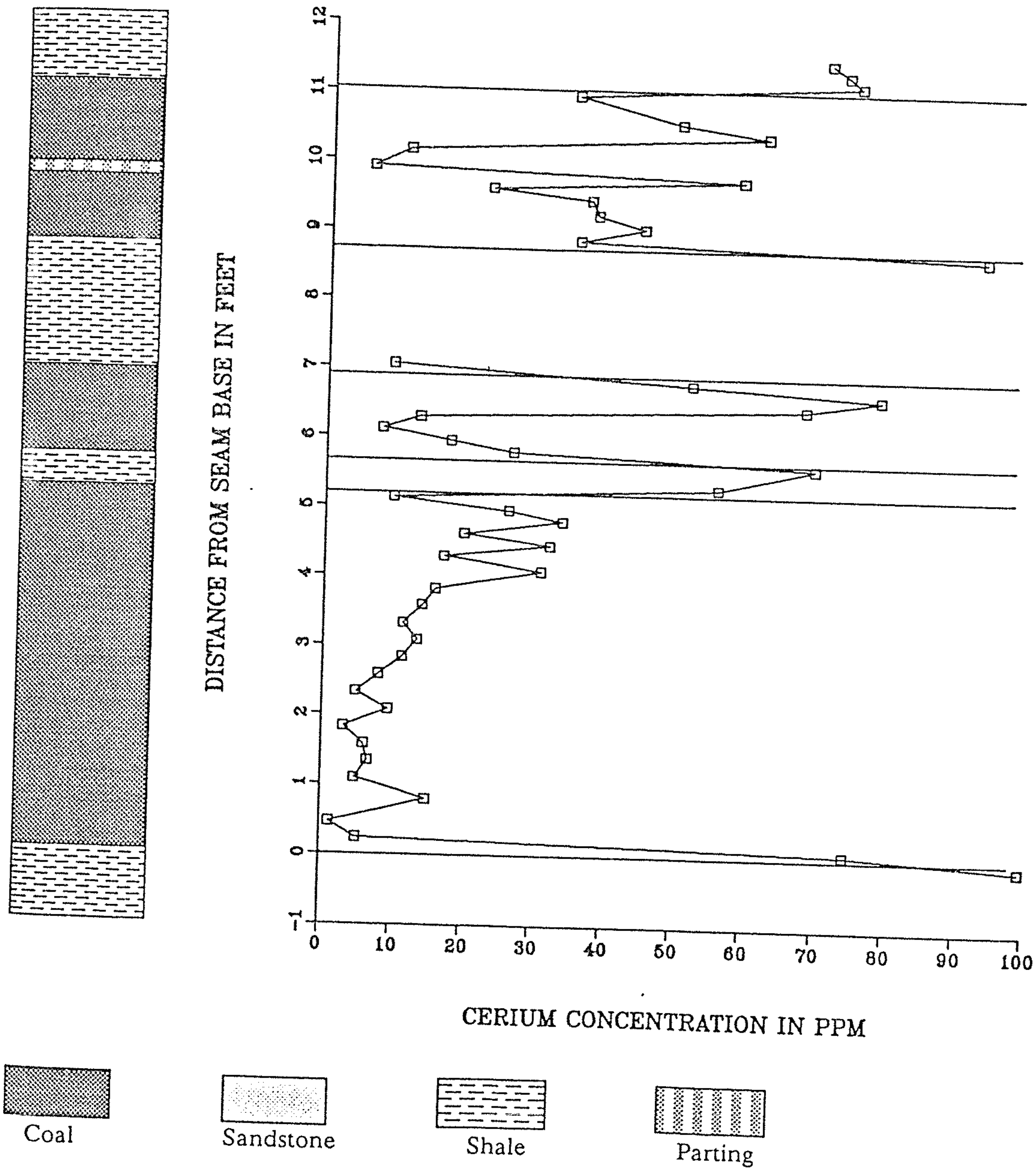


Figure D-201.

NEODYMIUM DISTRIBUTION
IN THE YORK CANYON "A" AND "MAIN" SEAMS

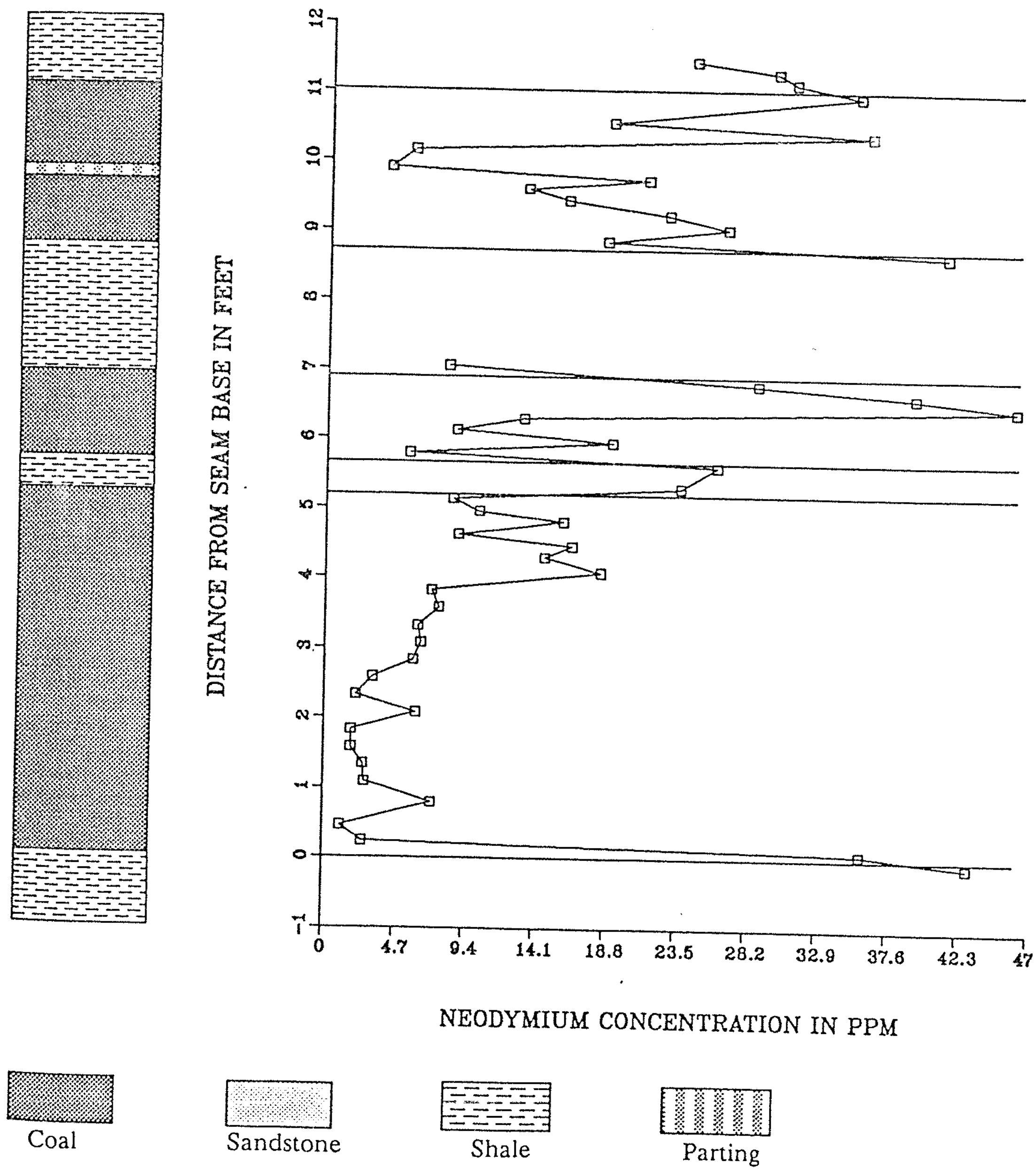


Figure D-202.

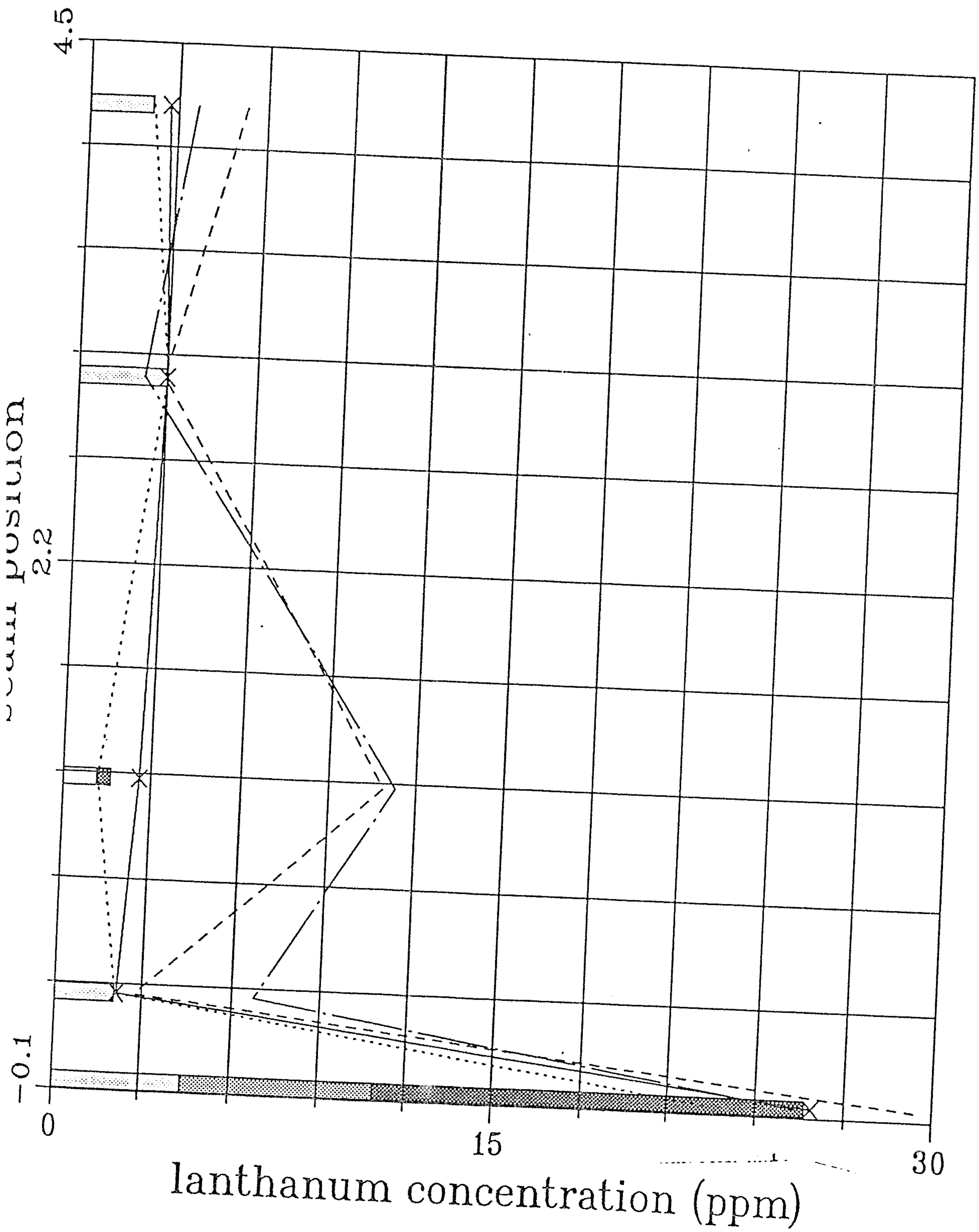


Figure D-203. Lanthanum float-clay-sink distributions in the LRA2 seam.

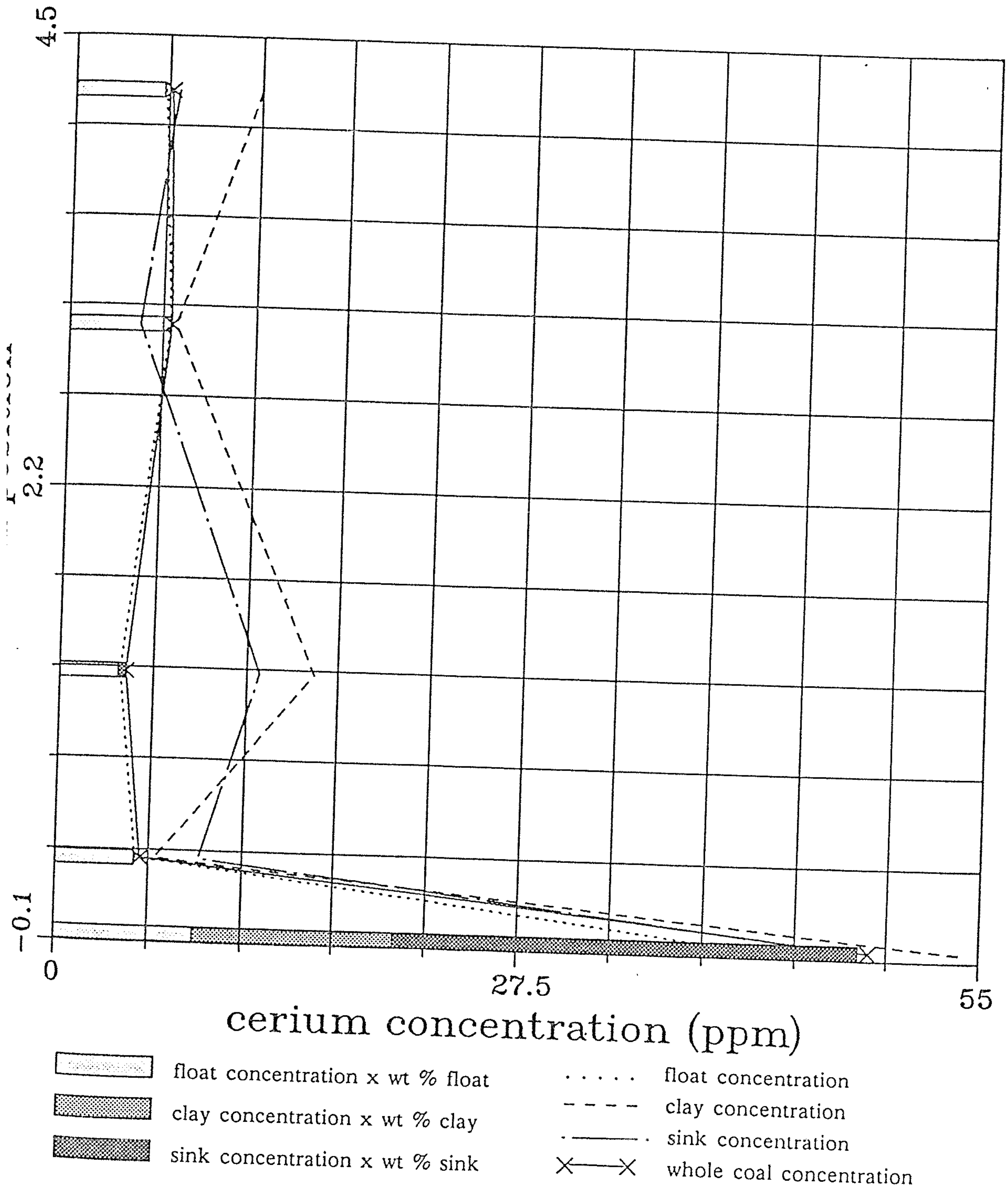


Figure D-204. Cerium float-clay-sink distribution in the LRA2 seam.

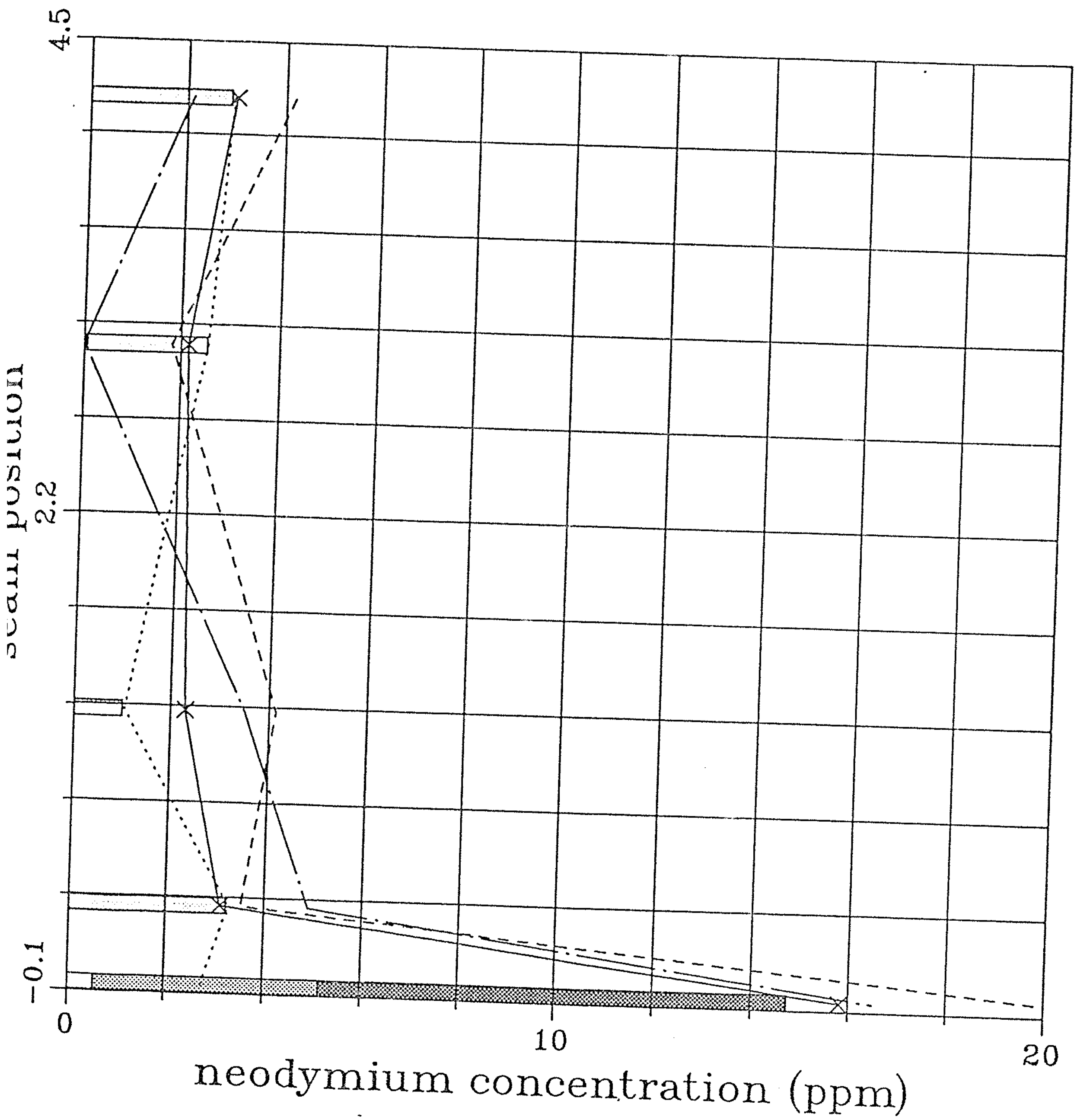


Figure D-205. Neodymium float-clay-sink distributions in the LRA2 seam.

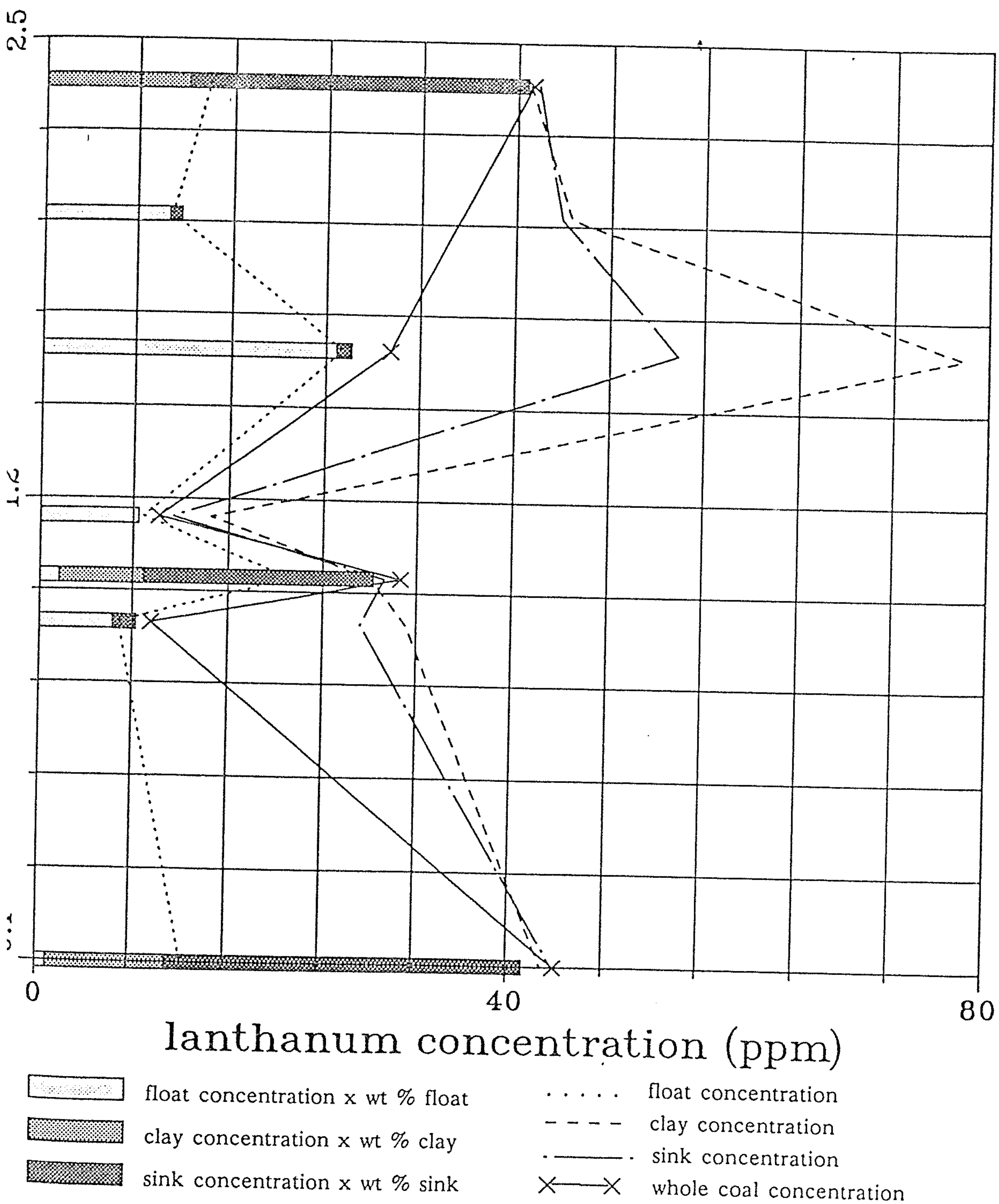


Figure D-206. Lanthanum float-clay-sink distributions in the YA seam.

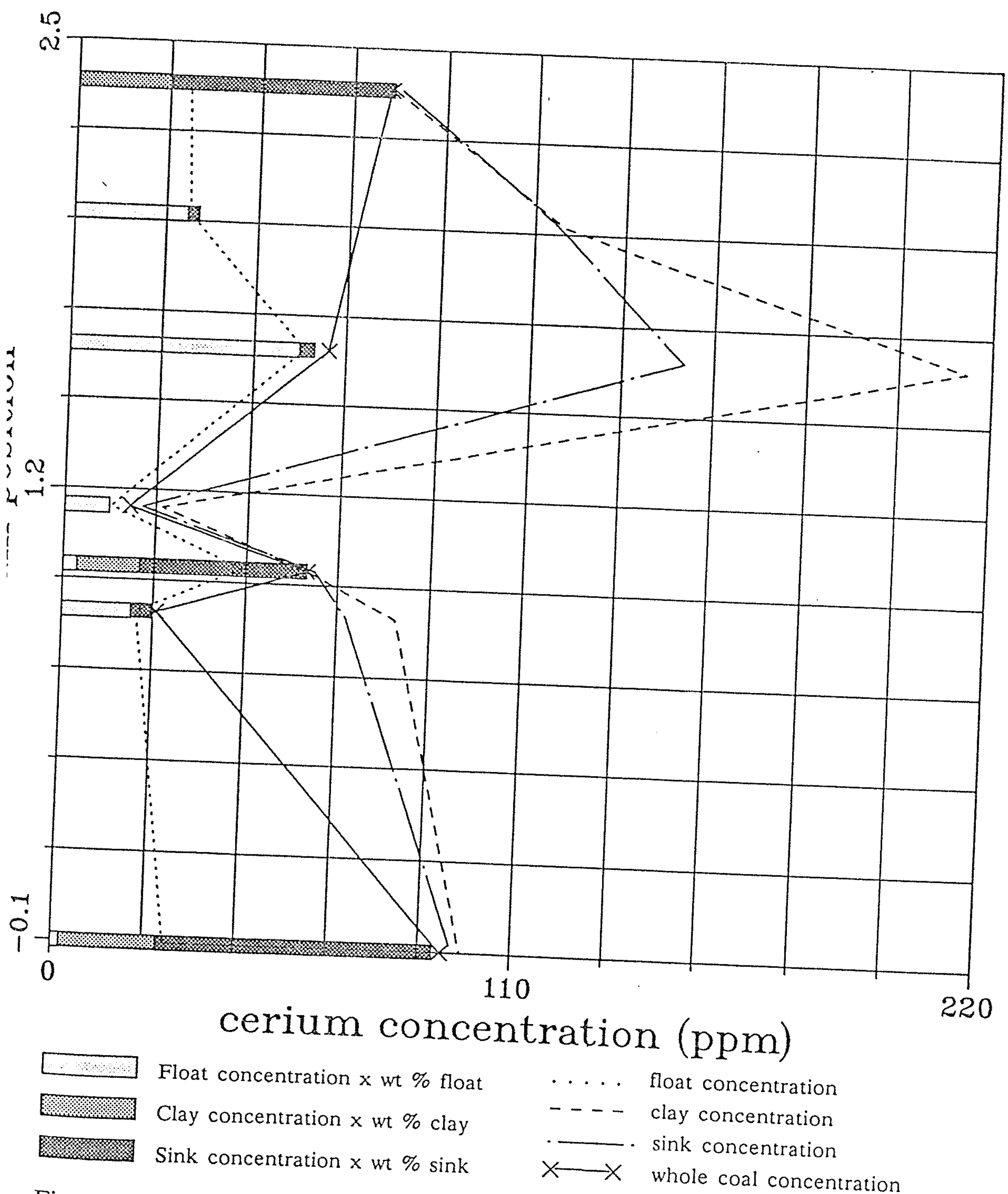
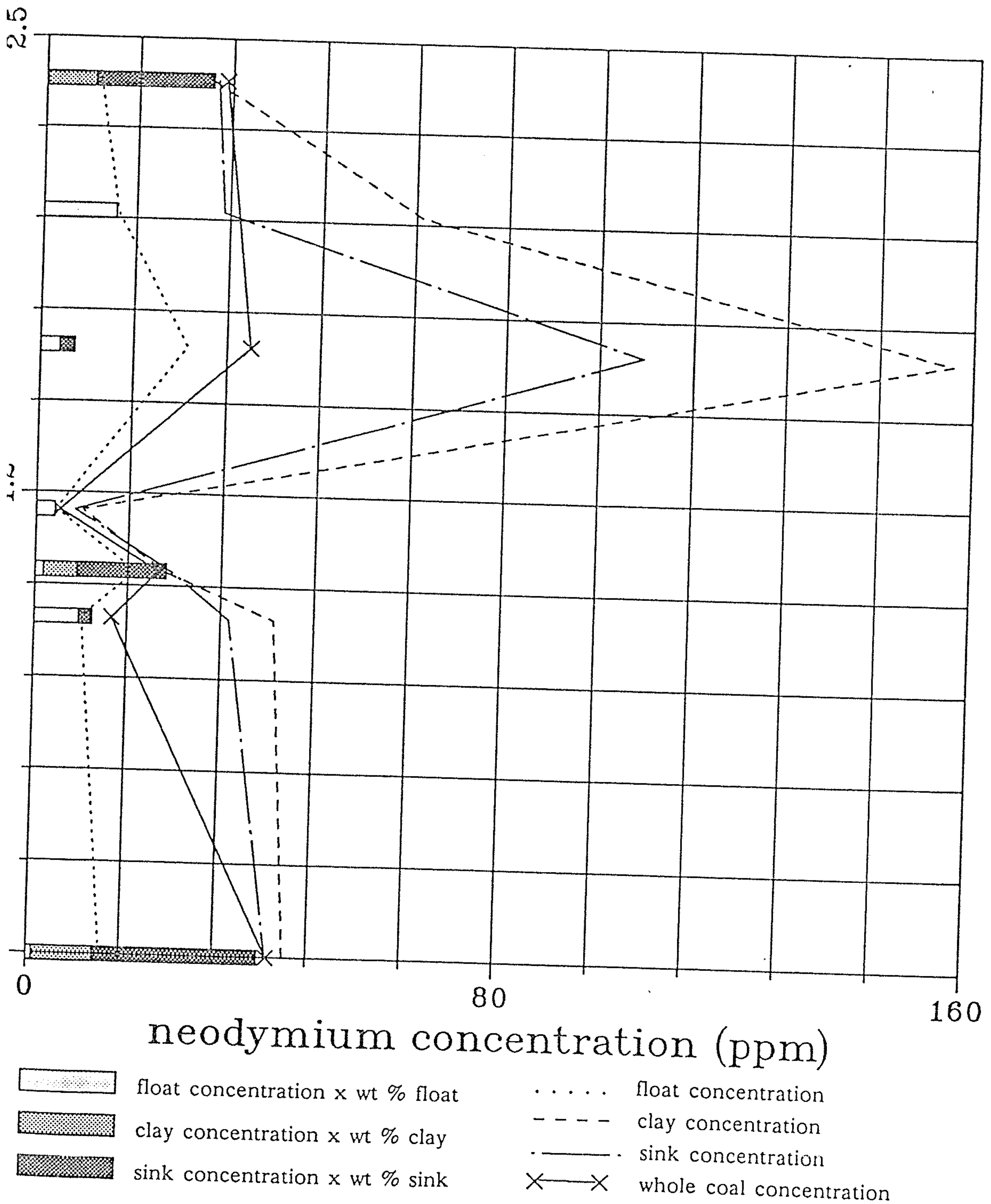
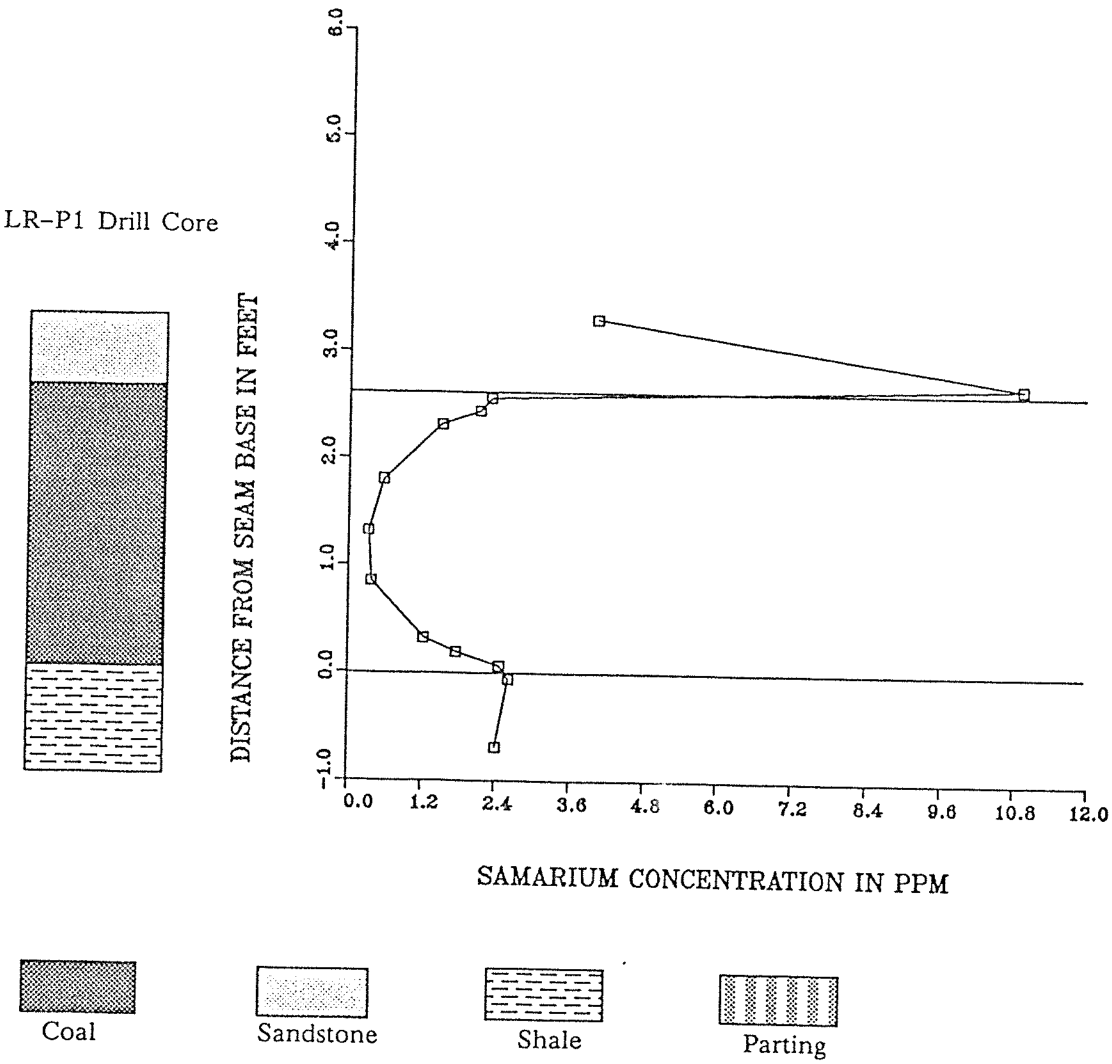


Figure D-207. Cerium float-clay-sink distributions in the YA seam.



igure D-208. Neodymiun float-clay-sink distributions in the YA seam.

SAMARIUM DISTRIBUTION
IN THE LEE RANCH P1 DRILL CORE



D-209.

EUROPIUM DISTRIBUTION IN THE LEE RANCH P1 DRILL CORE

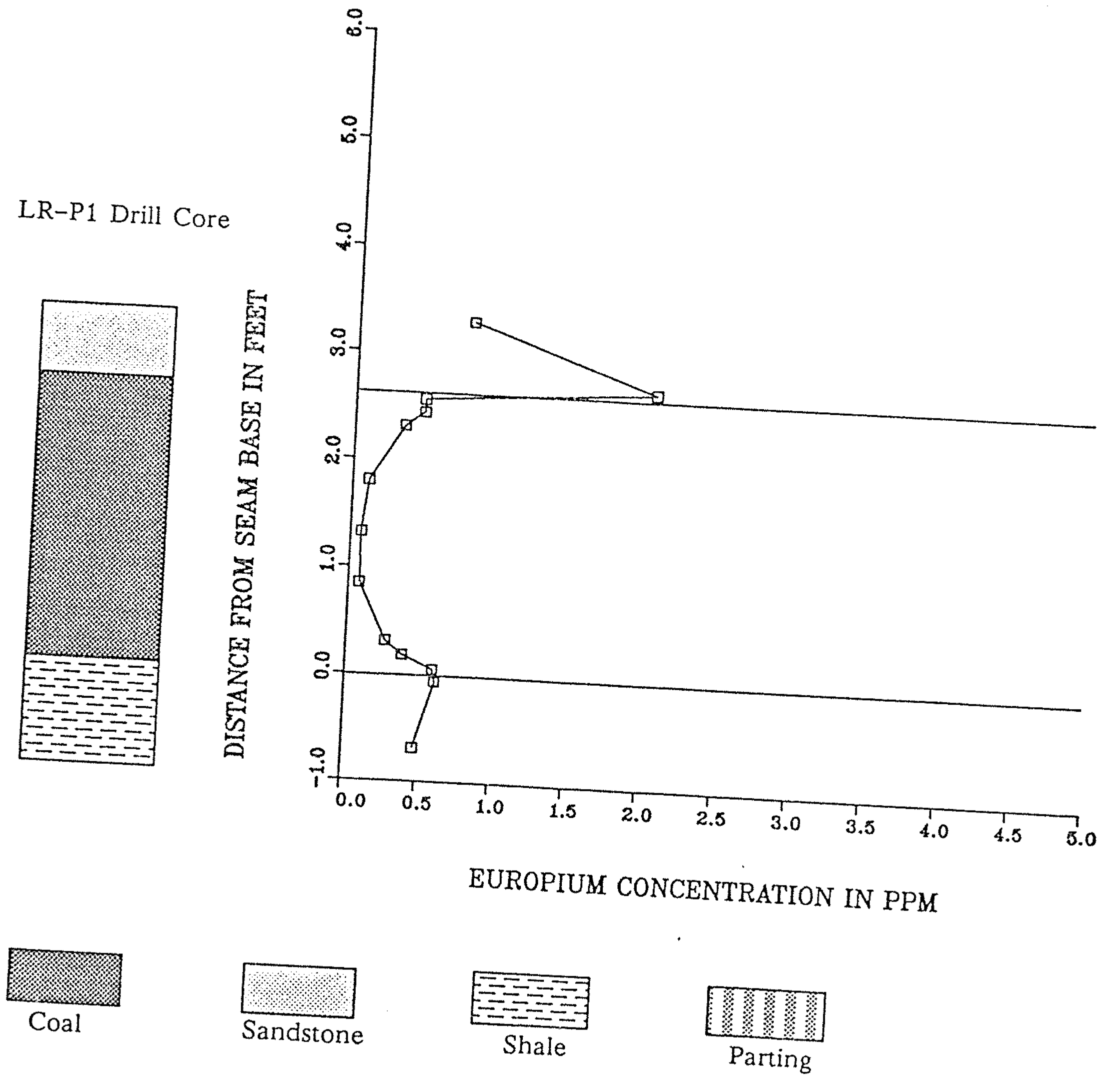


Figure D-210.

SAMARIUM DISTRIBUTION
IN THE LEE RANCH P2 DRILL CORE

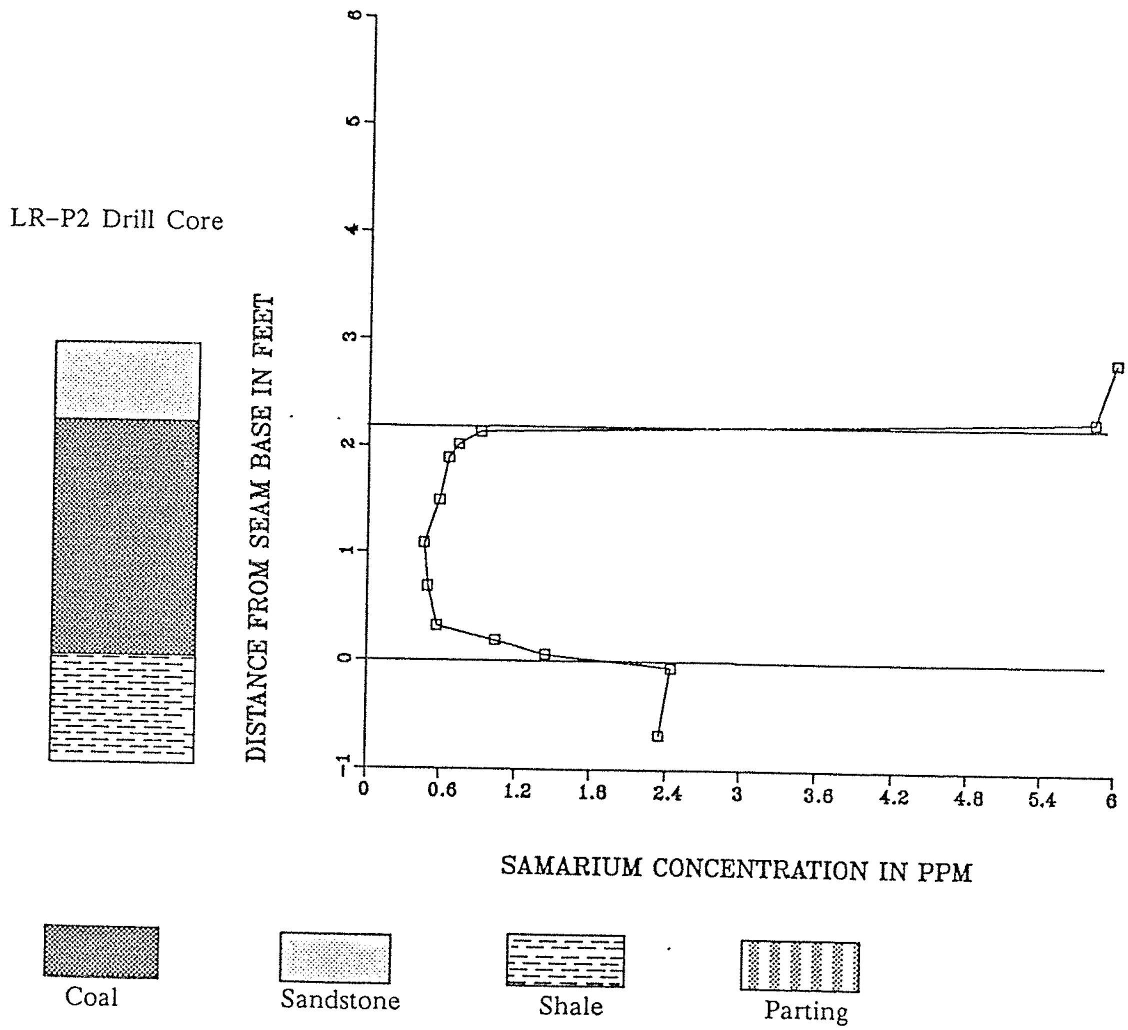


Figure D-211.

