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DRAFT

WELL LOG ANALYSIS REPORT

ON

ORE-IDA NO. 1 WELL,

ONTARIO, OREGON

by

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and GeothermEx, Inc.

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1. SUMMARY AND CONCLUSIONS

This report presents the results of reinterpretation of the well logs from the Ore-Ida No. 1 well at Ontario, Malheur County, Oregon. The well logs were digitized, edited and used in a computer-assisted qualitative analysis for lithologic zonation and fracture identification. Various histograms, crossplots and "Z-plots" of log data were visually checked. This interpretation refines and essentially corroborates the original well-site interpretation of the logs reported by the operator.

The well shows only sedimentary (sandstone/siltstone/claystone/tuff) rocks up to a depth of 4,570 feet, below which basalt/diabase appears. Below 8,155 feet, the well shows massive basalt/diabase. The individual basalt layers vary from 45 feet to 735 feet. Based on drill cutting and log response data, the well section below 4,570 feet was divided into 16 lithologic intervals and the characteristics of each interval described. thick

Fifteen different criteria of log response and drilling performance were used to identify potential fracture zones. Based on how many criteria are satisfied by a specific zone, it was described as fractured or probably fractured or possibly fractured. Fractures were found to be confined to basalt/diabase intervals. It was estimated that approximately 335 feet are fractured, 332 feet probably fractured and 92 feet possibly fractured.

Fractures may occur in the less compacted tuffs and sediments but are probably sealed.

This analysis did not reveal any reason to embark on a major reworking program for the well for the following reasons:

1. Fractured intervals are not numerous; all potential fracture zones are either open to flow through the liner, or if cemented, the casing is perforated.

2. Initial well test by nitrogen stimulation did not yield significant flow presumably because of mud damage to potentially productive zones. Stimulation of the well by chemical means or hydraulic fracturing to remove mud damage is expensive (several hundred thousand dollars). Without any positive evidence of the presence of a significant resource around this well such expenditure is not justified. While the well temperatures are adequate, little positive evidence exists of the presence of significant fluid reserves.

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3. Equilibrium temperature profile does not indicate any evidence of a convective gradient; hence major communicating fracture zones are not present in this well.

However, there is a small probability that ~~now~~ the well may flow on pumping, assuming that the artesian flow may have partly cleaned the well. If funds are available, it may be worthwhile to set a pump in the well and attempt to flow the well. If significant flow rates result (several hundred gallons per minute) a properly designed flow-test program should be initiated. If the well becomes self flowing at a significant rate a spinner log may be run to identify the flow zones. However, for reasons cited above, the probability of the well lying within an extensive geothermal fluid reservoir is quite low.

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2. INTRODUCTION

A geothermal test well was drilled at Ontario, Oregon in 1979, to a depth of 10,054 feet. Temperatures below 7,000 feet depth are greater than 300°F. Only sedimentary rocks were encountered up to 4,571 feet. Below 8,155 feet massive basalts were encountered. The hole did not respond to intial flow tests using liquid nitrogen; the hole has not been pumped.

Ore-Ida No. 1, a deep geothermal test hole, was spudded at Ontario, Malheur County, Oregon on August 19, 1979. The hole was drilled to a total depth of 10,054 feet by November 7, 1979. Testing and logging activities continued to November 27, 1979, after which the rig was moved from the site and the hole capped with a pressure-tight flange, valve and pressure recorder.

The well was drilled in order to develop a source of hot water for the Ore-Ida Foods, Inc. processing plant at Ontario. A cooperative program was contracted between Ore-Ida Foods and the U. S. Department of Energy. Ore-Ida Foods was serviced by CH2M-Hill as principal consultant, and GeothermEx, Inc., as technical consultant for exploration. The Department of Energy was represented by EGG-Idaho as program manager.

The well was drilled using standard rotary drilling techniques for a deep geothermal test hole. Gel-water mud was used during initial drilling. Buttressed 13-3/8-inch casing was landed to 925 feet depth and cemented bottom to top with 395 sacks of class G cement premixed with perlite, silica flour and gel. Drilling proceeded, using lignosulfonate muds. Weights, viscosities and acidities of the mud were altered for maximum penetration, hole stability and water loss control, to a depth of 8,216 feet, inclusive of a core from 8,188 to 8,216 feet depths. An intermediate string of 9-5/8-inch casing was landed and cemented bottom to top at 8,183 feet depth, with 5,000 cubic feet of class G cement premixed with perlite, silica flour, gel and R-11. Drilling was attempted with water, but connections were difficult and the drilling string was stuck on several occasions because of slough in an unstable hole. After experimenting with the mud weight, a full-weight (83 pounds per cubic foot) lignosulfonate program was re-instituted. The hole was stabilized and drilled to total depth. Circulation with fresh water to remove all possible residual mud was attempted after a 7-inch perforated liner was hung from 8,142 feet to 10,038 feet depth.

The well has not been thoroughly flow-tested. Liquid nitrogen stimulation tests did not produce fluid. Infill appeared to be restricted to less than 15 gallons per minute. It is reported that artesian flow of about 1 gallon per minute at about 70°F with a wellhead pressure of about 80 psi developed by February 1980. The well has not been pump-tested, although water now stands in the casings to surface. The hole is fully cased and/or lined to total depth. No down hole pressure tests have been made. No spinner tests have been attempted. Several months after the completion of the well a temperature log has been run (on July 11, 1980). The log gives the equilibrium temperature profile in the well.

This report presents the revised results of the analysis of well logs from the well ORE-IDA No. 1 in Ontario, Oregon. The analysis of the well logs from the subject well was performed at the wellsite shortly after drilling. The results were reported as part of a report by GeothermEx (1980). Since that was a well-site analysis and hence highly subjective, it was felt that a computer-aided analysis was warranted. The Earth Sciences Laboratory of the University of Utah Research Institute (UURI) digitized the well logs, edited the data and stored the digitized data on computer tapes. This digitized data base was used in a qualitative (but more objective than a wellsite analysis) interpretation of the well logs.

An objective of this study was to determine if any new light can be shed on the production possibility of the well, and if so, to decide whether or not the well should be retested and how.