EUROPIUM DISTRIBUTION IN THE LEE RANCH P2 DRILL CORE

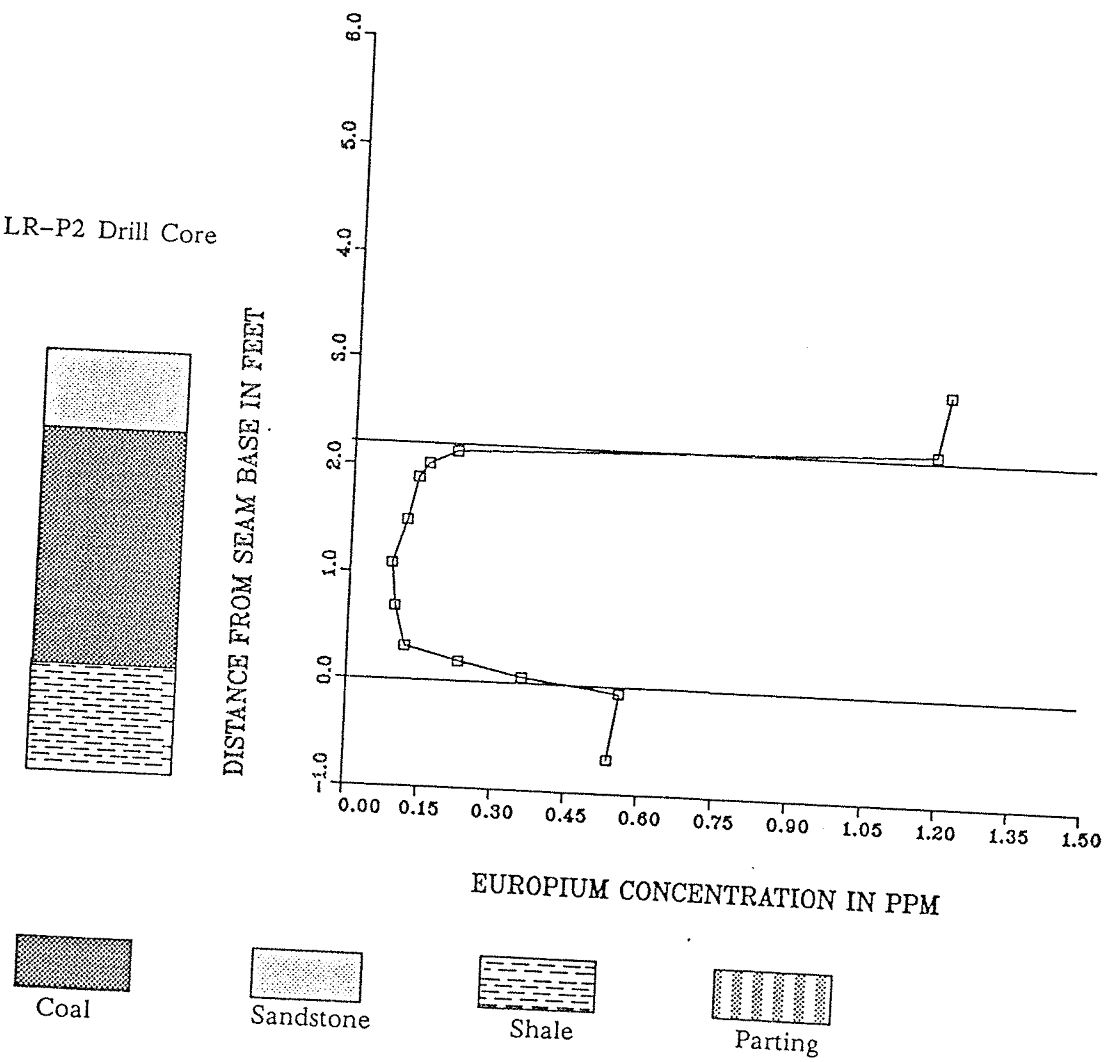


Figure D-212.

SAMARIUM DISTRIBUTION
IN THE LEE RANCH A2 DRILL CORE

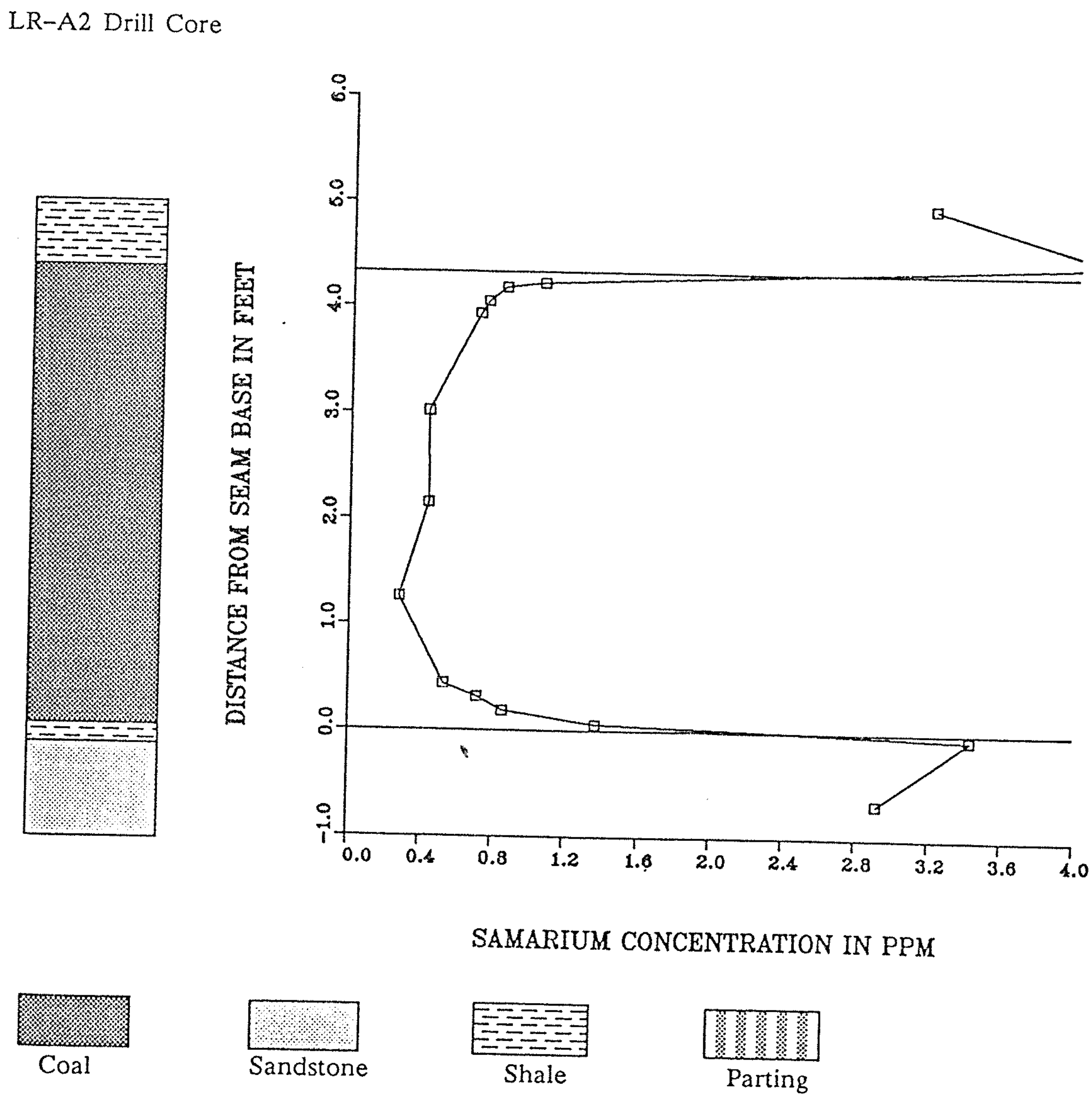


Figure D-213.

EUROPIUM DISTRIBUTION
IN THE LEE RANCH A2 DRILL CORE

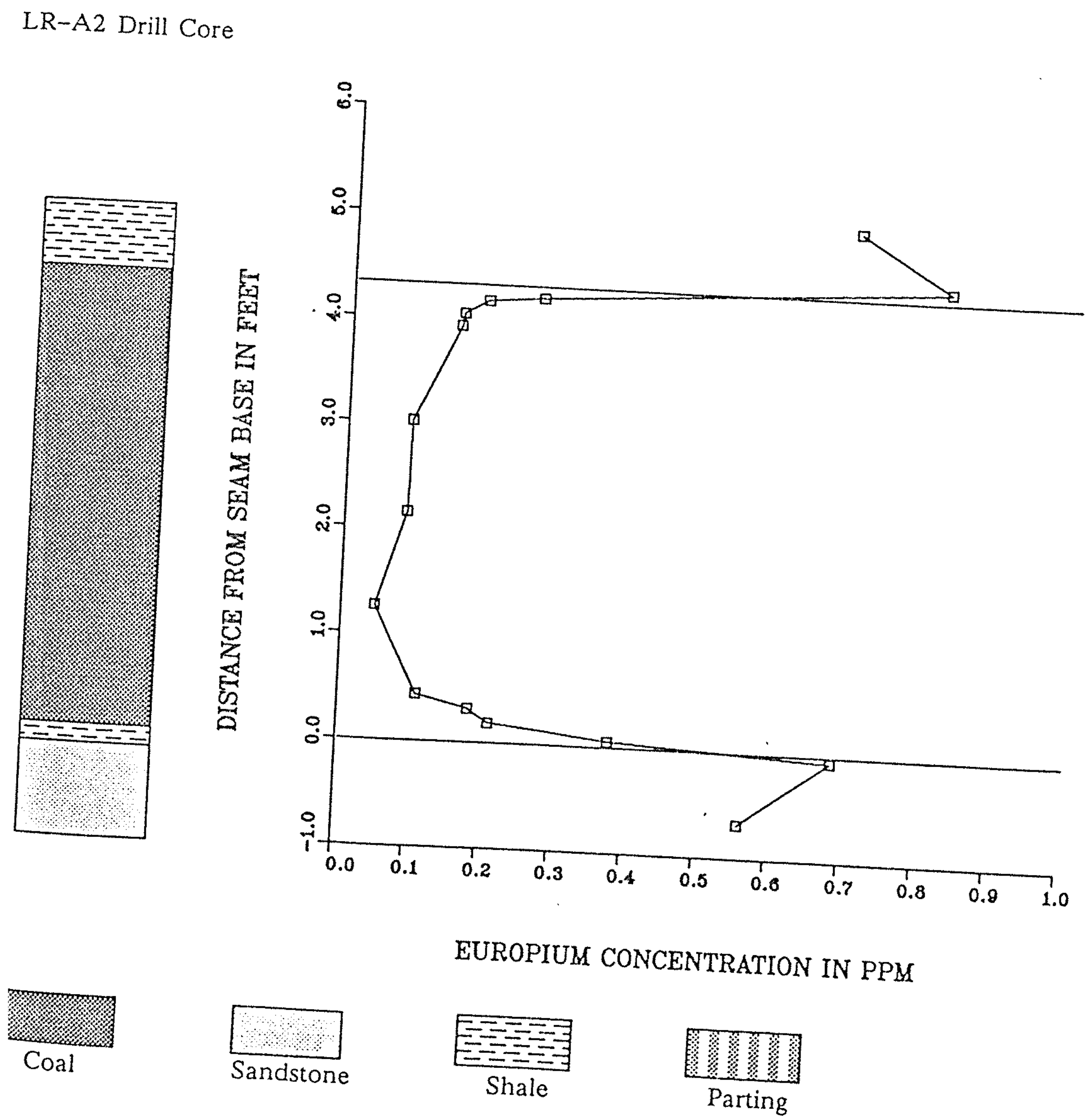


Figure D-214.

SAMARIUM DISTRIBUTION IN THE LEE RANCH A3 DRILL CORE

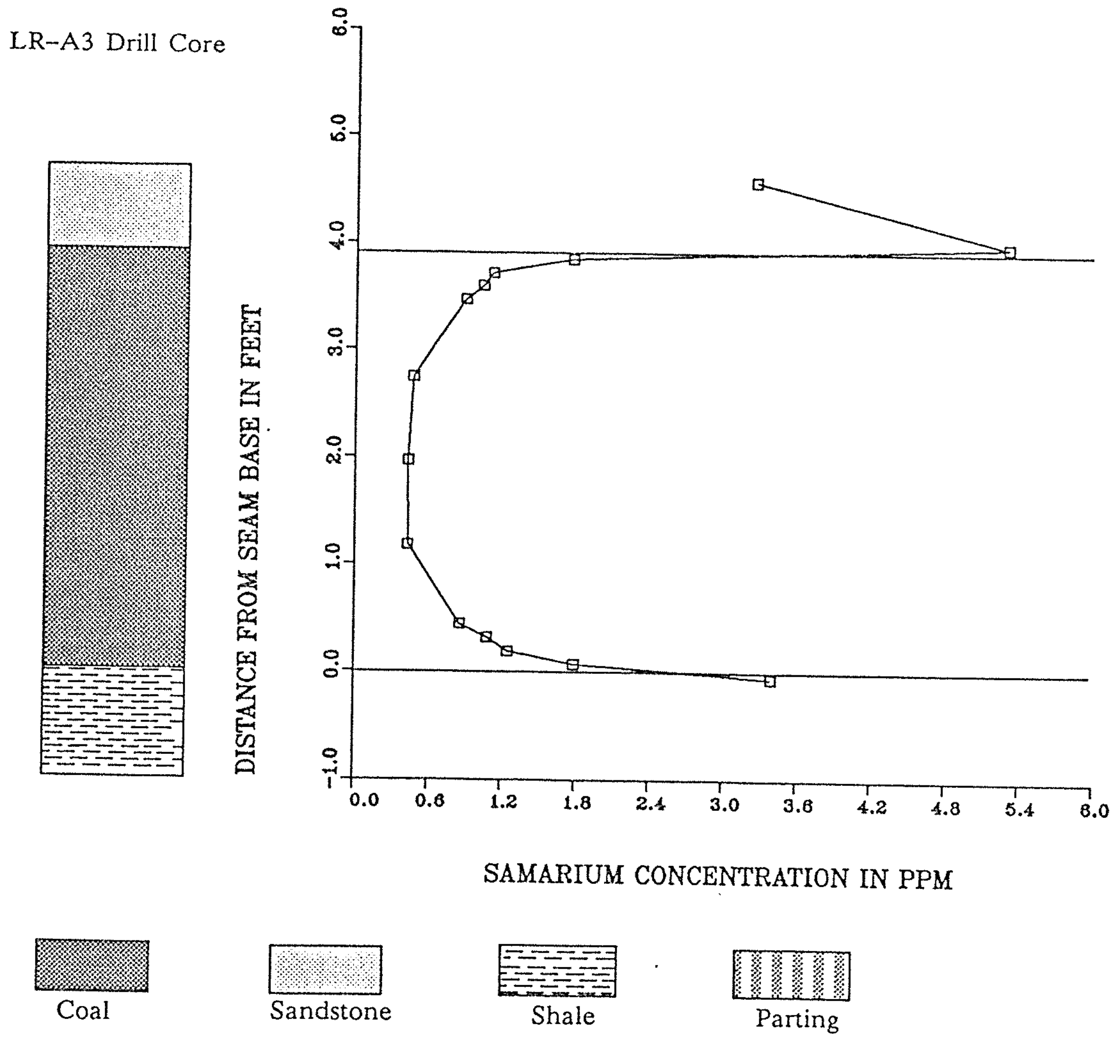


Figure D-215.

EUROPIUM DISTRIBUTION IN THE LEE RANCH A3 DRILL CORE

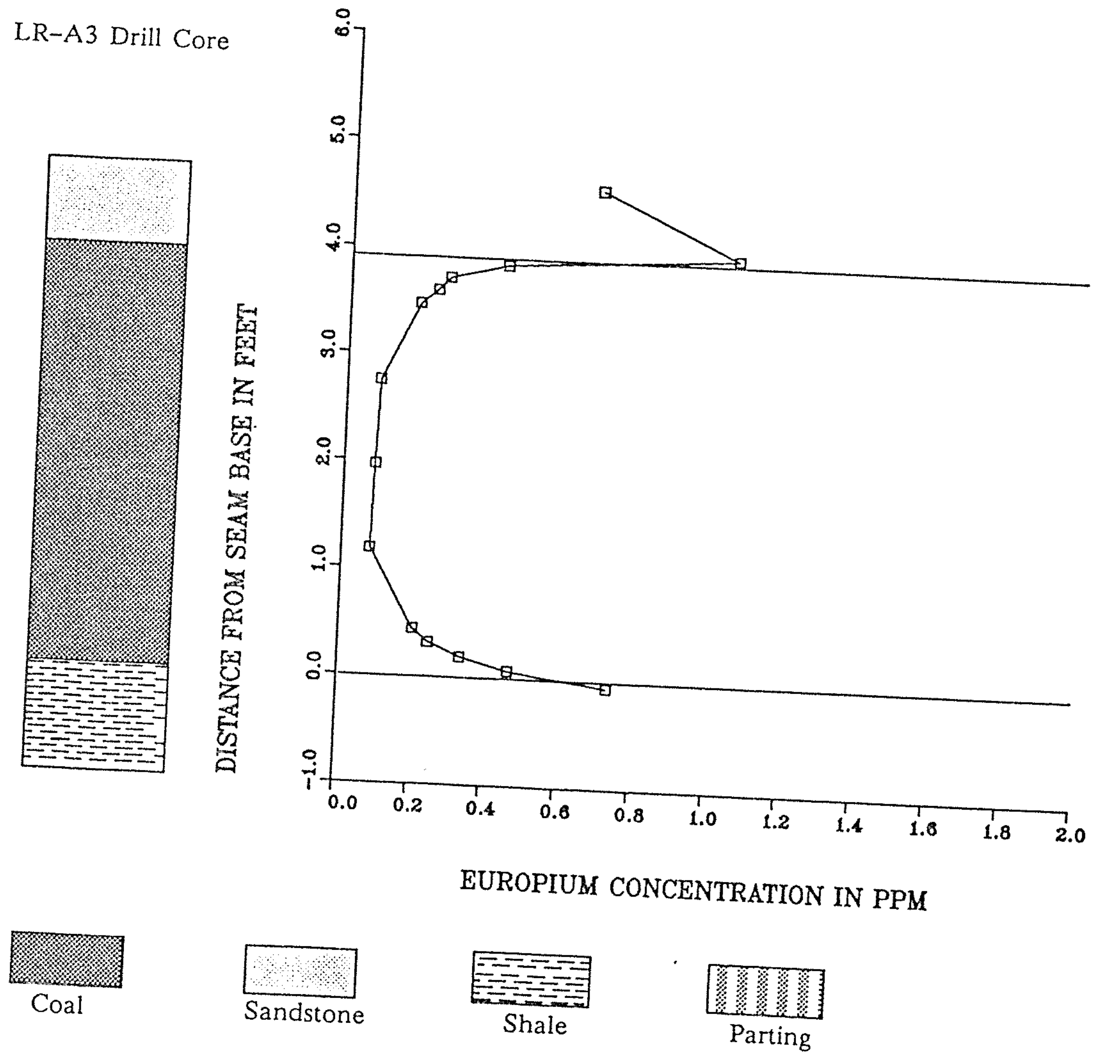


Figure D-216.

SAMARIUM DISTRIBUTION IN THE LEE RANCH B2 DRILL CORE

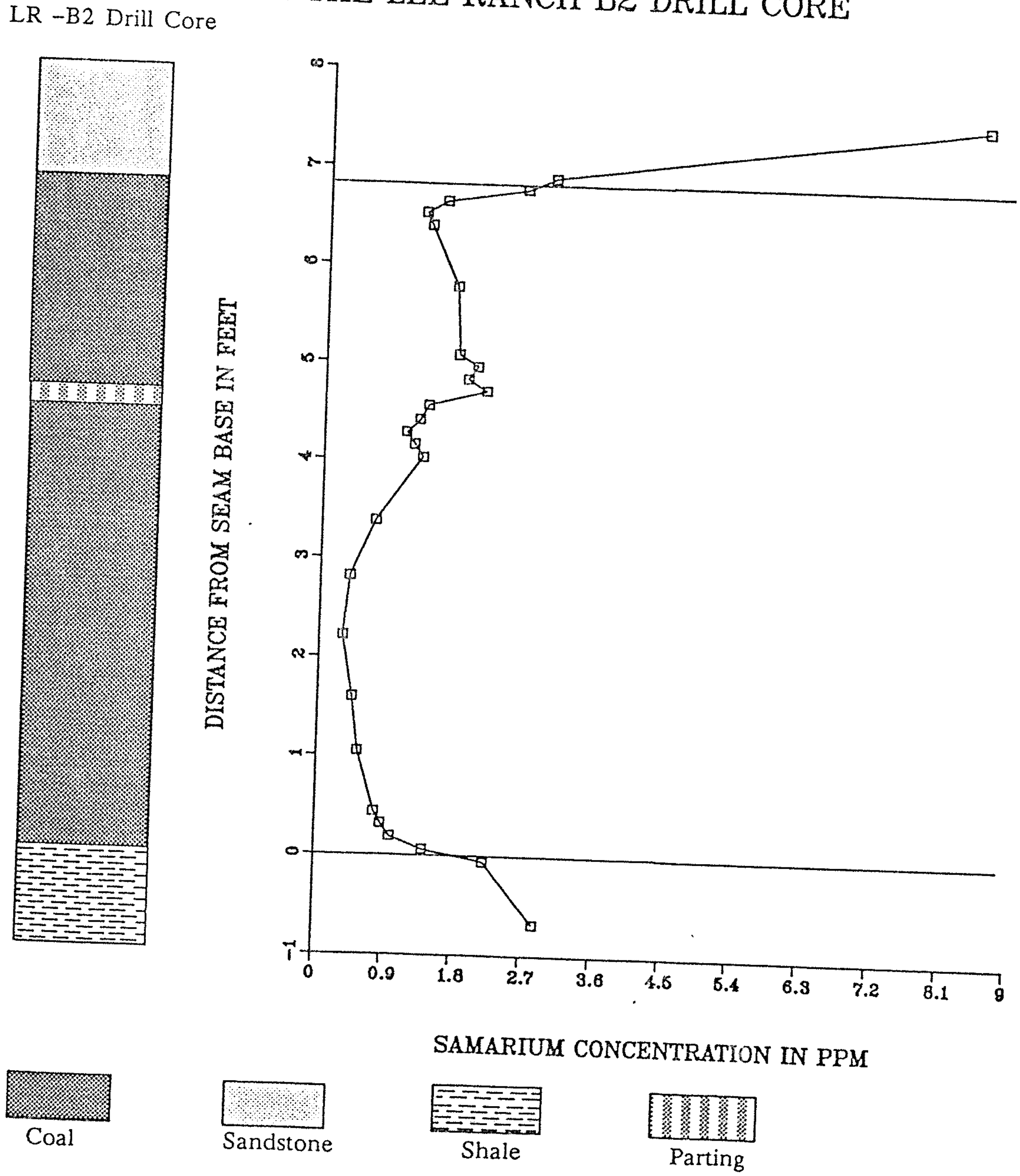


Figure D-217.

EUROPIUM DISTRIBUTION IN THE LEE RANCH B2 DRILL CORE

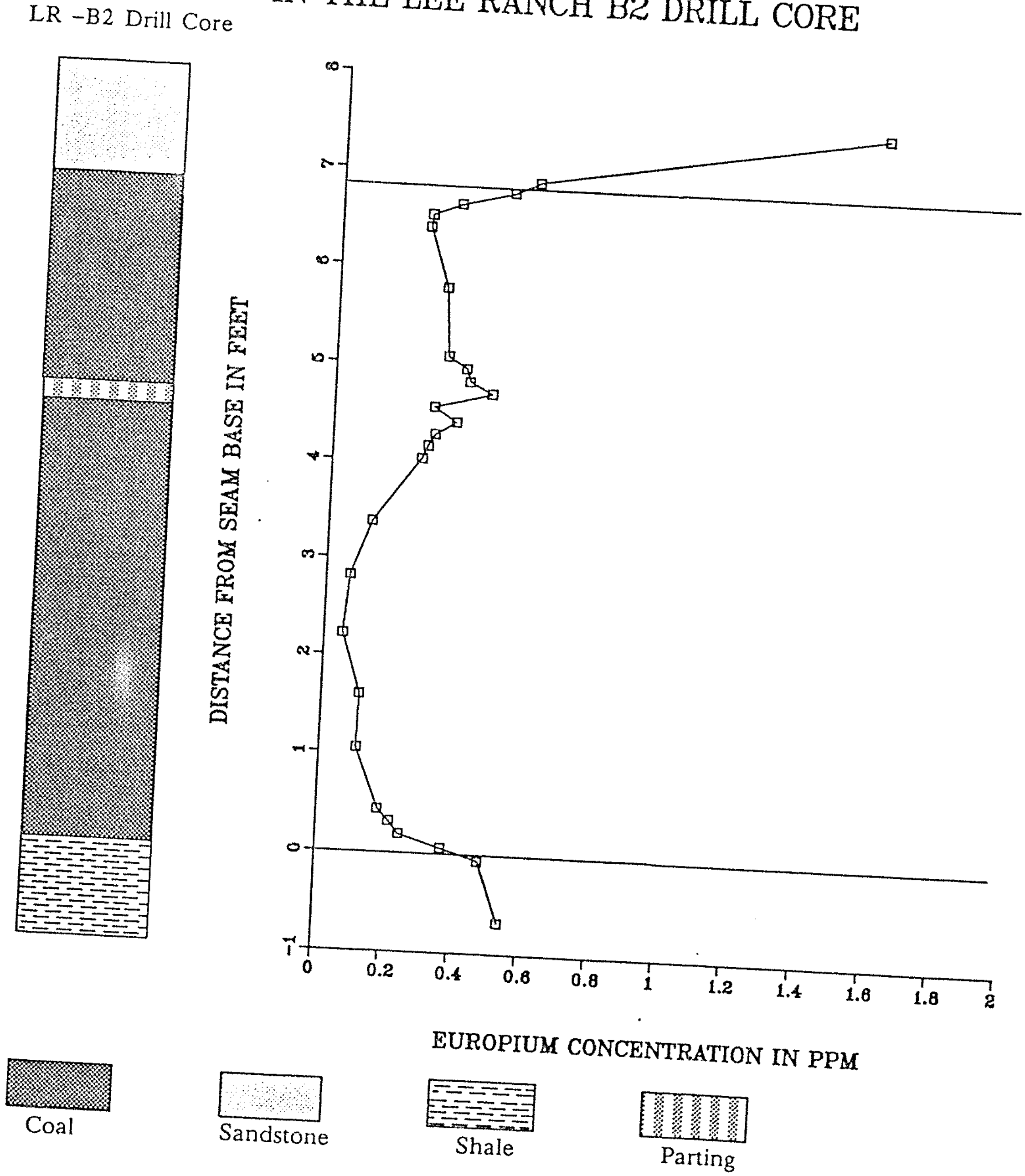


Figure D-218.

SAMARIUM DISTRIBUTION
IN THE YORK CANYON "A" AND "MAIN" SEAMS

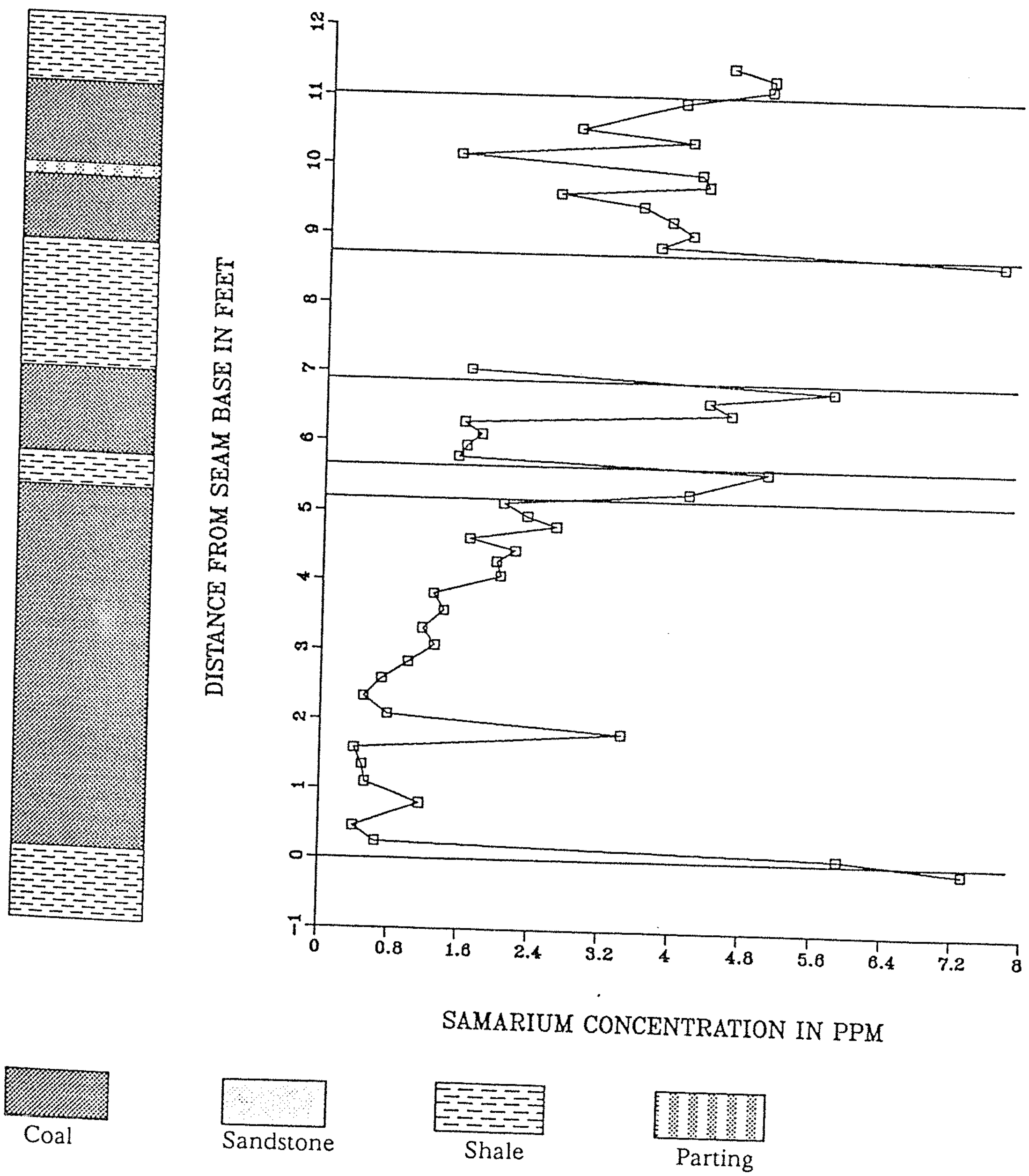


Figure D-221.

EUROPIUM DISTRIBUTION

IN THE YORK CANYON "A" AND "MAIN" SEAMS

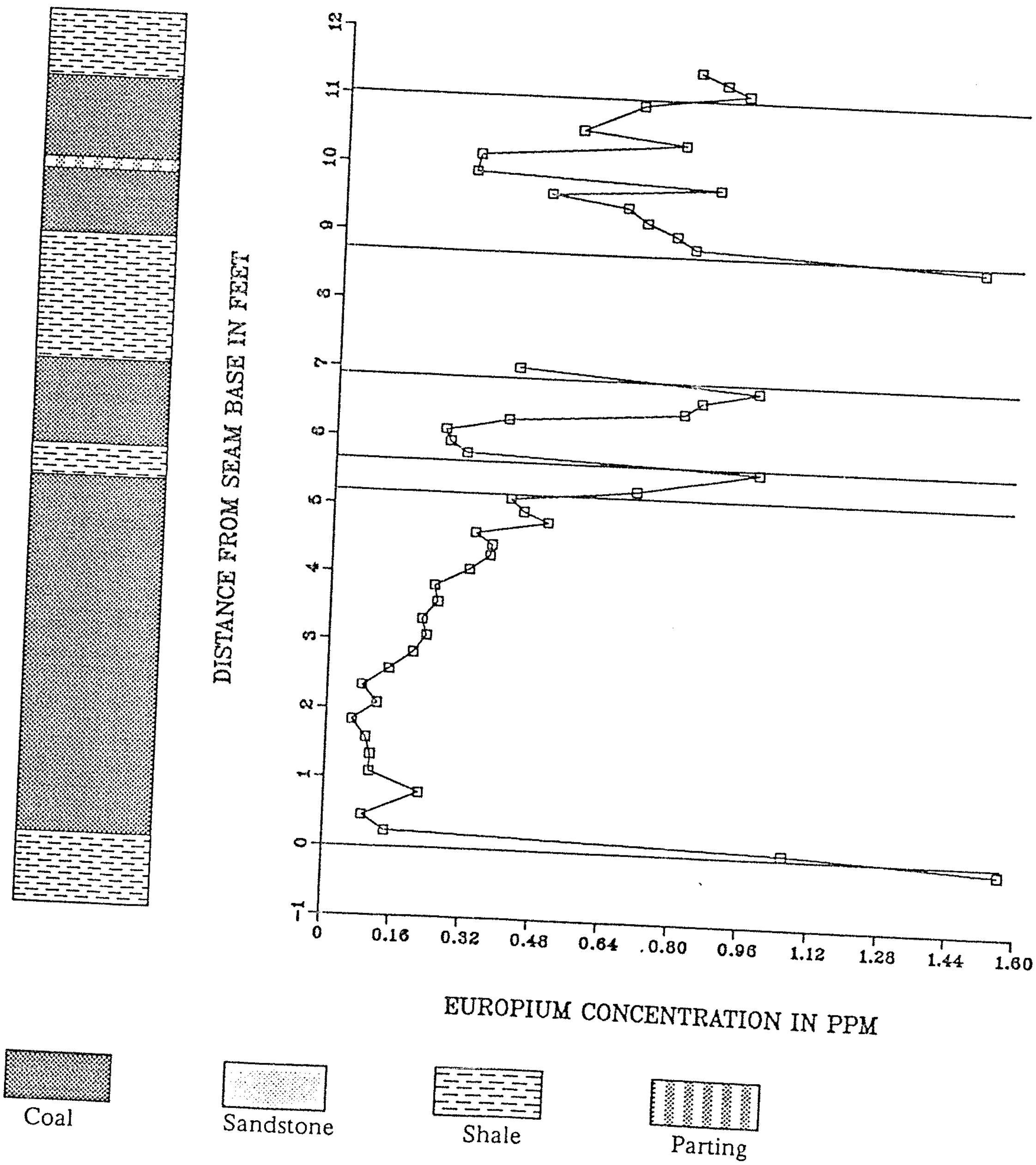


Figure D-222.

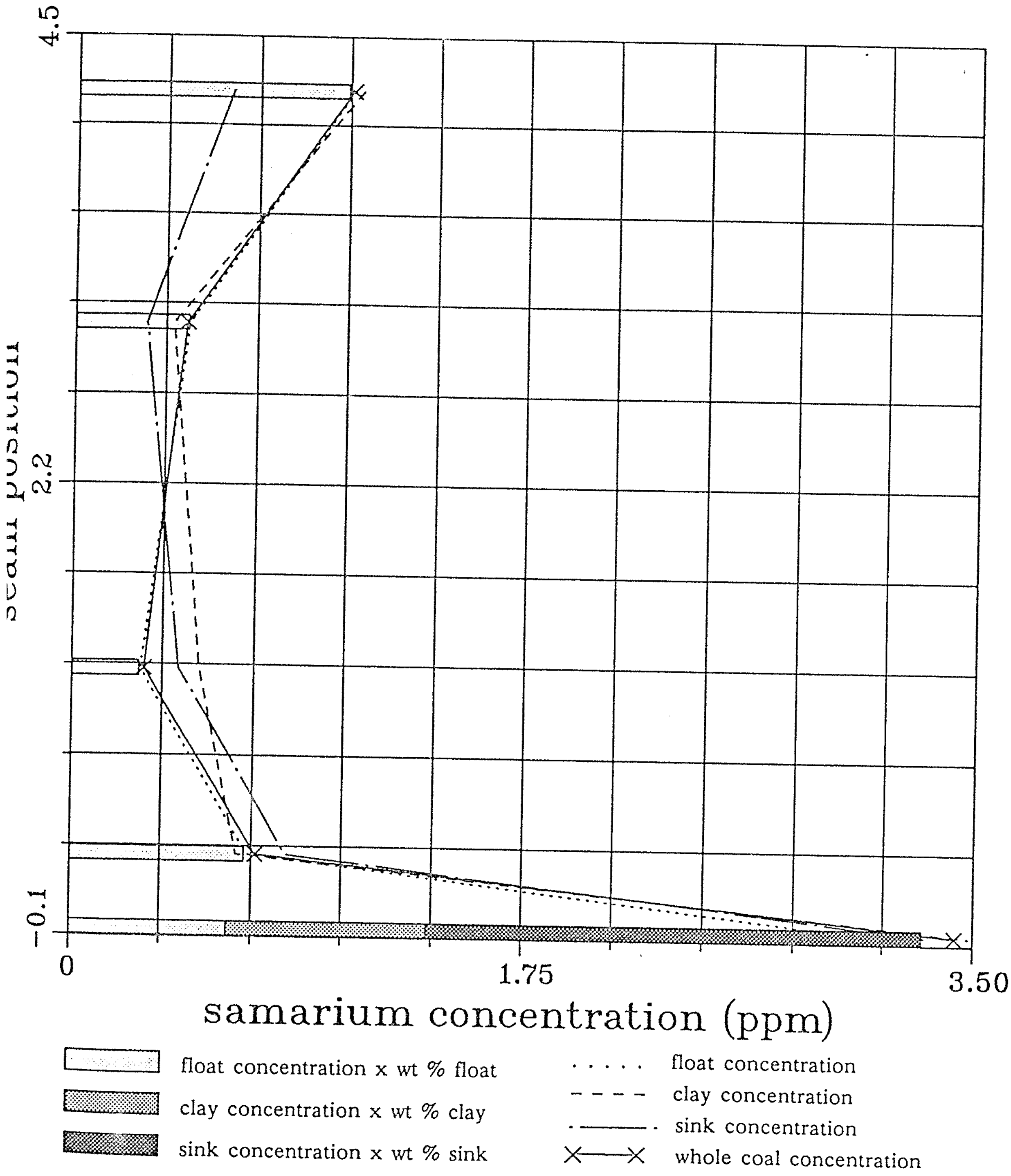


Figure D-223 Samarium float-clay-sink distributions in the LRA2 seam.

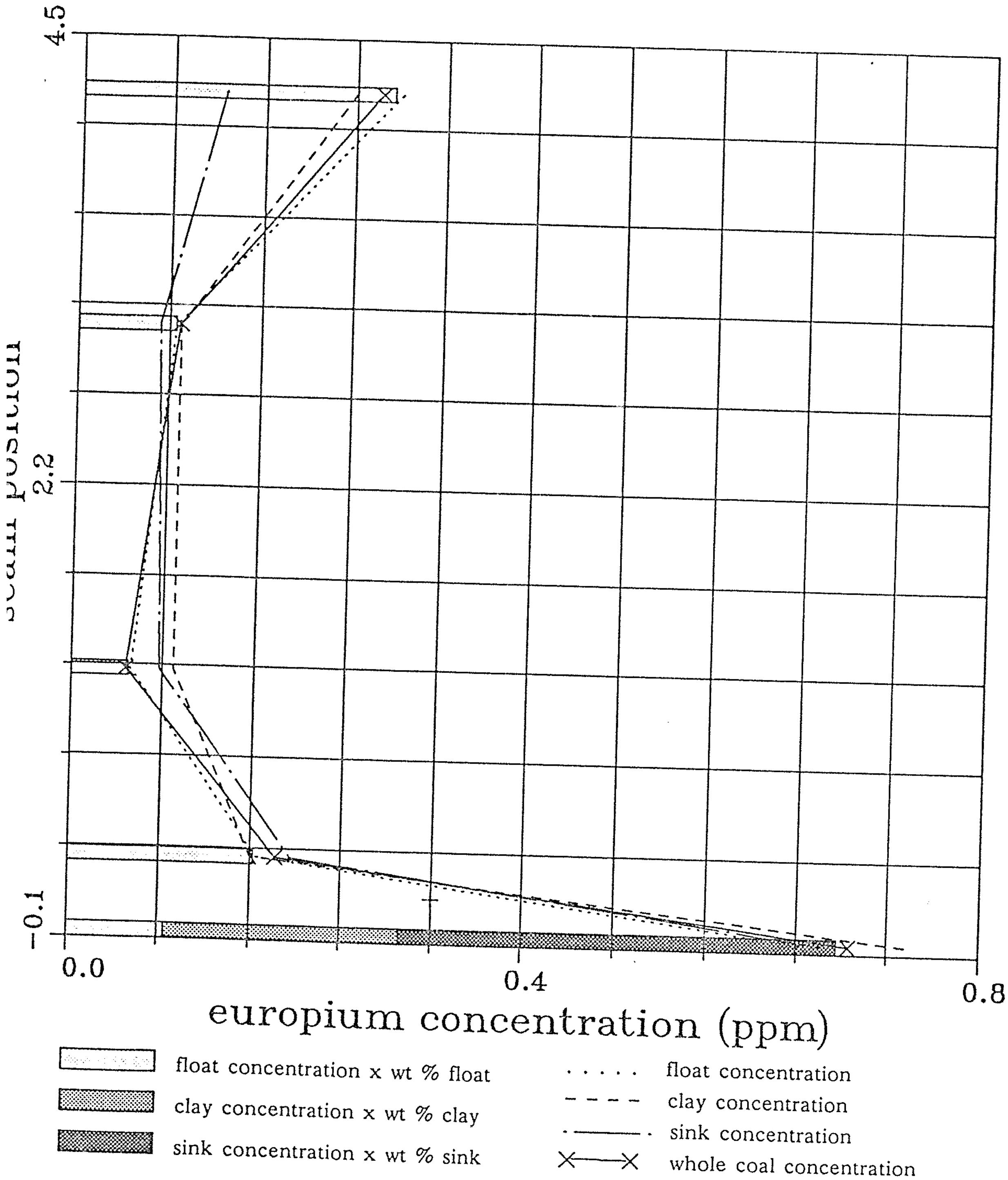


Figure D-224 Europium float-clay-sink distributions in the LRA2 seam.

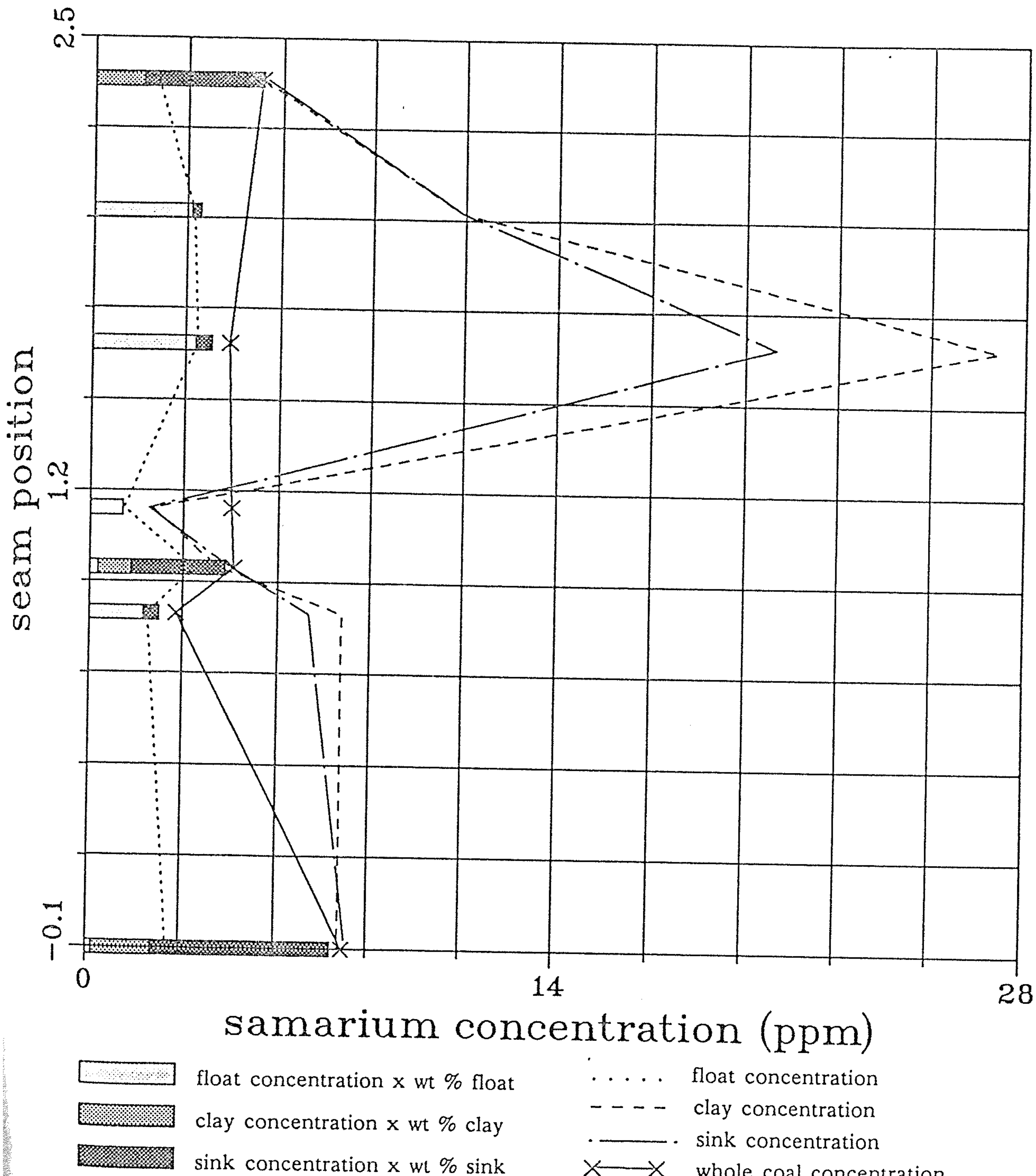


Figure D-225 Samarium float-clay-sink distributions in the YA seam.

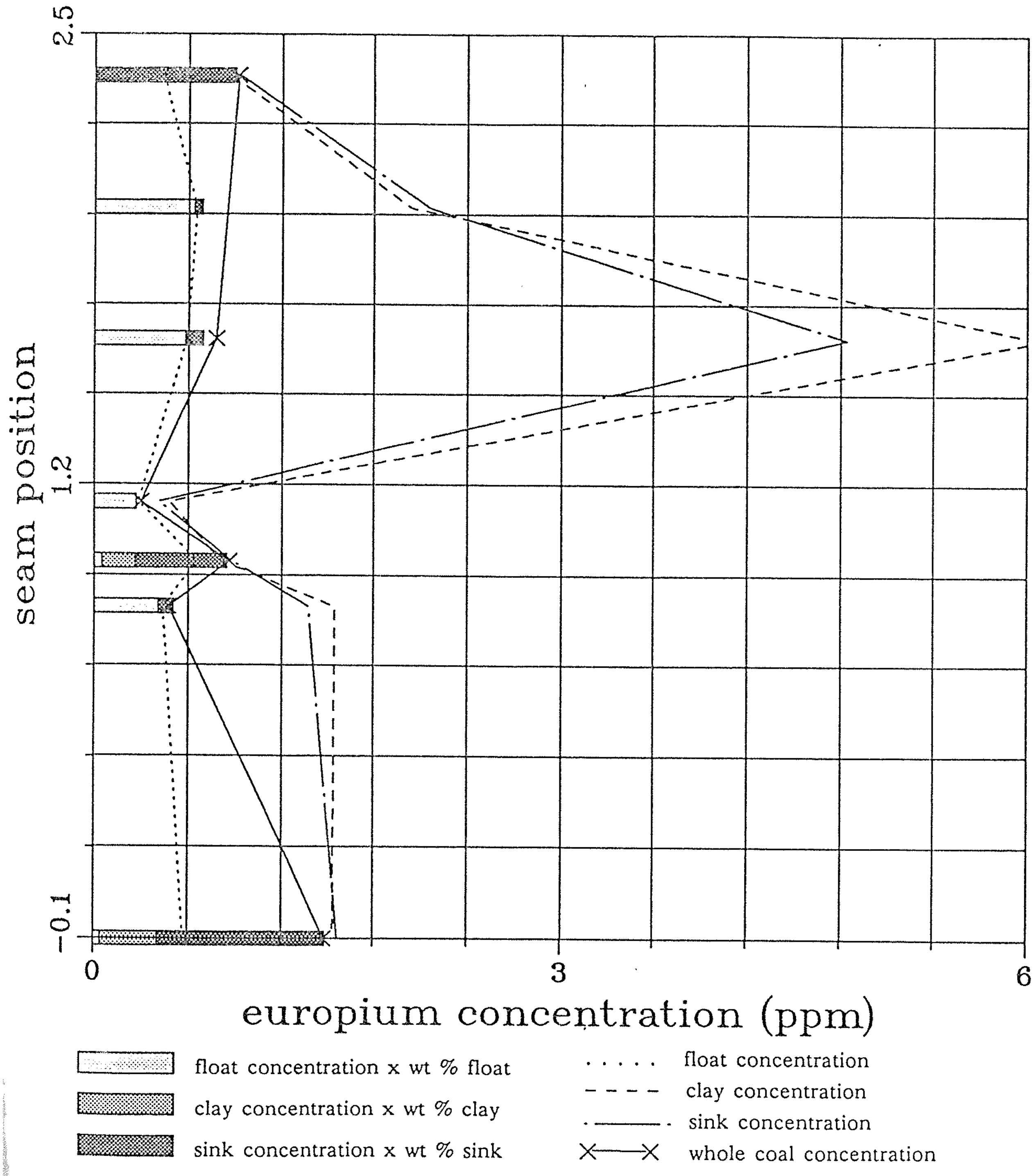


Figure D-226 Europium float-clay-sink distributions in the YA seam.

TERBIUM DISTRIBUTION IN THE LEE RANCH P1 DRILL CORE

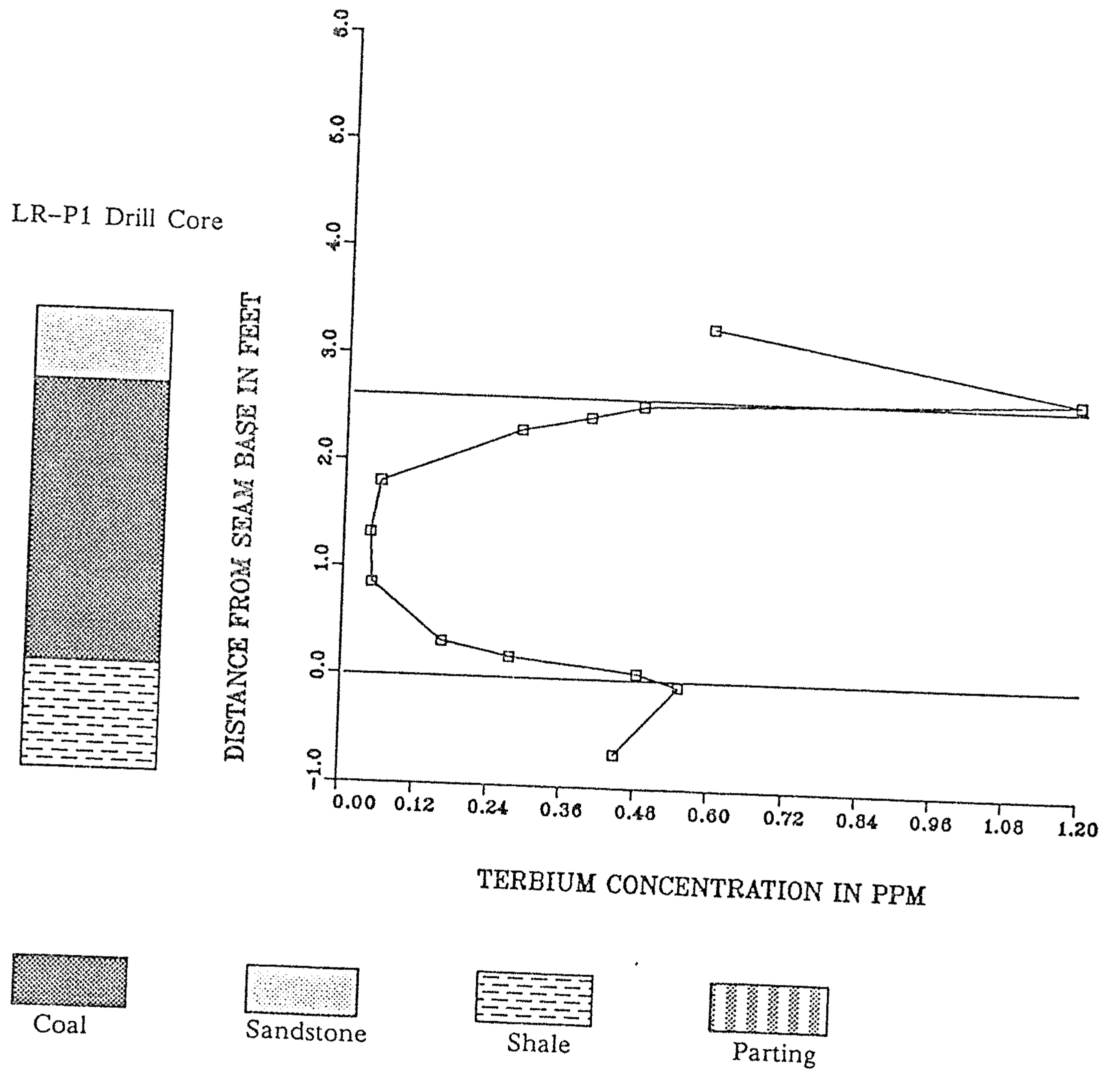


Figure D-227.

YTTERBIUM DISTRIBUTION IN THE LEE RANCH P1 DRILL CORE

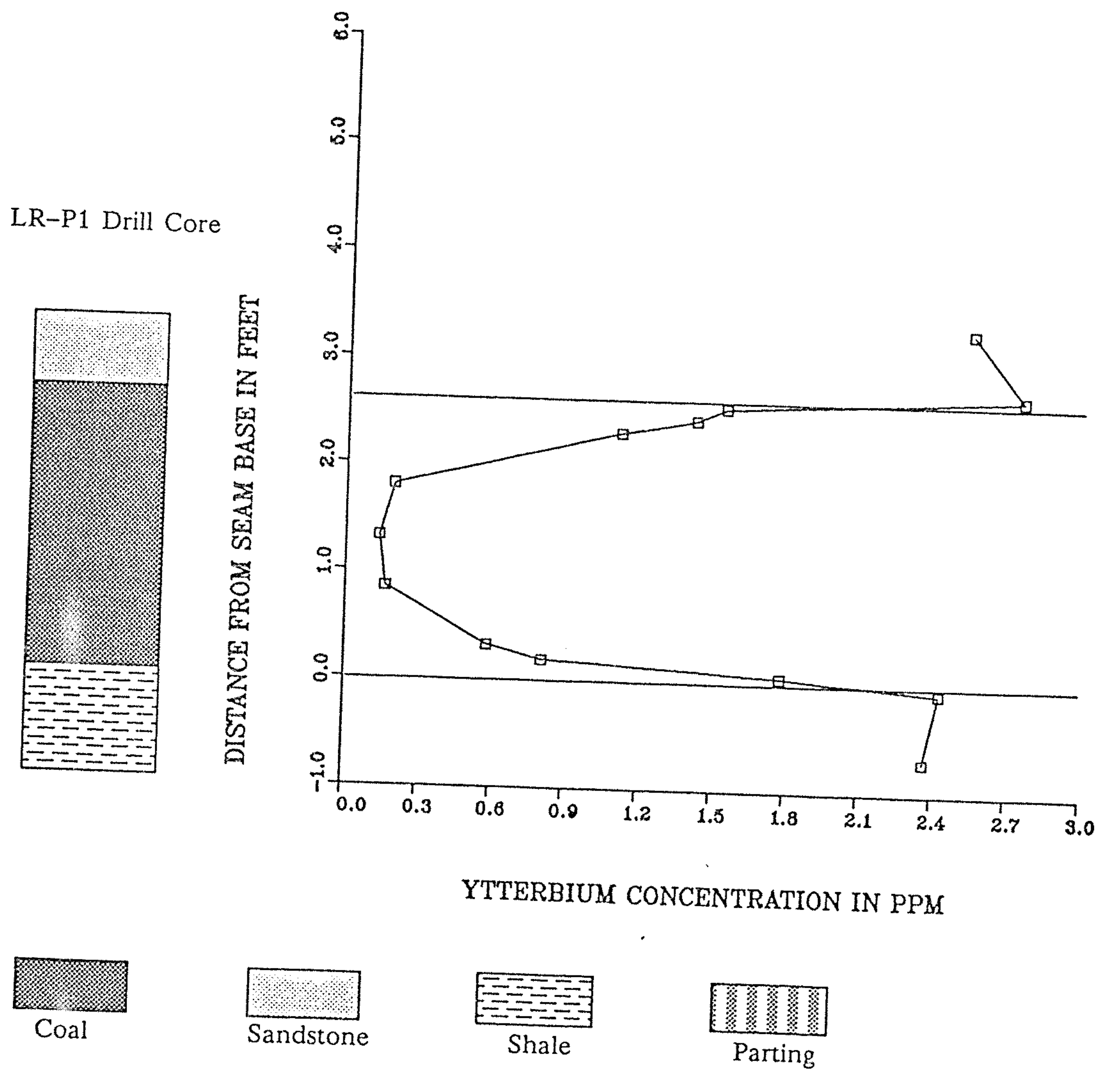


Figure D-228.

LUTETIUM DISTRIBUTION
IN THE LEE RANCH P1 DRILL CORE

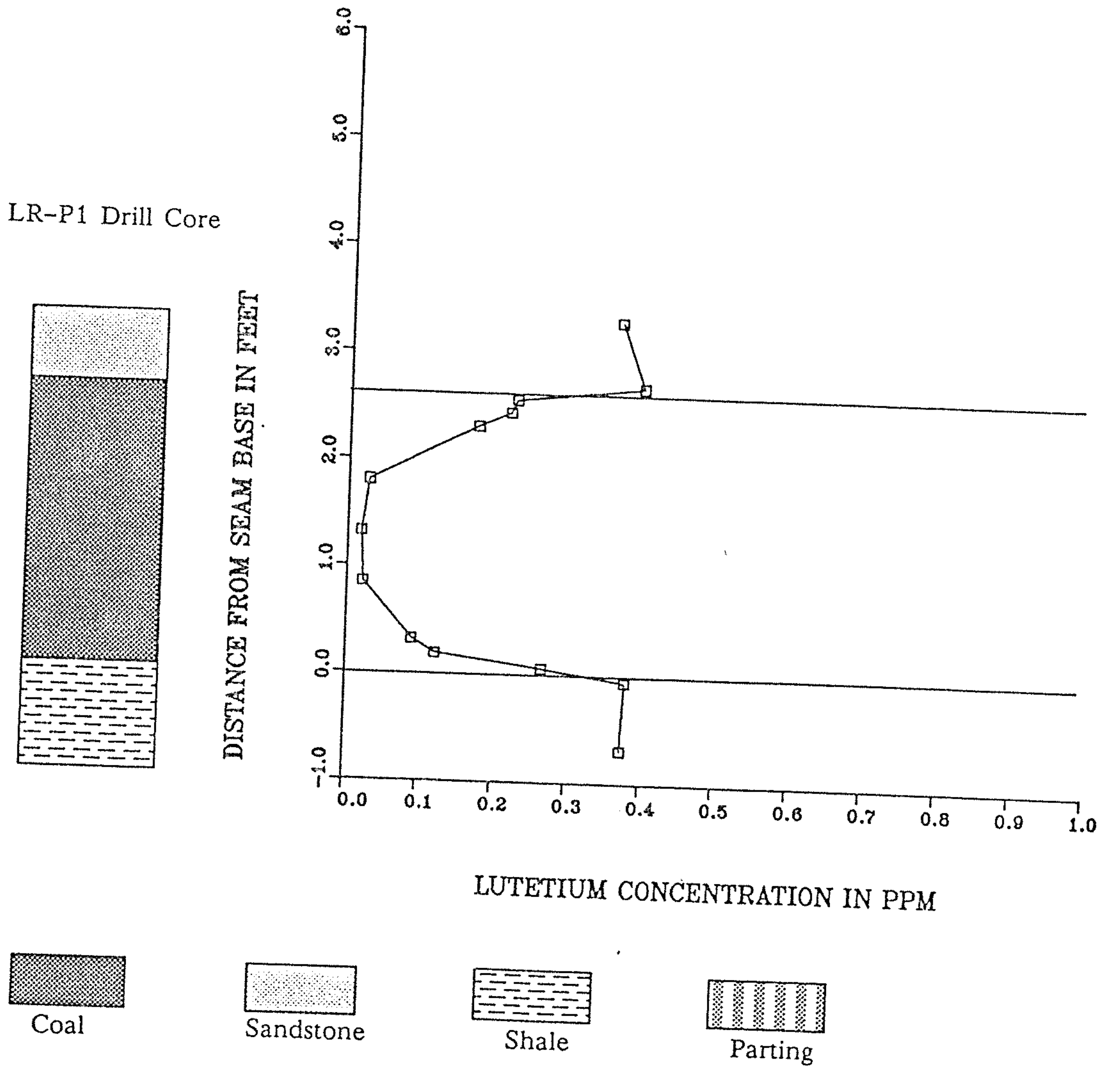


Figure D-229.

TERBIUM DISTRIBUTION
IN THE LEE RANCH P2 DRILL CORE

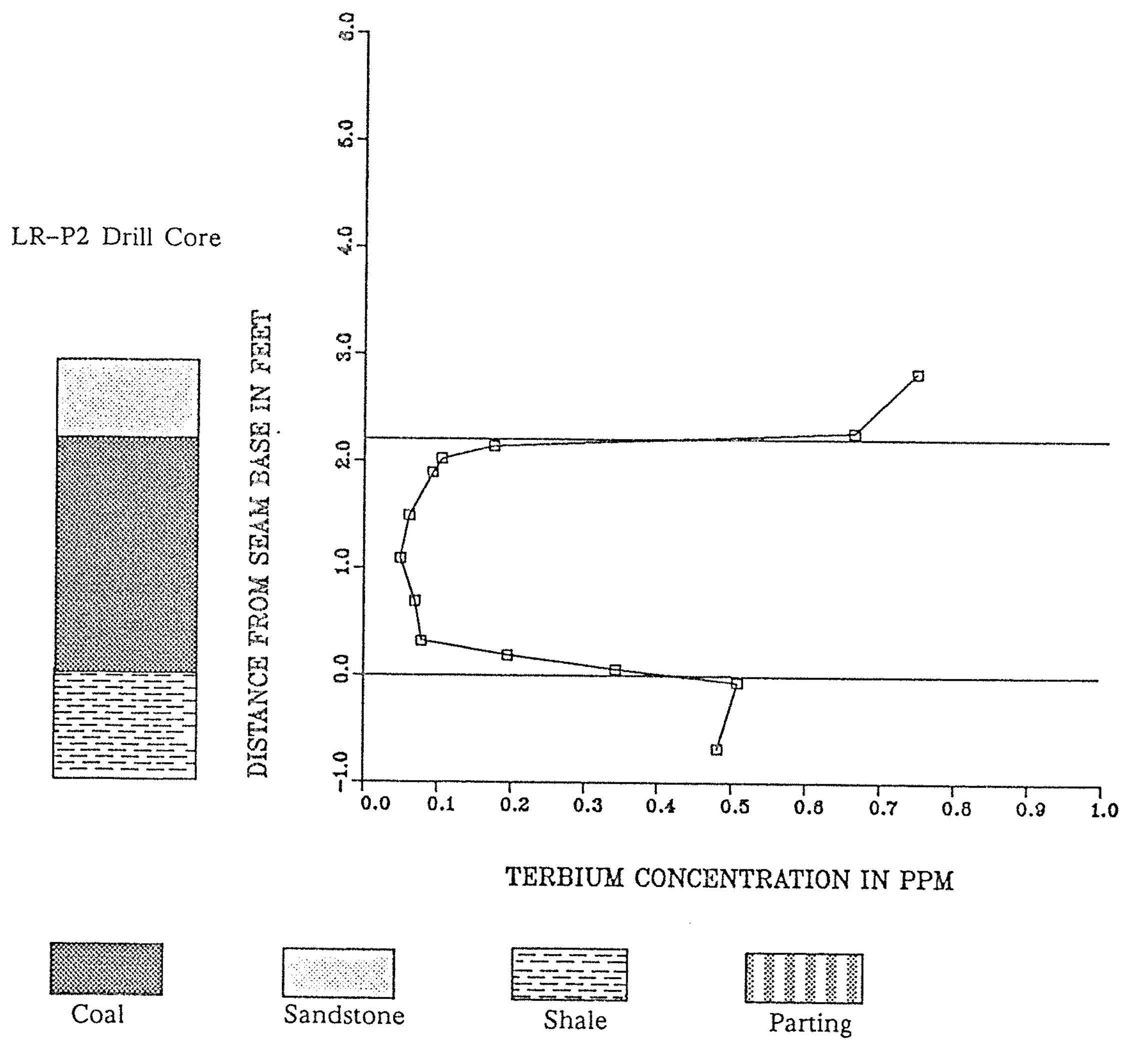


Figure D-230.

YTTERBIUM DISTRIBUTION IN THE LEE RANCH P2 DRILL CORE

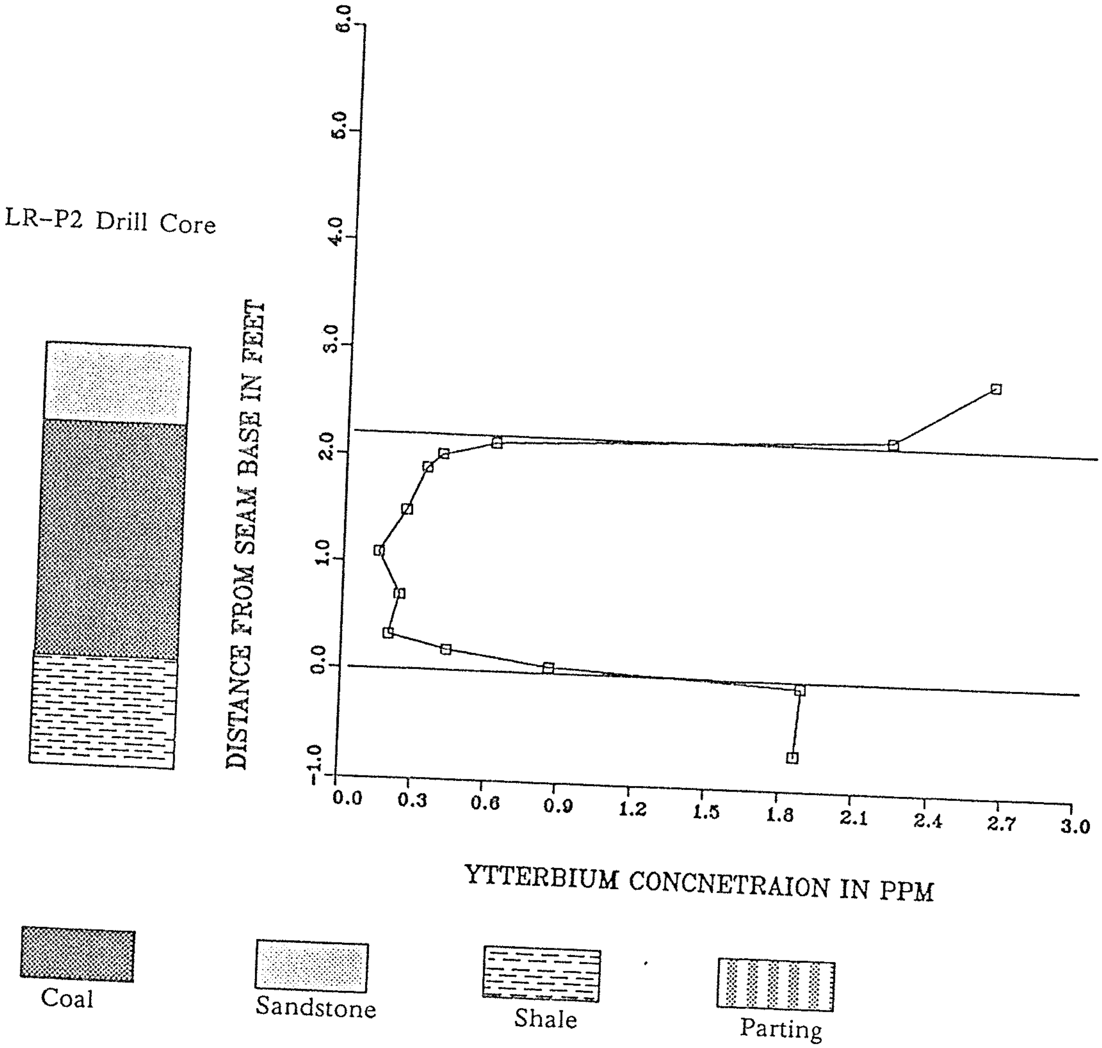


Figure D-231.

LUTETIUM DISTRIBUTION
IN THE LEE RANCH P2 DRILL CORE

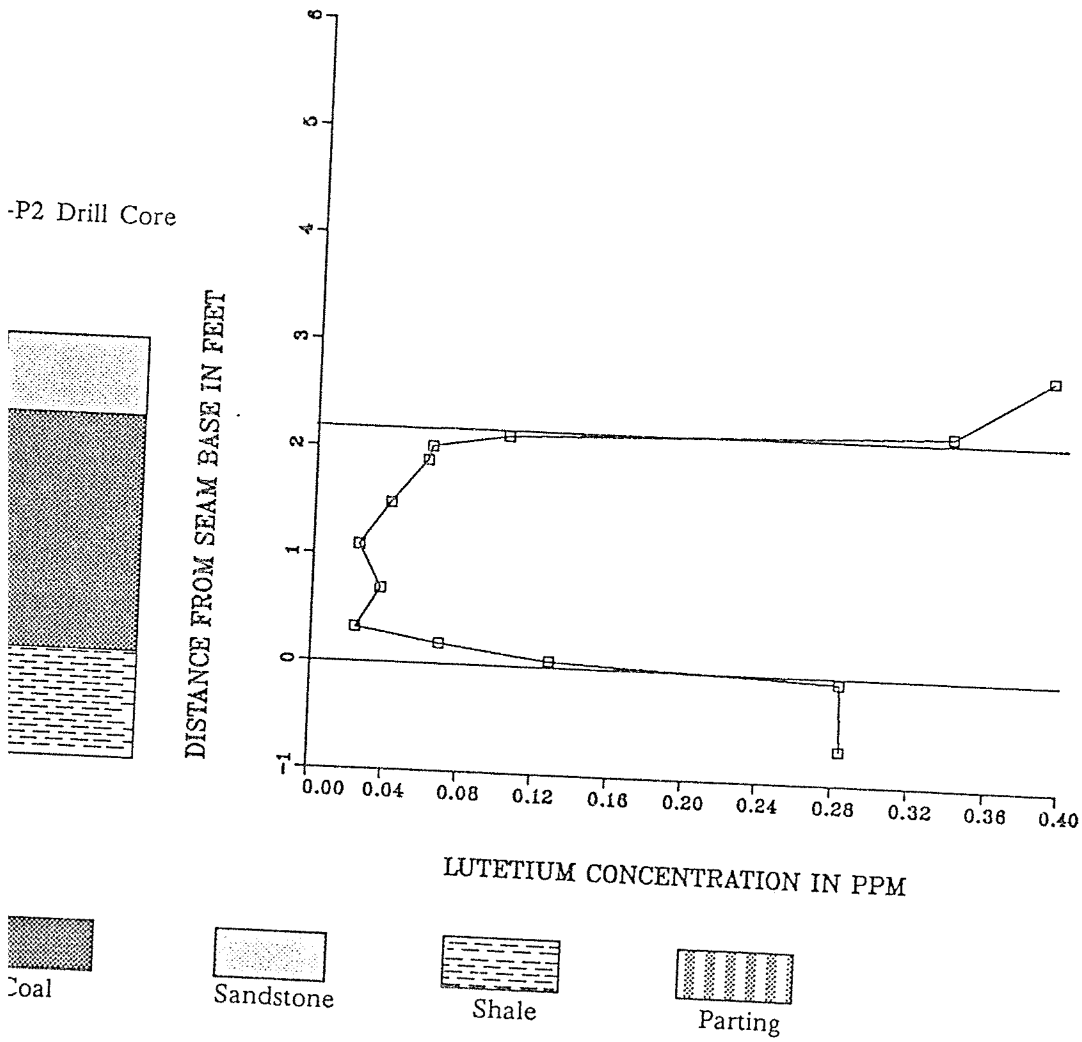


Figure D-232.

TERBIUM DISTRIBUTION
IN THE LEE RANCH A2 DRILL CORE

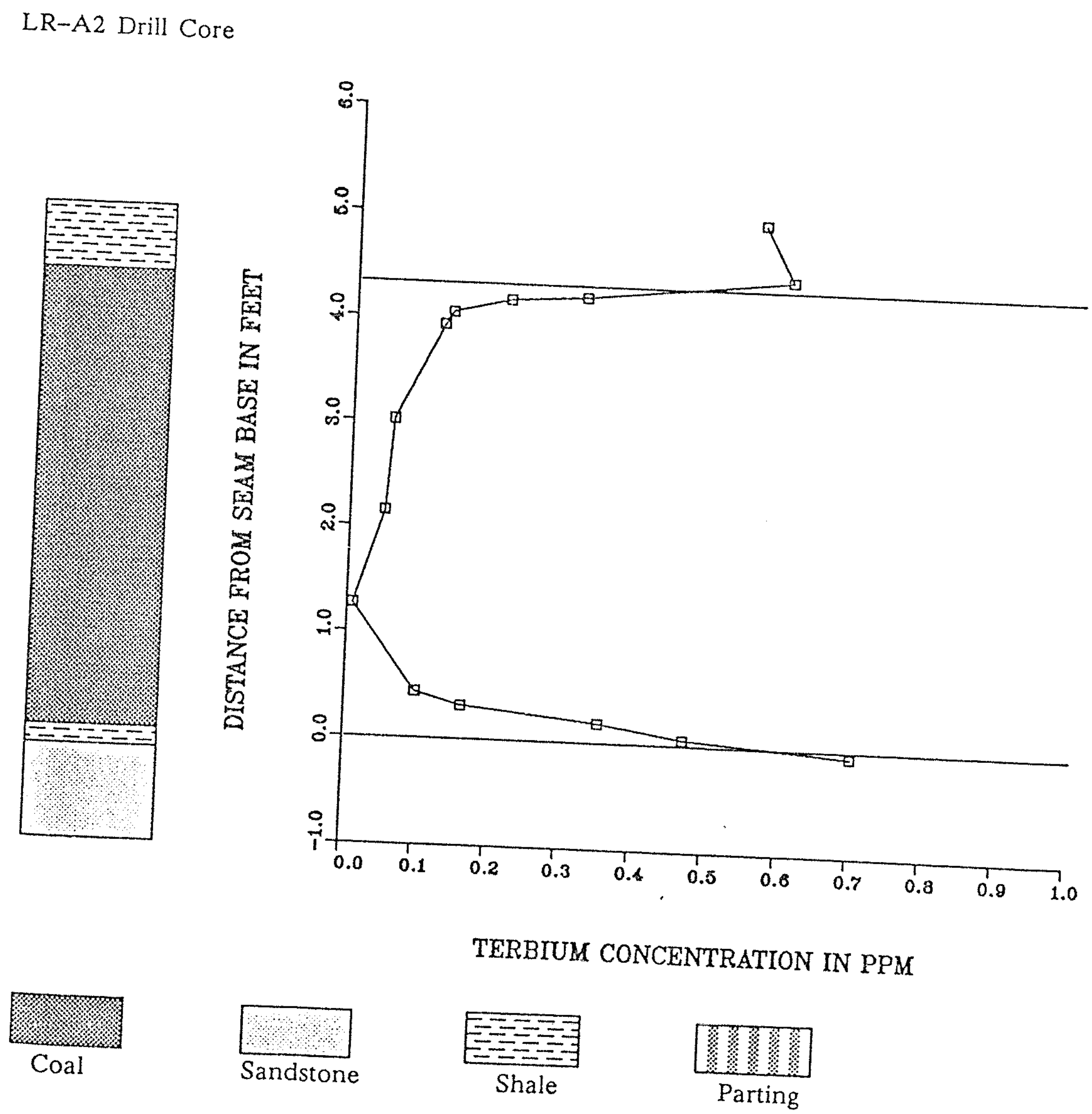


Figure D-233.

YTTERBIUM DISTRIBUTION IN THE LEE RANCH A2 DRILL CORE

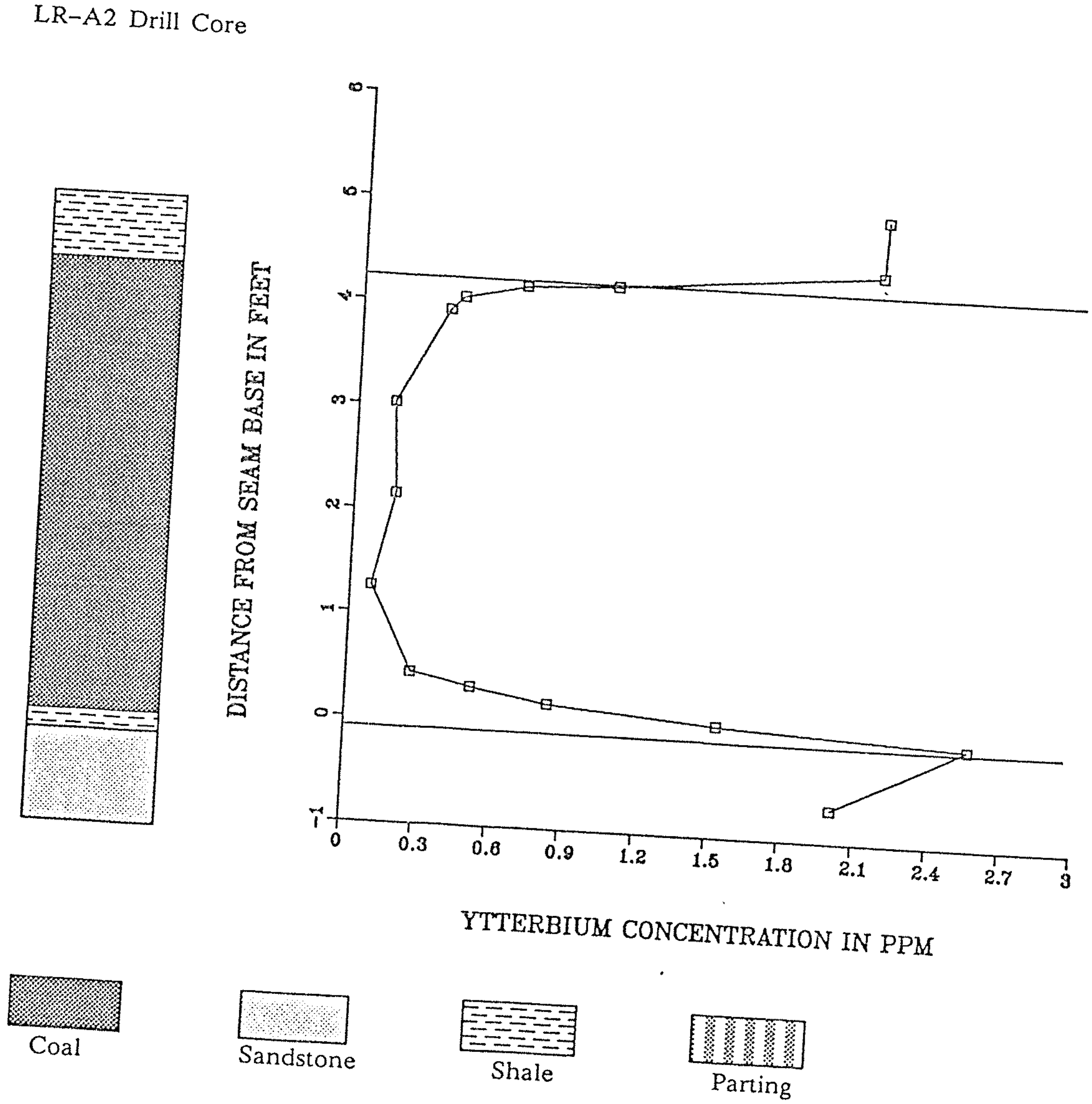


Figure D-234.