3. METHODOLOGY

Table 1 lists the well logs run in the well, together with other relevant information. All logs listed in Table 1 were run by Welex. The quality of logs generally is good. Dip logs show dip angle, azimuth and the relative correlation quality for each correlation interval. The Microseismogram-Cased Hole Log also provides casing collar locator, relative neutron response and relative amplitude of the compressional wave. The Fracture Finder-Microseismogram Log also provides self-potential, caliper and shear wave amplitude data. Compensated Density Log-Neutron also provides gamma ray, caliper and density correction ($\Delta\rho$) curves. Compensated Acoustic Velocity Log also presents self-potential, caliper and time depth integrator data. Dual Induction Guard Log provides self-potential, along with deep induction, medium induction and shallow guard logs.

Log No. 25 listed in Table 1 was prepared by the Energy Well Logging Service. Log No. 26 in Table 1 was prepared by GeothermEx, Inc. Logs 1 through 24 and 27 in Table 1 were run by Welex. The Computer Analyzed Log Systems (CAL) of Welex, listed as log 27 in Table 1, was not useful for this study. CAL is designed for petroleum wells in sedimentary formation. For tuffs and silicified "siltstones" or basalts and diabase CAL information is practically meaningless, because true matrix properties of these non-sedimentary lithologies are not known.

From the cutting log it is seen that the lithologic types encountered in this well can be grouped under four classes:

1. Sandstone
2. Siltstone and claystone
3. Tuffs and silicified "siltstones"
4. Basalts and diabase

In the above classification the silicified "siltstone" type as described in the cutting log probably represents tuffites. A careful examination of all available well logs allows establishment of a set of diagnostic criteria for each of the lithologic types. Table 2 presents these criteria.

Alteration due to hydrothermal or other causes appears to change sharply the log response of the lithologic types in this well. For example, diabase when fresh has a Δt of 45 and 50 μsec/ft. When

TABLE 1.

WELL LOGS RUN IN ORE-IDA NO. 1 WELL

	Log Type	Date	Top of Logged Interval (ft)	Bottom of Logged Interval (ft)
1.	Dual Induction Guard Log	9/18/79	925	7,150
2.	"	10/1/79	7,150	7,956
3.	"	11/8/79	8,182	10,053
4.	Compensated Acoustic Velocity	9/18/79	925	7,148
5.	"	10/1/79	7,148	7,952
6.	"	11/8/79	8,182	10,048
7.	Compensated Density Log-Neutron	9/18/79	925	7,250
8.	"	10/3/79	7,150	7,955
9.	"	11/8/79	8,182	10,038
10.	Fracture Finder Microseismogram Log	9/18/79	925	7,148
11.	"	10/1/79	7,148	7,952
12.	"	11/8/79	8,180	10,047
13.	Microseismogram Log-Cased Hole	11/9/79	6,800	8,198
14.	Dip Log	9/18/79	925	7,955
15.	"	11/9/79	8,180	9,931
16.	Temperature Log, Run No. 1	9/18/79	0	7,150
17.	Temperature Log, Run No. 2	9/19/79	0	7,150
18.	Temperature Log, Run No. 3	9/19/79	0	7,150

TABLE 1 Continued

	Log Type	Date	Top of Logged Interval (ft)	Bottom of Logged Interval (ft)
19.	Temperature Log, Run No. 4	9/20/79	0	7,140
20.	Temperature Log, Run No. 5	10/1/79	0	7,958
21.	Temperature Log, Run No. 6	10/2/79	0	7,958
22.	Temperature Log, Run No. 7	10/2/79	6,000	7,958
23.	Temperature Log, Run No. 8	11/9/79	0	10,053
24.	Temperature Log, Run No. 9	11/10/79	0	9,360
25.	Drilling Log, Mud Log, and Cuttings Log	For the entire drilling period	55	10,055
26.	Cuttings and Core Log of Binocular Microscope Description	For the entire drilled section	30	10,040
27.	Computer Analyzed Log System	Based on Welex logs	6,000	7,900

TABLE 2.

DIAGNOSTIC CRITERIA FOR LITHOLOGIC TYPES - ORE-IDA NO. 1

Lithologic Type	Drilling Rate	Hole Enlargement	Self-Potential	Gamma Ray	Conductivity
1. Sandstone	High	Sometimes negative enlargement due to mud cake	Moderate	Moderate (80-140 API)	Moderate
2. Siltstone and claystone	Moderate to high	Occasional	None	Moderate (80-150 API)	....
3. Tuffs and silicified "siltstone"	Moderate	Unusual	Low	High (>200 API), off-scale	....
4. Basalts and diabase	Slow	In fractured sections	Low, wandering	Low (20-70 API)	Very low

Lithologic Type	Sonic Travel Time	Bulk Density	Neutron Log Response	Dip Log Response	Other Characteristics
1. Sandstone	Moderate (55-100 μ sec/ft when compacted)	Moderate (2-2.6 gms/cc)	Moderate to low porosity	Excellent correlation quality, numerous correlation intervals	Occasional mudcake buildup
2. Siltstone and claystone	High (100-110 μ sec/ft)	Moderate (2.4-2.6 gms/cc)	High porosity	Excellent correlation quality, numerous correlation intervals	....
3. Tuffs and silicified "siltstone"	High (up to 150 μ sec/ft)	Low 2.4-2. gms/cc)	Low porosity	....	Characteristic high Δt on microseismogram
4. Basalts and diabase	Moderate (45-100 μ sec/ft)	High (up to 3.0 gms/cc)	High porosity	Poor correlation quality and very few correlation intervals	Convective heat flow on temperature log

hydrothermally altered it increases to as high as 100 μsec/ft. Similarly, diabase and basalt when fresh display densities in the range of 2.9 to 3.0 gms/cc. When altered, these lithologies display densities as low as 2.45 gms/cc for basalt and 2.80 gms/cc for diabase. Gamma ray delines due to alteration of diabase from 60 to 20 API units in typical cases.

With the help of the log response criteria presented in table 2, the drill cutting log, mud log, and particularly the data from the binocular microscope study of the cuttings, the entire well section was divided into broad intervals. Table 3 provides a description of these intervals. Each zone has a distinct lithologic description. The advantages of this zonation technique over a section based on drill cuttings alone are many. The most important advantage is that while cuttings data can define lithologic boundaries within a few tens of feet at best because of difference in velocities of cuttings because of differences in densities of lithologies, the log-derived data can be accurate to about one foot. Moreover, erroneous identification of lithology is possible when using cuttings because of their small size. Caving of overlying strata often invalidate cutting data. Once the logs can be "calibrated" as to their log responses (Table 2), log response becomes an accurate tool for lithologic zonation. Plate 5 of GeothermEx (1980) shows the lithologic zonation in this well as derived from drill cuttings data and log responses. In preparing Plate 5 it was observed that the binocular microscopic study of cuttings agreed much closer with the log responses than did the well-site drill cuttings report (Log 25 in Table 1).