LUTETIUM DISTRIBUTION IN THE LEE RANCH A2 DRILL CORE

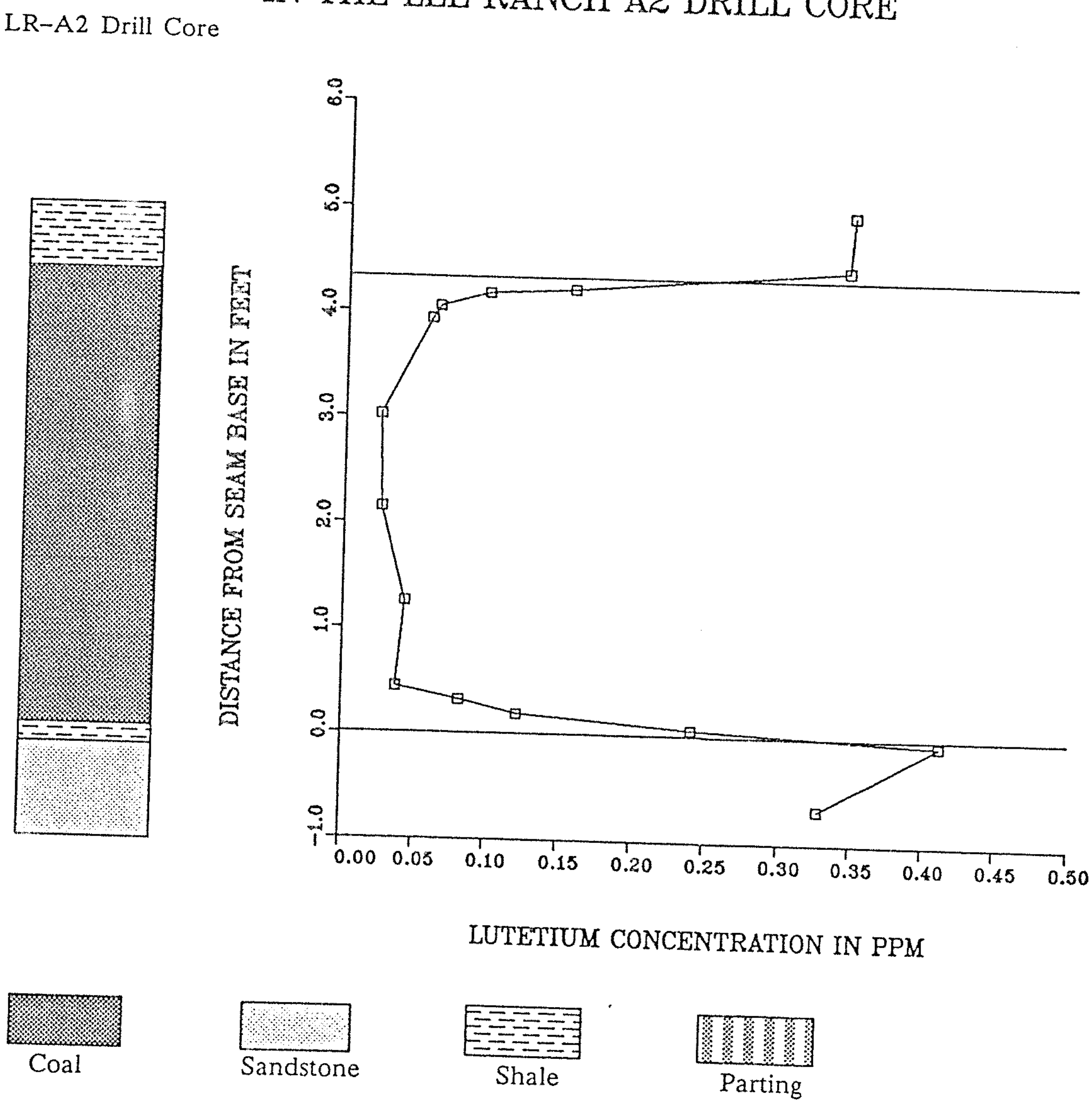


Figure D-235.

TERBIUM DISTRIBUTION
IN THE LEE RANCH A3 DRILL CORE

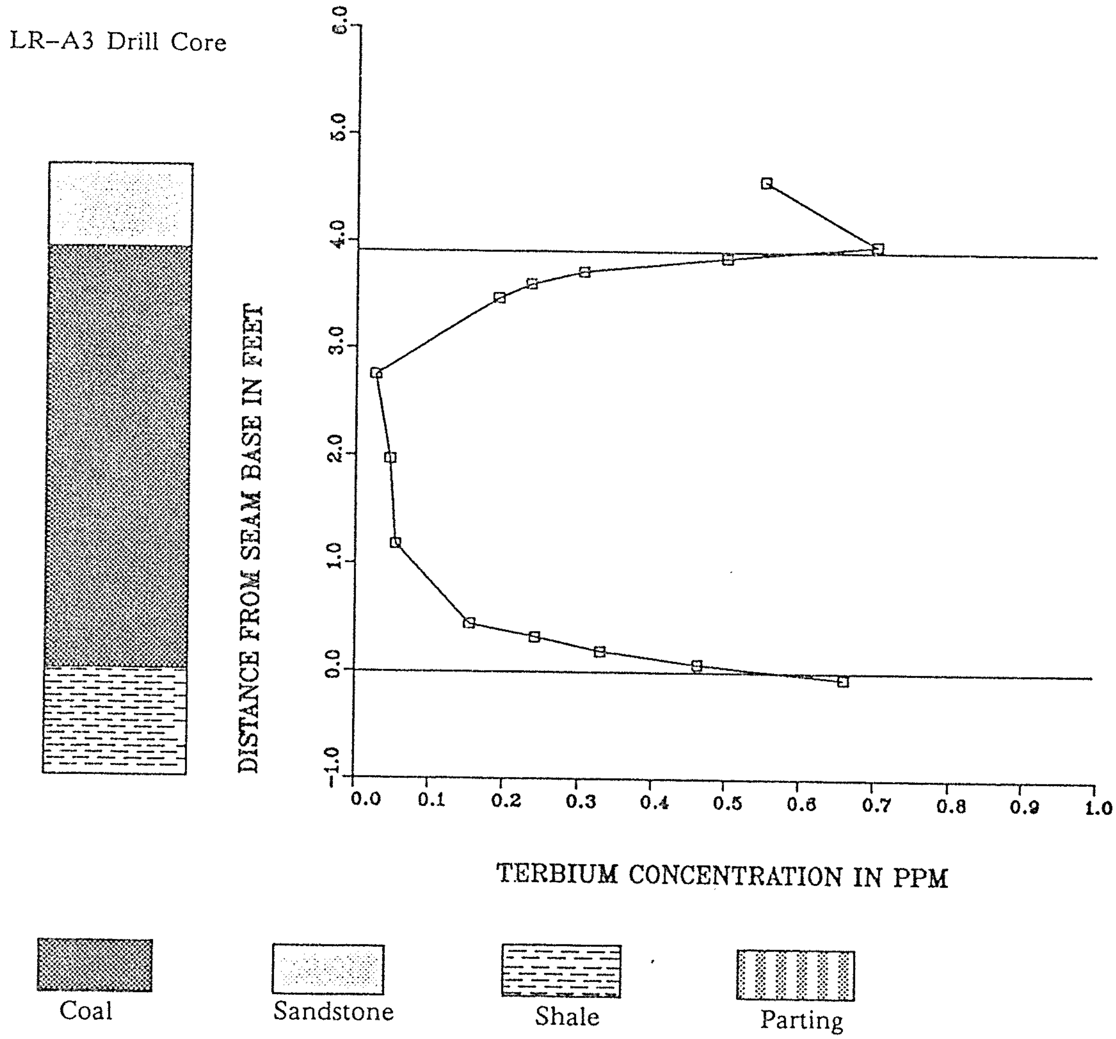


Figure D-236.

YTTERBIUM DISTRIBUTION
IN THE LEE RANCH A3 DRILL CORE

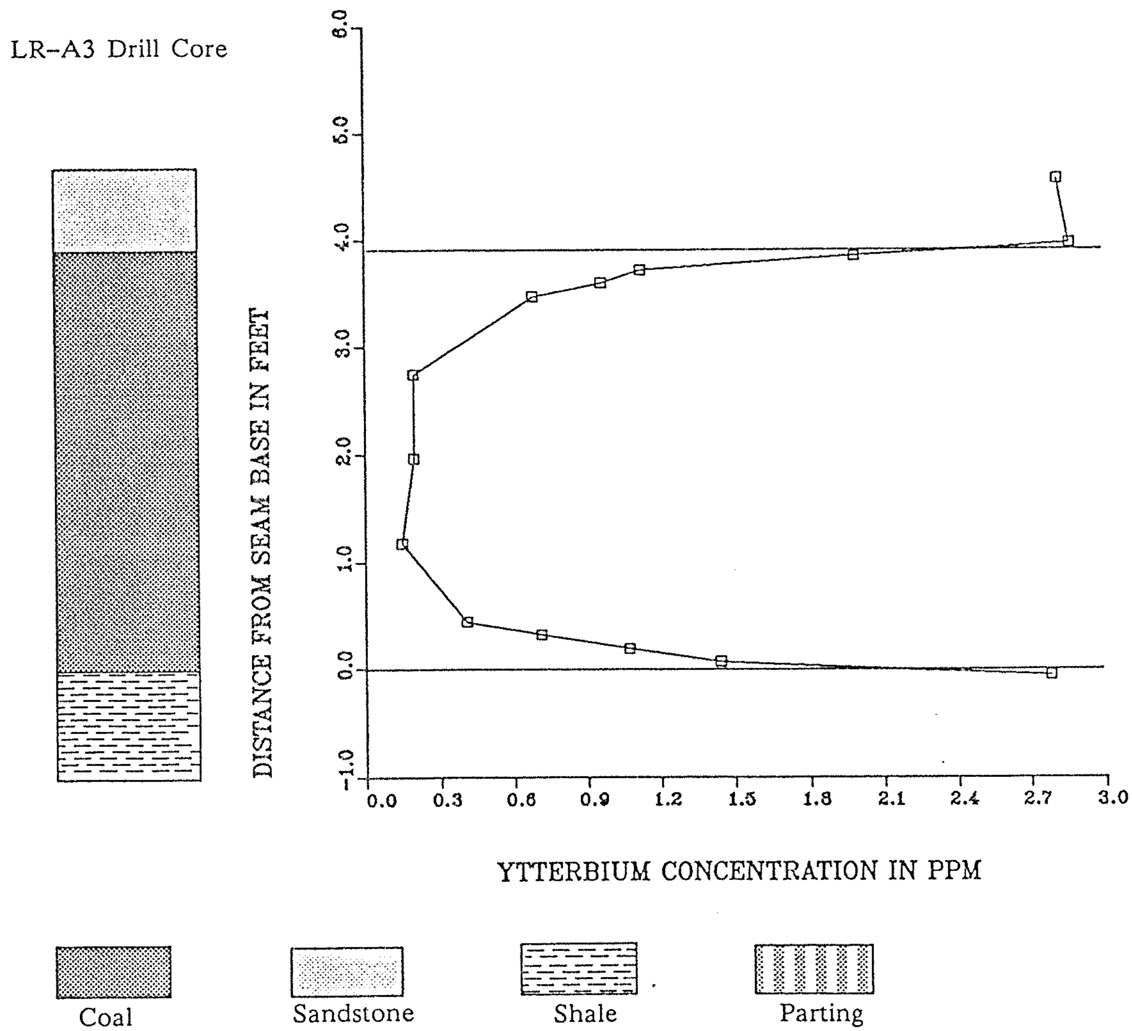


Figure D-237.

LUTETIUM DISTRIBUTION
IN THE LEE RANCH A3 DRILL CORE

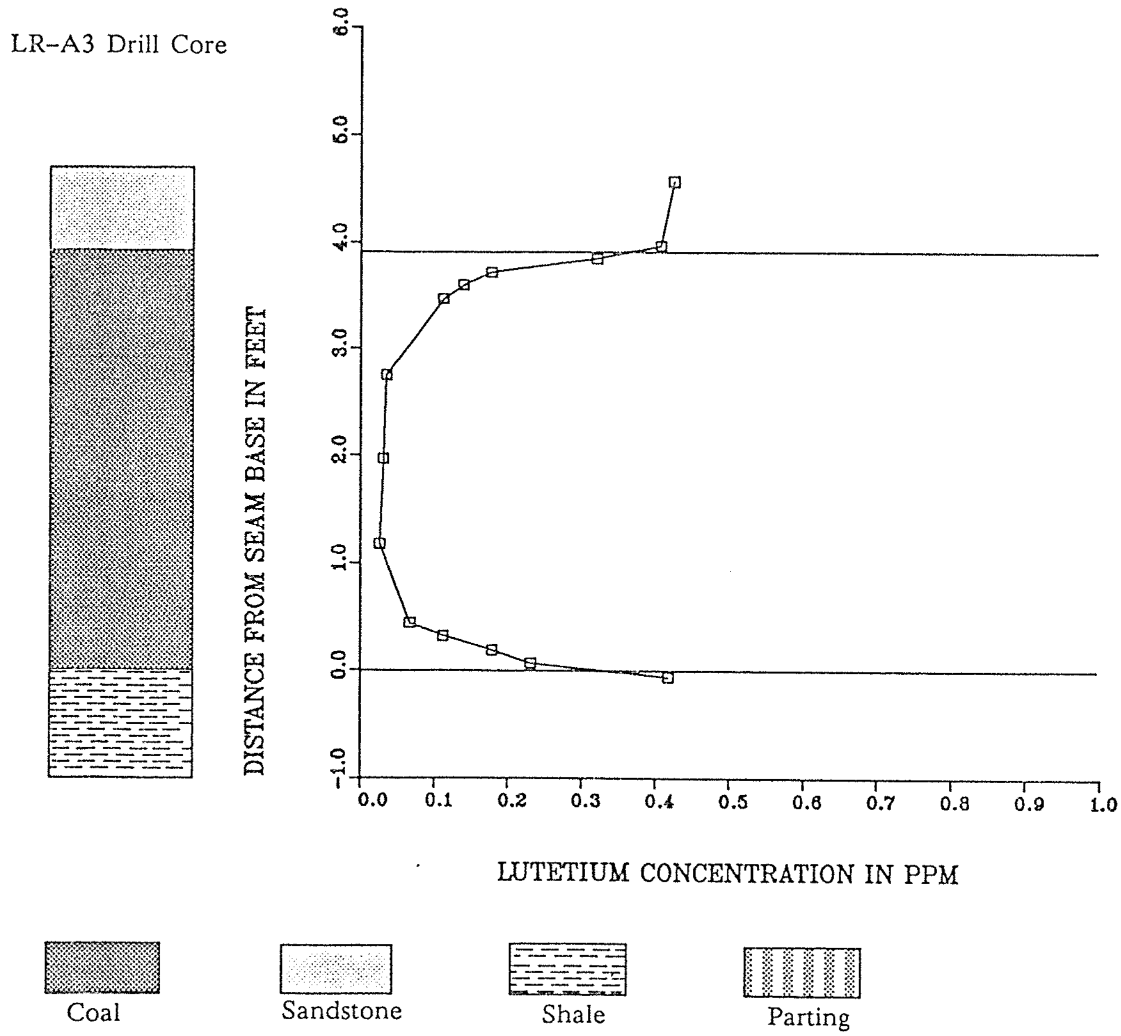


Figure D-238.

TERBIUM DISTRIBUTION IN THE LEE RANCH B2 DRILL CORE

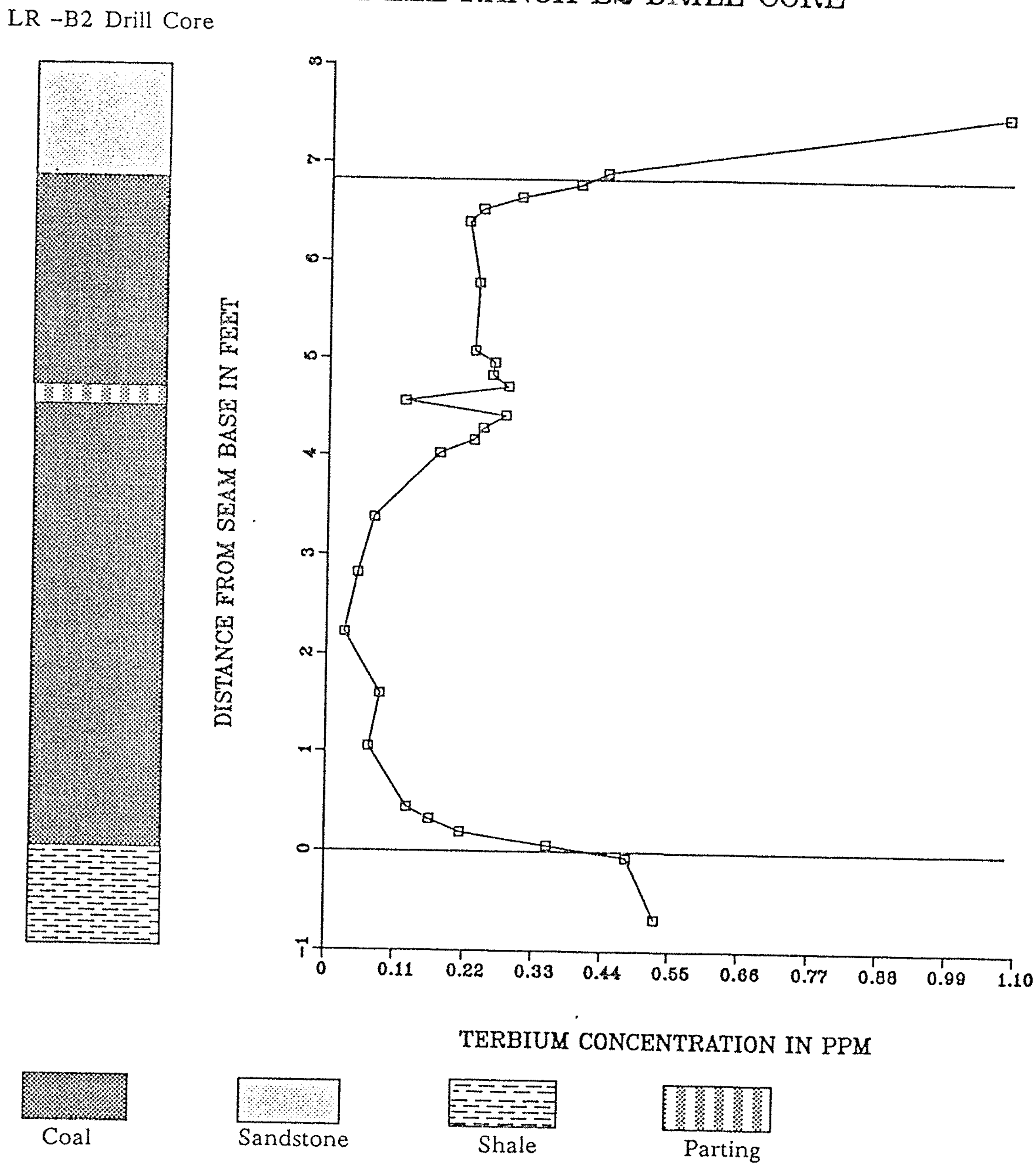


Figure D-239.

YTTERBIUM DISTRIBUTION IN THE LEE RANCH B2 DRILL CORE

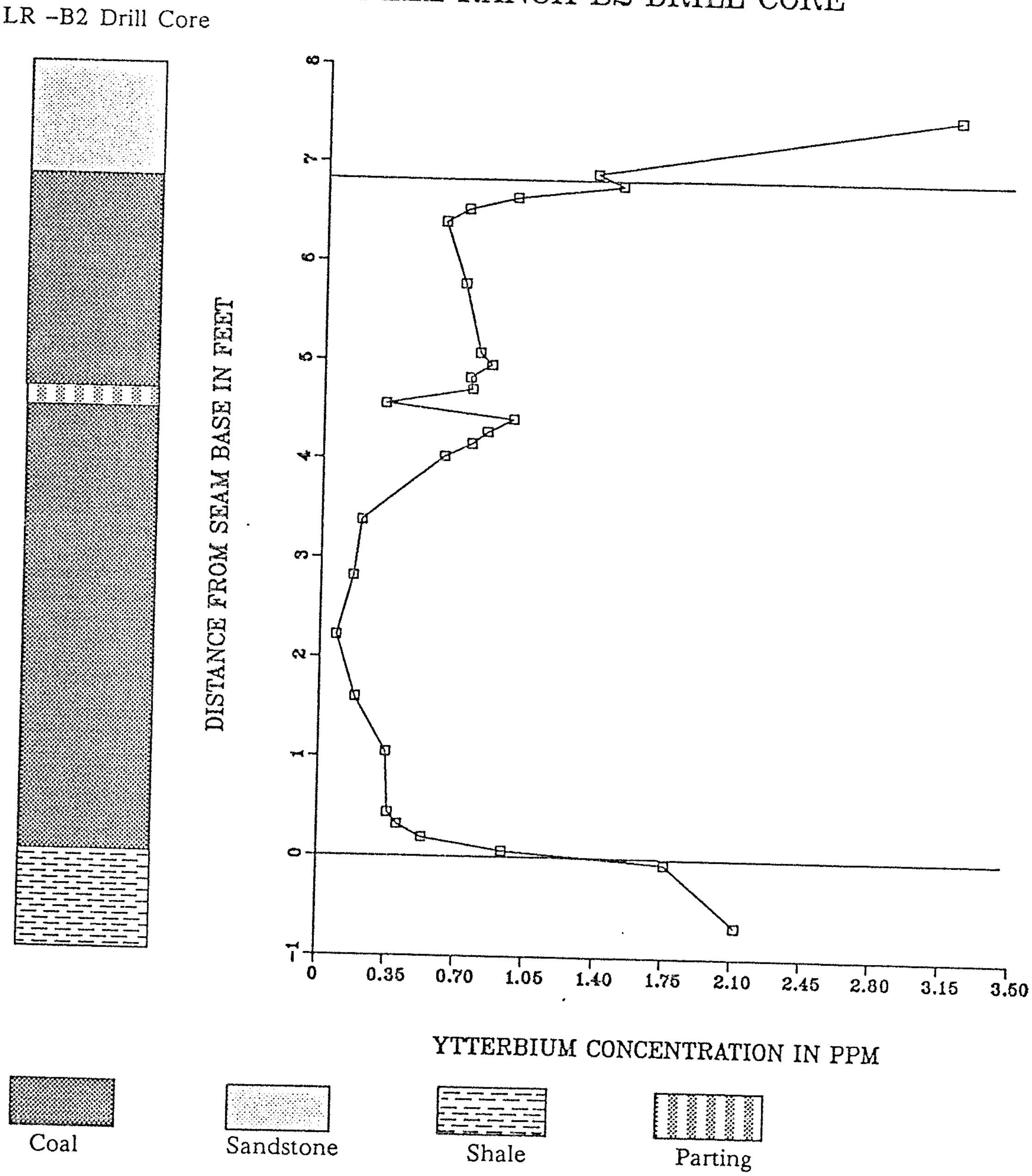


Figure D-240.

LUTETIUM DISTRIBUTION
IN THE LEE RANCH B2 DRILL CORE

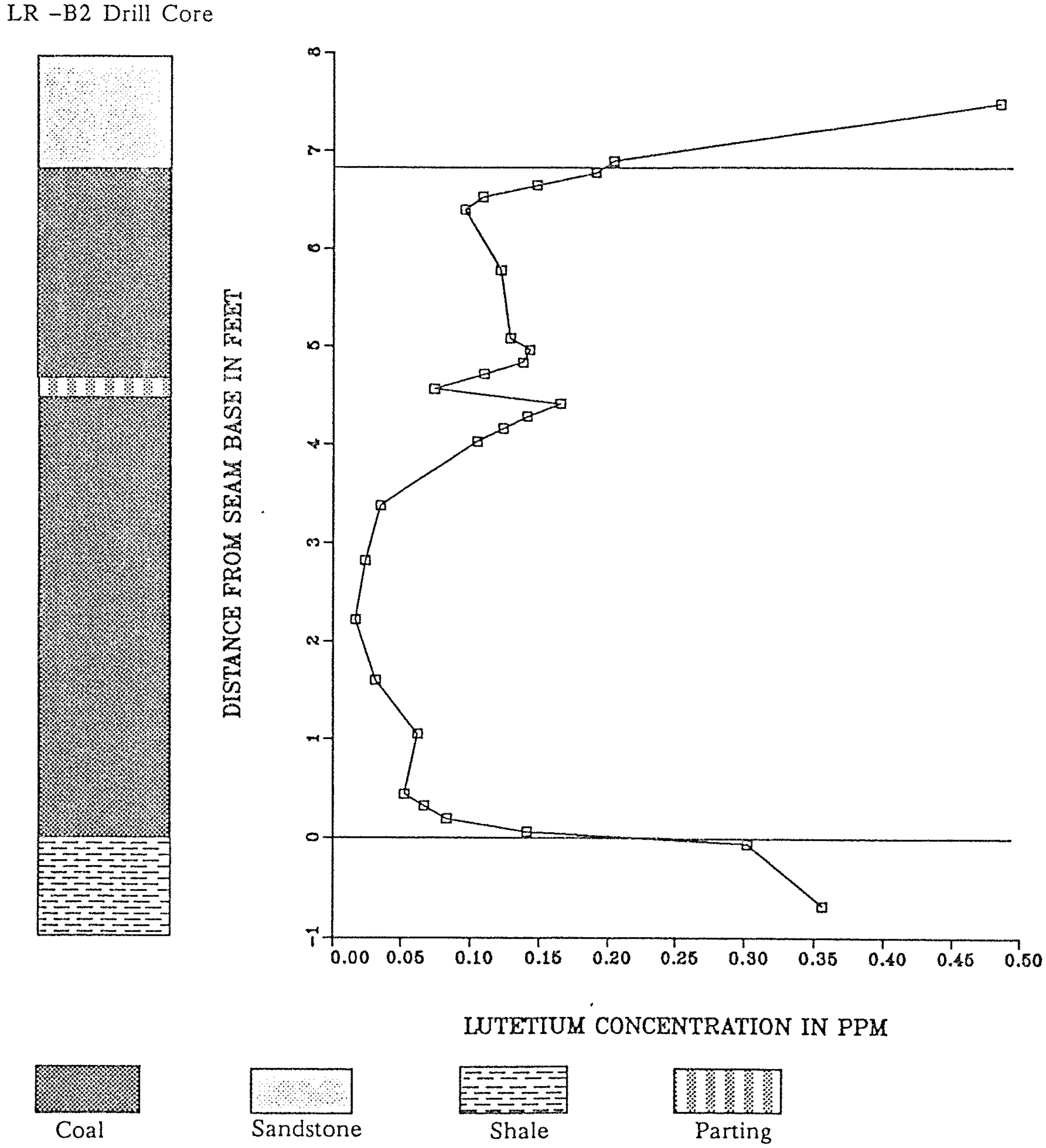


Figure D–241.

TERBIUM DISTRIBUTION
IN THE LEE RANCH B3 DRILL CORE

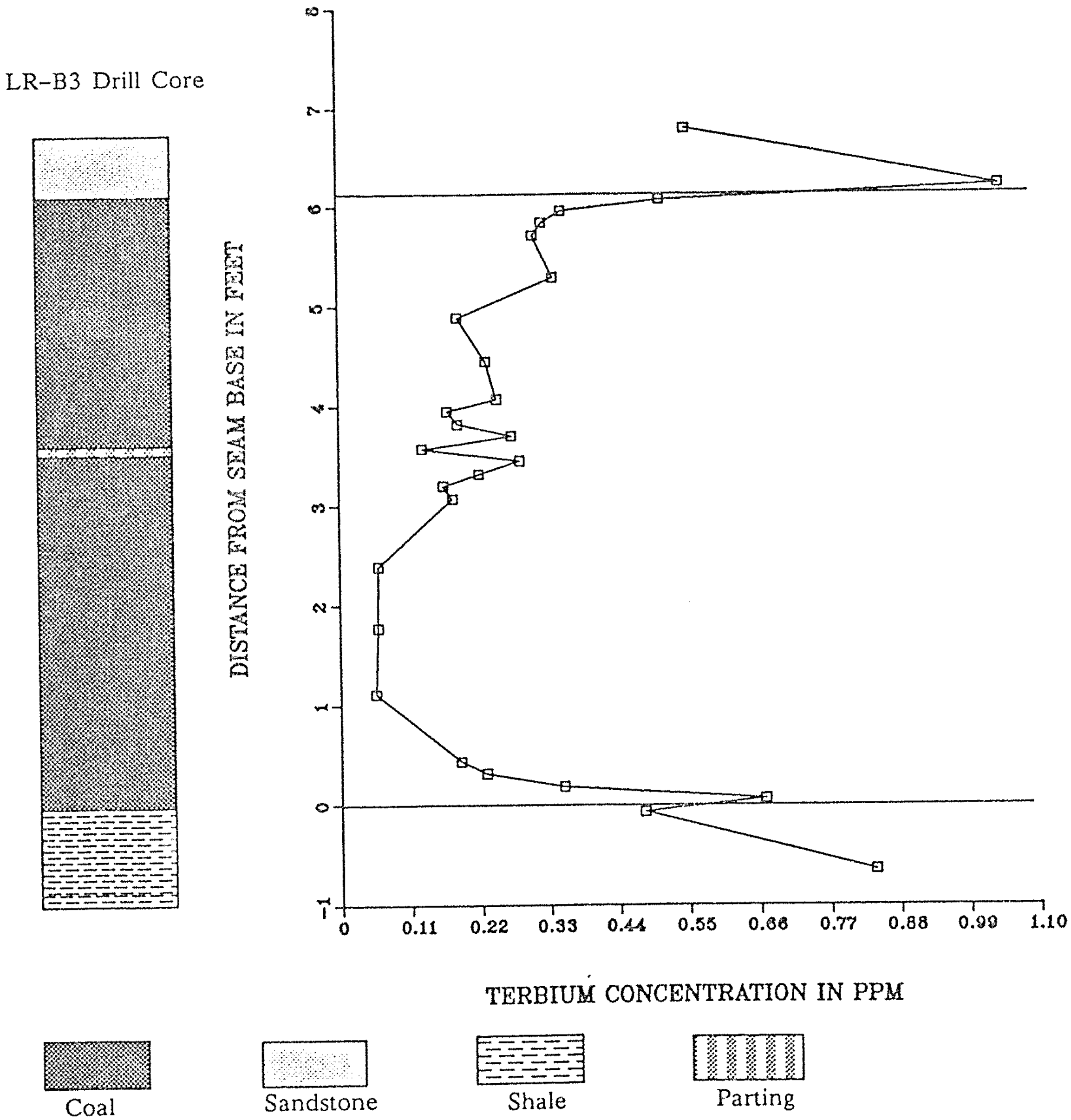


Figure D-242.

YTTERBIUM DISTRIBUTION
IN THE LEE RANCH B3 DRILL CORE

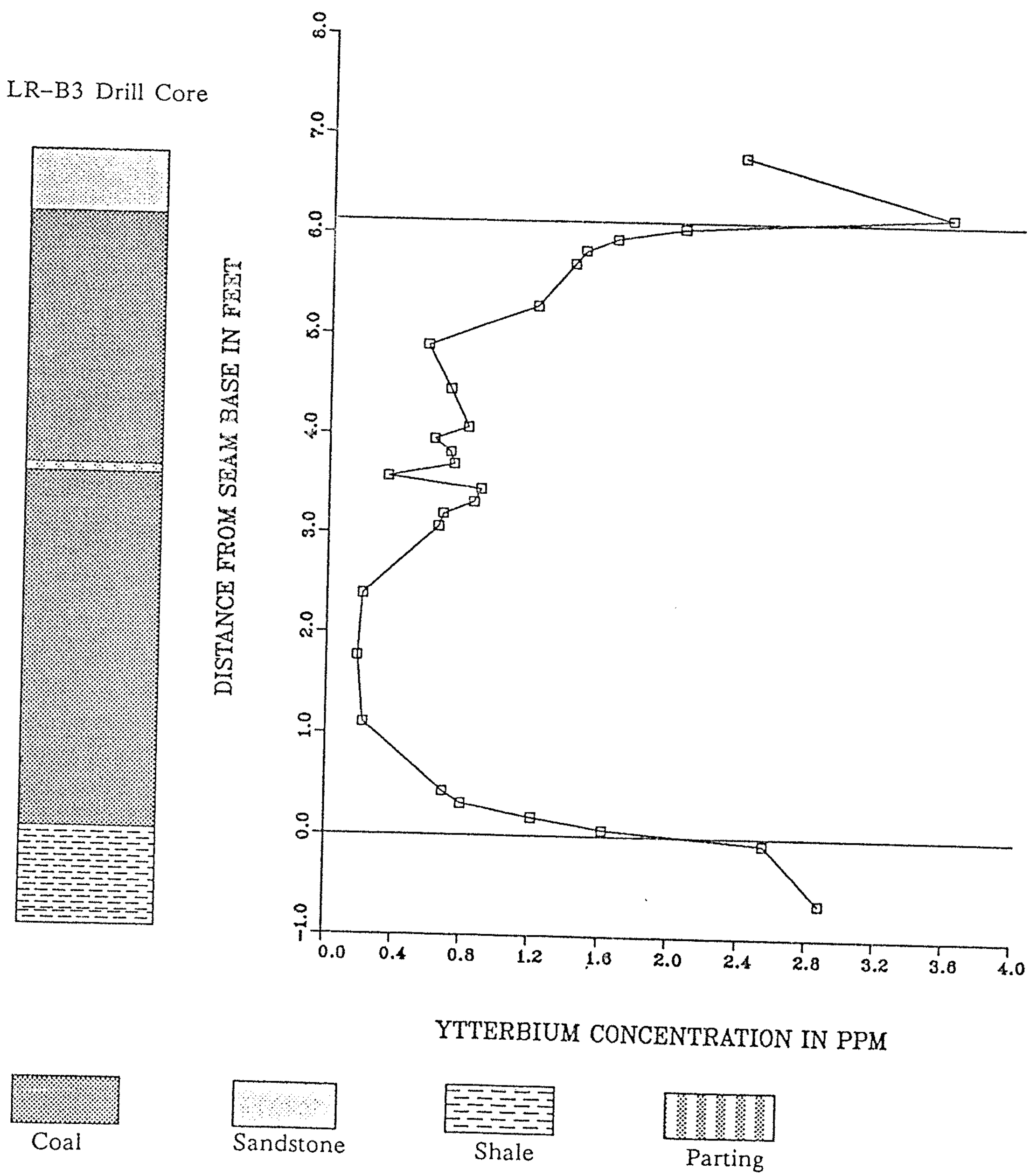


Figure D-243.

LUTETIUM DISTRIBUTION
IN THE LEE RANCH B3 DRILL CORE

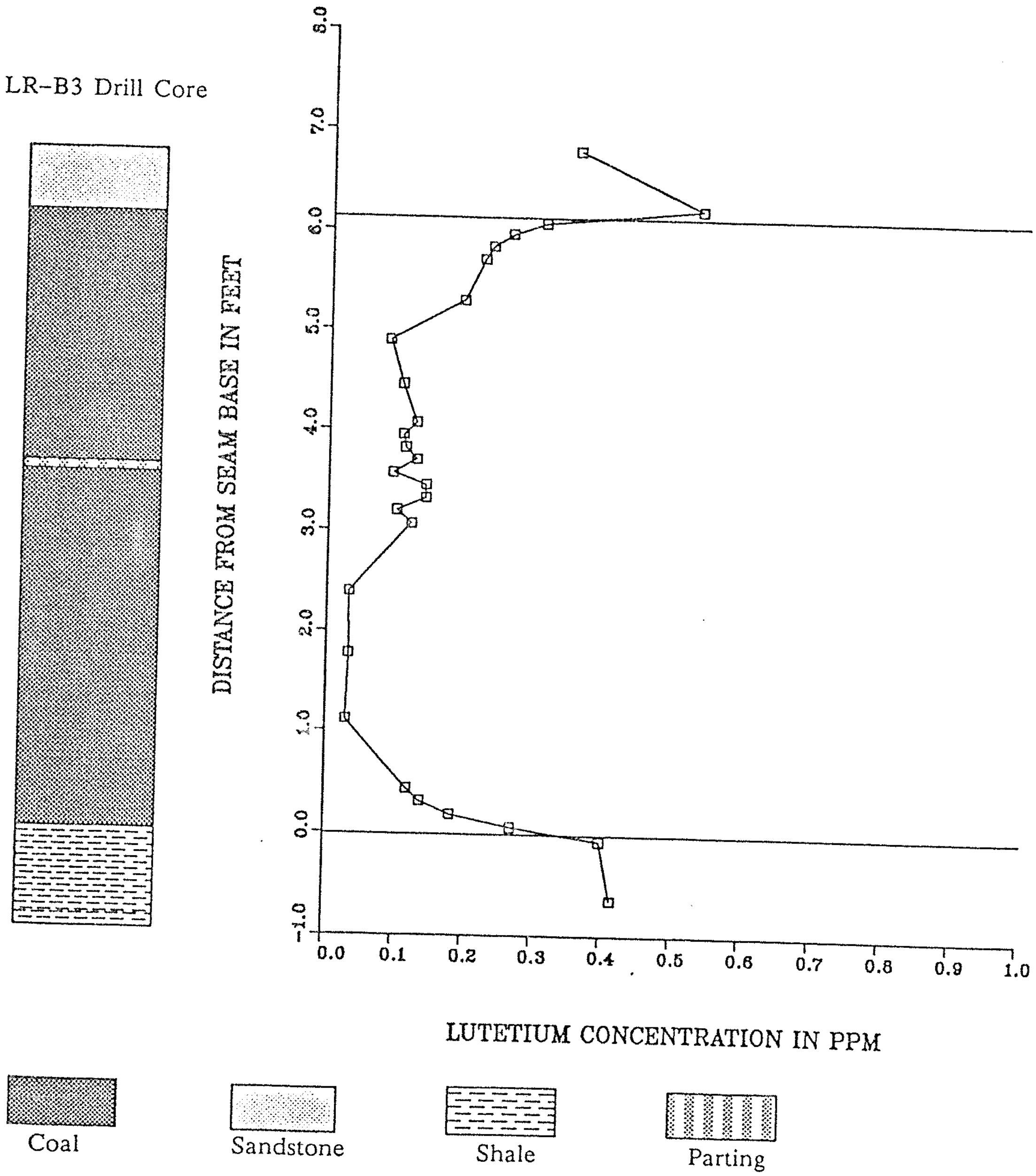


Figure D-244.

TERBIUM DISTRIBUTION
IN THE YORK CANYON "A" AND "MAIN" SEAMS

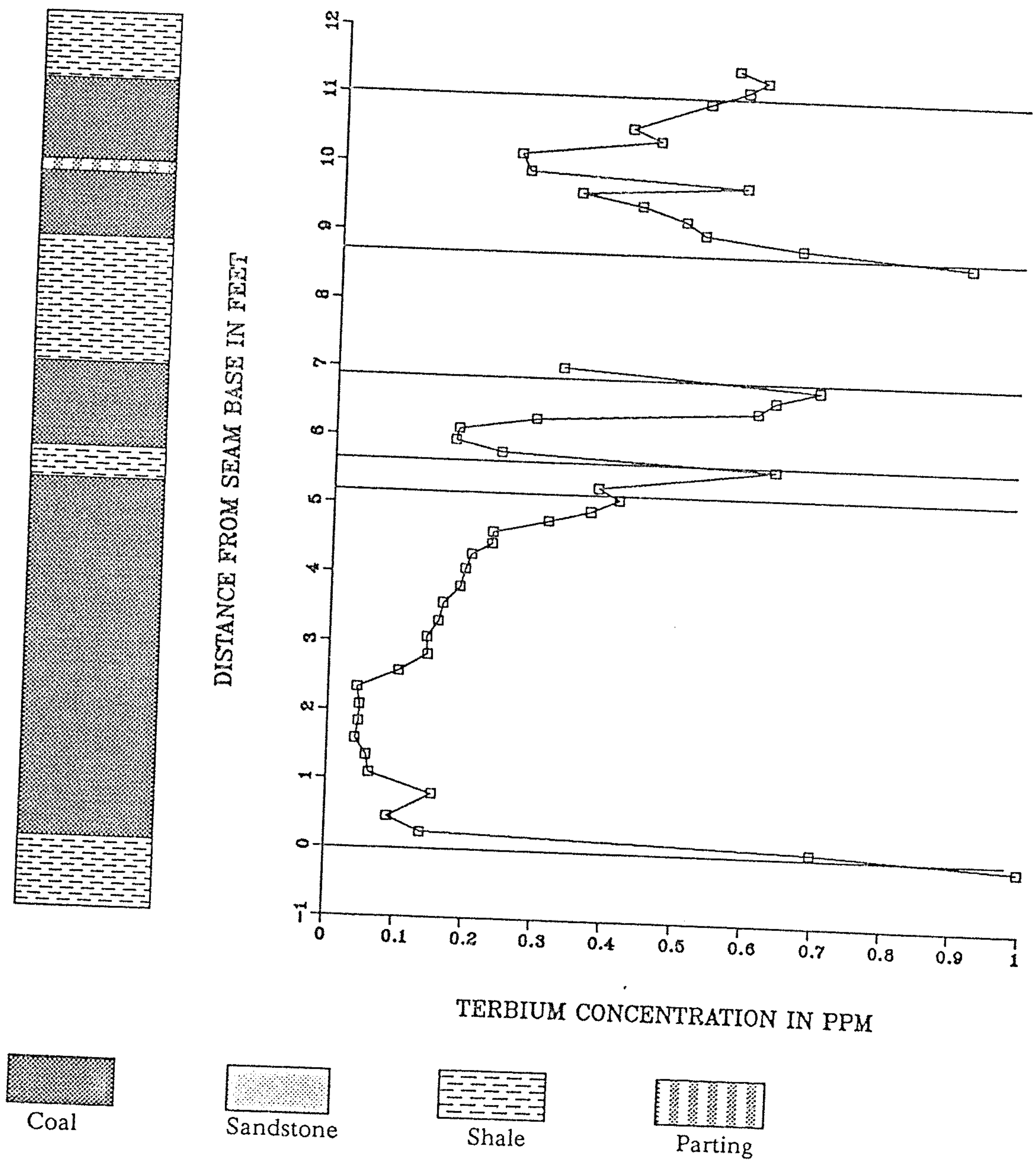


Figure D-245.

YTTERBIUM DISTRIBUTION
IN THE YORK CANYON "A" AND "MAIN" SEAMS

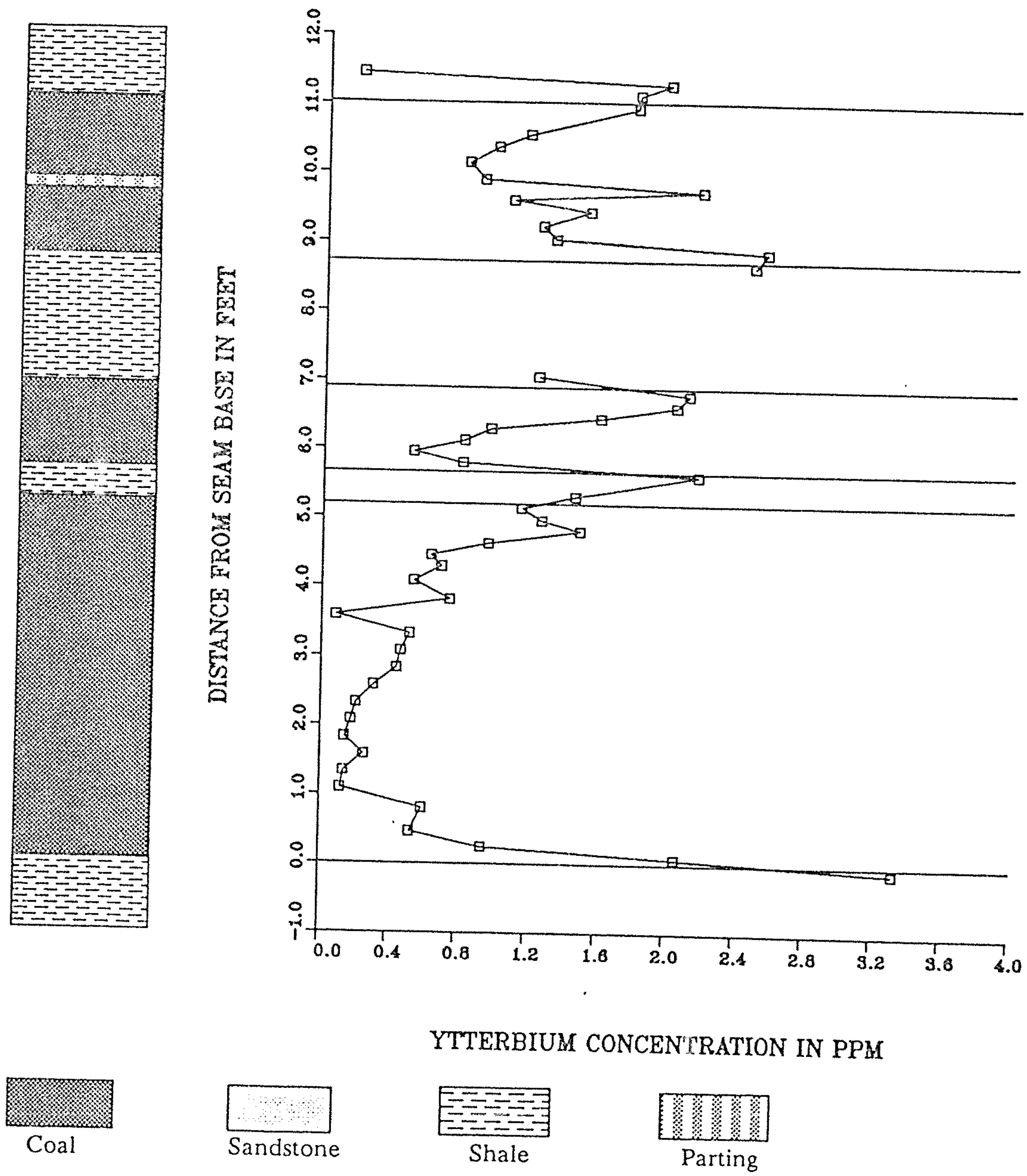


Figure D-246.

LUTETIUM DISTRIBUTION
IN THE YORK CANYON "A" AND "MAIN" SEAMS

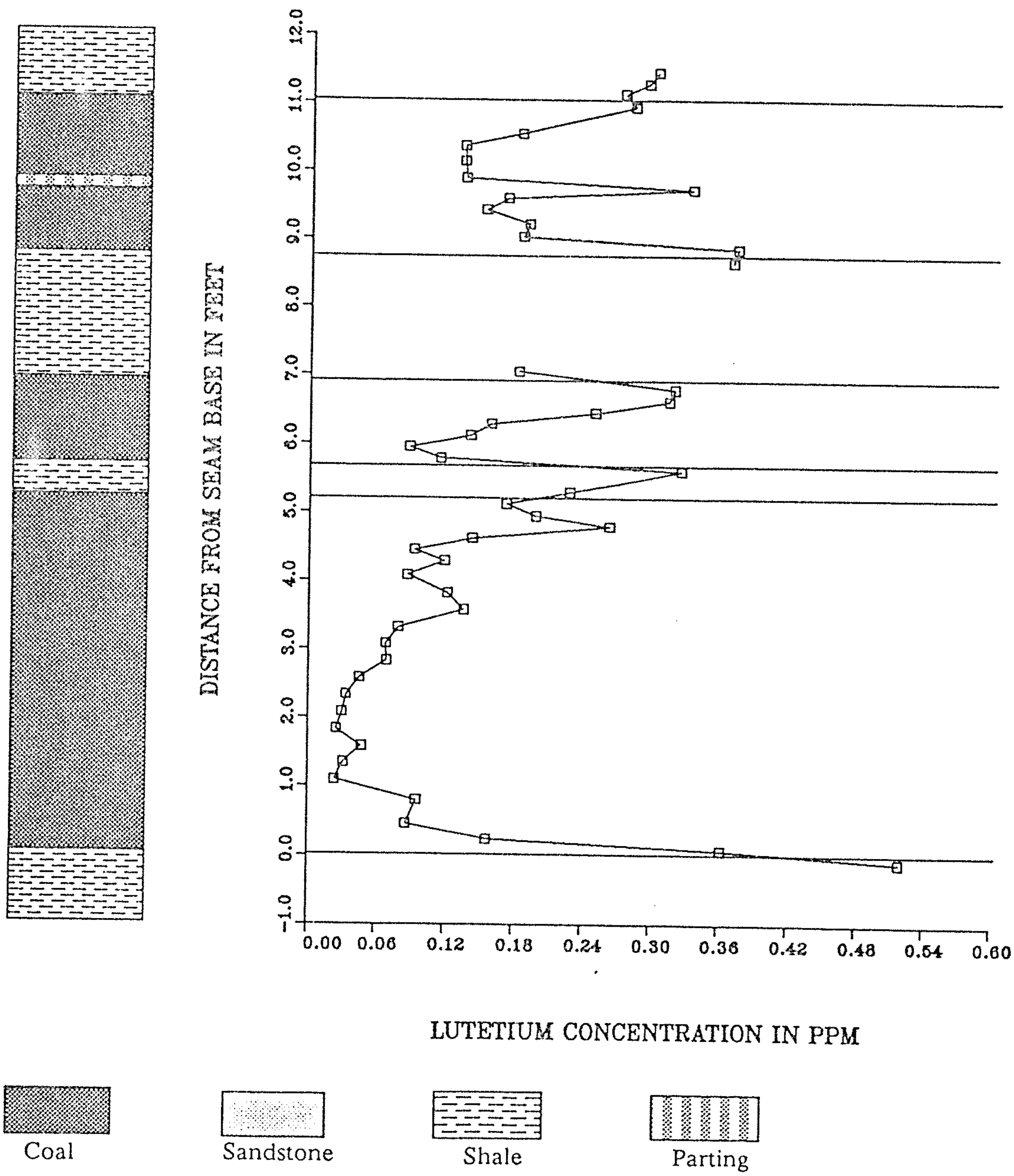


Figure D-247.

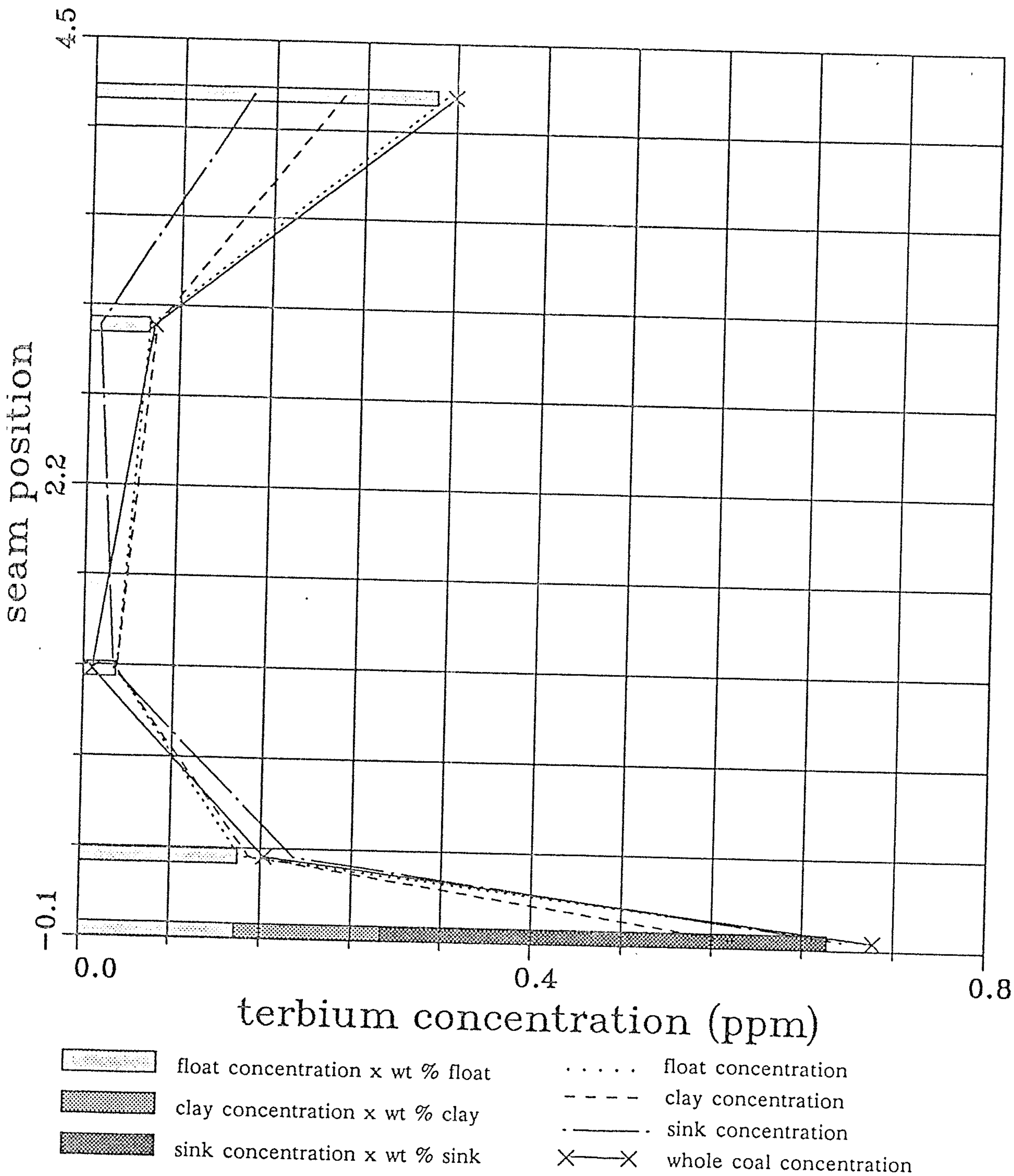
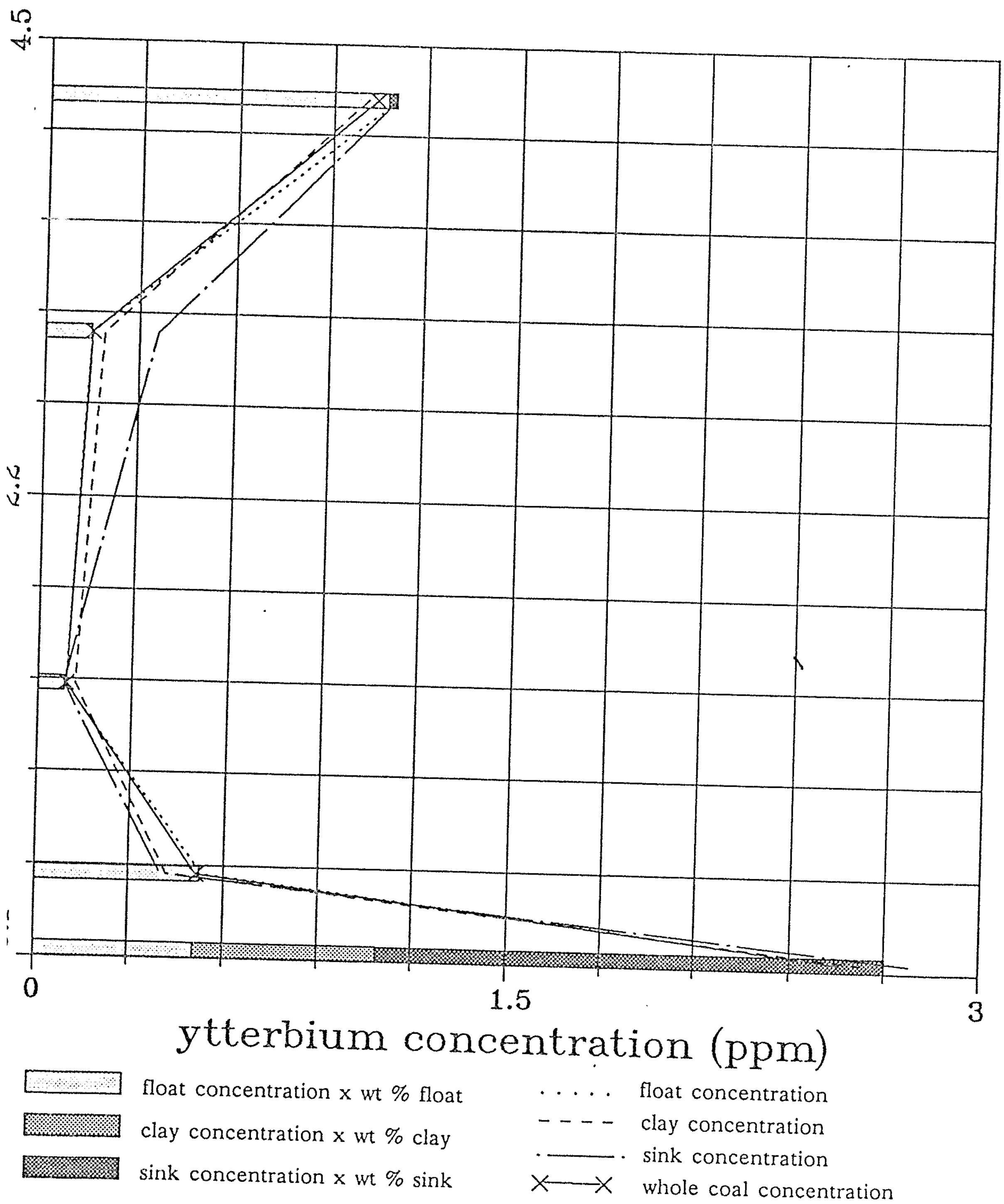


Figure D-248. Terbium float-clay-sink distributions in the LRA2 seam.



ure D-249. Ytterbium float-clay-sink distributions in the LRA2 seam.

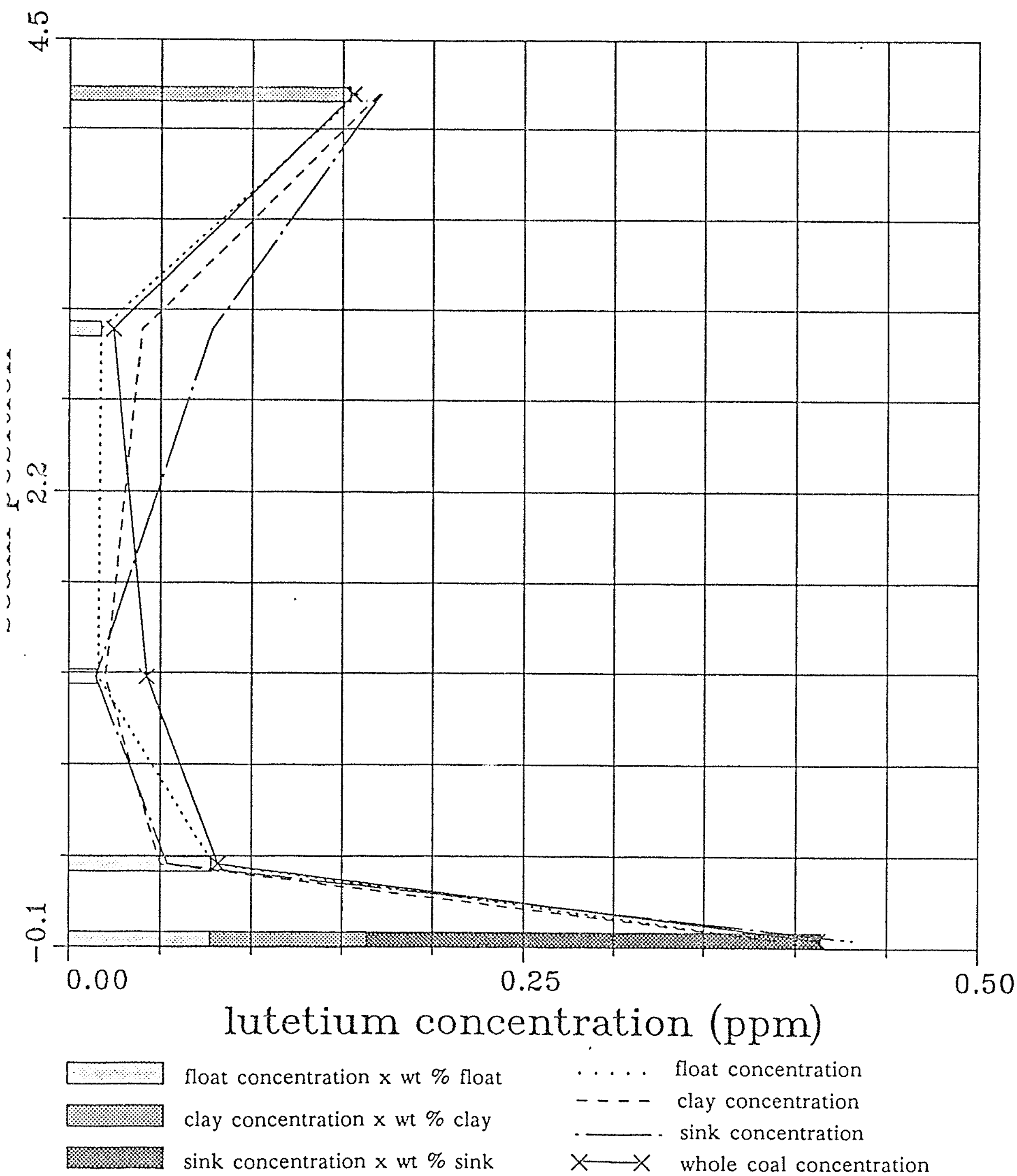


Figure D-250. Lutetium float-clay-sink distributions in the LRA2 seam.

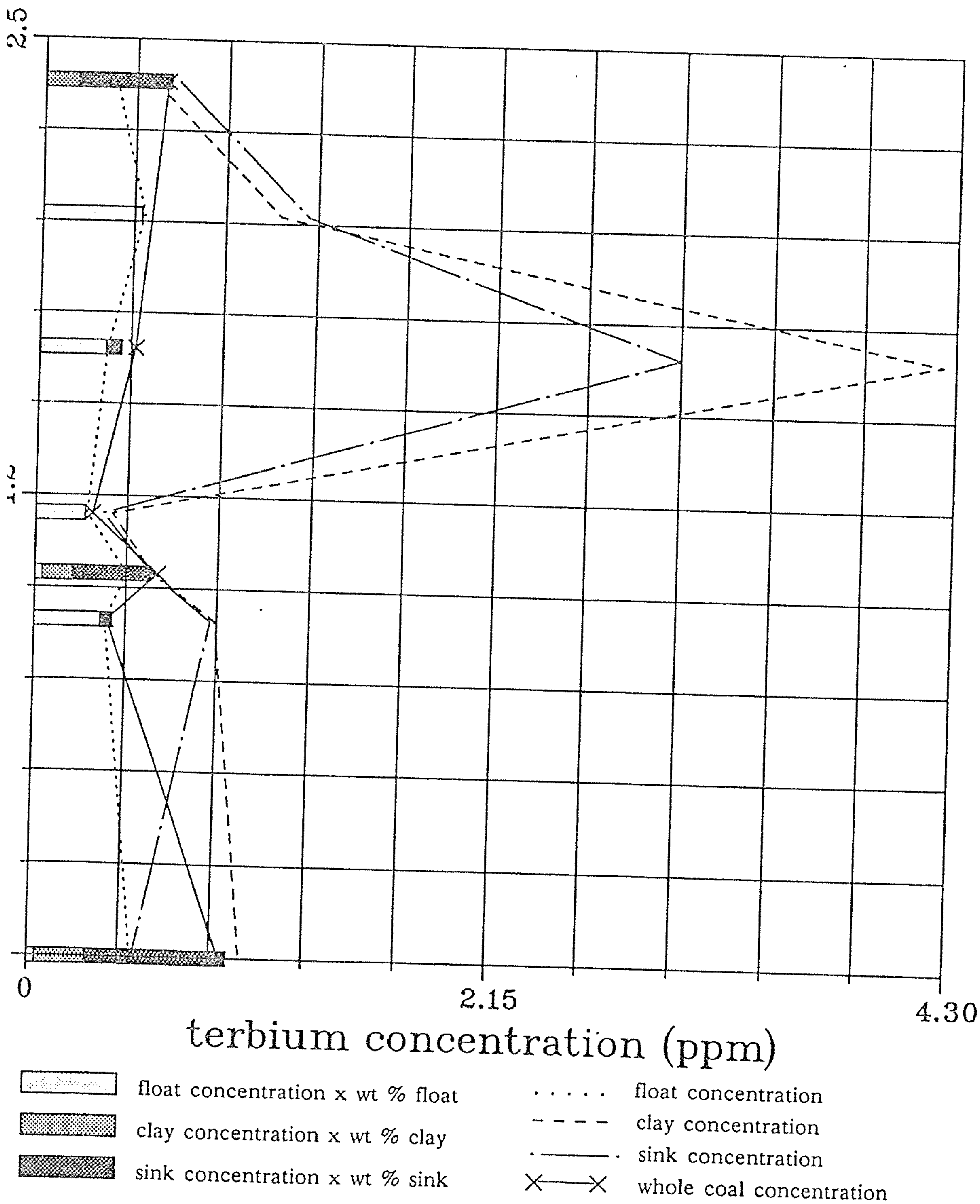


Figure D-251. Terbium float-clay-sink distributions in the YA seam.

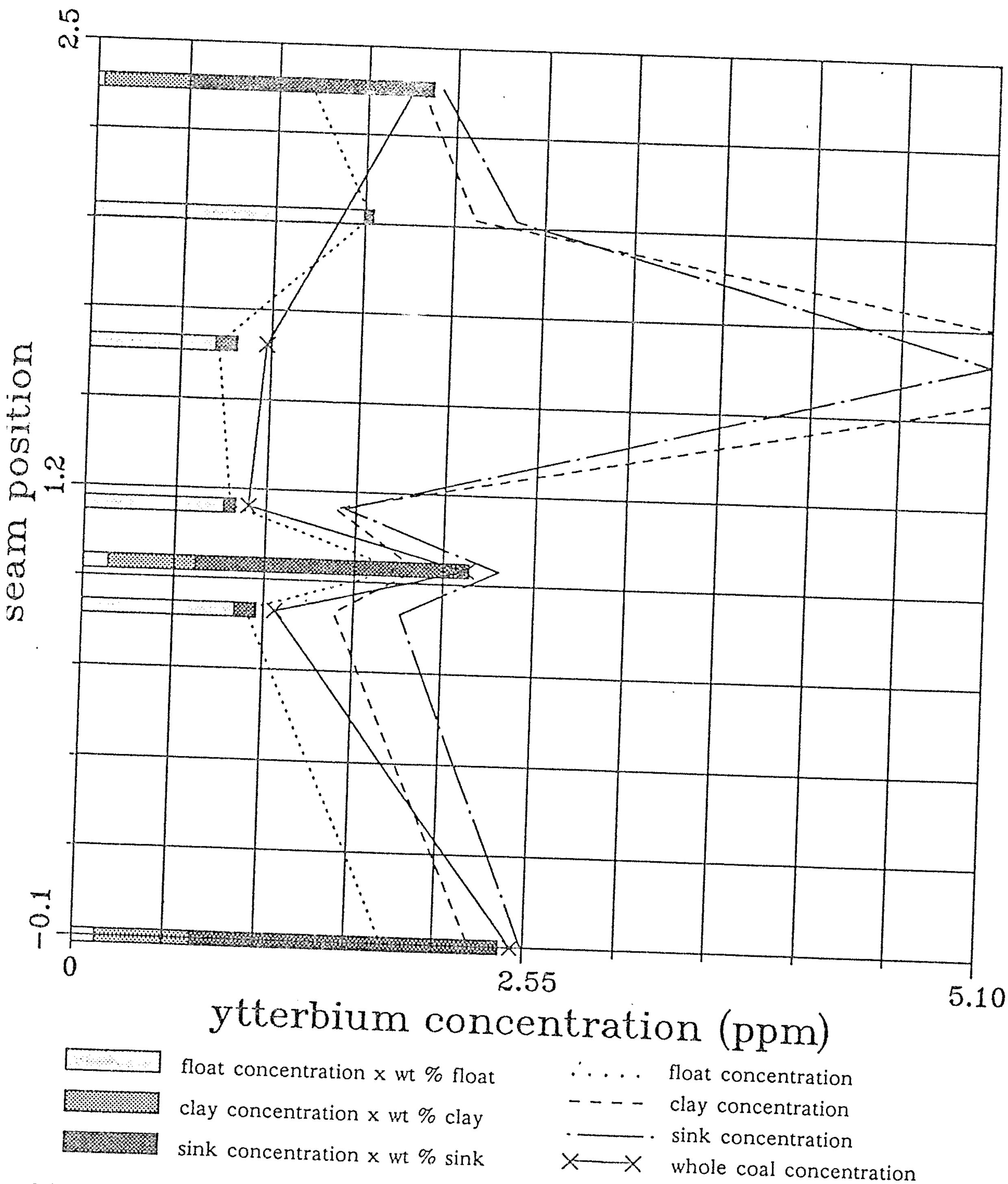
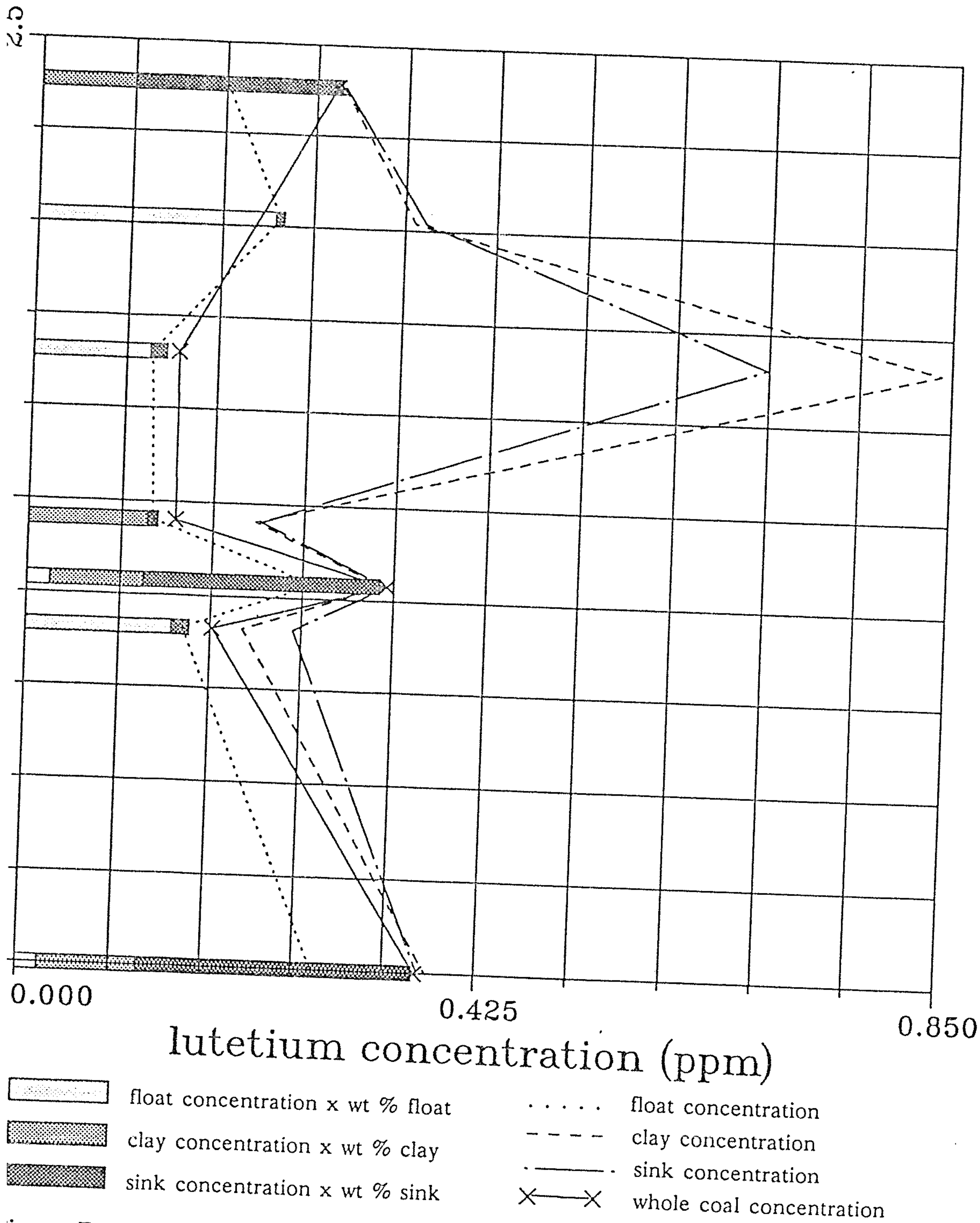


Figure D-252. Ytterbium float-clay-sink distributions in the YA seam.



igure D-253. Lutetium float-clay-sink distributions in the YA seam.

APPENDIX E

PEARSON CORRELATION ANALYSES

Table E-1.
Pearson Correlation Coefficients for the Lee Ranch and York Canyon Coal Samples Only.

VARIABLE	CASES	MEAN	STD DEV
MOIST	124	8.7871	5.271
ASH	124	11.6571	10
VM	124	40.5920	7.0194
FC	124	47.7507	8.8893
TOTSUL	124	.6889	.2873
AS	106	1.0260	.9672
BA	124	228.7507	499.3114
BR	112	.5643	.2587
CA	124	3157.5820	3925.1793
CE	124	16.6962	15.2037
CO	124	7.3124	4.3054
CR	124	6.3785	5.9449
CS	123	.3310	1.0487
EU	124	.3018	.2015
FE	124	4100.1471	6397.5266
HF	124	1.0255	.8804
LA	124	8.4960	8.1725
LU	124	.1235	.0811
NA	121	156.3516	241.1501
ND	124	8.0340	8.1997
RB	120	2.5065	9.5946
SB	124	2.3463	3.4518
SC	124	2.6380	2.0618
SE	124	1.8585	1.0180
SM	124	1.5094	1.1286
SR	124	168.0927	153.1883
TA	124	.2284	.1873
TB	124	.2369	.1612
TH	124	4.0178	6.0552
U	123	1.9355	2.3283
YB	124	.7812	.5323
ZN	111	12.3741	14.2989

	MOIST	ASH	VM	FC	TOTSUL	AS	BA	BR	CA	CE	CO
IOIST	1.0000	-.1348	.6946	-.3974	.3910	-.0278	-.2826	-.1575	.5387	-.3450	.5148
	(124)	(124)	(124)	(124)	(124)	(106)	(124)	(112)	(124)	(124)	(124)
	P= .	P= .136	P= .000	P= .000	P= .000	P= .777	P= .001	P= .097	P= .000	P= .000	P= .000
SH	-.1348	1.0000	-.4973	-.7284	.2625	.2770	.0055	-.0876	-.0981	.3414	.1509
	(124)	(124)	(124)	(124)	(124)	(106)	(124)	(112)	(124)	(124)	(124)
	P= .136	P= .	P= .000	P= .000	P= .003	P= .004	P= .952	P= .358	P= .279	P= .000	P= .094
M	.6946	-.4973	1.0000	-.2321	.2163	-.0508	-.1586	-.0287	.5104	-.5031	.1963
	(124)	(124)	(124)	(124)	(124)	(106)	(124)	(112)	(124)	(124)	(124)
	P= .000	P= .000	P= .	P= .009	P= .016	P= .605	P= .078	P= .764	P= .000	P= .000	P= .029

FC	-.3974 (124) P= .000	-.7284 (124) P= .000	-.2321 (124) P= .009	1.0000 (124) P= .	-.4651 (124) P= .000	-.2718 (106) P= .005	.1191 (124) P= .188	.1205 (112) P= .205	-.2932 (124) P= .001	.0145 (124) P= .873	-.3242 (124) P= .000
TOTSUL	.3910 (124) P= .000	.2625 (124) P= .003	.2163 (124) P= .016	-.4651 (124) P= .000	1.0000 (124) P= .	.1181 (106) P= .228	-.1214 (124) P= .179	-.1646 (112) P= .083	.2265 (124) P= .011	-.1999 (124) P= .026	.2476 (124) P= .006
AS	-.0278 (106) P= .777	.2770 (106) P= .004	-.0508 (106) P= .605	-.2718 (106) P= .005	.1181 (106) P= .228	1.0000 (106) P= .	-.0048 (106) P= .961	-.0102 (104) P= .918	-.1617 (106) P= .098	.0012 (106) P= .990	.0972 (106) P= .321
BA	-.2826 (124) P= .001	.0055 (124) P= .952	-.1586 (124) P= .078	.1191 (124) P= .188	-.1214 (124) P= .179	-.0048 (106) P= .961	1.0000 (124) P= .	-.0061 (112) P= .949	-.1545 (124) P= .087	.0913 (124) P= .313	-.0247 (124) P= .785
BR	-.1575 (112) P= .097	-.0876 (112) P= .358	-.0287 (112) P= .764	.1205 (112) P= .205	-.1646 (112) P= .083	-.0102 (104) P= .918	-.0061 (112) P= .949	1.0000 (112) P= .	.0238 (112) P= .803	-.1011 (112) P= .289	.0147 (112) P= .878
CA	.5387 (124) P= .000	-.0981 (124) P= .279	.5104 (124) P= .000	-.2932 (124) P= .001	.2265 (124) P= .011	-.1617 (106) P= .098	-.1545 (124) P= .087	.0238 (112) P= .803	1.0000 (124) P= .	-.3445 (124) P= .000	.2968 (124) P= .001
CE	-.3450 (124) P= .000	.3414 (124) P= .000	-.5031 (124) P= .000	.0145 (124) P= .873	-.1999 (124) P= .026	.0012 (106) P= .990	.0913 (124) P= .313	-.1011 (112) P= .289	-.3445 (124) P= .000	1.0000 (124) P= .	-.0115 (124) P= .899
CO	.5148 (124) P= .000	.1509 (124) P= .094	.1963 (124) P= .029	-.3242 (124) P= .000	.2476 (124) P= .006	.0972 (106) P= .321	-.0247 (124) P= .785	.0147 (112) P= .878	.2968 (124) P= .001	-.0115 (124) P= .899	1.0000 (124) P= .