The well logs were digitized and edited by UURI and stored on computer tapes. These digitized data were utilized in refining the results of the well-site analysis reported in GeothermEx (1980). The log responses for each interval in Table 3 were histogrammed from the digitzied data (Figures 1 through 120). The log repsonses histogrammed were gamma ray intensity (GR), interval transit time (Δt), bulk density (ρ), neutron porosity (ϕ_N), mechanical strength index (MSI), caliper reading and electrical resistivity (R). MSI is a relative, quantitative indication of the mechanical strength of formations and is defined by

$$MSI = \rho/(\Delta t)^2.$$

The digitized log data were also cross-plotted. Several "Z-plots" of ρ vs. ϕ_N with a third log response along the Z-axis were made (Figures 121 through 152 and 185 through 216). The Z-axis

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Table 3. BROAD LITHOLOGIC ZONATION

Zone	Gross Thickness (ft)	Lithology	Permeability Characteristics
4,571-4,616 ft	45	Basalt/Diabase	Possible fracture permeability
4,660-5,137 ft	477	Clayey/Tuffaceous Siltstone	Intergranular, very low permeability
5,152-5,387 ft	135	Basalt/Diabase	Possible fracture permeability
5,296-5,560 ft	264	Siltstone	Intergranular, very low permeability
5,572-5,644 ft	72	Basalt/Diabase	Possible fracture permeability
5,651-6,026 ft	375	Claystone/Siltstone	Intergranular, very low permeability
6,031-6,286 ft	255	Altered Basalt/ Diabase	Possible fracture permeability
6,294-7,008 ft	714	Sandstone/ Siltstone	Intergranular permeability
7,015-7,135 ft	120	Sandstone/Siltstone/Basalt/ Diabase	Fracture permeability
7,147-7,798 ft	651	Siltstone/ Claystone	Intergranular, very low permeability
7,803-7,926 ft	123	Tuff/Sandstone/ Siltstone	Intergranular, very low permeability
8,155-8,404 ft	249	Partially altered Basalt/ Diabase	Probable fracture permeability
8,466-8,826 ft	360	Basalt/Diabase	Probable fracture permeability
8,863-9,238 ft	375	Basalt/Diabase	Fracture permeability
9,253-9,577 ft	324	Siltstone/Claystone/Basalt/ Diabase	Intergranular, very low permeability
9,581-9,938 ft	357	Basalt/Diabase/ Tuff	Probable fracture permeability

variables used were GR, R, Δt and caliper reading. Crossplots were made of MSI vs. GR (Figures 153 through 168) and MSI vs. caliper reading (Figures 169 through 184).

By visual examination of the histograms and crossplots both lithologic zonation and fracture identification were improved. Table 3 is a summary of the lithology and permeability characteristics defined by this analysis. Section 4 gives detailed description of the characteristics of each interval as obtained from this analysis. Section 5 gives the methodology and results of using the log responses to identify fractures and/or permeable zones.

4. DETAILED DESCRIPTION OF ZONES

4,571-4,616 feet

Low GR (40 to 80). Low Δt (mostly 40 to 60). High ρ (2.90 to 3.10). Low ϕ_N (10 to 20). MSI distribution bimodal with peaks between 0.2 x 10^{3} to 0.4 x 10^{-3} and 0.1 x 10^{-2} to 0.12 x 10^{-2}. Moderate caliper reading (14 to 16). R between 13.3 to 35.6. General increase of hole size with decrease in MSI.

Although the drill cutting description indicates a preponderance of siltstone with lesser amounts of basalt/diabase and a minor amount of pyrite, the log responses are strongly influenced by basalt/diabase and pyrite; for example the high ρ and low Δt. The sedimentary material in cuttings must be from caving.

4,660-5,137 feet

High GR (100 to 180). High Δt (80 to 140). Low ρ (2.2 to 2.5). High ϕ_N (20-35). MSI low (0.1 x 10^{-3} to 0.4 x 10^{-3}). Moderate caliper reading (13 to 17). R low (2.2 to 24.4). No correlation between MSI and GR or MSI and caliper reading. MSI being low for all GR values and caliper readings (figure 154).

Drill cutting description and log responses indicate that the lithology is clayey (and at places tuffaceous) siltstone. Porosity is estimated to be between 10 to 14 percent.

5,152 to 5,287 feet

Low GR (60-80). Low Δt (40 to 60). High ρ (2.6 to 3.1). Low ϕ_N (10-25). MSI high (0.9 x 10^{-3} to 0.11 x 10^{-2}). Moderate caliper reading (14 to 16). High R (24.4 to 68.9). Drill cutting and log responses show that the interval primarily consists of basalt/diabase with a few siltstone zones. MSI for basalt/diabase zones are independent of caliper reading (figure 171).

5,296-5,560 feet

High GR (100 to 180). High Δt (80-120). Low ρ (2.3 to 2.6). High ϕ_N (20 to 35). Low MSI (0.1 to 0.4 x 10^{-3}). Low caliper reading (12 to 15). Low R (2.2 to 35.5). Log responses indicate predominantly sedimentary rocks in this interval. Drill cuttings from this interval are unreliable because of numerous incidents of caving when this section was drilled. ρ decreases with increase in ϕ_N indicating a sedimentary interval (figure 188). MSI is uniformly low and independent GR and caliper reading (figures 156 and 172). Porosity at the bottom of the interval is estimated to be 13 to 15 percent.

5,572 to 5,644 feet

Low GR (40 to 80). Low to medium Δt (40 to 120). High ρ (2.8 to 3.1). Low ϕ_N (10 to 30). MSI distribution bimodal (figure 75) with peaks between 0.2×10^{-3} to 0.5×10^{-3} and between 0.8×10^{-3} and 0.12×10^{-2}. Low caliper reading (12 to 14). Low to moderate R (13.3 to 35.5). Lower R associated with higher ϕ_N and lower ρ, that is, sedimentary zones. Drill cutting description and log analysis indicate a primarily basalt/diabase section with a few siltstone zones.