	MOIST	ASH	VM	FC	TOTSUL	AS	BA	BR	CA	CE	CO
CR	-.2536 (124) P= .004	.7097 (124) P= .000	-.4485 (124) P= .000	-.4414 (124) P= .000	-.0444 (124) P= .624	.2504 (106) P= .010	.0607 (124) P= .503	.0078 (112) P= .935	-.2182 (124) P= .015	.4477 (124) P= .000	.0829 (124) P= .360
CS	-.0516 (123) P= .571	.6853 (123) P= .000	-.3642 (123) P= .000	-.4816 (123) P= .000	.1208 (123) P= .183	.3482 (105) P= .000	.0131 (123) P= .885	-.1427 (111) P= .135	-.1081 (123) P= .234	.4176 (123) P= .000	.1667 (123) P= .065
EU	-.3596 (124) P= .000	.4544 (124) P= .000	-.5392 (124) P= .000	-.0836 (124) P= .356	-.2406 (124) P= .007	.0204 (106) P= .836	.1033 (124) P= .254	.0028 (112) P= .977	-.3547 (124) P= .000	.8301 (124) P= .000	.2086 (124) P= .020
FE	.3965 (124) P= .000	.2028 (124) P= .024	.1774 (124) P= .049	-.3674 (124) P= .000	.3414 (124) P= .000	.2103 (106) P= .030	-.1638 (124) P= .069	-.1498 (112) P= .115	.1347 (124) P= .136	-.0124 (124) P= .891	.1485 (124) P= .100
HF	-.0185 (124) P= .838	.4429 (124) P= .000	-.1867 (124) P= .038	-.3491 (124) P= .000	-.0474 (124) P= .601	.1867 (106) P= .055	-.0391 (124) P= .667	.0126 (112) P= .895	-.2026 (124) P= .024	.4538 (124) P= .000	-.0329 (124) P= .717
LA	-.3888 (124) P= .000	.3180 (124) P= .000	-.5138 (124) P= .000	.0493 (124) P= .587	-.2184 (124) P= .015	-.0003 (106) P= .998	.1077 (124) P= .234	-.1287 (112) P= .176	-.3538 (124) P= .000	.9703 (124) P= .000	-.0874 (124) P= .335
LU	-.2480 (124) P= .005	.4847 (124) P= .000	-.4518 (124) P= .000	-.1866 (124) P= .038	-.1374 (124) P= .128	.0895 (106) P= .362	.0328 (124) P= .718	.0679 (112) P= .477	-.2824 (124) P= .001	.5461 (124) P= .000	.3628 (124) P= .000
NA	.6877 (121) P= .000	-.0673 (121) P= .463	.5866 (121) P= .000	-.3852 (121) P= .000	.2254 (121) P= .013	.0657 (106) P= .503	-.1710 (121) P= .061	-.0146 (112) P= .879	.4685 (121) P= .000	-.3001 (121) P= .001	.6073 (121) P= .000
ND	-.4691 (124) P= .000	.2722 (124) P= .002	-.5494 (124) P= .000	.1287 (124) P= .154	-.2870 (124) P= .001	-.0430 (106) P= .662	.1581 (124) P= .080	-.0722 (112) P= .450	-.3586 (124) P= .000	.9092 (124) P= .000	.0028 (124) P= .975
RB	-.0976 (120) P= .289	.6869 (120) P= .000	-.3964 (120) P= .000	-.4576 (120) P= .000	.1141 (120) P= .215	.2650 (103) P= .007	.0333 (120) P= .718	-.1416 (109) P= .142	-.1066 (120) P= .246	.4077 (120) P= .000	.1469 (120) P= .109

	MOIST	ASH	VM	FC	TOTSUL	AS	BA	BR	CA	CE	CO
SB	.3109 (124) P= .000	.2671 (124) P= .003	.1812 (124) P= .044	-.4425 (124) P= .000	.1850 (124) P= .040	.1357 (106) P= .166	.1557 (124) P= .084	.0856 (112) P= .370	.1703 (124) P= .059	-.1889 (124) P= .036	.5326 (124) P= .000

	MOIST	ASH	VM	FC	TOTSUL	AS	BA	BR	CA	CE	CO
SC	-.2858 (124) P= .001	.5985 (124) P= .000	-.5010 (124) P= .000	-.2754 (124) P= .002	-.0978 (124) P= .280	.1816 (106) P= .062	.0527 (124) P= .561	.0278 (112) P= .771	-.2933 (124) P= .001	.4864 (124) P= .000	.1542 (124) P= .087
SE	-.2244 (124) P= .012	.4402 (124) P= .000	-.3848 (124) P= .000	-.1896 (124) P= .035	-.1596 (124) P= .077	.2161 (106) P= .026	.0759 (124) P= .402	.0255 (112) P= .790	-.3365 (124) P= .000	.4225 (124) P= .000	-.0077 (124) P= .932
SM	-.4798 (124) P= .000	.3714 (124) P= .000	-.6087 (124) P= .000	.0643 (124) P= .478	-.3003 (124) P= .001	-.0086 (106) P= .930	.1306 (124) P= .148	-.0459 (112) P= .631	-.4000 (124) P= .000	.8105 (124) P= .000	.0820 (124) P= .365
SR	-.4434 (124) P= .000	-.1468 (124) P= .104	-.2467 (124) P= .006	.3593 (124) P= .000	-.3139 (124) P= .000	-.0510 (106) P= .603	.4107 (124) P= .000	-.0239 (112) P= .802	-.2357 (124) P= .008	.3172 (124) P= .000	-.1828 (124) P= .042
TA	.0094 (124) P= .918	.5769 (124) P= .000	-.2553 (124) P= .004	-.4452 (124) P= .000	.0207 (124) P= .819	.3155 (106) P= .001	-.0147 (124) P= .872	.0012 (112) P= .990	-.2056 (124) P= .022	.4270 (124) P= .000	.1079 (124) P= .233
TB	-.2510 (124) P= .005	.4514 (124) P= .000	-.4511 (124) P= .000	-.1498 (124) P= .097	-.1662 (124) P= .065	.0244 (106) P= .804	.0805 (124) P= .374	.0745 (112) P= .435	-.2800 (124) P= .002	.6409 (124) P= .000	.3771 (124) P= .000
TH	.0808 (124) P= .372	.2415 (124) P= .007	-.0973 (124) P= .282	-.1939 (124) P= .031	.0074 (124) P= .935	.0307 (106) P= .755	-.0488 (124) P= .591	-.0715 (112) P= .454	-.1763 (124) P= .050	.4273 (124) P= .000	-.0759 (124) P= .402
U	.0616 (123) P= .499	.3236 (123) P= .000	-.1496 (123) P= .099	-.2447 (123) P= .006	.0137 (123) P= .880	.1036 (105) P= .293	.0165 (123) P= .856	-.0554 (111) P= .564	-.1937 (123) P= .032	.3831 (123) P= .000	-.0245 (123) P= .788
YB	-.2397 (124) P= .007	.4450 (124) P= .000	-.4286 (124) P= .000	-.1605 (124) P= .075	-.1298 (124) P= .151	.0617 (106) P= .530	.0293 (124) P= .747	.0791 (112) P= .407	-.2782 (124) P= .002	.5494 (124) P= .000	.3825 (124) P= .000
ZN	-.1290 (111) P= .177	.4252 (111) P= .000	-.3427 (111) P= .000	-.2290 (111) P= .016	.2563 (111) P= .007	.2918 (93) P= .005	.0480 (111) P= .617	.1161 (99) P= .252	-.1545 (111) P= .105	.3887 (111) P= .000	.4176 (111) P= .000

	CR	CS	EU	FE	HF	LA	LU	NA	ND	RB	SB
CR	1.0000 (124) P= .	.7176 (123) P= .000	.6337 (124) P= .000	-.0575 (124) P= .526	.5607 (124) P= .000	.4413 (124) P= .000	.6314 (124) P= .000	-.1286 (121) P= .160	.4177 (124) P= .000	.7355 (120) P= .000	.1175 (124) P= .194
CS	.7176 (123) P= .000	1.0000 (123) P= .	.4264 (123) P= .000	.1115 (123) P= .220	.2973 (123) P= .001	.3845 (123) P= .000	.3908 (123) P= .000	-.0123 (120) P= .894	.3405 (123) P= .000	.9513 (119) P= .000	.0030 (123) P= .974
EU	.6337 (124) P= .000	.4264 (123) P= .000	1.0000 (124) P= .	-.1259 (124) P= .164	.4218 (124) P= .000	.7618 (124) P= .000	.8467 (124) P= .000	-.1980 (121) P= .029	.8490 (124) P= .000	.4269 (120) P= .000	.1262 (124) P= .162
FE	-.0575 (124) P= .526	.1115 (123) P= .220	-.1259 (124) P= .164	1.0000 (124) P= .	.1261 (124) P= .163	-.0352 (124) P= .698	-.1235 (124) P= .172	.2302 (121) P= .011	-.1368 (124) P= .130	.0207 (120) P= .823	.0636 (124) P= .483
HF	.5607 (124) P= .000	.2973 (123) P= .001	.4218 (124) P= .000	.1261 (124) P= .163	1.0000 (124) P= .	.4541 (124) P= .000	.3635 (124) P= .000	-.0641 (121) P= .485	.2454 (124) P= .006	.2866 (120) P= .002	.0631 (124) P= .486
LA	.4413 (124) P= .000	.3845 (123) P= .000	.7618 (124) P= .000	-.0352 (124) P= .698	.4541 (124) P= .000	1.0000 (124) P= .	.5074 (124) P= .000	-.3474 (121) P= .000	.8570 (124) P= .000	.3748 (120) P= .000	-.2258 (124) P= .012
LU	.6314	.3908	.8467	-.1235	.3635	.5074	1.0000	-.0549	.5798	.3848	.3919

	CR	CS	EU	FE	HF	LA	LU	NA	ND	RB	SB
	(124) P= .000	(123) P= .000	(124) P= .000	(124) P= .172	(124) P= .000	(124) P= .000	(124) P= .	(121) P= .550	(124) P= .000	(120) P= .000	(124) P= .000
NA	-.1286 (121) P= .160	-.0123 (120) P= .894	-.1980 (121) P= .029	.2302 (121) P= .011	-.0641 (121) P= .485	-.3474 (121) P= .000	-.0549 (121) P= .550	1.0000 (121) P= .	-.3700 (121) P= .000	-.0540 (117) P= .563	.3635 (121) P= .000
ND	.4177 (124) P= .000	.3405 (123) P= .000	.8490 (124) P= .000	-.1368 (124) P= .130	.2454 (124) P= .006	.8570 (124) P= .000	.5798 (124) P= .000	-.3700 (121) P= .000	1.0000 (124) P= .	.3574 (120) P= .000	-.1807 (124) P= .045
RB	.7355 (120) P= .000	.9513 (119) P= .000	.4269 (120) P= .000	.0207 (120) P= .823	.2866 (120) P= .002	.3748 (120) P= .000	.3848 (120) P= .000	-.0540 (117) P= .563	.3574 (120) P= .000	1.0000 (120) P= .	-.0154 (120) P= .867
SB	.1175 (124) P= .194	.0030 (123) P= .974	.1262 (124) P= .162	.0636 (124) P= .483	.0631 (124) P= .486	-.2258 (124) P= .012	.3919 (124) P= .000	.3635 (121) P= .000	-.1807 (124) P= .045	-.0154 (120) P= .867	1.0000 (124) P= .

	CR	CS	EU	FE	HF	LA	LU	NA	ND	RB	SB
SC	.8617 (124) P= .000	.5575 (123) P= .000	.7460 (124) P= .000	-.0771 (124) P= .395	.4505 (124) P= .000	.4527 (124) P= .000	.7882 (124) P= .000	-.1580 (121) P= .083	.4996 (124) P= .000	.5616 (120) P= .000	.2318 (124) P= .010
SE	.6122 (124) P= .000	.3876 (123) P= .000	.4480 (124) P= .000	.0668 (124) P= .461	.7100 (124) P= .000	.4282 (124) P= .000	.4118 (124) P= .000	-.1638 (121) P= .073	.3039 (124) P= .001	.3587 (120) P= .000	-.0474 (124) P= .601
SM	.5937 (124) P= .000	.4023 (123) P= .000	.9143 (124) P= .000	-.1790 (124) P= .047	.3091 (124) P= .000	.7645 (124) P= .000	.7153 (124) P= .000	-.3219 (121) P= .000	.8580 (124) P= .000	.4193 (120) P= .000	-.0490 (124) P= .589
SR	-.1541 (124) P= .087	-.0809 (123) P= .374	.2181 (124) P= .015	-.2363 (124) P= .008	-.1804 (124) P= .045	.3159 (124) P= .000	-.0102 (124) P= .910	-.3037 (121) P= .001	.4687 (124) P= .000	-.0658 (120) P= .475	-.1743 (124) P= .053
TA	.6633 (124) P= .000	.5224 (123) P= .000	.4270 (124) P= .000	.1235 (124) P= .172	.8399 (124) P= .000	.4326 (124) P= .000	.4673 (124) P= .000	.0180 (121) P= .844	.2314 (124) P= .010	.4766 (120) P= .000	.0790 (124) P= .383
TB	.6023 (124) P= .000	.3500 (123) P= .000	.9330 (124) P= .000	-.1355 (124) P= .133	.3555 (124) P= .000	.5788 (124) P= .000	.9322 (124) P= .000	-.0805 (121) P= .380	.6846 (124) P= .000	.3475 (120) P= .000	.3886 (124) P= .000
TH	.2861 (124) P= .001	.1967 (123) P= .029	.2749 (124) P= .002	.1171 (124) P= .195	.8553 (124) P= .000	.4190 (124) P= .000	.1935 (124) P= .031	-.0483 (121) P= .599	.1783 (124) P= .048	.1660 (120) P= .070	-.0171 (124) P= .851
U	.3831 (123) P= .000	.2302 (122) P= .011	.3225 (123) P= .000	.1828 (123) P= .043	.8311 (123) P= .000	.3723 (123) P= .000	.2914 (123) P= .001	-.0444 (120) P= .630	.1627 (123) P= .072	.1778 (119) P= .053	.0452 (123) P= .620
YB	.5833 (124) P= .000	.3523 (123) P= .000	.8577 (124) P= .000	-.1216 (124) P= .179	.3140 (124) P= .000	.5019 (124) P= .000	.9797 (124) P= .000	-.0402 (121) P= .662	.5819 (124) P= .000	.3375 (120) P= .000	.4003 (124) P= .000
ZN	.4760 (111) P= .000	.4275 (110) P= .000	.5303 (111) P= .000	.0217 (111) P= .821	.2548 (111) P= .007	.3729 (111) P= .000	.6316 (111) P= .000	.0919 (108) P= .344	.3885 (111) P= .000	.4842 (107) P= .000	.1795 (111) P= .059

	SC	SE	SM	SR	TA	TB	TH	U	YB	ZN
SC	1.0000 (124) P= .	.5802 (124) P= .000	.7018 (124) P= .000	-.1240 (124) P= .170	.5198 (124) P= .000	.7622 (124) P= .000	.2660 (124) P= .003	.3955 (123) P= .000	.7705 (124) P= .000	.5575 (111) P= .000
SE	.5802 (124) P= .000	1.0000 (124) P= .	.4031 (124) P= .000	-.0963 (124) P= .287	.7196 (124) P= .000	.3722 (124) P= .000	.6051 (124) P= .000	.7176 (123) P= .000	.3572 (124) P= .000	.2649 (111) P= .005
SM	.7018	.4031	1.0000	.2802	.3230	.8080	.1981	.2228	.7289	.4681

	(124)	(124)	(124)	(124)	(124)	(124)	(124)	(123)	(124)	(111)
	P= .000	P= .000	P= .	P= .002	P= .000	P= .000	P= .027	P= .013	P= .000	P= .000
SR	-.1240	-.0963	.2802	1.0000	-.2280	.0926	-.1484	-.1790	.0153	-.0258
	(124)	(124)	(124)	(124)	(124)	(124)	(124)	(123)	(124)	(111)
	P= .170	P= .287	P= .002	P= .	P= .011	P= .306	P= .100	P= .048	P= .866	P= .788
TA	.5198	.7196	.3230	-.2280	1.0000	.3741	.6912	.7099	.3896	.3854
	(124)	(124)	(124)	(124)	(124)	(124)	(124)	(123)	(124)	(111)
	P= .000	P= .000	P= .000	P= .011	P= .	P= .000	P= .000	P= .000	P= .000	P= .000
TB	.7622	.3722	.8080	.0926	.3741	1.0000	.1893	.2658	.9449	.5706
	(124)	(124)	(124)	(124)	(124)	(124)	(124)	(123)	(124)	(111)
	P= .000	P= .000	P= .000	P= .306	P= .000	P= .	P= .035	P= .003	P= .000	P= .000
TH	.2660	.6051	.1981	-.1484	.6912	.1893	1.0000	.9143	.1585	.1278
	(124)	(124)	(124)	(124)	(124)	(124)	(124)	(123)	(124)	(111)
	P= .003	P= .000	P= .027	P= .100	P= .000	P= .035	P= .	P= .000	P= .079	P= .181
U	.3955	.7176	.2228	-.1790	.7099	.2658	.9143	1.0000	.2542	.2076
	(123)	(123)	(123)	(123)	(123)	(123)	(123)	(123)	(123)	(110)
	P= .000	P= .000	P= .013	P= .048	P= .000	P= .003	P= .000	P= .	P= .005	P= .030
YB	.7705	.3572	.7289	.0153	.3896	.9449	.1585	.2542	1.0000	.6114
	(124)	(124)	(124)	(124)	(124)	(124)	(124)	(123)	(124)	(111)
	P= .000	P= .000	P= .000	P= .866	P= .000	P= .000	P= .079	P= .005	P= .	P= .000
ZN	.5575	.2649	.4681	-.0258	.3854	.5706	.1278	.2076	.6114	1.0000
	(111)	(111)	(111)	(111)	(111)	(111)	(111)	(110)	(111)	(111)
	P= .000	P= .005	P= .000	P= .788	P= .000	P= .000	P= .181	P= .030	P= .000	P= .

Table E-2.
Pearson Correlation Coefficients for All Lee Ranch Seams, Coal Samples Only.

VARIABLE	CASES	MEAN	STD DEV
MOIST	84	12.2077	2.0984
ASH	84	11.6308	9.0525
VM	84	44.0023	4.4365
FC	84	44.3667	5.9177
TOTSUL	84	.7670	.1889
AS	66	1.0789	1.1183
BA	84	130.7546	554.0018
BR	72	.5442	.2458
CA	84	4460.3571	3968.2397
CE	84	13.0054	9.9763
CO	84	8.8296	4.1380
CR	84	5.6676	4.3941
CS	83	.3103	.7353
EU	84	.2568	.1379
FE	84	6052.0748	6978.5011
HF	84	1.0662	.9949
LA	84	6.2498	5.1736
LU	84	.1130	.0734
NA	81	282.9400	195.3192
ND	84	5.3006	3.2239
RB	80	1.7925	4.0397
SB	84	3.3372	3.8142
SC	84	2.3130	1.4741
SE	84	1.7518	.9961
SM	84	1.1368	.5965
SR	84	119.6369	29.8497
TA	84	.2404	.1820
TB	84	.2149	.1366
TH	84	4.4109	7.1630
U	83	2.0872	2.7031
YB	84	.7143	.4765

	MOIST	ASH	VM	FC	TOTSUL	AS	BA	BR	CA	CE	CO
MOIST	1.0000	-.6136	.2069	.7835	.0556	-.3377	-.0390	-.2191	.0467	-.1072	.0979
	(84)	(84)	(84)	(84)	(84)	(66)	(84)	(72)	(84)	(84)	(84)
	P= .	P= .000	P= .059	P= .000	P= .615	P= .006	P= .725	P= .064	P= .673	P= .332	P= .376
ASH	-.6136	1.0000	-.8293	-.9080	.1564	.3347	.0301	.0155	-.1548	.3415	.0873
	(84)	(84)	(84)	(84)	(84)	(66)	(84)	(72)	(84)	(84)	(84)
	P= .000	P= .	P= .000	P= .000	P= .155	P= .006	P= .786	P= .897	P= .160	P= .001	P= .430
VM	.2069	-.8293	1.0000	.5188	-.2358	-.2118	.0325	.0113	.2706	-.3528	-.2446

	MOIST	ASH	VM	FC	TOTSUL	AS	BA	BR	CA	CE	CO
	(84) P= .059	(84) P= .000	(84) P= .	(84) P= .000	(84) P= .031	(66) P= .088	(84) P= .769	(72) P= .925	(84) P= .013	(84) P= .001	(84) P= .025
FC	.7835 (84) P= .000	-.9080 (84) P= .000	.5188 (84) P= .000	1.0000 (84) P= .	-.0625 (84) P= .572	-.3578 (66) P= .003	-.0703 (84) P= .525	-.0326 (72) P= .786	.0337 (84) P= .761	-.2580 (84) P= .018	.0498 (84) P= .653
TOTSUL	.0556 (84) P= .615	.1564 (84) P= .155	-.2358 (84) P= .031	-.0625 (84) P= .572	1.0000 (84) P= .	.1842 (66) P= .139	.0126 (84) P= .910	-.2287 (72) P= .053	.0137 (84) P= .902	.1494 (84) P= .175	.1515 (84) P= .169
AS	-.3377 (66) P= .006	.3347 (66) P= .006	-.2118 (66) P= .088	-.3578 (66) P= .003	.1842 (66) P= .139	1.0000 (66) P= .	-.0183 (66) P= .884	.0411 (64) P= .747	-.2726 (66) P= .027	.1837 (66) P= .140	.1568 (66) P= .209
BA	-.0390 (84) P= .725	.0301 (84) P= .786	.0325 (84) P= .769	-.0703 (84) P= .525	.0126 (84) P= .910	-.0183 (66) P= .884	1.0000 (84) P= .	.0153 (72) P= .898	.0060 (84) P= .957	-.0144 (84) P= .896	.2016 (84) P= .066
BR	-.2191 (72) P= .064	.0155 (72) P= .897	.0113 (72) P= .925	-.0326 (72) P= .786	-.2287 (72) P= .053	.0411 (64) P= .747	.0153 (72) P= .898	1.0000 (72) P= .	.1347 (72) P= .259	-.1192 (72) P= .318	.2256 (72) P= .057
CA	.0467 (84) P= .673	-.1548 (84) P= .160	.2706 (84) P= .013	.0337 (84) P= .761	.0137 (84) P= .902	-.2726 (66) P= .027	.0060 (84) P= .957	.1347 (72) P= .259	1.0000 (84) P= .	-.3300 (84) P= .002	.0171 (84) P= .878
CE	-.1072 (84) P= .332	.3415 (84) P= .001	-.3528 (84) P= .001	-.2580 (84) P= .018	.1494 (84) P= .175	.1837 (66) P= .140	-.0144 (84) P= .896	-.1192 (72) P= .318	-.3300 (84) P= .002	1.0000 (84) P= .	-.0504 (84) P= .649
CO	.0979 (84) P= .376	.0873 (84) P= .430	-.2446 (84) P= .025	.0498 (84) P= .653	.1515 (84) P= .169	.1568 (66) P= .209	.2016 (84) P= .066	.2256 (72) P= .057	.0171 (84) P= .878	-.0504 (84) P= .649	1.0000 (84) P= .

	MOIST	ASH	VM	FC	TOTSUL	AS	BA	BR	CA	CE	CO
CR	-.5518 (84) P= .000	.5837 (84) P= .000	-.3801 (84) P= .000	-.6079 (84) P= .000	-.0936 (84) P= .397	.5355 (66) P= .000	.1029 (84) P= .352	.2462 (72) P= .037	-.2405 (84) P= .028	.4201 (84) P= .000	.0698 (84) P= .528
CS	-.2732 (83) P= .012	.4825 (83) P= .000	-.4489 (83) P= .000	-.4018 (83) P= .000	.2147 (83) P= .051	.5218 (65) P= .000	.0059 (83) P= .958	-.0491 (71) P= .684	-.1928 (83) P= .081	.5091 (83) P= .000	.1179 (83) P= .288
EU	-.3300 (84) P= .002	.5256 (84) P= .000	-.4662 (84) P= .000	-.4545 (84) P= .000	.0528 (84) P= .634	.2818 (66) P= .022	.1047 (84) P= .343	.1110 (72) P= .353	-.3716 (84) P= .001	.6160 (84) P= .000	.3661 (84) P= .001
FE	-.0773 (84) P= .485	.3057 (84) P= .005	-.2932 (84) P= .007	-.2479 (84) P= .023	.3421 (84) P= .001	.2212 (66) P= .074	-.0453 (84) P= .682	-.1490 (72) P= .211	-.1513 (84) P= .170	.2989 (84) P= .006	-.1118 (84) P= .311
HF	-.2946 (84) P= .007	.3669 (84) P= .001	-.2851 (84) P= .009	-.3475 (84) P= .001	-.1211 (84) P= .273	.1658 (66) P= .183	-.0111 (84) P= .920	.1030 (72) P= .389	-.3177 (84) P= .003	.7138 (84) P= .000	-.1541 (84) P= .162
LA	-.0963 (84) P= .384	.3331 (84) P= .002	-.3352 (84) P= .002	-.2582 (84) P= .018	.1448 (84) P= .189	.1669 (66) P= .180	-.0314 (84) P= .777	-.1181 (. 72) P= .323	-.3034 (84) P= .005	.9907 (84) P= .000	-.1159 (84) P= .294
LU	-.3140 (84) P= .004	.4716 (84) P= .000	-.4388 (84) P= .000	-.3924 (84) P= .000	.0169 (84) P= .879	.2639 (66) P= .032	.0607 (84) P= .583	.2888 (72) P= .014	-.2873 (84) P= .008	.2880 (84) P= .008	.4765 (84) P= .000
NA	-.0935 (81) P= .406	-.1415 (81) P= .208	.1688 (81) P= .132	.0904 (81) P= .422	-.2136 (81) P= .055	.0189 (66) P= .880	.0674 (81) P= .550	.1334 (72) P= .264	.0884 (81) P= .433	-.1151 (81) P= .306	.4242 (81) P= .000
ND	-.1712 (84) P= .119	.4155 (84) P= .000	-.4011 (84) P= .000	-.3348 (84) P= .002	.1665 (84) P= .130	.2697 (66) P= .029	.0139 (84) P= .900	-.0620 (72) P= .605	-.3298 (84) P= .002	.9312 (84) P= .000	.1192 (84) P= .280
B	-.2569 (80) P= .021	.4877 (80) P= .000	-.4534 (80) P= .000	-.4074 (80) P= .000	.1904 (80) P= .091	.5743 (63) P= .000	.0036 (80) P= .975	-.0332 (69) P= .786	-.1688 (80) P= .135	.4915 (80) P= .000	.1869 (80) P= .097
3	-.2836 (84)	.3764 (84)	-.2271 (84)	-.4055 (84)	.0426 (84)	.1301 (66)	.3372 (84)	.1930 (72)	-.0828 (84)	-.0995 (84)	.4360 (84)

P= .009 P= .000 P= .038 P= .000 P= .700 P= .298 P= .002 P= .104 P= .454 P= .368 P= .000

	MOIST	ASH	VM	FC	TOTSUL	AS	BA	BR	CA	CE	CO
SC	-.4339 (84) P= .000	.6081 (84) P= .000	-.4899 (84) P= .000	-.5629 (84) P= .000	.0840 (84) P= .447	.4717 (66) P= .000	.1111 (84) P= .314	.1945 (72) P= .102	-.3393 (84) P= .002	.4568 (84) P= .000	.2683 (84) P= .014
SE	-.3325 (84) P= .002	.4282 (84) P= .000	-.4014 (84) P= .000	-.3541 (84) P= .001	-.0743 (84) P= .502	.2857 (66) P= .020	.0716 (84) P= .518	.1294 (72) P= .279	-.3767 (84) P= .000	.6816 (84) P= .000	.0418 (84) P= .706
SM	-.2443 (84) P= .025	.4785 (84) P= .000	-.4618 (84) P= .000	-.3858 (84) P= .000	.1158 (84) P= .294	.2752 (66) P= .025	.0784 (84) P= .479	.0361 (72) P= .763	-.3673 (84) P= .001	.7243 (84) P= .000	.3752 (84) P= .000
SR	-.0526 (84) P= .635	-.1013 (84) P= .359	.1895 (84) P= .084	.0129 (84) P= .907	-.0499 (84) P= .652	.0822 (66) P= .512	.5346 (84) P= .000	.0319 (72) P= .790	.1548 (84) P= .160	-.0952 (84) P= .389	.3479 (84) P= .001
TA	-.3360 (84) P= .002	.4712 (84) P= .000	-.4577 (84) P= .000	-.3776 (84) P= .000	-.0915 (84) P= .408	.3231 (66) P= .008	.0262 (84) P= .813	.1842 (72) P= .121	-.3880 (84) P= .000	.7324 (84) P= .000	.0251 (84) P= .821
TB	-.3066 (84) P= .005	.4837 (84) P= .000	-.4309 (84) P= .000	-.4169 (84) P= .000	.0577 (84) P= .602	.2427 (66) P= .050	.1330 (84) P= .228	.2422 (72) P= .040	-.2928 (84) P= .007	.3121 (84) P= .004	.5097 (84) P= .000
TH	-.0383 (84) P= .729	.1961 (84) P= .074	-.2116 (84) P= .053	-.1412 (84) P= .200	-.0479 (84) P= .665	-.0049 (66) P= .969	-.0153 (84) P= .890	-.0399 (72) P= .739	-.2837 (84) P= .009	.7761 (84) P= .000	-.1883 (84) P= .086
U	-.1010 (83) P= .364	.3230 (83) P= .003	-.3121 (83) P= .004	-.2599 (83) P= .018	-.0187 (83) P= .867	.0950 (65) P= .452	.0727 (83) P= .514	-.0126 (71) P= .917	-.3138 (83) P= .004	.7502 (83) P= .000	-.1224 (83) P= .270
YB	-.2990 (84) P= .006	.4563 (84) P= .000	-.4283 (84) P= .000	-.3768 (84) P= .000	.0478 (84) P= .666	.2525 (66) P= .041	.0699 (84) P= .527	.2519 (72) P= .033	-.2889 (84) P= .008	.2796 (84) P= .010	.5073 (84) P= .000
ZN	-.1056 (82) P= .345	.2344 (82) P= .034	-.3035 (82) P= .006	-.1325 (82) P= .235	.1842 (82) P= .098	.4172 (64) P= .001	.0548 (82) P= .625	.2765 (70) P= .020	-.1353 (82) P= .225	.2883 (82) P= .009	.5442 (82) P= .000

	CR	CS	EU	FE	HF	LA	LU	NA	ND	RB	SB
CR	1.0000 (84) P= .	.5592 (83) P= .000	.7205 (84) P= .000	.0362 (84) P= .744	.5917 (84) P= .000	.4204 (84) P= .000	.5912 (84) P= .000	-.0135 (81) P= .905	.5664 (84) P= .000	.5832 (80) P= .000	.3015 (84) P= .005
CS	.5592 (83) P= .000	1.0000 (83) P= .	.4771 (83) P= .000	.2412 (83) P= .028	.1632 (83) P= .140	.5157 (83) P= .000	.3721 (83) P= .001	.0164 (80) P= .885	.6107 (83) P= .000	.9494 (79) P= .000	-.0003 (83) P= .998
EU	.7205 (84) P= .000	.4771 (83) P= .000	1.0000 (84) P= .	.0367 (84) P= .740	.5697 (84) P= .000	.5649 (84) P= .000	.8509 (84) P= .000	.1006 (81) P= .372	.7769 (84) P= .000	.5183 (80) P= .000	.4874 (84) P= .000
FE	.0362 (84) P= .744	.2412 (83) P= .028	.0367 (84) P= .740	1.0000 (84) P= .	.1181 (84) P= .285	.3056 (84) P= .005	-.0597 (84) P= .590	-.1993 (81) P= .075	.2713 (84) P= .013	.2216 (80) P= .048	-.1498 (84) P= .174
HF	.5917 (84) P= .000	.1632 (83) P= .140	.5697 (84) P= .000	.1181 (84) P= .285	1.0000 (84) P= .	.7183 (84) P= .000	.3178 (84) P= .003	-.2060 (81) P= .065	.6135 (84) P= .000	.1642 (80) P= .145	.0320 (84) P= .773
LA	.4204 (84) P= .000	.5157 (83) P= .000	.5649 (84) P= .000	.3056 (84) P= .005	.7183 (84) P= .000	1.0000 (84) P= .	.2381 (84) P= .029	-.1521 (81) P= .175	.9040 (84) P= .000	.4876 (80) P= .000	-.1389 (84) P= .208
LU	.5912 (84) P= .000	.3721 (83) P= .001	.8509 (84) P= .000	-.0597 (84) P= .590	.3178 (84) P= .003	.2381 (84) P= .029	1.0000 (84) P= .	.1535 (81) P= .171	.4573 (84) P= .000	.4238 (80) P= .000	.6763 (84) P= .000

NA	-.0135 (81) P= .905	.0164 (80) P= .885	.1006 (81) P= .372	-.1993 (81) P= .075	-.2060 (81) P= .065	-.1521 (81) P= .175	.1535 (81) P= .171	1.0000 (81) P= .	-.0498 (81) P= .659	.1109 (77) P= .337	.0647 (81) P= .566
ND	.5664 (84) P= .000	.6107 (83) P= .000	.7769 (84) P= .000	.2713 (84) P= .013	.6135 (84) P= .000	.9040 (84) P= .000	.4573 (84) P= .000	-.0498 (81) P= .659	1.0000 (84) P= .	.6122 (80) P= .000	.0531 (84) P= .631
RB	.5832 (80) P= .000	.9494 (79) P= .000	.5183 (80) P= .000	.2216 (80) P= .048	.1642 (80) P= .145	.4876 (80) P= .000	.4238 (80) P= .000	.1109 (77) P= .337	.6122 (80) P= .000	1.0000 (80) P= .	.0394 (80) P= .728
SB	.3015 (84) P= .005	-.0003 (83) P= .998	.4874 (84) P= .000	-.1498 (84) P= .174	.0320 (84) P= .773	-.1389 (84) P= .208	.6763 (84) P= .000	.0647 (81) P= .566	.0531 (84) P= .631	.0394 (80) P= .728	1.0000 (84) P= .

	CR	CS	EU	FE	HF	LA	LU	NA	ND	RB	SB
SC	.8236 (84) P= .000	.5530 (83) P= .000	.8623 (84) P= .000	.0470 (84) P= .671	.4868 (84) P= .000	.4261 (84) P= .000	.8515 (84) P= .000	.0138 (81) P= .903	.6139 (84) P= .000	.6060 (80) P= .000	.5689 (84) P= .000
SE	.5847 (84) P= .000	.3653 (83) P= .001	.5926 (84) P= .000	.1867 (84) P= .089	.7587 (84) P= .000	.6563 (84) P= .000	.3734 (84) P= .000	-.1021 (81) P= .364	.6375 (84) P= .000	.3725 (80) P= .001	-.0007 (84) P= .995
SM	.6520 (84) P= .000	.5357 (83) P= .000	.9655 (84) P= .000	.0881 (84) P= .426	.5353 (84) P= .000	.6695 (84) P= .000	.7594 (84) P= .000	.1144 (81) P= .309	.8797 (84) P= .000	.5756 (80) P= .000	.3525 (84) P= .001
SR	-.0479 (84) P= .665	.0869 (83) P= .435	.0051 (84) P= .963	-.2226 (84) P= .042	-.2597 (84) P= .017	-.1319 (84) P= .232	-.0016 (84) P= .989	.3751 (81) P= .001	-.0606 (84) P= .584	.1123 (80) P= .321	.2181 (84) P= .046
TA	.6653 (84) P= .000	.4494 (83) P= .000	.6388 (84) P= .000	.1151 (84) P= .297	.8462 (84) P= .000	.7278 (84) P= .000	.4583 (84) P= .000	-.1193 (81) P= .289	.6861 (84) P= .000	.4289 (80) P= .000	.0399 (84) P= .719
TB	.6286 (84) P= .000	.3293 (83) P= .002	.9060 (84) P= .000	-.0757 (84) P= .494	.3673 (84) P= .001	.2626 (84) P= .016	.9428 (84) P= .000	.1242 (81) P= .269	.5061 (84) P= .000	.3762 (80) P= .001	.7245 (84) P= .000
TH	.2851 (84) P= .009	.1489 (83) P= .179	.4326 (84) P= .000	.0864 (84) P= .435	.8733 (84) P= .000	.7914 (84) P= .000	.1845 (84) P= .093	-.1968 (81) P= .078	.5813 (84) P= .000	.1355 (80) P= .231	-.0703 (84) P= .525
U	.4217 (83) P= .000	.2534 (82) P= .022	.5359 (83) P= .000	.1651 (83) P= .136	.8556 (83) P= .000	.7512 (83) P= .000	.3093 (83) P= .004	-.2006 (80) P= .074	.6036 (83) P= .000	.2525 (79) P= .025	-.0043 (83) P= .969
YB	.5651 (84) P= .000	.3782 (83) P= .000	.8516 (84) P= .000	-.0613 (84) P= .579	.2873 (84) P= .008	.2260 (84) P= .039	.9927 (84) P= .000	.1765 (81) P= .115	.4569 (84) P= .000	.4270 (80) P= .000	.6911 (84) P= .000
ZN	.3898 (82) P= .000	.3623 (81) P= .001	.5539 (82) P= .000	.0927 (82) P= .407	.1913 (82) P= .085	.2353 (82) P= .033	.6124 (82) P= .000	.2964 (79) P= .008	.4054 (82) P= .000	.5169 (78) P= .000	.2905 (82) P= .008

	SC	SE	SM	SR	TA	TB	TH	U	YB	ZN
SC	1.0000 (84) P= .	.5225 (84) P= .000	.7905 (84) P= .000	-.0055 (84) P= .960	.5833 (84) P= .000	.8501 (84) P= .000	.2939 (84) P= .007	.4616 (83) P= .000	.8448 (84) P= .000	.5908 (82) P= .000
SE	.5225 (84) P= .000	1.0000 (84) P= .	.5770 (84) P= .000	-.0033 (84) P= .977	.7924 (84) P= .000	.3750 (84) P= .000	.6601 (84) P= .000	.7531 (83) P= .000	.3362 (84) P= .002	.2266 (82) P= .041
SM	.7905 (84) P= .000	.5770 (84) P= .000	1.0000 (84) P= .	.0226 (84) P= .839	.6368 (84) P= .000	.8154 (84) P= .000	.4365 (84) P= .000	.5051 (83) P= .000	.7675 (84) P= .000	.5679 (82) P= .000

SR	-.0055	-.0033	.0226	1.0000	-.1489	.0348	-.1827	-.1465	.0154	.0658
	(84)	(84)	(84)	(84)	(84)	(84)	(84)	(83)	(84)	(82)
	P= .960	P= .977	P= .839	P= .	P= .176	P= .753	P= .096	P= .186	P= .890	P= .557
TA	.5833	.7924	.6368	-.1489	1.0000	.4457	.7355	.7656	.4242	.3287
	(84)	(84)	(84)	(84)	(84)	(84)	(84)	(83)	(84)	(82)
	P= .000	P= .000	P= .000	P= .176	P= .	P= .000	P= .000	P= .000	P= .000	P= .003
TB	.8501	.3750	.8154	.0348	.4457	1.0000	.2138	.3198	.9481	.5728
	(84)	(84)	(84)	(84)	(84)	(84)	(84)	(83)	(84)	(82)
	P= .000	P= .000	P= .000	P= .753	P= .000	P= .	P= .051	P= .003	P= .000	P= .000
TH	.2939	.6601	.4365	-.1827	.7355	.2138	1.0000	.9190	.1609	.1054
	(84)	(84)	(84)	(84)	(84)	(84)	(84)	(83)	(84)	(82)
	P= .007	P= .000	P= .000	P= .096	P= .000	P= .051	P= .	P= .000	P= .144	P= .346
U	.4616	.7531	.5051	-.1465	.7656	.3198	.9190	1.0000	.2817	.2123
	(83)	(83)	(83)	(83)	(83)	(83)	(83)	(83)	(83)	(81)
	P= .000	P= .000	P= .000	P= .186	P= .000	P= .003	P= .000	P= .	P= .010	P= .057
YB	.8448	.3362	.7675	.0154	.4242	.9481	.1609	.2817	1.0000	.6195
	(84)	(84)	(84)	(84)	(84)	(84)	(84)	(83)	(84)	(82)
	P= .000	P= .002	P= .000	P= .890	P= .000	P= .000	P= .144	P= .010	P= .	P= .000
ZN	.5908	.2266	.5679	.0658	.3287	.5728	.1054	.2123	.6195	1.0000
	(82)	(82)	(82)	(82)	(82)	(82)	(82)	(81)	(82)	(82)
	P= .000	P= .041	P= .000	P= .557	P= .003	P= .000	P= .346	P= .057	P= .000	P= .

Table E-3.
Pearson Correlation Coefficients for the York Canyon Seams, Coal Samples Only.

VARIABLE	CASES	MEAN	STD DEV
MOIST	40	1.6038	.3606
ASH	40	11.7122	11.7831
VM	40	33.4305	5.9879
FC	40	54.8573	9.9108
TOTSUL	40	.5248	.3791
AS	40	9385	.6491
BA	40	434.5425	262.6533
BR	40	.6005	2799
CA	40	1.7542	2.2073
CE	40	24.4470	20.6459
CO	40	4.1263	2.5790
CR	40	7.8713	8.1852
CS	40	.3740	1.5167
EU	40	3964	2721
FE	40	1.0991	2.9045
HF	40	.9400	.6408
LA	40	13.2130	10.9542
LU	40	.1457	.0925
NA	40	−99.9900	.0000
ND	40	13.7740	11.8340
RB	40	3.9345	15.6428
SB	40	.2652	.2455
SC	40	3.3207	2.8419
SE	40	2.0825	1.0395
SM	40	2.2919	1.5274
SR	40	269.8500	237.5642
TA	40	.2034	.1980
TB	40	.2832	.1975
TH	40	3.1924	2.3254
U	40	1.6208	1.2021
YB	40	.9217	.6169
ZN	29	15.1741	16.2016

	MOIST	ASH	VM	FC	TOTSUL	AS	BA	BR	CA	CE	CO
MOIST	1.0000 (40) P= .	.7239 (40) P= .000	-.4309 (40) P= .006	-.6002 (40) P= .000	.2630 (40) P= .101	.0738 (40) P= .651	-.1205 (40) P= .459	-.1578 (40) P= .331	-.1533 (40) P= .345	.2536 (40) P= .114	.4163 (40) P= .008
ASH	.7239 (40) P= .000	1.0000 (40) P= .	-.5419 (40) P= .000	-.8615 (40) P= .000	.4065 (40) P= .009	.1994 (40) P= .217	-.0817 (40) P= .616	-.2206 (40) P= .171	-.0786 (40) P= .630	.3982 (40) P= .011	.4515 (40) P= .003

VM	-.4309	-.5419	1.0000	.0401	.0074	-.0037	.1960	.1276	-.0196	-.4210	-.4066
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .006	P= .000	P= .	P= .806	P= .964	P= .982	P= .225	P= .433	P= .904	P= .007	P= .009
FC	-.6002	-.8615	.0401	1.0000	-.4877	-.2348	-.0214	.1852	.1053	-.2190	-.2912
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .000	P= .000	P= .806	P= .	P= .001	P= .145	P= .896	P= .252	P= .518	P= .175	P= .068
TOTSUL	.2630	.4065	.0074	-.4877	1.0000	.0273	-.0661	-.0731	-.1802	-.1823	-.0792
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .101	P= .009	P= .964	P= .001	P= .	P= .867	P= .685	P= .654	P= .266	P= .260	P= .627
AS	.0738	.1994	-.0037	-.2348	.0273	1.0000	.2386	-.1065	-.1741	-.1988	-.3283
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .651	P= .217	P= .982	P= .145	P= .867	P= .	P= .138	P= .513	P= .283	P= .219	P= .039
BA	-.1205	-.0817	.1960	-.0214	-.0661	.2386	1.0000	-.2372	-.0264	-.0111	-.2340
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .459	P= .616	P= .225	P= .896	P= .685	P= .138	P= .	P= .141	P= .871	P= .946	P= .146
BR	-.1578	-.2206	.1276	.1852	-.0731	-.1065	-.2372	1.0000	-.0265	-.1749	-.2855
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .331	P= .171	P= .433	P= .252	P= .654	P= .513	P= .141	P= .	P= .871	P= .281	P= .074
CA	-.1533	-.0786	-.0196	.1053	-.1802	-.1741	-.0264	-.0265	1.0000	-.0323	.1692
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .345	P= .630	P= .904	P= .518	P= .266	P= .283	P= .871	P= .871	P= .	P= .843	P= .297
CE	.2536	.3982	-.4210	-.2190	-.1823	-.1988	-.0111	-.1749	-.0323	1.0000	.7407
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .114	P= .011	P= .007	P= .175	P= .260	P= .219	P= .946	P= .281	P= .843	P= .	P= .000
CO	.4163	.4515	-.4066	-.2912	-.0792	-.3283	-.2340	-.2855	.1692	.7407	1.0000
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .008	P= .003	P= .009	P= .068	P= .627	P= .039	P= .146	P= .074	P= .297	P= .000	P= .