5,651-6,026 feet

High GR (100 to 180). High Δt (80 to 120). Low ρ (2.3 to 2.6). High ϕ_N (20 to 40). Low MSI (0.2×10^{-3} to 0.4×10^{-3}). Low caliper reading (12 to 14). Low R (2.2 to 24.4). Drill cutting description indicates a predominantly claystone and siltstone sequence with very few basalt/diabase zones. From ρ vs. ϕ_N Z-plots (figures 142, 190, 206) it appears possible to separate the claystone trend from the siltstone cluster. Claystone points are characterized by low resistivity and higher ϕ_N, Δt and caliper values. MSI is independent of GR and caliper reading (figures 158 and 174). The lower half of the interval has porosities on the order of 12 to 15 percent.

6,031-6,286 feet

Low GR (40 to 80). Low to medium Δt (40 to 100). ρ varies over a wide range (2.2 to 3.0) but peaks between 2.8 to 2.9. ϕ_N ranges from low to high (15 to 40) with a low peak (20). Moderate MSI (0.5×10^{-3} to 0.8×10^{-3}. High caliper reading (14 to 17). Low R (2.2 to 24.4). MSI is independent of caliper reading (figure 175). Drilling cutting description indicates a predominantly sausseritized and otherwise altered basalt section with traces of pyrite. The ρ vs. ϕ_N Z-plots (figures 127, 143, 191, 207) indicate a general decline of with increase in ϕ_N, presumably because of alteration. Alteration seems to be causing a reduction in R (figure 143). This zone is possibly fractured (see table 4).

Table 4. SUSPECTED FRACTURE ZONES

Zone	Criteria 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Remarks
7,050-7,130 ft		X		X	X	?	X	X		?		X	X	X	X	Fractured
8,178-8,216 ft			X	X			X						X		X	Possibly Fractured
8,320-8,400 ft					X	X	X	X		?		X	X	X	X	Probably Fractured
8,450-8,520 ft			X	?		X	X	X		?		X	X	X	X	Probably Fractured
8,640-8,670 ft						X		X				X	X	X		Possibly Fractured
8,730-8,840 ft						X	X	X		?		X	X	X	X	Probably Fractured
8,970-8,990 ft	X				X	X	X			?		X	X	X		Probably Fractured
9,020-9,235 ft			X		X	X	X	X		X		X	X	X	X	Fractured
9,792-9,806 ft	X			?	X					?		X	X	X		Possibly Fractured
9,880-9,890 ft	X					X					X	X	X	X	?	Possibly Fractured
9,924-9,936 ft					X		X	X		X		X	X	X	?	Probably Fractured
9,985-10,010 ft	?			X	X	X						X	X	X		Possibly Fractured

6,294-7,008 feet

GR shows a large range with high values (100 to 200). Δt moderate (60 to 100). ρ ranges from low to moderate (2.2 to 2.7). ϕ_N ranges from moderate to high (15 to 35). MSI low (0.2×10^{-3} to 0.5×10^{-3}). Low caliper reading (12 to 15). R is low to moderate (2.2 to 35.6). Drill cutting description and log responses indicate the interval to be primarily sandstone and siltstone with some claystone zones. ρ vs. ϕ_N Z-plots show large data scattering. In general, the claystone zones plot as points with high ρ, low R and high Δt on the Z-plots, defining the upper limit of the data (figure 144). MSI is uniformly low over all ranges of GR and caliper reading (figures 160 and 176). This zone is primarily intergranular and permeable. The estimated porosity at various depths in this interval ranges from 16 to 29 percent.

7,015-7,135 feet

Low GR (40 to 80). Δt low (40 to 60). ρ distribution is bimodal with peaks around 2.1 to 2.4 and 3.0 to 3.1. ϕ_N bimodal with peaks around 15 to 25 and 30 to 45. Very broad range in MSI (figure 79), from 0.3×10^{-3} to 0.2×10^{-2}. Caliper reading low to moderate (11 to 15). R moderate to high (13.3 to 46.7). Drill cutting description indicates a mixture of sandstone, siltstone and basalt/diabase lithologies with some alteration. This complex lithologic variation gives rise to wide scatters in the Z-plots (figures 129, 145, 193, 209). This zone appears to have the best fracture permeability in the well (see table 4).

7,147-7,798 feet

Moderate to high GR (80 to 180). Moderate Δt (60 to 100). Moderate ρ (2.4 to 2.7). Large range in ϕ_N (10 to 40). Low MSI (0.2 to 0.5×10^{-3}). Moderate caliper reading (13 to 15). Low R (2.2 to 24.4). Drill cutting description indicates a siltstone and claystone sequence with a few basalt/diabase and sandstone zones. Z-plots of ρ vs. ϕ_N show that ρ shows almost little change for a large change in ϕ_N (figures 130, 146, 194, 210). The reason for this may be the fact that the entire sequence is a tight siltstone with varying amounts of clay. MSI is independent of GR and caliper reading (figures 162 and 178). The estimated porosity at the bottom of the interval is about 18 percent.

7,803-7,926 feet

GR distribution appears bimodal with peaks around 40 to 60 and 120 to 160. Δt is moderate (60 to 100). ρ is low to moderate (2.2 to 2.7). ϕ_N appears bimodal with peaks around 15 to 20 and 30 to 45. MSI is low to moderate (0.2×10^{-3} to 0.7×10^{-3}). Caliper readings are low to moderate (12 to 16). R is moderate (13.3 to 24.4). Drill cutting description indicates this interval to be a complex mixture of tuffs, sandstone and siltstone. The crossplots consequently show large scattering. This zone appears to be of low intergranular permeability.

8,155-8,404 feet

GR is low (20 to 40). Δt is low to moderate (60 to 120). Very wide range in ρ (1.4 to 3.0). Wide range of ϕ_N (15-50). Large range in MSI (from less than 0.1×10^{-3} to $0.6\ 10^{-3}$). Large range in caliper reading (9 to 15). Low to moderate R (2.2 to 35.6). Drill cutting description indicates the interval to be partially altered basalt/diabase. The caliper readings indicate excessive hole enlargement, which has caused excessively low values of ρ and unusually high values of Δt and ϕ_N. Z-plots (Figures 132, 148, 196, 212) indicate two possible linear trends, one (with smaller slope) for relatively unaltered basalt and the other for altered basalts. Caliper reading appears to increase (that is, hole appears to enlarge) at low MSI values (Figure 180). Fracture zones are suspected at 8,320-8,400 and 8,178-8,216 feet.

8,466-8,826 feet

GR is low (20 to 60). Δt is low to moderate (60-100). ρ varies over a wide range (1.9 to 3.0). Wide range in ϕ_N (10-50). MSI shows a large range (0.1 to 0.8×10^{-3}). Shows excessive hole enlargement (caliper reading 11 to 15). High R (24.4 to 46.6). Drill cutting description indicates this section to be basalt/diabase. Z-plots show large scatter (Fgiures 133, 149, 197, 213). MSI appears to increase with GR (Figure 165). Caliper reading increases as MSI declines (Figure 181). In general, altered basalts appear to be weak mechanically and to cause excessive hole enlargement and high values of ρ, Δt and ϕ_N. This zone appears fractured in the intervals 8,730-8,840 feet, 8,640-8,670 feet and 8,450-8,520 feet.

8,863-9,238 feet

GR is low (20 to 60). Δt is low to mdoerate (60 to 100). ρ varies from 2.4 to 3.0. ϕ_N ranges from 20 to 40. MSI varies widely (0.1×10^{-3} to 0.8×10^{-3}). Considerable hole enlargement (caliper reading 11 to 13) is apparent. R varies from moderate to high (13.3 to 46.6). Drill cutting description indicates a basalt/diabase interval. Z-plots (Fgiures 134, 150, 198, 214) indicate less scatter than the basalt sections discussed before. Fracture zones are suspected at 9,020-9,235 feet and 8,970-8,990 feet.

9,253-9,577 feet

Wide range in GR--from moderate (40) to very high (240). Δt low to high (60 to 120). ρ varies widely, from 2.2 to 3.0. ϕ_N varies from 20 to 35. MSI varies from 0.1×10^{-3} to 0.6×10^{-3}. Caliper reading is 10 to 12. R varies from low to moderate (2.2 to 35.5). Drill cutting indicates a primarily siltstone and claystone sequence with a few basalt/diabase zones. Z-plots of ρ vs. ϕ_N with GR (Figure 135) show two clusters. The upper cluster with lower GR, higher ρ and lower ϕ_N corresponds to basalts/diabase. The lower cluster with higher GR, lower ρ and higher ϕ_N corresponds to a siltstone and claystone sequence. The siltstone/claystone cluster also shows higher Δt (Figure 199). A fracture zone is suspected at 9,300-9,510 feet.

9,581-9,938 feet

GR distribution appears bimodal with peaks around 40 to 80 and 220 to 240. Δt ranges from moderate to high (60 to 120). ρ ranges from 2.4 to 3.0. ϕ_N ranges from 10 to 35. MSI ranges from 0.2×10^{-3} to 0.7×10^{-3}. Caliper reading is 10 to 12. R ranges from low to high (2.2 to 68.9). Drill cutting description indicates a basalt/diabase section with some tuff. Z-plots of ρ vs. ϕ_N show two clusters. The upper cluster with lower GR, higher ρ and higher ϕ_N appears to represent basalt/diabase, while the lower cluster represents tuffs. The lower cluster also has higher Δt (Figure 200). Suspected fracture zones are at 9,792-9,806 feet, 9,880-9,890 feet, and 9,924-9,936 feet.

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5. FRACTURE IDENTIFICATION

Fractures in geothermal systems can be detected and evaluated with varying degrees of certainty from various well logs. The most useful evaluation procedure is to combine the fracture detection criteria from various well logs and determine an overall probability of occurrence and general nature of the fractures in a well. Based on the available well logs, the following fracture detection criteria have been applied to the subject well (Sanyal, et al., 1979). Some are self-evident (1, 2) while others are highly inductive.

1. Drilling Rate - Usually fractured intervals display faster drilling rates.

2. Mud Circulation Data - Most fracture zones cause lost circulation of mud.

3. Drill Cuttings Data - Drill cuttings sometimes show vein-filling minerals indicating partial filling of fractures.

4. Self-Potential - Igneous rock formations do not usually display self-potential unelss fractured, when mud-filtration through fractures may give rise to a streaming potential.

5. Conductivity - Igneous rock formations usually display very low conductivity unless fractured. In fracture zones shallow-investigation resistivity logs show higher conductivity because of the presence of mud in fractures.

6. Separation between Shallow Guard and Induction Logs - In fractured igneous formations, the shallow guard log should show higher conductivity than the induction logs, which have a higher depth of investigation.

7. Hole Enlargement - Fractured sections often show hole enlargement.

8. Three-Arm and One-Arm Caliper Data - When there is an inclined fracture, the hole usually becomes non-circular in cross section, due to preferential hole enlargement in the direction of the fracture. A three-arm caliper gives an average diameter of the well. On the other hand, the one-arm caliper with a pad-mounted device, such as the density tool, tends to give the maximum width of the borehole. This is so because the

caliper arm in such a tool is pressed very hard against the borehole wall and when the tool is pulled up during logging the caliper arm tends to align itself and extend in the direction of the maximum width. Thus for a fracture zone the one-arm caliper indicates a larger diameter than the three-arm tool.

9. $\Delta\rho$ Curve - When the caliper log shows that a borehole is smooth but the $\Delta\rho$ curve shows large corrections to the density reading, it may imply either mudcake buildup or the presence of fractures. In igneous lithology, mudcake buildup is not common; hence an unusual value of $\Delta\rho$ in a smooth section of the hole indicates fracures.

10. Neutron and Density Logs - In an igneous formation, fractures usually account for most of the porosity, unless there is vesicular porosity. Hency neutron and density logs should indicate relatively higher porosities in fractures zones.

11. Comparison of Sonic and Density Porosities - In fractured zones, sonic log-derived porosity will be lower than the density log-derived porosity because the sonic log does not "see" most fractures. Unfortunately, in Ore-Ida No. 1 it is difficult to do this comparison because to calculate porosities one needs the properties of the matrix. Even though lithologic zonation in this well was possible, accurate matrix values for each lithology cannot be determined without a more quantitative approach.

12. Compressional Wave Amplitude - Fracture zones cause a reduction in the amplitude of the compressional sonic wave.

13. Microseismogram - Fracture zones cause interference in sonic waves. As a result, in the full wave-train presentation in the microseismogram, fracture zones are indicated by interference patterns.