	MOIST	ASH	VM	FC	TOTSUL	AS	BA	BR	CA	CE	CO
CR	.6773	.8613	-.5525	-.6902	.0957	.1038	-.2002	-.2396	-.1889	.4195	.5300
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .000	P= .000	P= .000	P= .000	P= .557	P= .524	P= .216	P= .136	P= .243	P= .007	P= .000
CS	.8491	.8783	-.5329	-.7222	.1076	.2511	.0080	-.2345	-.1001	.3989	.4643
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .000	P= .000	P= .000	P= .000	P= .509	P= .118	P= .961	P= .145	P= .539	P= .011	P= .003
EU	.2774	.4595	-.4744	-.2597	-.2265	-.2714	-.1921	-.1523	.0901	.9092	.8298
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .083	P= .003	P= .002	P= .106	P= .160	P= .090	P= .235	P= .348	P= .581	P= .000	P= .000
FE	.2390	.5215	-.0801	-.5717	.9527	.0334	-.0576	-.0406	-.0905	-.0322	.0296
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .137	P= .001	P= .623	P= .000	P= .000	P= .838	P= .724	P= .804	P= .578	P= .844	P= .856
HF	.3553	.7114	-.5059	-.5401	-.0478	.2647	-.0878	-.1812	-.2818	.4068	.3133
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .024	P= .000	P= .001	P= .000	P= .769	P= .099	P= .590	P= .263	P= .078	P= .009	P= .049
LA	.1787	.3726	-.3879	-.2086	-.1797	-.1614	.0374	-.2477	-.1140	.9554	.6493
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .270	P= .018	P= .013	P= .196	P= .267	P= .320	P= .819	P= .123	P= .483	P= .000	P= .000
LU	.2630	.5205	-.4833	-.3268	-.1455	-.2378	-.3273	-.2617	.0425	.7415	.8313
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .101	P= .001	P= .002	P= .040	P= .370	P= .140	P= .039	P= .103	P= .794	P= .000	P= .000
NA	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P=1.000	P=1.000	P=1.000	P=1.000	P=1.000	P=1.000	P=1.000	P=1.000	P=1.000	P=1.000	P=1.000
ND	.2236	.3145	-.3568	-.1584	-.2054	-.2583	.0643	-.2008	.0786	.9265	.8066
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .165	P= .048	P= .024	P= .329	P= .203	P= .108	P= .694	P= .214	P= .630	P= .000	P= .000
RB	.8532	.9027	-.5327	-.7514	.1733	.2528	.0088	-.2377	-.1063	.3909	.4614

	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .000	P= .000	P= .000	P= .000	P= .285	P= .115	P= .957	P= .140	P= .514	P= .013	P= .003
SB	.4090	.5159	-.3653	-.3927	-.0405	-.0779	-.3364	-.1023	-.1616	.2402	.4417
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .009	P= .001	P= .020	P= .012	P= .804	P= .633	P= .034	P= .530	P= .319	P= .135	P= .004

	MOIST	ASH	VM	FC	TOTSUL	AS	BA	BR	CA	CE	CO
SC	.4740	.6408	-.5081	-.4549	-.0583	-.0940	-.3143	-.1553	-.1420	.4394	.5630
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .002	P= .000	P= .001	P= .003	P= .721	P= .564	P= .048	P= .338	P= .382	P= .005	P= .000
SE	.3152	.4774	-.3963	-.3281	-.1568	.0940	-.1181	-.1852	-.2358	.1668	.2266
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .048	P= .002	P= .011	P= .039	P= .334	P= .564	P= .468	P= .253	P= .143	P= .304	P= .160
SM	.2901	.4228	-.4509	-.2303	-.2425	-.2452	-.1665	-.2132	.0757	.8089	.7768
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .069	P= .007	P= .004	P= .153	P= .132	P= .127	P= .304	P= .187	P= .643	P= .000	P= .000
SR	-.1796	-.2347	.1500	.1884	-.1965	-.0840	.7781	-.1332	.2602	.2438	.0312
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .268	P= .145	P= .355	P= .244	P= .224	P= .606	P= .000	P= .412	P= .105	P= .129	P= .849
TA	.4153	.7486	-.4587	-.6129	.0530	.3364	-.0411	-.2461	-.2384	.3179	.2217
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .008	P= .000	P= .003	P= .000	P= .745	P= .034	P= .801	P= .126	P= .138	P= .046	P= .169
TB	.2460	.4341	-.4671	-.2339	-.2131	-.3312	-.2973	-.1532	.0852	.8599	.8549
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .126	P= .005	P= .002	P= .146	P= .187	P= .037	P= .062	P= .345	P= .601	P= .000	P= .000
TH	.4564	.6925	-.5515	-.4902	-.0300	.2929	-.1288	-.2147	-.2951	.3274	.2767
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .003	P= .000	P= .000	P= .001	P= .854	P= .067	P= .428	P= .183	P= .065	P= .039	P= .084
U	.2623	.4861	-.4392	-.3126	-.0635	.1153	-.2290	-.1764	-.2732	.1433	.1867
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .102	P= .001	P= .005	P= .050	P= .697	P= .479	P= .155	P= .276	P= .088	P= .378	P= .249
YB	.1944	.4464	-.4331	-.2690	-.1577	-.3081	-.3610	-.1794	.0682	.7495	.8255
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .229	P= .004	P= .005	P= .093	P= .331	P= .053	P= .022	P= .268	P= .676	P= .000	P= .000
ZN	.4829	.7462	-.4525	-.6150	.4848	-.0669	-.1788	-.2195	-.1421	.5030	.6611
	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)
	P= .008	P= .000	P= .014	P= .000	P= .008	P= .730	P= .353	P= .253	P= .462	P= .005	P= .000

	CR	CS	EU	FE	HF	LA	LU	NA	ND	RB	SB
CR	1.0000	.8152	.5618	.2005	.7730	.4084	.6665	.0000	.3526	.8208	.7716
	(40)	(40)	(40)	(40)	(40)	(40)	(. 40)	(40)	(40)	(40)	(40)
	P= .	P= .000	P= .000	P= .215	P= .000	P= .009	P= .000	P=1.000	P= .026	P= .000	P= .000
CS	.8152	1.0000	.4222	.1674	.6371	.3544	.4299	.0000	.3208	.9973	.4633
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .000	P= .	P= .007	P= .302	P= .000	P= .025	P= .006	P=1.000	P= .044	P= .000	P= .003
EU	.5618	.4222	1.0000	-.0541	.4887	.8131	.8805	.0000	.8904	.4110	.4358
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .000	P= .007	P= .	P= .740	P= .001	P= .000	P= .000	P=1.000	P= .000	P= .008	P= .005
FE	.2005	.1674	-.0541	1.0000	.0657	-.0378	-.0155	.0000	-.0621	.2351	.0021
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .215	P= .302	P= .740	P= .	P= .687	P= .817	P= .924	P=1.000	P= .703	P= .144	P= .990
HF	.7730	.6371	.4887	.0657	1.0000	.4565	.6132	.0000	.2935	.6339	.5256
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .000	P= .000	P= .001	P= .687	P= .	P= .003	P= .000	P=1.000	P= .066	P= .000	P= .000
LA	.4084	.3544	.8131	-.0378	.4565	1.0000	.7013	.0000	.8335	.3479	.2262

	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .009	P= .025	P= .000	P= .817	P= .003	P= .	P= .000	P=1.000	P= .000	P= .028	P= .160
LU	.6665	.4299	.8805	-.0155	.6132	.7013	1.0000	.0000	.7253	.4245	.5731
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .000	P= .006	P= .000	P= .924	P= .000	P= .000	P= .	P=1.000	P= .000	P= .006	P= .000
NA	.0000	.0000	.0000	.0000	.0000	.0000	.0000	1.0000	.0000	.0000	.0000
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P=1.000	P=1.000	P=1.000	P=1.000	P=1.000	P=1.000	P=1.000	P= .	P=1.000	P=1.000	P=1.000
ND	.3526	.3208	.8904	-.0621	.2935	.8335	.7253	.0000	1.0000	.3138	.1948
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .026	P= .044	P= .000	P= .703	P= .066	P= .000	P= .000	P=1.000	P= .	P= .049	P= .228
RB	.8208	.9973	.4110	.2351	.6339	.3479	.4245	.0000	.3138	1.0000	.4592
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .000	P= .000	P= .008	P= .144	P= .000	P= .028	P= .006	P=1.000	P= .049	P= .	P= .003
SB	.7716	.4633	.4358	.0021	.5256	.2262	.5731	.0000	.1948	.4592	1.0000
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .000	P= .003	P= .005	P= .990	P= .000	P= .160	P= .000	P=1.000	P= .228	P= .003	P= .

	CR	CS	EU	FE	HF	LA	LU	NA	ND	RB	SB
SC	.8775	.5732	.6552	.0558	.6470	.3941	.7491	.0000	.4311	.5714	.7816
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .000	P= .000	P= .000	P= .732	P= .000	P= .012	P= .000	P=1.000	P= .005	P= .000	P= .000
SE	.6735	.4535	.2987	-.1191	.7024	.2139	.4333	.0000	.1380	.4425	.7321
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .000	P= .003	P= .061	P= .464	P= .000	P= .185	P= .005	P=1.000	P= .396	P= .004	P= .000
SM	.5726	.4085	.9015	-.0673	.4165	.7323	.7759	.0000	.8100	.3966	.4189
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .000	P= .009	P= .000	P= .680	P= .008	P= .000	P= .000	P=1.000	P= .000	P= .011	P= .007
SR	-.3390	-.1427	.1023	-.1474	-.3118	.2167	-.1728	.0000	.3504	-.1470	-.3917
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .032	P= .380	P= .530	P= .364	P= .050	P= .179	P= .286	P=1.000	P= .027	P= .365	P= .012
TA	.7736	.6545	.3765	.1325	.8985	.3730	.5573	.0000	.2057	.6587	.4778
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .000	P= .000	P= .017	P= .415	P= .000	P= .018	P= .000	P=1.000	P= .203	P= .000	P= .002
TB	.5647	.3759	.9794	-.0494	.4821	.7764	.9189	.0000	.8462	.3655	.5013
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .000	P= .017	P= .000	P= .762	P= .002	P= .000	P= .000	P=1.000	P= .000	P= .020	P= .001
TH	.8011	.6571	.4214	.0354	.8690	.3483	.5630	.0000	.2374	.6519	.6323
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .000	P= .000	P= .007	P= .828	P= .000	P= .028	P= .000	P=1.000	P= .140	P= .000	P= .000
U	.6880	.3945	.3045	-.0235	.7024	.1738	.4801	.0000	.1002	.3901	.7726
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .000	P= .012	P= .056	P= .885	P= .000	P= .284	P= .002	P=1.000	P= .538	P= .013	P= .000
YB	.5914	.3499	.8991	-.0217	.5013	.6950	.9614	.0000	.7254	.3431	.5892
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)
	P= .000	P= .027	P= .000	P= .894	P= .001	P= .000	P= .000	P=1.000	P= .000	P= .030	P= .000
ZN	.5969	.5410	.5228	.5938	.5917	.5250	.6549	.0000	.4593	.5794	.3511
	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)
	P= .001	P= .002	P= .004	P= .001	P= .001	P= .003	P= .000	P=1.000	P= .012	P= .001	P= .062

	SC	SE	SM	SR	TA	TB	TH	U	YB	ZN
SC	1.0000	.6689	.6595	-.3380	.5793	.6893	.7147	.7026	.7180	.5410
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(29)
	P= .	P= .000	P= .000	P= .033	P= .000	P= .000	P= .000	P= .000	P= .000	P= .002
SE	.6689	1.0000	.2933	-.3308	.6583	.3328	.8357	.9264	.3480	.3192

	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(29)
	P= .000	P= .	P= .066	P= .037	P= .000	P= .036	P= .000	P= .000	P= .028	P= .091
SM	.6595	.2933	1.0000	.0864	.3238	.8865	.3598	.2711	.7964	.4412
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(29)
	P= .000	P= .066	P= .	P= .596	P= .042	P= .000	P= .023	P= .091	P= .000	P= .017
SR	-.3380	-.3308	.0864	1.0000	-.3199	-.0047	-.4050	-.4452	-.1240	-.1974
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(29)
	P= .033	P= .037	P= .596	P= .	P= .044	P= .977	P= .010	P= .004	P= .446	P= .305
TA	.5793	.6583	.3238	-.3199	1.0000	.3529	.8694	.6927	.4056	.5949
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(29)
	P= .000	P= .000	P= .042	P= .044	P= .	P= .026	P= .000	P= .000	P= .009	P= .001
TB	.6893	.3328	.8865	-.0047	.3529	1.0000	.4250	.3605	.9402	.5561
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(29)
	P= .000	P= .036	P= .000	P= .977	P= .026	P= .	P= .006	P= .022	P= .000	P= .002
TH	.7147	.8357	.3598	-.4050	.8694	.4250	1.0000	.8770	.4305	.5144
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(29)
	P= .000	P= .000	P= .023	P= .010	P= .000	P= .006	P= .	P= .000	P= .006	P= .004
U	.7026	.9264	.2711	-.4452	.6927	.3605	.8770	1.0000	.3881	.3544
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(29)
	P= .000	P= .000	P= .091	P= .004	P= .000	P= .022	P= .000	P= .	P= .013	P= .059
YB	.7180	.3480	.7964	-.1240	.4056	.9402	.4305	.3881	1.0000	.5806
	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(29)
	P= .000	P= .028	P= .000	P= .446	P= .009	P= .000	P= .006	P= .013	P= .	P= .001
ZN	.5410	.3192	.4412	-.1974	.5949	.5561	.5144	.3544	.5806	1.0000
	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)
	P= .002	P= .091	P= .017	P= .305	P= .001	P= .002	P= .004	P= .059	P= .001	P= .

Table E-4.
Pearson Correlation Coefficients for the Lee Ranch and York Canyon, All Samples

VARIABLE	CASES	MEAN	STD DEV
MOIST	158	7.8614	5.1585
ASH	158	25.8440	29.8549
VM	158	34.9785	13.0207
FC	158	39.1774	18.9844
TOTSUL	157	.6104	.3462
AS	136	2.0937	4.8197
BA	158	389.5347	885.9430
BR	141	.5778	.7744
CA	146	3281.8866	5718.2054
CE	158	2.9370	25.6424
CO	158	8.4227	6.3401
CR	158	12.9668	15.7780
CS	157	2.1295	4.2574
EU	158	4219	.3475
FE	158	7919.6982	25011.8500
HF	158	1.8600	2.0485
LA	158	13.2923	13.1079
LU	158	.1700	.1233
NA	152	404.8134	1226.6713
ND	158	11.3153	11.1026
RB	136	18.7947	36.5609
SB	158	2.2762	3.1683
SC	158	4.4468	4.3869
SE	156	1.8407	1.0391
SM	158	2.1202	1.8471
SR	158	175.1133	144.7590
TA	158	.4322	.5106
TB	158	.3164	.2353
TH	158	5.7431	6.5092
U	157	2.4898	2.4289
YB	158	1.0768	.8213
ZN	144	23.1189	28.0234

	MOIST	ASH	VM	FC	TOTSUL	AS	BA	BR	CA	CE	CO
MOIST	1.0000	-.3908	.6249	.1860	.4247	-.1346	-.1521	-.0845	.2565	-.4248	.1432
	(158)	(158)	(158)	(158)	(157)	(136)	(158)	(141)	(146)	(158)	(158)
	P= .	P= .000	P= .000	P= .019	P= .000	P= .118	P= .056	P= .319	P= .002	P= .000	P= .073
ASH	-.3908	1.0000	-.9009	-.9547	-.3975	.4734	.2373	.0035	.0703	.7496	.3793
	(158)	(158)	(158)	(158)	(157)	(136)	(158)	(141)	(146)	(158)	(158)
	P= .000	P= .	P= .000	P= .000	P= .000	P= .000	P= .003	P= .968	P= .399	P= .000	P= .000

VM		.6249	-.9009	1.0000	.7309	.5030	-.4164	-.2372	-.0036	.1062	-.7705	-.2705
		(158)	(158)	(158)	(158)	(157)	(136)	(158)	(141)	(146)	(158)	(158)
		P= .000	P= .000	P= .	P= .000	P= .000	P= .000	P= .003	P= .966	P= .202	P= .000	P= .001
FC		.1860	-.9547	.7309	1.0000	.2786	-.4547	-.2105	-.0029	-.1826	-.6503	-.4110
		(158)	(158)	(158)	(158)	(157)	(136)	(158)	(141)	(146)	(158)	(158)
		P= .019	P= .000	P= .000	P= .	P= .000	P= .000	P= .008	P= .973	P= .027	P= .000	P= .000
TOTSUL		.4247	-.3975	.5030	.2786	1.0000	-.1887	-.1572	-.0999	.0100	-.3935	.0600
		(157)	(157)	(157)	(157)	(157)	(136)	(157)	(140)	(146)	(157)	(157)
		P= .000	P= .000	P= .000	P= .000	P= .	P= .028	P= .049	P= .240	P= .905	P= .000	P= .455
AS		-.1346	.4734	-.4164	-.4547	-.1887	1.0000	.0565	.1654	.0503	.3606	.3138
		(136)	(136)	(136)	(136)	(136)	(136)	(136)	(132)	(128)	(136)	(136)
		P= .118	P= .000	P= .000	P= .000	P= .028	P= .	P= .514	P= .058	P= .573	P= .000	P= .000
BA		-.1521	.2373	-.2372	-.2105	-.1572	.0565	1.0000	.2006	-.0493	.1787	.1077
		(158)	(158)	(158)	(158)	(157)	(136)	(158)	(141)	(146)	(158)	(158)
		P= .056	P= .003	P= .003	P= .008	P= .049	P= .514	P= .	P= .017	P= .554	P= .025	P= .178
BR		-.0845	.0035	-.0036	-.0029	-.0999	.1654	.2006	1.0000	-.0590	.0013	.0362
		(141)	(141)	(141)	(141)	(140)	(132)	(141)	(141)	(134)	(141)	(141)
		P= .319	P= .968	P= .966	P= .973	P= .240	P= .058	P= .017	P= .	P= .499	P= .988	P= .670
CA		.2565	.0703	.1062	-.1826	.0100	.0503	-.0493	-.0590	1.0000	-.0641	.3642
		(146)	(146)	(146)	(146)	(146)	(128)	(146)	(134)	(146)	(146)	(146)
		P= .002	P= .399	P= .202	P= .027	P= .905	P= .573	P= .554	P= .499	P= .	P= .442	P= .000
CE		-.4248	.7496	-.7705	-.6503	-.3935	.3606	.1787	.0013	-.0641	1.0000	.3523
		(158)	(158)	(158)	(158)	(157)	(136)	(158)	(141)	(146)	(158)	(158)
		P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .025	P= .988	P= .442	P= .	P= .000
CO		.1432	.3793	-.2705	-.4110	.0600	.3138	.1077	.0362	.3642	.3523	1.0000
		(158)	(158)	(158)	(158)	(157)	(136)	(158)	(141)	(146)	(158)	(158)
		P= .073	P= .000	P= .001	P= .000	P= .455	P= .000	P= .178	P= .670	P= .000	P= .000	P= .

		MOIST	ASH	VM	FC	TOTSUL	AS	BA	BR	CA	CE	CO
CR		-.3466	.8388	-.7919	-.7759	-.4013	.3780	.2974	.0289	-.1651	.7316	.1972
		(158)	(158)	(158)	(158)	(157)	(136)	(158)	(141)	(146)	(158)	(158)
		P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .734	P= .046	P= .000	P= .013
CS		-.2750	.8429	-.7709	-.7970	-.4341	.5083	.3005	.0751	-.0931	.7066	.2948
		(157)	(157)	(157)	(157)	(156)	(135)	(157)	(140)	(145)	(157)	(157)
		P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .378	P= .265	P= .000	P= .000
EU		-.4162	.7212	-.7342	-.6306	-.3790	.3452	.1992	.0328	-.0461	.9333	.4530
		(158)	(158)	(158)	(158)	(157)	(136)	(158)	(141)	(146)	(158)	(158)
		P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .012	P= .700	P= .581	P= .000	P= .000
FE		-.0684	.2892	-.1342	-.3628	.0581	.1804	.0397	.0596	.0405	.1536	.1203
		(158)	(158)	(158)	(158)	(157)	(136)	(158)	(141)	(146)	(158)	(158)
		P= .393	P= .000	P= .093	P= .000	P= .470	P= .036	P= .621	P= .483	P= .628	P= .054	P= .132
HF		-.3071	.8415	-.7593	-.8025	-.4720	.3913	.1907	.0133	.1566	.6535	.3570
		(158)	(158)	(158)	(158)	(157)	(136)	(158)	(141)	(146)	(158)	(158)
		P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .016	P= .876	P= .059	P= .000	P= .000
LA		-.4583	.7609	-.7886	-.6557	-.4220	.3473	.1949	-.0080	-.0789	.9849	.2966
		(158)	(158)	(158)	(158)	(157)	(136)	(158)	(141)	(146)	(158)	(158)
		P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .014	P= .925	P= .344	P= .000	P= .000
LU		-.4000	.7908	-.7729	-.7135	-.4286	.3830	.2425	.0798	-.0580	.7643	.4604
		(158)	(158)	(158)	(158)	(157)	(136)	(158)	(141)	(146)	(158)	(158)
		P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .002	P= .347	P= .487	P= .000	P= .000
NA		-.1049	.4527	-.3750	-.4510	-.1334	.3247	.0840	.0027	.5058	.3110	.6249
		(152)	(152)	(152)	(152)	(151)	(135)	(152)	(141)	(143)	(152)	(152)
		P= .198	P= .000	P= .000	P= .000	P= .103	P= .000	P= .304	P= .974	P= .000	P= .000	P= .000
ND		-.4952	.6218	-.7003	-.4974	-.3897	.2721	.1690	-.0071	-.1130	.9464	.3171
		(158)	(158)	(158)	(158)	(157)	(136)	(158)	(141)	(146)	(158)	(158)
		P= .000	P= .000	P= .000	P= .000	P= .000	P= .001	P= .034	P= .933	P= .174	P= .000	P= .000
RB		-.3331	.9069	-.8424	-.8484	-.4427	.5323	.2702	.0316	.0492	.7852	.4361
		(154)	(154)	(154)	(154)	(153)	(133)	(154)	(138)	(142)	(154)	(154)

	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .001	P= .712	P= .561	P= .000	P= .000
SB	.3314 (158) P= .000	.0082 (158) P= .918	.1502 (158) P= .060	-.1160 (158) P= .147	.1614 (157) P= .043	-.0029 (136) P= .973	.2142 (158) P= .007	.0337 (141) P= .692	.0854 (146) P= .305	-.1726 (158) P= .030	.3180 (158) P= .000

	MOIST	ASH	VM	FC	TOTSUL	AS	BA	BR	CA	CE	CO
SC	-.3806 (158) P= .000	.8296 (158) P= .000	-.8052 (158) P= .000	-.7523 (158) P= .000	-.4099 (157) P= .000	.4244 (136) P= .000	.2893 (158) P= .000	.0592 (141) P= .486	-.1867 (146) P= .024	.7756 (158) P= .000	.2534 (158) P= .001
SE	-.1376 (156) P= .087	.0493 (156) P= .541	-.0963 (156) P= .232	-.0115 (156) P= .887	-.0656 (155) P= .418	-.0678 (134) P= .437	.0069 (156) P= .932	-.0489 (139) P= .568	-.2782 (144) P= .001	.1353 (156) P= .092	-.1289 (156) P= .109
SM	-.4721 (158) P= .000	.6878 (158) P= .000	-.7401 (158) P= .000	-.5740 (158) P= .000	-.3987 (157) P= .000	.3298 (136) P= .000	.1820 (158) P= .022	.0076 (141) P= .929	-.0849 (146) P= .308	.9293 (158) P= .000	.4004 (158) P= .000
SR	-.3894 (158) P= .000	.0092 (158) P= .908	-.1689 (158) P= .034	.1013 (158) P= .205	-.2514 (157) P= .001	.0156 (136) P= .857	.3333 (158) P= .000	.0481 (141) P= .571	-.1813 (146) P= .029	.2299 (158) P= .004	-.1234 (158) P= .122
TA	-.2830 (158) P= .000	.8224 (158) P= .000	-.7303 (158) P= .000	-.7925 (158) P= .000	-.4170 (157) P= .000	.3071 (136) P= .000	.1870 (158) P= .019	-.0202 (141) P= .812	.0267 (146) P= .749	.6099 (158) P= .000	.2122 (158) P= .007
TB	-.3698 (158) P= .000	.7095 (158) P= .000	-.7076 (158) P= .000	-.6305 (158) P= .000	-.3817 (157) P= .000	.3396 (136) P= .000	.2270 (158) P= .004	.0449 (141) P= .597	-.0608 (146) P= .466	.8402 (158) P= .000	.4845 (158) P= .000
TH	-.1277 (158) P= .110	.5725 (158) P= .000	-.5108 (158) P= .000	-.5500 (158) P= .000	-.2722 (157) P= .001	.2954 (136) P= .000	.1207 (158) P= .131	-.0018 (141) P= .983	-.0998 (146) P= .231	.6045 (158) P= .000	.1273 (158) P= .111
U	-.0984 (157) P= .220	.4824 (157) P= .000	-.4229 (157) P= .000	-.4686 (157) P= .000	-.2090 (156) P= .009	.1743 (135) P= .043	.1722 (157) P= .031	.0010 (140) P= .991	-.1305 (145) P= .118	.4871 (157) P= .000	.0599 (157) P= .456
YB	-.3845 (158) P= .000	.7511 (158) P= .000	-.7361 (158) P= .000	-.6763 (158) P= .000	-.4145 (157) P= .000	.4021 (136) P= .000	.2458 (158) P= .002	.1145 (141) P= .176	-.0372 (146) P= .656	.7486 (158) P= .000	.4731 (158) P= .000
ZN	-.3608 (144) P= .000	.7522 (144) P= .000	-.7156 (144) P= .000	-.7007 (144) P= .000	-.2863 (144) P= .001	.4220 (123) P= .000	.2891 (144) P= .000	.2970 (127) P= .001	-.0484 (133) P= .580	.7594 (144) P= .000	.5212 (144) P= .000

	CR	CS	EU	FE	HF	LA	LU	NA	ND	RB	SB
CR	1.0000 (158) P= .	.8722 (157) P= .000	.7379 (158) P= .000	.1200 (158) P= .133	.6661 (158) P= .000	.7365 (158) P= .000	.7970 (158) P= .000	.1425 (152) P= .080	.6371 (158) P= .000	.8640 (154) P= .000	-.0008 (158) P= .992
CS	.8722 (157) P= .000	1.0000 (157) P= .	.6732 (157) P= .000	.2466 (157) P= .002	.6943 (157) P= .000	.7065 (157) P= .000	.7628 (157) P= .000	.2476 (151) P= .002	.5878 (157) P= .000	.9255 (153) P= .000	-.0133 (157) P= .868
EU	.7379 (158) P= .000	.6732 (157) P= .000	1.0000 (158) P= .	.1779 (158) P= .025	.6040 (158) P= .000	.8955 (158) P= .000	.8627 (158) P= .000	.3532 (152) P= .000	.9241 (158) P= .000	.7702 (154) P= .000	-.0026 (158) P= .974
FE	.1200 (158) P= .133	.2466 (157) P= .002	.1779 (158) P= .025	1.0000 (158) P= .	.1475 (158) P= .064	.1510 (158) P= .058	.2355 (158) P= .003	.1370 (152) P= .092	.1106 (158) P= .166	.2262 (154) P= .005	-.0148 (158) P= .853
HF	.6661 (158) P= .000	.6943 (157) P= .000	.6040 (158) P= .000	.1475 (158) P= .064	1.0000 (158) P= .	.6689 (158) P= .000	.7013 (158) P= .000	.5031 (152) P= .000	.5122 (158) P= .000	.7527 (154) P= .000	-.0079 (158) P= .922
LA	.7365	.7065	.8955	.1510	.6689	1.0000	.7487	.2774	.9217	.7762	-.1982

	CR	CS	EU	FE	HF	LA	LU	NA	ND	RB	SB
	(158) P= .000	(157) P= .000	(158) P= .000	(158) P= .058	(158) P= .000	(158) P= .	(158) P= .000	(152) P= .001	(158) P= .000	(154) P= .000	(158) P= .013
LU	.7970 (158) P= .000	.7628 (157) P= .000	.8627 (158) P= .000	.2355 (158) P= .003	.7013 (158) P= .000	.7487 (158) P= .000	1.0000 (158) P= .	.3681 (152) P= .000	.7270 (158) P= .000	.8058 (154) P= .000	.1923 (158) P= .015
NA	.1425 (152) P= .080	.2476 (151) P= .002	.3532 (152) P= .000	.1370 (152) P= .092	.5031 (152) P= .000	.2774 (152) P= .001	.3681 (152) P= .000	1.0000 (152) P= .	.2407 (152) P= .003	.4650 (148) P= .000	.0237 (152) P= .771
ND	.6371 (158) P= .000	.5878 (157) P= .000	.9241 (158) P= .000	.1106 (158) P= .166	.5122 (158) P= .000	.9217 (158) P= .000	.7270 (158) P= .000	.2407 (152) P= .003	1.0000 (158) P= .	.6747 (154) P= .000	-.1865 (158) P= .019
RB	.8640 (154) P= .000	.9255 (153) P= .000	.7702 (154) P= .000	.2262 (154) P= .005	.7527 (154) P= .000	.7762 (154) P= .000	.8058 (154) P= .000	.4650 (148) P= .000	.6747 (154) P= .000	1.0000 (154) P= .	-.0542 (154) P= .504
SB	-.0008 (158) P= .992	-.0133 (157) P= .868	-.0026 (158) P= .974	-.0148 (158) P= .853	-.0079 (158) P= .922	-.1982 (158) P= .013	.1923 (158) P= .015	.0237 (152) P= .771	-.1865 (158) P= .019	-.0542 (154) P= .504	1.0000 (158) P= .

	CR	CS	EU	FE	HF	LA	LU	NA	ND	RB	SB
SC	.9602 (158) P= .000	.8579 (157) P= .000	.8173 (158) P= .000	.1709 (158) P= .032	.6480 (158) P= .000	.7692 (158) P= .000	.8654 (158) P= .000	.1815 (152) P= .025	.7052 (158) P= .000	.8660 (154) P= .000	.0458 (158) P= .567
SE	.0829 (156) P= .304	-.0368 (155) P= .650	.1137 (156) P= .158	-.0613 (156) P= .447	.1452 (156) P= .071	.1710 (156) P= .033	.0686 (156) P= .395	-.1994 (150) P= .014	.1301 (156) P= .106	-.0864 (152) P= .290	-.0505 (156) P= .531
SM	.7199 (158) P= .000	.6574 (157) P= .000	.9725 (158) P= .000	.1477 (158) P= .064	.5574 (158) P= .000	.8974 (158) P= .000	.8079 (158) P= .000	.3106 (152) P= .000	.9344 (158) P= .000	.7519 (154) P= .000	-.0945 (158) P= .237
SR	.0908 (158) P= .257	.0961 (157) P= .231	.1778 (158) P= .025	-.1087 (158) P= .174	-.0853 (158) P= .286	.2384 (158) P= .003	.0538 (158) P= .502	-.0954 (152) P= .243	.3530 (158) P= .000	.0781 (154) P= .336	-.1535 (158) P= .054
TA	.6303 (158) P= .000	.6144 (157) P= .000	.5159 (158) P= .000	.1173 (158) P= .142	.8033 (158) P= .000	.6595 (158) P= .000	.5622 (158) P= .000	.2614 (152) P= .001	.4702 (158) P= .000	.6319 (154) P= .000	-.0431 (158) P= .591
TB	.7434 (158) P= .000	.6868 (157) P= .000	.9562 (158) P= .000	.1917 (158) P= .016	.6044 (158) P= .000	.8044 (158) P= .000	.9375 (158) P= .000	.3227 (152) P= .000	.8360 (158) P= .000	.7480 (154) P= .000	.1922 (158) P= .016
TH	.5433 (158) P= .000	.5159 (157) P= .000	.5001 (158) P= .000	.1134 (158) P= .156	.7073 (158) P= .000	.6200 (158) P= .000	.4918 (158) P= .000	.1711 (152) P= .035	.4418 (158) P= .000	.5250 (154) P= .000	-.0520 (158) P= .516
U	.4332 (157) P= .000	.3748 (156) P= .000	.4187 (157) P= .000	.0969 (157) P= .227	.6062 (157) P= .000	.5104 (157) P= .000	.4075 (157) P= .000	.0743 (151) P= .365	.3504 (157) P= .000	.3644 (153) P= .000	.0046 (157) P= .954
YB	.7569 (158) P= .000	.7287 (157) P= .000	.8609 (158) P= .000	.2319 (158) P= .003	.6640 (158) P= .000	.7254 (158) P= .000	.9765 (158) P= .000	.3891 (152) P= .000	.7194 (158) P= .000	.7742 (154) P= .000	.2001 (158) P= .012
ZN	.7082 (144) P= .000	.7663 (143) P= .000	.7898 (144) P= .000	.2508 (144) P= .002	.6356 (144) P= .000	.7472 (144) P= .000	.8148 (144) P= .000	.3963 (138) P= .000	.7098 (144) P= .000	.8375 (140) P= .000	.0221 (144) P= .793

	SC	SE	SM	SR	TA	TB	TH	U	YB	ZN
SC	1.0000 (158) P= .	.1141 (156) P= .156	.7985 (158) P= .000	.0885 (158) P= .269	.6025 (158) P= .000	.8316 (158) P= .000	.5484 (158) P= .000	.4646 (157) P= .000	.8388 (158) P= .000	.7753 (144) P= .000
SE	.1141	1.0000	.1188	-.0820	.2941	.0861	.4272	.6009	.0376	-.0107

	(156)	(156)	(156)	(156)	(156)	(156)	(156)	(155)	(156)	(142)
	P= .156	P= .	P= .140	P= .309	P= .000	P= .285	P= .000	P= .000	P= .641	P= .900
SM	.7985	.1188	1.0000	.2170	.4838	.9102	.4616	.3695	.8048	.7649
	(158)	(156)	(158)	(158)	(158)	(158)	(158)	(157)	(158)	(144)
	P= .000	P= .140	P= .	P= .006	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000
SR	.0885	-.0820	.2170	1.0000	-.0599	.1239	-.0764	-.1006	.0571	.1116
	(158)	(156)	(158)	(158)	(158)	(158)	(158)	(157)	(158)	(144)
	P= .269	P= .309	P= .006	P= .	P= .455	P= .121	P= .340	P= .210	P= .476	P= .183
TA	.6025	.2941	.4838	-.0599	1.0000	.4794	.6445	.6517	.5055	.5788
	(158)	(156)	(158)	(158)	(158)	(158)	(158)	(157)	(158)	(144)
	P= .000	P= .000	P= .000	P= .455	P= .	P= .000	P= .000	P= .000	P= .000	P= .000
TB	.8316	.0861	.9102	.1239	.4794	1.0000	.4582	.3850	.9330	.7865
	(158)	(156)	(158)	(158)	(158)	(158)	(158)	(157)	(158)	(144)
	P= .000	P= .285	P= .000	P= .121	P= .000	P= .	P= .000	P= .000	P= .000	P= .000
TH	.5484	.4272	.4616	-.0764	.6445	.4582	1.0000	.8954	.4638	.4652
	(158)	(156)	(158)	(158)	(158)	(158)	(158)	(157)	(158)	(144)
	P= .000	P= .000	P= .000	P= .340	P= .000	P= .000	P= .	P= .000	P= .000	P= .000
U	.4646	.6009	.3695	-.1006	.6517	.3850	.8954	1.0000	.3751	.3861
	(157)	(155)	(157)	(157)	(157)	(157)	(157)	(157)	(157)	(143)
	P= .000	P= .000	P= .000	P= .210	P= .000	P= .000	P= .000	P= .	P= .000	P= .000
YB	.8388	.0376	.8048	.0571	.5055	.9330	.4638	.3751	1.0000	.8139
	(158)	(156)	(158)	(158)	(158)	(158)	(158)	(157)	(158)	(144)
	P= .000	P= .641	P= .000	P= .476	P= .000	P= .000	P= .000	P= .000	P= .	P= .000
ZN	.7753	-.0107	.7649	.1116	.5788	.7865	.4652	.3861	.8139	1.0000
	(144)	(142)	(144)	(144)	(144)	(144)	(144)	(143)	(144)	(144)
	P= .000	P= .900	P= .000	P= .183	P= .000	P= .000	P= .000	P= .000	P= .000	P= .

Table E-5.
Pearson Correlation Coefficients for All Lee Ranch Samples.

VARIABLE	CASES	MEAN	STD DEV
MOIST	109	10.5023	3.9392
ASH	109	27.1823	30.8689
VM	109	37.2535	13.6923
FC	109	35.5640	17.6848
TOTSUL	109	.6579	.3289
AS	87	2.6506	5.9303
BA	109	3351.6834	1048.8430
BR	92	.5774	.9115
CA	97	4938.8660	6412.6035
CE	109	23.0791	24.5197
CO	109	10.2231	6.6985
CR	109	11.7758	13.9248
CS	109	2.3203	4.5639
EU	109	.3874	.3378
FE	109	11479.3686	29465.0588
HF	109	2.0948	2.2536
LA	109	11.5181	12.2191
LU	109	.1669	.1279
NA	10	644.9625	1430.7082
ND	109	9.0665	9.5349
RB	105	19.8962	37.9981
SB	109	3.1502	3.4745
SC	109	4.0645	3.9705
SE	108	1.7323	1.0258
SM	109	1.8223	1.7634
SR	109	129.8706	52.4985
TA	109	.4646	.5479
TB	109	.3037	.2341
TH	109	6.1590	7.2199
U	109	2.6262	2.6950
YB	109	1.0683	.8518
ZN	106	23.2738	29.8688

	MOIST	ASH	VM	FC	TOTSUL	AS	BA	BR	CA	CE	CO
MOIST	1.0000	-.9014	.8307	.9302	.5427	-.4328	-.1715	-.1167	-.1656	-.6676	-.3450
	(109)	(109)	(109)	(109)	(108)	(87)	(109)	(92)	(97)	(109)	(109)
	P= .	P= .000	P= .000	P= .000	P= .000	P= .000	P= .075	P= .268	P= .105	P= .000	P= .000
ASH	-.9014	1.0000	-.9790	-.9875	-.6212	.5285	.2524	.0693	.1244	.7891	.3988
	(109)	(109)	(109)	(109)	(108)	(87)	(109)	(92)	(97)	(109)	(109)
	P= .000	P= .	P= .000	P= .000	P= .000	P= .000	P= .008	P= .512	P= .225	P= .000	P= .000
VM	.8307	-.9790	1.0000	.9347	.6161	-.5208	-.2376	-.0516	-.0932	-.7901	-.4425

	(109)	(109)	(109)	(109)	(108)	(87)	(109)	(92)	(97)	(109)	(109)
	P= .000	P= .000	P= .	P= .000	P= .000	P= .000	P= .013	P= .625	P= .364	P= .000	P= .000
FC	.9302	-.9875	.9347	1.0000	.6068	-.5177	-.2565	-.0806	-.1425	-.7657	-.3535
	(109)	(109)	(109)	(109)	(108)	(87)	(109)	(92)	(97)	(109)	(109)
	P= .000	P= .000	P= .000	P= .	P= .000	P= .000	P= .007	P= .445	P= .164	P= .000	P= .000
TOTSUL	.5427	-.6212	.6161	.6068	1.0000	-.2966	-.1646	-.1117	-.1744	-.4652	-.0089
	(108)	(108)	(108)	(108)	(108)	(87)	(108)	(91)	(97)	(108)	(108)
	P= .000	P= .000	P= .000	P= .000	P= .	P= .005	P= .089	P= .292	P= .088	P= .000	P= .927
AS	-.4328	.5285	-.5208	-.5177	-.2966	1.0000	.0599	.2157	-.0151	.4837	.2885
	(87)	(87)	(87)	(87)	(87)	(87)	(87)	(83)	(79)	(87)	(87)
	P= .000	P= .000	P= .000	P= .000	P= .005	P= .	P= .581	P= .050	P= .895	P= .000	P= .007
BA	-.1715	.2524	-.2376	-.2565	-.1646	.0599	1.0000	.2203	-.0120	.1768	.1580
	(109)	(109)	(109)	(109)	(108)	(87)	(109)	(92)	(97)	(109)	(109)
	P= .075	P= .008	P= .013	P= .007	P= .089	P= .581	P= .	P= .035	P= .907	P= .066	P= .101
BR	-.1167	.0693	-.0516	-.0806	-.1117	.2157	.2203	1.0000	-.0023	.0719	.0692
	(92)	(92)	(92)	(92)	(91)	(83)	(92)	(92)	(85)	(92)	(92)
	P= .268	P= .512	P= .625	P= .445	P= .292	P= .050	P= .035	P= .	P= .983	P= .496	P= .512
CA	-.1656	.1244	-.0932	-.1425	-.1744	-.0151	-.0120	-.0023	1.0000	.1122	.2411
	(97)	(97)	(97)	(97)	(97)	(79)	(97)	(85)	(97)	(97)	(97)
	P= .105	P= .225	P= .364	P= .164	P= .088	P= .895	P= .907	P= .983	P= .	P= .274	P= .017
CE	-.6676	.7891	-.7901	-.7657	-.4652	.4837	.1768	.0719	.1122	1.0000	.4814
	(109)	(109)	(109)	(109)	(108)	(87)	(109)	(92)	(97)	(109)	(109)
	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .066	P= .496	P= .274	P= .	P= .000
CO	-.3450	.3988	-.4425	-.3535	-.0089	.2885	.1580	.0692	.2411	.4814	1.0000
	(109)	(109)	(109)	(109)	(108)	(87)	(109)	(92)	(97)	(109)	(109)
	P= .000	P= .000	P= .000	P= .000	P= .927	P= .007	P= .101	P= .512	P= .017	P= .000	P= .