14. Rock Strength - The mechanical strength of a rock is proportional to MSI. A rock with high MSI can undergo brittle fracture; a rock with low MSI does not usually show brittle fracturing.

15. Temperature Anomaly - If a temperature log is run soon after drilling, the fractured zones show cooling effect due to mud invasion.

Table 4 lists all suspected fracture zones in Ore-Ida No. 1 with checkmarks for the satisfied criteria. The zones considered in Table 4 are different from those in Table 3, because the lithologic zonation considered in Table 3 is too coarse for locating individual fracture zones. Only those sections of the intervals listed in Table 3 that are suspected to be fractured are included in Table 4. A question mark in Table 4 implies that it is not clear whether the criterion is satisfied or not. Based on the number of satisfied criteria, we have concluded whether a zone is fractured, probably fractured or possibly fractured.

In the subject well, the fracture zones appeared to be confined to basalts. There are some permeable zones in the sedimentary sections in this well which have intergranular rather than fracture porosity. For such zones many of the criteria used in Table 4 are not relevant.

By adding up the gross thicknesses of fractured intervals from Table 4, we estimate approximately 335 feet apparent, 332 feet probable and 92 feet possible cumulative fractured interval.

6. DISCUSSION

Essentially this log interpretation effort did not significantly change the results of the well-site log interpretation reported by GeothermEx (1980). No attempt was made to perform a fully quantitative interpretation; for no conclusions of major practical significance would have been obtained from such a study.

Log responses and drill cutting data reveal an essentially sedimentary (sandstone/siltstone/claystone/tuff) sequence to a depth of 4,570 feet. Between 4,571 and 8,154 feet, basalt/diabase and sedimentary layers alternate. Below 8,154 feet the lithology is massive basalt with the exception of the 9,253-9,577 feet section, where sediments occur. Below 7,000 feet, static well temperature exceeds 300°F, which is the lower limit for a commercially attractive resource.

Fractures, as identified from logs, are confined to the basalts. Zones with suspected fractures and temperatures over 300°F add up to a maximum of about 759 feet. However, the individual fracture zones are not very thick. Also, the mere indication of fracture from log responses does not imply a productive fracture zone. For productivity, fractures must be open and interconnected, and a source of fluid must be present. Hence a flow test is the only way to prove a well's productivity.

The well did not show significant flow rate during nitrogen stimulaton. It is likely that the lack of a significant flow rate was due to well damage caused by drilling mud. All suspected fractured intervals were open to the well through either the slotted liner or perforations in the casing. The sedimentary, apparently permeable, section between 6,900 and 7,000 feet also was perforated. In a meeting held between the project staff, ORE-IDA and EG&G it had been pointed out that the lost circulation zone at 7,169 feet was not perforated. However, the occurrence of lost circulation when the bit was at 7,169 feet did not necessarily mean that the fractures which took fluid were at that depth; shallower fractures could have accepted the fluid. It is most likely that the fracture zone at 7,050-7,130 feet had taken most of the fluid during this lost circulation; there is no clear evidence on logs of fractures at 7,169 feet. Temperature logs taken at various times show cooling at depths between 7,000 and 7,200 feet; it is difficult to pinpoint the depth of this anomaly. If extensive fractures were present at 7,169 feet it is likely that the nearest perforations at 7,140 feet would have produced the fluid from those fractures. Hence a reperforation of this well is unwarranted.

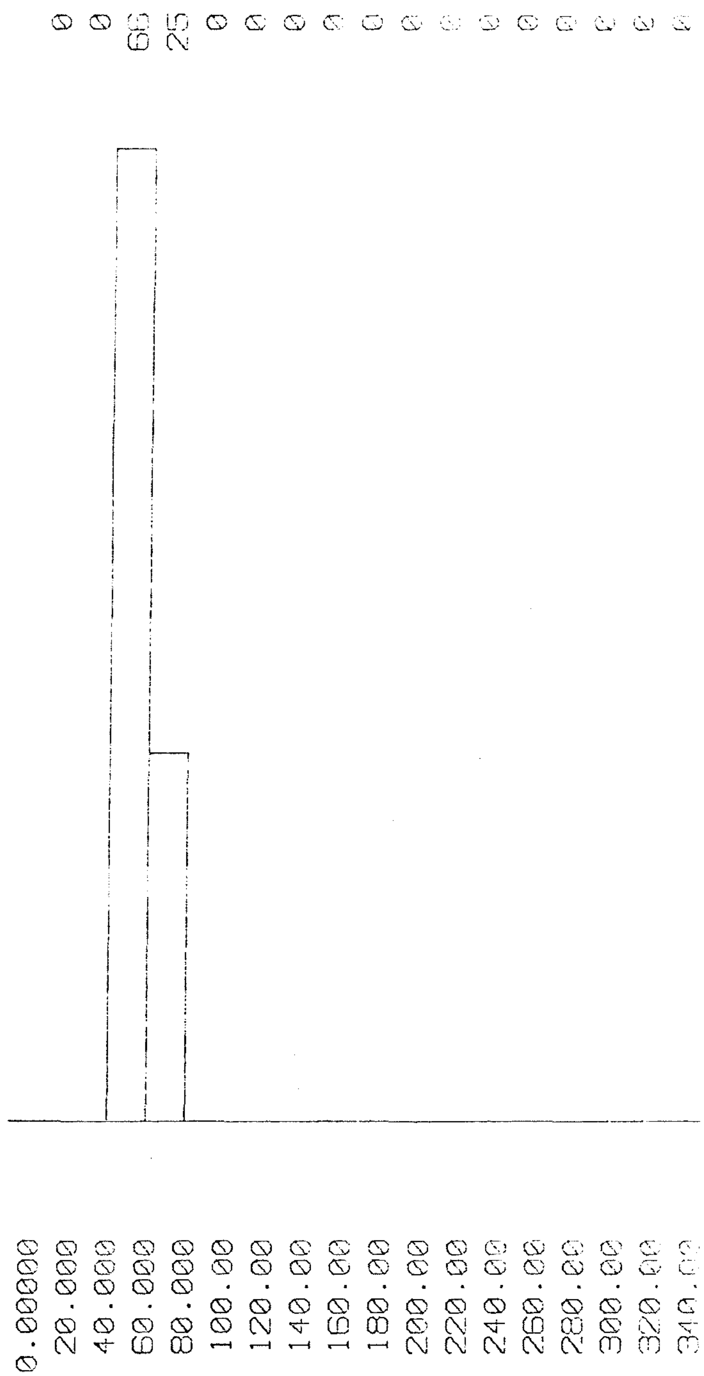
No major re-work of this well can be advised for several reasons. First, the well does not show extensive fracture zones; all fracture zones appear to be open to the well. Second, the equilibrium temperature profile measured in the well on July 11, 1980 showed a linear conductive gradient without any sign of an isothermal, convection zone. Hence the presence of a significant fractured reservoir is not possible. Third, any stimulation (chemical or hydraulic fracturing) of the well to remove well damage will be expensive (several hundred thousand dollars). Such expenses cannot be justified in the absence of a sizable indicated reserve. The Los Alamos Scientific Laboratory has declined to consider the well as a candidate for a stimulation experiment under the DOE Stimulation project.

However, there is a small probability that the reported "artesian flow" from the well may have gradually cleaned up some well damage. In that case it may be worthwhile installing a test pump and attempting to flow the well. If a significant flow rate (several hundred gallons per minute) can be obtained, a proper well test program should be designed. If the well shows significant artesian flow a spinner log should be run to identify the productive horizons.

7. REFERENCES

1. GeothermEx: "Technical Report--Deep Well Test and Exploration Program for Ore-Ida No. 1, Ontario, Oregon," Sub-Subcontract No. ET-78-C-07-1725-GTX between CH2M-Hill Central, Inc. and GeothermEx, Inc., May, 1980.

2. Sanyla, S. K., Wells, L. E., and Bickham, G.: "Geothermal Well Log Interpretation--State-of-the-Art," Report submitted to the Los Alamos Scientific Laboratory, September, 1979.



MINIMUM VALUE = 51.140
MAXIMUM VALUE = 68.435
MEAN VALUE = 58.025
VARIANCE = 13.112
DEVIATION = 3.6211

GAMMA RAY
API UNITS

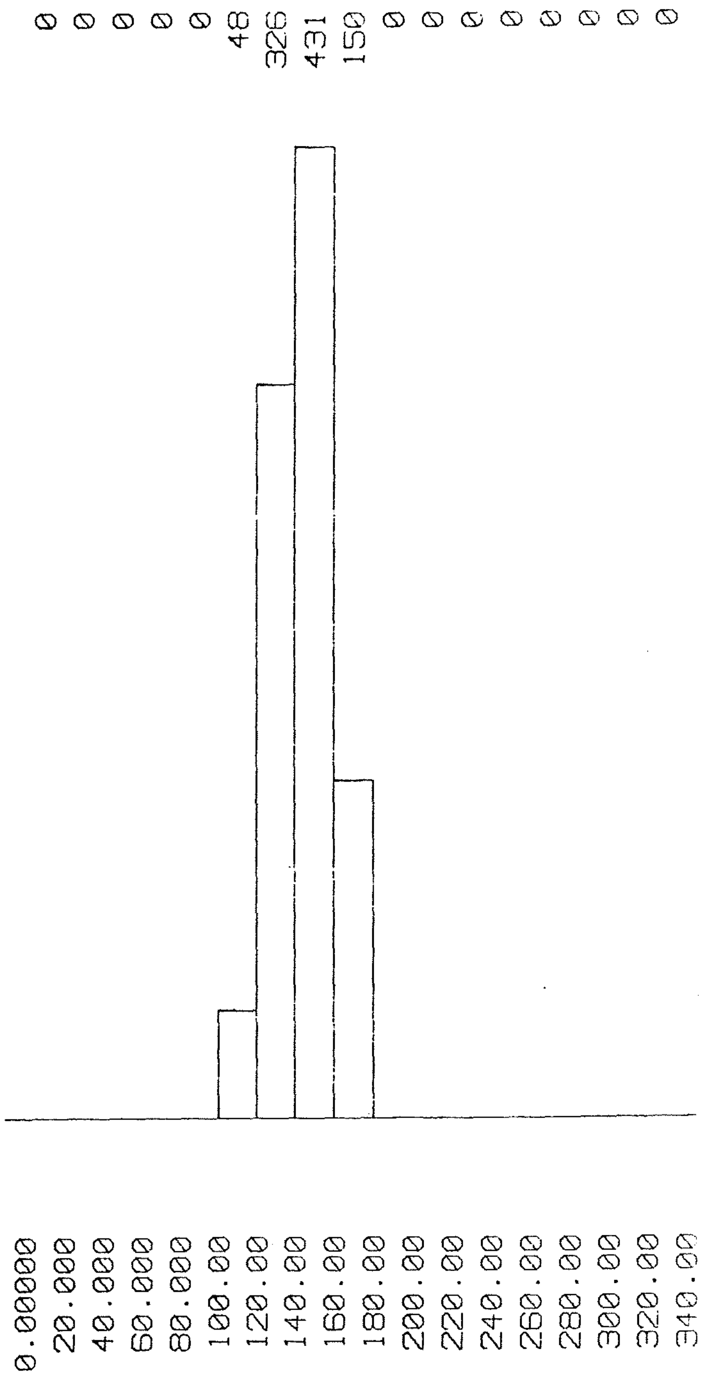
1 INCH = 13.200 VALUES

TOTAL NUMBER OF VALUES = 91

ORID-1-A

4571.00 - 4616.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 1. Histogram of Gamma Ray Intensity (4571 - 4616 ft.)



MINIMUM VALUE = 104.54
MAXIMUM VALUE = 178.16
MEAN VALUE = 144.04
VARIANCE = 211.50
DEVIATION = 14.543
1 INCH = 86.200 VALUES