	MOIST	ASH	VM	FC	TOTSUL	AS	BA	BR	CA	CE	CO
CR	-.6937	.8195	-.8134	-.8007	-.6244	.5318	.3632	.1676	-.1263	.7195	.2793
	(109)	(109)	(109)	(109)	(108)	(87)	(109)	(92)	(97)	(109)	(109)
	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .110	P= .218	P= .000	P= .003
CS	-.6571	.8110	-.8095	-.7889	-.6056	.5667	.3182	.1673	-.0829	.7376	.2782
	(108)	(108)	(108)	(108)	(107)	(86)	(108)	(91)	(96)	(108)	(108)
	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .001	P= .113	P= .422	P= .000	P= .004
EU	-.6550	.7483	-.7420	-.7317	-.4370	.4549	.2168	.0818	.1113	.9274	.6060
	(109)	(109)	(109)	(109)	(108)	(87)	(109)	(92)	(97)	(109)	(109)
	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .024	P= .438	P= .278	P= .000	P= .000
FE	-.3741	.3281	-.2228	-.4002	.0190	.1529	.0556	.0644	-.0407	.2440	.0349
	(109)	(109)	(109)	(109)	(108)	(87)	(109)	(92)	(97)	(109)	(109)
	P= .000	P= .000	P= .020	P= .000	P= .845	P= .157	P= .566	P= .542	P= .692	P= .011	P= .719
HF	-.7981	.8783	-.8751	-.8556	-.6524	.4069	.1940	.0261	.1506	.7406	.3184
	(109)	(109)	(109)	(109)	(108)	(87)	(109)	(92)	(97)	(109)	(109)
	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .043	P= .805	P= .141	P= .000	P= .001
LA	-.6969	.8261	-.8218	-.8058	-.5026	.4864	.1933	.0718	.1100	.9902	.4392
	(109)	(109)	(109)	(109)	(108)	(87)	(109)	(92)	(97)	(109)	(109)
	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .044	P= .496	P= .284	P= .000	P= .000
LU	-.7323	.8186	-.8144	-.7983	-.5421	.4623	.2750	.1353	.0088	.7439	.5208
	(109)	(109)	(109)	(109)	(108)	(87)	(109)	(92)	(97)	(109)	(109)
	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .004	P= .198	P= .932	P= .000	P= .000
NA	-.5492	.5410	-.5573	-.5114	-.2700	.2993	.1070	.0032	.4533	.4863	.6003
	(103)	(103)	(103)	(103)	(102)	(86)	(103)	(92)	(94)	(103)	(103)
	P= .000	P= .000	P= .000	P= .000	P= .006	P= .005	P= .282	P= .976	P= .000	P= .000	P= .000
ND	-.6465	.7590	-.7570	-.7388	-.4387	.4509	.1702	.0553	.1307	.9806	.5434
	(109)	(109)	(109)	(109)	(108)	(87)	(109)	(92)	(97)	(109)	(109)
	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .077	P= .600	P= .202	P= .000	P= .000
RB	-.7588	.8882	-.8945	-.8577	-.6297	.6055	.2822	.0992	.1255	.8342	.4789
	(105)	(105)	(105)	(105)	(104)	(84)	(105)	(89)	(93)	(105)	(105)
	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .004	P= .355	P= .231	P= .000	P= .000

SB	.0207	-.0466	.0694	.0277	.1115	-.0790	.2698	.0453	-.1079	-.1646	.1718
	(109)	(109)	(109)	(109)	(108)	(87)	(109)	(92)	(97)	(109)	(109)
	P= .831	P= .630	P= .473	P= .775	P= .251	P= .467	P= .005	P= .668	P= .293	P= .087	P= .074

	MOIST	ASH	VM	FC	TOTSUL	AS	BA	BR	CA	CE	CO
SC	-.7037	.8379	-.8326	-.8179	-.5846	.5914	.3551	.1740	-.1431	.7841	.3652
	(109)	(109)	(109)	(109)	(108)	(87)	(109)	(92)	(97)	(109)	(109)
	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .097	P= .162	P= .000	P= .000
SE	-.0501	.0296	-.0203	-.0359	.0081	-.0641	.0160	-.0031	-.2928	.1376	-.1155
	(108)	(108)	(108)	(108)	(107)	(86)	(108)	(91)	(96)	(108)	(108)
	P= .607	P= .761	P= .835	P= .712	P= .934	P= .558	P= .869	P= .976	P= .004	P= .156	P= .234
SM	-.6373	.7436	-.7430	-.7227	-.4419	.4582	.1936	.0703	.1269	.9475	.5998
	(109)	(109)	(109)	(109)	(108)	(87)	(109)	(92)	(97)	(109)	(109)
	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .044	P= .505	P= .215	P= .000	P= .000
SR	-.1680	.2632	-.2626	-.2562	-.2517	.3239	.7188	.2434	.0650	.3188	.2563
	(109)	(109)	(109)	(109)	(108)	(87)	(109)	(92)	(97)	(109)	(109)
	P= .081	P= .006	P= .006	P= .007	P= .009	P= .002	P= .000	P= .019	P= .527	P= .001	P= .007
TA	-.6998	.7855	-.7690	-.7757	-.5974	.3178	.1899	.0321	.0339	.6166	.1722
	(109)	(109)	(109)	(109)	(108)	(87)	(109)	(92)	(97)	(109)	(109)
	P= .000	P= .000	P= .000	P= .000	P= .000	P= .003	P= .048	P= .762	P= .742	P= .000	P= .073
TB	-.6447	.7366	-.7309	-.7199	-.4543	.4375	.2648	.0911	.0239	.8105	.5892
	(109)	(109)	(109)	(109)	(108)	(87)	(109)	(92)	(97)	(109)	(109)
	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .005	P= .388	P= .816	P= .000	P= .000
TH	-.3959	.4941	-.5006	-.4749	-.3568	.2892	.1174	.0391	-.1340	.6306	.0670
	(109)	(109)	(109)	(109)	(108)	(87)	(109)	(92)	(97)	(109)	(109)
	P= .000	P= .000	P= .000	P= .000	P= .000	P= .007	P= .224	P= .712	P= .191	P= .000	P= .489
U	-.3205	.4177	-.4110	-.4108	-.2564	.1625	.1852	.0124	-.1726	.5214	-.0041
	(108)	(108)	(108)	(108)	(107)	(86)	(108)	(91)	(96)	(108)	(108)
	P= .001	P= .000	P= .000	P= .000	P= .008	P= .135	P= .055	P= .907	P= .093	P= .000	P= .966
YB	-.7153	.8063	-.8044	-.7846	-.5344	.4838	.2878	.1581	.0266	.7536	.5407
	(109)	(109)	(109)	(109)	(108)	(87)	(109)	(92)	(97)	(109)	(109)
	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .002	P= .132	P= .796	P= .000	P= .000
ZN	-.6441	.7511	-.7575	-.7242	-.4318	.4598	.2928	.3494	.0048	.8170	.5759
	(106)	(106)	(106)	(106)	(106)	(85)	(106)	(89)	(95)	(106)	(106)
	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .002	P= .001	P= .963	P= .000	P= .000

	CR	CS	EU	FE	HF	LA	LU	NA	ND	RB	SB
CR	1.0000	.9235	.7237	.2014	.7629	.7346	.8419	.2804	.6987	.8826	.0322
	(109)	(108)	(109)	(109)	(109)	(109)	(109)	(103)	(109)	(105)	(109)
	P= .	P= .000	P= .000	P= .036	P= .000	P= .000	P= .000	P= .004	P= .000	P= .000	P= .739
CS	.9235	1.0000	.6982	.2678	.6805	.7588	.7977	.2855	.7094	.9104	-.0696
	(108)	(108)	(108)	(108)	(108)	(108)	(108)	(102)	(108)	(104)	(108)
	P= .000	P= .	P= .000	P= .005	P= .000	P= .000	P= .000	P= .004	P= .000	P= .000	P= .474
EU	.7237	.6982	1.0000	.2660	.6595	.8993	.8483	.5261	.9634	.8188	.0580
	(109)	(108)	(109)	(109)	(109)	(109)	(109)	(103)	(109)	(105)	(109)
	P= .000	P= .000	P= .	P= .005	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .549
FE	.2014	.2678	.2660	1.0000	.1245	.2570	.2894	.0835	.2517	.2589	-.1156
	(109)	(108)	(109)	(109)	(109)	(109)	(109)	(103)	(109)	(105)	(109)
	P= .036	P= .005	P= .005	P= .	P= .197	P= .007	P= .002	P= .402	P= .008	P= .008	P= .231
HF	.7629	.6805	.6595	.1245	1.0000	.7798	.7374	.5297	.6753	.7577	-.1068
	(109)	(108)	(109)	(109)	(109)	(109)	(109)	(103)	(109)	(105)	(109)
	P= .000	P= .000	P= .000	P= .197	P= .	P= .000	P= .000	P= .000	P= .000	P= .000	P= .269
LA	.7346	.7588	.8993	.2570	.7798	1.0000	.7389	.4671	.9636	.8405	-.1846
	(109)	(108)	(109)	(109)	(109)	(109)	(109)	(103)	(109)	(105)	(109)
	P= .000	P= .000	P= .000	P= .007	P= .000	P= .	P= .000	P= .000	P= .000	P= .000	P= .055

LU	.8419 (109) P= .000	.7977 (108) P= .000	.8483 (109) P= .000	.2894 (109) P= .002	.7374 (109) P= .000	.7389 (109) P= .000	1.0000 (109) P= .	.4731 (103) P= .000	.7527 (109) P= .000	.8466 (105) P= .000	.2445 (109) P= .010
NA	.2804 (103) P= .004	.2855 (102) P= .004	.5261 (103) P= .000	.0835 (103) P= .402	.5297 (103) P= .000	.4671 (103) P= .000	.4731 (103) P= .000	1.0000 (103) P= .	.4969 (103) P= .000	.5693 (99) P= .000	-.1128 (103) P= .257
ND	.6987 (109) P= .000	.7094 (108) P= .000	.9634 (109) P= .000	.2517 (109) P= .008	.6753 (109) P= .000	.9636 (109) P= .000	.7527 (109) P= .000	.4969 (103) P= .000	1.0000 (109) P= .	.8266 (105) P= .000	-.1139 (109) P= .238
RB	.8826 (105) P= .000	.9104 (104) P= .000	.8188 (105) P= .000	.2589 (105) P= .008	.7577 (105) P= .000	.8405 (105) P= .000	.8466 (105) P= .000	.5693 (99) P= .000	.8266 (105) P= .000	1.0000 (105) P= .	-.1149 (105) P= .243
SB	.0322 (109) P= .739	-.0696 (108) P= .474	.0580 (109) P= .549	-.1156 (109) P= .231	-.1068 (109) P= .269	-.1846 (109) P= .055	.2445 (109) P= .010	-.1128 (103) P= .257	-.1139 (109) P= .238	-.1149 (105) P= .243	1.0000 (109) P= .

	CR	CS	EU	FE	HF	LA	LU	NA	ND	RB	SB
SC	.9601 (109) P= .000	.9231 (108) P= .000	.8138 (109) P= .000	.2709 (109) P= .004	.7255 (109) P= .000	.7911 (109) P= .000	.9092 (109) P= .000	.3254 (103) P= .001	.7734 (109) P= .000	.9151 (105) P= .000	.1102 (109) P= .254
SE	-.0181 (108) P= .852	-.0795 (107) P= .416	.0857 (108) P= .378	-.0350 (108) P= .719	.1732 (108) P= .073	.1712 (108) P= .076	.0122 (108) P= .900	-.1966 (102) P= .048	.1008 (108) P= .299	-.1559 (104) P= .114	-.0008 (108) P= .994
SM	.7133 (109) P= .000	.7092 (108) P= .000	.9924 (109) P= .000	.2573 (109) P= .007	.6451 (109) P= .000	.9189 (109) P= .000	.8145 (109) P= .000	.5137 (103) P= .000	.9822 (109) P= .000	.8308 (105) P= .000	-.0153 (109) P= .875
SR	.4560 (109) P= .000	.5091 (108) P= .000	.3458 (109) P= .000	-.0309 (109) P= .750	.1365 (109) P= .157	.3140 (109) P= .001	.3507 (109) P= .000	.1261 (103) P= .204	.3162 (109) P= .001	.4401 (105) P= .000	.1861 (109) P= .053
TA	.5496 (109) P= .000	.5359 (108) P= .000	.4864 (109) P= .000	.1117 (109) P= .248	.8062 (109) P= .000	.6965 (109) P= .000	.5170 (109) P= .000	.2794 (103) P= .004	.5558 (109) P= .000	.5474 (105) P= .000	-.1196 (109) P= .215
TB	.7681 (109) P= .000	.7200 (108) P= .000	.9466 (109) P= .000	.2589 (109) P= .007	.6460 (109) P= .000	.7854 (109) P= .000	.9375 (109) P= .000	.4485 (103) P= .000	.8510 (109) P= .000	.7940 (105) P= .000	.2780 (109) P= .003
TH	.4742 (109) P= .000	.4415 (108) P= .000	.4818 (109) P= .000	.1035 (109) P= .284	.6899 (109) P= .000	.6656 (109) P= .000	.4460 (109) P= .000	.1646 (103) P= .097	.5215 (109) P= .000	.4431 (105) P= .000	-.1253 (109) P= .194
U	.3563 (108) P= .000	.3014 (107) P= .002	.3994 (108) P= .000	.0883 (108) P= .363	.5845 (108) P= .000	.5652 (108) P= .000	.3513 (108) P= .000	.0553 (102) P= .581	.4257 (108) P= .000	.2782 (104) P= .004	-.0535 (108) P= .582
YB	.8396 (109) P= .000	.8034 (108) P= .000	.8633 (109) P= .000	.2798 (109) P= .003	.7175 (109) P= .000	.7439 (109) P= .000	.9957 (109) P= .000	.4922 (103) P= .000	.7667 (109) P= .000	.8564 (105) P= .000	.2450 (109) P= .010
ZN	.7734 (106) P= .000	.7843 (105) P= .000	.8366 (106) P= .000	.2779 (106) P= .004	.6163 (106) P= .000	.8058 (106) P= .000	.8233 (106) P= .000	.4533 (100) P= .000	.8207 (106) P= .000	.8624 (102) P= .000	.0110 (106) P= .911

	SC	SE	SM	SR	TA	TB	TH	U	YB	ZN
SC	1.0000 (109) P= .	-.0040 (108) P= .967	.8006 (109) P= .000	.4888 (109) P= .000	.5399 (109) P= .000	.8587 (109) P= .000	.4946 (109) P= .000	.3921 (108) P= .000	.9134 (109) P= .000	.8528 (106) P= .000
SE	-.0040 (108) P= .967	1.0000 (108) P= .	.0550 (108) P= .572	-.0723 (108) P= .457	.3513 (108) P= .000	.0464 (108) P= .634	.4837 (108) P= .000	.6596 (107) P= .000	-.0178 (108) P= .855	-.0377 (105) P= .703

SM	.8006	.0550	1.0000	.3484	.4816	.9176	.4670	.3677	.8315	.8395
	(109)	(108)	(109)	(109)	(109)	(109)	(109)	(108)	(109)	(106)
	P= .000	P= .572	P= .	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000
SR	.4888	-.0723	.3484	1.0000	.1088	.3714	.1052	.0799	.3801	.4490
	(109)	(108)	(109)	(109)	(109)	(109)	(109)	(108)	(109)	(106)
	P= .000	P= .457	P= .000	P= .	P= .260	P= .000	P= .276	P= .411	P= .000	P= .000
TA	.5399	.3513	.4816	.1088	1.0000	.4401	.5821	.6229	.4869	.5425
	(109)	(108)	(109)	(109)	(109)	(109)	(109)	(108)	(109)	(106)
	P= .000	P= .000	P= .000	P= .260	P= .	P= .000	P= .000	P= .000	P= .000	P= .000
TB	.8587	.0464	.9176	.3714	.4401	1.0000	.4264	.3460	.9460	.8185
	(109)	(108)	(109)	(109)	(109)	(109)	(109)	(108)	(109)	(106)
	P= .000	P= .634	P= .000	P= .000	P= .000	P= .	P= .000	P= .000	P= .000	P= .000
TH	.4946	.4837	.4670	.1052	.5821	.4264	1.0000	.8974	.4312	.4152
	(109)	(108)	(109)	(109)	(109)	(109)	(109)	(108)	(109)	(106)
	P= .000	P= .000	P= .000	P= .276	P= .000	P= .000	P= .	P= .000	P= .000	P= .000
U	.3921	.6596	.3677	.0799	.6229	.3460	.8974	1.0000	.3285	.3317
	(108)	(107)	(108)	(108)	(108)	(108)	(108)	(108)	(108)	(105)
	P= .000	P= .000	P= .000	P= .411	P= .000	P= .000	P= .000	P= .	P= .001	P= .001
YB	.9134	-.0178	.8315	.3801	.4869	.9460	.4312	.3285	1.0000	.8391
	(109)	(108)	(109)	(109)	(109)	(109)	(109)	(108)	(109)	(106)
	P= .000	P= .855	P= .000	P= .000	P= .000	P= .000	P= .000	P= .001	P= .	P= .000
ZN	.8528	-.0377	.8395	.4490	.5425	.8185	.4152	.3317	.8391	1.0000
	(106)	(105)	(106)	(106)	(106)	(106)	(106)	(105)	(106)	(106)
	P= .000	P= .703	P= .000	P= .000	P= .000	P= .000	P= .000	P= .001	P= .000	P= .

Table E-6.
Pearson Correlation Coefficients for All York Canyon Samples.

VARIABLE	CASES	MEAN	STD DEV
MOIST	49	1.9867	1.0270
ASH	49	22.8669	27.5362
VM	49	29.9178	9.7369
FC	49	47.2153	19.4819
TOTSUL	49	.5059	.3634
AS	49	1.1049	.8737
BA	49	473.7347	285.6717
BR	49	.5786	4173
CA	49	1.7439	2.6375
CE	49	32.223	27.1687
CO	49	4.4179	2.6051
CR	49	15.6163	19.1727
CS	49	1.7088	3.4948
EU	49	.4988	.3598
FE	49	1.2476	2.6408
HF	49	1.3378	1.3765
LA	49	17.2392	14.2477
LU	49	.1767	1133
NA	49	−99.9900	.0000
ND	49	16.3176	12.7122
RB	49	16.4343	33.5267
SB	49	.3320	.2782
SC	49	5.2973	5.1388
SE	48	2.0846	1.0382
SM	49	2.7828	1.8741
SR	49	275.7551	217.6043
TA	49	.3601	4117
TB	49	.3444	2378
TH	49	4.8181	4.4757
U	49	2.1892	1.6879
YB	49	1.0958	.7570
ZN	38	'22.6868	22.4301

	MOIST	ASH	VM	FC	TOTSUL	AS	BA	BR	CA	CE	CO
MOIST	1.0000	.8445	-.7515	-.8180	.0159	.3783	.1788	-.4505	-.2246	.5941	.3703
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .	P= .000	P= .000	P= .000	P= .914	P= .007	P= .219	P= .001	P= .121	P= .000	P= .009
ASH	.8445	1.0000	-.8830	-.9721	.0265	.4883	.3200	-.2899	-.2302	.7499	.4414
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .000	P= .	P= .000	P= .000	P= .857	P= .000	P= .025	P= .043	P= .112	P= .000	P= .002
VM	-.7515	-.8830	1.0000	.7483	.1113	-.3980	-.2307	.2660	.1966	-.7449	-.4618

	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .000	P= .000	P= .	P= .000	P= .447	P= .005	P= .111	P= .065	P= .176	P= .000	P= .001
FC	-.8180	-.9721	.7483	1.0000	-.0931	-.4913	-.3369	.2768	.2271	-.6876	-.3930
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .000	P= .000	P= .000	P= .	P= .525	P= .000	P= .018	P= .054	P= .117	P= .000	P= .005
TOTSUL	.0159	.0265	.1113	-.0931	1.0000	-.0398	-.1661	-.1048	-.1237	-.2017	-.1665
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .914	P= .857	P= .447	P= .525	P= .	P= .786	P= .254	P= .473	P= .397	P= .165	P= .253
AS	.3783	.4883	-.3980	-.4913	-.0398	1.0000	.2213	-.3720	-.2963	.2014	.0039
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .007	P= .000	P= .005	P= .000	P= .786	P= .	P= .126	P= .008	P= .039	P= .165	P= .979
BA	.1788	.3200	-.2307	-.3369	-.1661	.2213	1.0000	-.0848	-.1734	.2906	-.0276
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .219	P= .025	P= .111	P= .018	P= .254	P= .126	P= .	P= .562	P= .233	P= .043	P= .851
BR	-.4505	-.2899	.2660	.2768	-.1048	-.3720	-.0848	1.0000	.3664	-.2639	-.2860
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .001	P= .043	P= .065	P= .054	P= .473	P= .008	P= .562	P= .	P= .010	P= .067	P= .046
CA	-.2246	-.2302	.1966	.2271	-.1237	-.2963	-.1734	.3664	1.0000	-.2403	-.0191
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .121	P= .112	P= .176	P= .117	P= .397	P= .039	P= .233	P= .010	P= .	P= .096	P= .896
CE	.5941	.7499	-.7449	-.6876	-.2017	.2014	.2906	-.2639	-.2403	1.0000	.6655
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .000	P= .000	P= .000	P= .000	P= .165	P= .165	P= .043	P= .067	P= .096	P= .	P= .000
CO	.3703	.4414	-.4618	-.3930	-.1665	.0039	-.0276	-.2860	-.0191	.6655	1.0000
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .009	P= .002	P= .001	P= .005	P= .253	P= .979	P= .851	P= .046	P= .896	P= .000	P= .

	MOIST	ASH	VM	FC	TOTSUL	AS	BA	BR	CA	CE	CO
CR	.8315	.9687	-.8749	-.9319	-.0490	.4785	.2433	-.3148	-.2598	.7497	.4325
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .000	P= .000	P= .000	P= .000	P= .738	P= .001	P= .092	P= .028	P= .071	P= .000	P= .002
CS	.8734	.9514	-.8535	-.9181	-.0937	.4390	.3361	-.3268	-.2481	.7422	.4852
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .000	P= .000	P= .000	P= .000	P= .522	P= .002	P= .018	P= .022	P= .086	P= .000	P= .000
EU	.5122	.7321	-.7330	-.6684	-.2145	.1224	.1768	-.1498	-.1150	.9405	.6766
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .000	P= .000	P= .000	P= .000	P= .139	P= .402	P= .224	P= .304	P= .431	P= .000	P= .000
FE	.1823	.3125	-.1452	-.3691	.8734	.0983	-.0127	-.0672	-.0911	.0584	.0611
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .210	P= .029	P= .319	P= .009	P= .000	P= .502	P= .931	P= .647	P= .533	P= .690	P= .677
HF	.5580	.7531	-.7008	-.7142	-.1717	.1684	.4201	-.0663	-.2822	.6718	.3501
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .000	P= .000	P= .000	P= .000	P= .238	P= .248	P= .003	P= .651	P= .049	P= .000	P= .014
LA	.5752	.7397	-.7303	-.6805	-.2142	.2217	.3285	-.2961	-.2926	.9770	.6229
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .000	P= .000	P= .000	P= .000	P= .139	P= .126	P= .021	P= .039	P= .041	P= .000	P= .000
LU	.4871	.7301	-.7239	-.6701	-.1847	.1219	.0862	-.1555	-.1026	.8415	.7218
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .000	P= .000	P= .000	P= .000	P= .204	P= .404	P= .556	P= .286	P= .483	P= .000	P= .000
NA	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P=1.000	P=1.000	P=1.000	P=1.000	P=1.000	P=1.000	P=1.000	P=1.000	P=1.000	P=1.000	P=1.000
ND	.4100	.5527	-.5762	-.4932	-.2220	.0340	.2711	-.2102	-.1124	.9218	.7417
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .003	P= .000	P= .000	P= .000	P= .125	P= .817	P= .060	P= .147	P= .442	P= .000	P= .000
RB	.8164	.9599	-.8584	-.9277	-.0930	.4326	.3841	-.2500	-.2503	.7455	.4901
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .000	P= .000	P= .000	P= .000	P= .525	P= .002	P= .006	P= .083	P= .083	P= .000	P= .000

SB	.6181 (49) P= .000	.6832 (49) P= .000	-.6339 (49) P= .000	-.6488 (49) P= .000	-.1142 (49) P= .435	.2691 (49) P= .062	-.0392 (49) P= .789	-.3086 (49) P= .031	-.2697 (49) P= .061	.5276 (49) P= .000	.5199 (49) P= .000

	MOIST	ASH	VM	FC	TOTSUL	AS	BA	BR	CA	CE	CO
SC	.7554 (49) P= .000	.9051 (49) P= .000	-.8440 (49) P= .000	-.8574 (49) P= .000	-.1018 (49) P= .486	.3422 (49) P= .016	.1665 (49) P= .253	-.2363 (49) P= .102	-.2116 (49) P= .144	.7566 (49) P= .000	.4658 (49) P= .001
SE	.1588 (48) P= .281	.1309 (48) P= .375	-.1654 (48) P= .261	-.1024 (48) P= .488	-.1117 (48) P= .450	.1403 (48) P= .342	-.1709 (48) P= .246	-.2830 (48) P= .051	-.2010 (48) P= .171	.0556 (48) P= .707	.1595 (48) P= .279
SM	.5232 (49) P= .000	.6957 (49) P= .000	-.7065 (49) P= .000	-.6302 (49) P= .000	-.2271 (49) P= .117	.1242 (49) P= .395	.1606 (49) P= .270	-.2393 (49) P= .098	-.1454 (49) P= .319	.8947 (49) P= .000	.6804 (49) P= .000
SR	.0086 (49) P= .953	-.0644 (49) P= .660	.0647 (49) P= .659	.0587 (49) P= .688	-.1997 (49) P= .169	-.0608 (49) P= .678	.6151 (49) P= .000	-.0655 (49) P= .655	.2569 (49) P= .075	.1559 (49) P= .285	.0407 (49) P= .781
TA	.7883 (49) P= .000	.9522 (49) P= .000	-.8581 (49) P= .000	-.9169 (49) P= .000	-.0919 (49) P= .530	.5142 (49) P= .000	.3415 (49) P= .016	-.3176 (49) P= .026	-.3244 (49) P= .023	.7293 (49) P= .000	.3705 (49) P= .009
TB	.4677 (49) P= .001	.6790 (49) P= .000	-.6944 (49) P= .000	-.6127 (49) P= .000	-.2178 (49) P= .133	.0425 (49) P= .772	.0730 (49) P= .618	-.1318 (49) P= .367	-.0858 (49) P= .558	.9048 (49) P= .000	.7282 (49) P= .000
TH	.7114 (49) P= .000	.9092 (49) P= .000	-.8533 (49) P= .000	-.8586 (49) P= .000	-.1451 (49) P= .320	.5468 (49) P= .000	.3061 (49) P= .032	-.2842 (49) P= .048	-.3475 (49) P= .014	.7199 (49) P= .000	.3789 (49) P= .007
U	.5449 (49) P= .000	.7502 (49) P= .000	-.7202 (49) P= .000	-.7005 (49) P= .000	-.1694 (49) P= .244	.3718 (49) P= .009	.1491 (49) P= .307	-.0804 (49) P= .583	-.1496 (49) P= .305	.5345 (49) P= .000	.3124 (49) P= .029
YB	.3045 (49) P= .033	.6051 (49) P= .000	-.6098 (49) P= .000	-.5505 (49) P= .000	-.1700 (49) P= .243	.0847 (49) P= .563	.0193 (49) P= .896	-.0568 (49) P= .699	-.0535 (49) P= .715	.7766 (49) P= .000	.6230 (49) P= .000
ZN	.4688 (38) P= .003	.7793 (38) P= .000	-.7002 (38) P= .000	-.7516 (38) P= .000	.1090 (38) P= .515	.1642 (38) P= .325	.4258 (38) P= .008	-.0172 (38) P= .919	-.1760 (38) P= .291	.7069 (38) P= .000	.5849 (38) P= .000

	CR	CS	EU	FE	HF	LA	LU	NA	ND	RB	SB
CR	1.0000 (49) P= .	.9131 (49) P= .000	.7643 (49) P= .000	.1911 (49) P= .188	.7048 (49) P= .000	.7378 (49) P= .000	.7690 (49) P= .000	.0000 (49) P=1.000	.5609 (49) P= .000	.9118 (49) P= .000	.7460 (49) P= .000
CS	.9131 (49) P= .000	1.0000 (49) P= .	.7019 (49) P= .000	.1683 (49) P= .248	.7781 (49) P= .000	.7264 (49) P= .000	.6724 (49) P= .000	.0000 (49) P=1.000	.5517 (49) P= .000	.9833 (49) P= .000	.6762 (49) P= .000
EU	.7643 (49) P= .000	.7019 (49) P= .000	1.0000 (49) P= .	.0371 (49) P= .800	.6783 (49) P= .000	.8857 (49) P= .000	.9234 (49) P= .000	.0000 (49) P=1.000	.8986 (49) P= .000	.7140 (49) P= .000	.5858 (49) P= .000
FE	.1911 (49) P= .188	.1683 (49) P= .248	.0371 (49) P= .800	1.0000 (49) P= .	.0921 (49) P= .529	.0540 (49) P= .712	.0592 (49) P= .686	.0000 (49) P=1.000	.0021 (49) P= .988	.1991 (49) P= .170	.0738 (49) P= .614
HF	.7048 (49) P= .000	.7781 (49) P= .000	.6783 (49) P= .000	.0921 (49) P= .529	1.0000 (49) P= .	.6874 (49) P= .000	.6810 (49) P= .000	.0000 (49) P=1.000	.5326 (49) P= .000	.8046 (49) P= .000	.5530 (49) P= .000
LA	.7378 (49) P= .000	.7264 (49) P= .000	.8857 (49) P= .000	.0540 (49) P= .712	.6874 (49) P= .000	1.0000 (49) P= .	.8175 (49) P= .000	.0000 (49) P=1.000	.8664 (49) P= .000	.7346 (49) P= .000	.5214 (49) P= .000

LU	.7690	.6724	.9234	.0592	.6810	.8175	1.0000	.0000	.7911	.7006	.6563
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .000	P= .000	P= .000	P= .686	P= .000	P= .000	P= .	P=1.000	P= .000	P= .000	P= .000
NA	.0000	.0000	.0000	.0000	.0000	.0000	.0000	1.0000	.0000	.0000	.0000
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P=1.000	P=1.000	P=1.000	P=1.000	P=1.000	P=1.000	P=1.000	P= .	P=1.000	P=1.000	P=1.000
ND	.5609	.5517	.8986	.0021	.5326	.8664	.7911	.0000	1.0000	.5599	.4038
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .000	P= .000	P= .000	P= .988	P= .000	P= .000	P= .000	P=1.000	P= .	P= .000	P= .004
RB	.9118	.9833	.7140	.1991	.8046	.7346	.7006	.0000	.5599	1.0000	.6638
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .000	P= .000	P= .000	P= .170	P= .000	P= .000	P= .000	P=1.000	P= .000	P= .	P= .000
SB	.7460	.6762	.5858	.0738	.5530	.5214	.6563	.0000	.4038	.6638	1.0000
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .000	P= .000	P= .000	P= .614	P= .000	P= .000	P= .000	P=1.000	P= .004	P= .000	P= .

	CR	CS	EU	FE	HF	LA	LU	NA	ND	RB	SB
SC	.9603	.8518	.8234	.1314	.7208	.7287	.8305	.0000	.6149	.8487	.7755
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .000	P= .000	P= .000	P= .368	P= .000	P= .000	P= .000	P=1.000	P= .000	P= .000	P= .000
SE	.2053	.1219	.1039	-.0994	.1954	.0876	.1892	.0000	.0647	.0929	.5564
	(48)	(48)	(48)	(48)	(48)	(48)	(48)	(48)	(48)	(48)	(48)
	P= .162	P= .409	P= .482	P= .501	P= .183	P= .554	P= .198	P=1.000	P= .662	P= .530	P= .000
SM	.7407	.6826	.9432	.0210	.6365	.8481	.8560	.0000	.8651	.6844	.5900
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .000	P= .000	P= .000	P= .886	P= .000	P= .000	P= .000	P=1.000	P= .000	P= .000	P= .000
SR	-.1118	-.0228	.0511	-.1389	-.1380	.1414	-.1282	.0000	.2728	-.0342	-.2834
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .445	P= .877	P= .727	P= .341	P= .344	P= .333	P= .380	P=1.000	P= .058	P= .815	P= .048
TA	.9446	.9087	.7090	.1645	.7985	.7441	.7490	.0000	.5192	.9164	.6728
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .000	P= .000	P= .000	P= .259	P= .000	P= .000	P= .000	P=1.000	P= .000	P= .000	P= .000
TB	.7199	.6457	.9825	.0291	.6343	.8544	.9463	.0000	.8800	.6605	.6129
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .000	P= .000	P= .000	P= .842	P= .000	P= .000	P= .000	P=1.000	P= .000	P= .000	P= .000
TH	.9193	.8587	.7209	.1234	.7910	.7261	.7366	.0000	.5362	.8750	.7224
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .000	P= .000	P= .000	P= .398	P= .000	P= .000	P= .000	P=1.000	P= .000	P= .000	P= .000
U	.7825	.6990	.6103	.0705	.7110	.5413	.6748	.0000	.3968	.7084	.7681
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .000	P= .000	P= .000	P= .630	P= .000	P= .000	P= .000	P=1.000	P= .005	P= .000	P= .000
YB	.6614	.5009	.8904	.0456	.5465	.7427	.9225	.0000	.7592	.5491	.5973
	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(49)
	P= .000	P= .000	P= .000	P= .756	P= .000	P= .000	P= .000	P=1.000	P= .000	P= .000	P= .000
ZN	.7066	.6899	.7323	.4225	.7792	.7260	.8017	.0000	.6365	.7655	.5057
	(38)	(38)	(38)	(38)	(38)	(38)	(38)	(38)	(38)	(38)	(38)
	P= .000	P= .000	P= .000	P= .008	P= .000	P= .000	P= .000	P=1.000	P= .000	P= .000	P= .001

	SC	SE	SM	SR	TA	TB	TH	U	YB	ZN
SC	1.0000	.2704	.8013	-.1539	.8801	.7987	.8906	.8192	.7480	.7226
	(49)	(48)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(38)
	P= .	P= .063	P= .000	P= .291	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000
SE	.2704	1.0000	.1426	-.2948	.2072	.1342	.3620	.5606	.1658	.0924
	(48)	(48)	(48)	(48)	(48)	(48)	(48)	(48)	(48)	(37)
	P= .063	P= .	P= .334	P= .042	P= .158	P= .363	P= .011	P= .000	P= .260	P= .586

SM	.8013	.1426	1.0000	.0454	.6686	.9285	.6772	.5623	.8208	.6669
	(49)	(48)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(38)
	P= .000	P= .334	P= .	P= .757	P= .000	P= .000	P= .000	P= .000	P= .000	P= .000
SR	-.1539	-.2948	.0454	1.0000	-.1203	-.0126	-.1923	-.2606	-.1145	-.1139
	(49)	(48)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(38)
	P= .291	P= .042	P= .757	P= .	P= .410	P= .932	P= .185	P= .070	P= .433	P= .496
TA	.8801	.2072	.6686	-.1203	1.0000	.6568	.9369	.7806	.5904	.7384
	(49)	(48)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(38)
	P= .000	P= .158	P= .000	P= .410	P= .	P= .000	P= .000	P= .000	P= .000	P= .000
TB	.7987	.1342	.9285	-.0126	.6568	1.0000	.6692	.5977	.9131	.7281
	(49)	(48)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(38)
	P= .000	P= .363	P= .000	P= .932	P= .000	P= .	P= .000	P= .000	P= .000	P= .000
TH	.8906	.3620	.6772	-.1923	.9369	.6692	1.0000	.8786	.6404	.7460
	(49)	(48)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(38)
	P= .000	P= .011	P= .000	P= .185	P= .000	P= .000	P= .	P= .000	P= .000	P= .000
U	.8192	.5606	.5623	-.2606	.7806	.5977	.8786	1.0000	.5913	.6804
	(49)	(48)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(38)
	P= .000	P= .000	P= .000	P= .070	P= .000	P= .000	P= .000	P= .	P= .000	P= .000
YB	.7480	.1658	.8208	-.1145	.5904	.9131	.6404	.5913	1.0000	.7294
	(49)	(48)	(49)	(49)	(49)	(49)	(49)	(49)	(49)	(38)
	P= .000	P= .260	P= .000	P= .433	P= .000	P= .000	P= .000	P= .000	P= .	P= .000
ZN	.7226	.0924	.6669	-.1139	.7384	.7281	.7460	.6804	.7294	1.0000
	(38)	(37)	(38)	(38)	(38)	(38)	(38)	(38)	(38)	(38)
	P= .000	P= .586	P= .000	P= .496	P= .000	P= .000	P= .000	P= .000	P= .000	P= .

Table E-7. Lee Ranch and York Canyon

Element	Coal Only			Coal+Boundaries+Partings		
	Slope	Intercept	R	Slope	Intercept	R
Ce	.223	7.92	.341	.873	3.21	.749
Cr	1.19	4.07	.709	1.59	5.26	.838
Cs	6.53	9.51	.685	5.92	13.33	.842
Eu	22.47	4.87	.454	61.96	−2.99	7.21
La	.388	8.36	.318	1.73	2.81	.761
Lu	59.52	4.30	.484	191.47	−6.96	.791
Rb	.723	9.99	.687	.746	12.30	.907
Sc	2.89	4.02	.598	5.65	.738	.830
Sm	3.28	6.71	.371	11.12	2.27	.688
Ta	30.69	4.65	.577	48.10	5.06	.822
Tb	27.90	5.04	.451	90.03	−2.64	.709
Yb	8.33	5.15	.445	27.30	−3.56	.751
Zn	.309	7.38	.425	.820	7.76	.752

Table E-8. Lee Ranch

Element	Coal Only			Coal+Boundaries+Partings		
	Slope	Intercept	R	Slope	Intercept	R
Ce	.310	7.60	.342	.993	4.25	.789
Cr	1.202	4.82	.584	1.82	5.79	.818
Cs	5.97	9.81	.438	5.50	14.58	.811
Eu	34.49	2.77	.526	68.38	.693	.748
La	.582	7.99	.333	2.09	3.14	.826
Lu	58.17	5.05	.471	197.52	−5.79	.819

d	1.16	5.45	.415	2.46	4.90	.759
b	1.11	9.86	.488	.729	13.43	.789
c	3.73	2.99	.608	6.51	.707	.838
m	7.26	3.37	.479	13.02	3.46	.744
a	23.43	5.99	.471	44.26	6.62	.786
b	32.05	4.74	.484	97.12	−.231	.737
b	8.67	5.44	.456	29.22	−4.04	.806
n	.159	9.78	.234	.772	8.90	.751

Table E-9. York Canyon

lement	Coal Only			Coal+Boundaries+Partings		
	Slope	Intercept	R	Slope	Intercept	R
e	2.28	6.16	.398	.760	−1.68	.750
r	1.24	1.95	.861	1.39	1.14	.968
s	6.82	9.16	.878	7.50	10.06	.951
u	19.89	3.82	.459	56.03	−5.08	.732
a	.401	6.42	.372	1.43	−1.78	.740
u	66.27	2.06	.520	177.42	−8.48	.730
b	.680	9.03	.903	.788	9.91	.960
)	24.76	5.14	.516	67.63	.412	.683
:	2.65	2.89	.641	4.85	−2.82	.905
n	3.26	4.24	.423	10.22	−5.58	.696
a	44.55	2.65	.749	63.68	−.065	.952
)	25.90	4.38	.434	78.63	−4.22	.679
n	3.51	.510	.692	5.59	−4.08	.909
	4.77	3.99	.486	12.24	−3.93	.750
n	.642	2.41	.746	1.06	2.26	.779