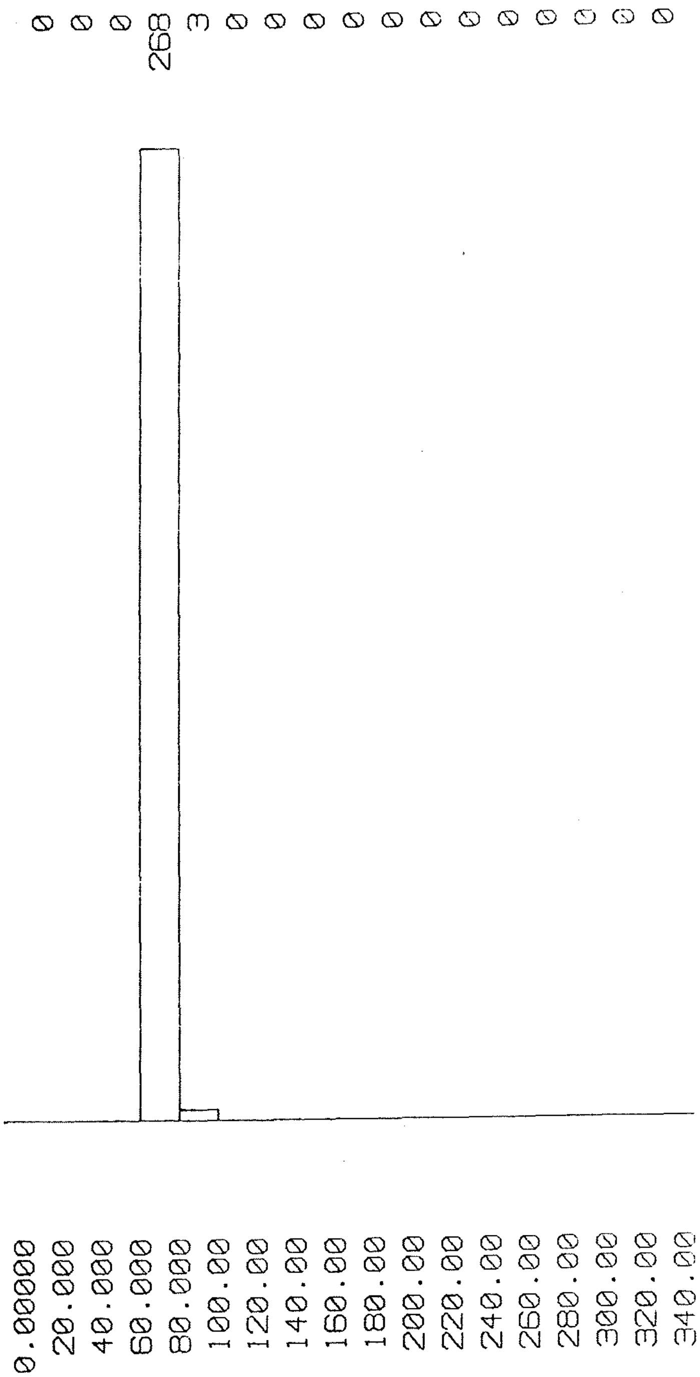
GAMMA RAY
API UNITS

TOTAL NUMBER OF VALUES = 955

ORID-1-A

4660.00 - 5137.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 2. Histogram of Gamma Ray Intensity (4660 - 5137 ft.)



MINIMUM VALUE = 60.971
MAXIMUM VALUE = 84.471
MEAN VALUE = 68.788
VARIANCE = 14.244
DEVIATION = 3.7742
1 INCH = 53.600 VALUES

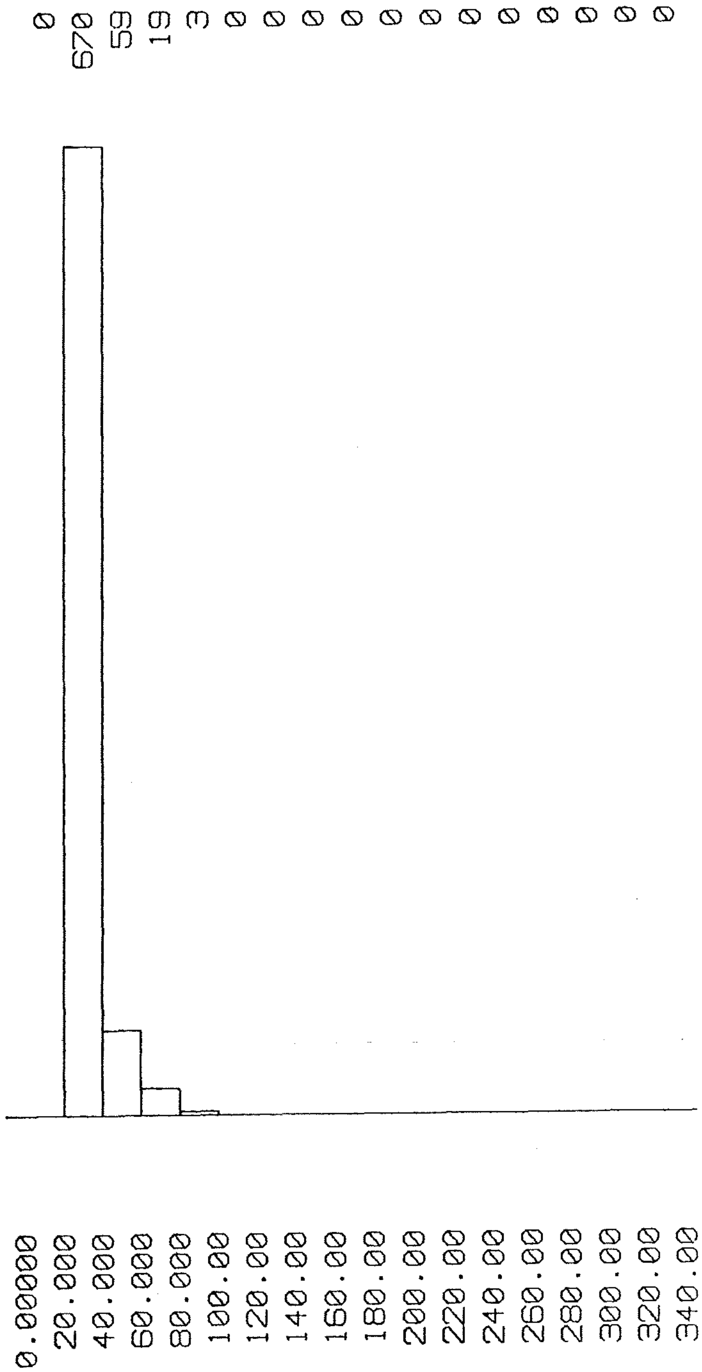
GAMMA RAY
API UNITS

TOTAL NUMBER OF VALUES = 271

ORID-1-A

5152.00 - 5287.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 3. Histogram of Gamma Ray Intensity (5152 - 5287 ft.)



MINIMUM VALUE = 20.000
MAXIMUM VALUE = 93.537
MEAN VALUE = 30.662
VARIANCE = 98.717
DEVIATION = 9.9356
1 INCH = 134.00 VALUES

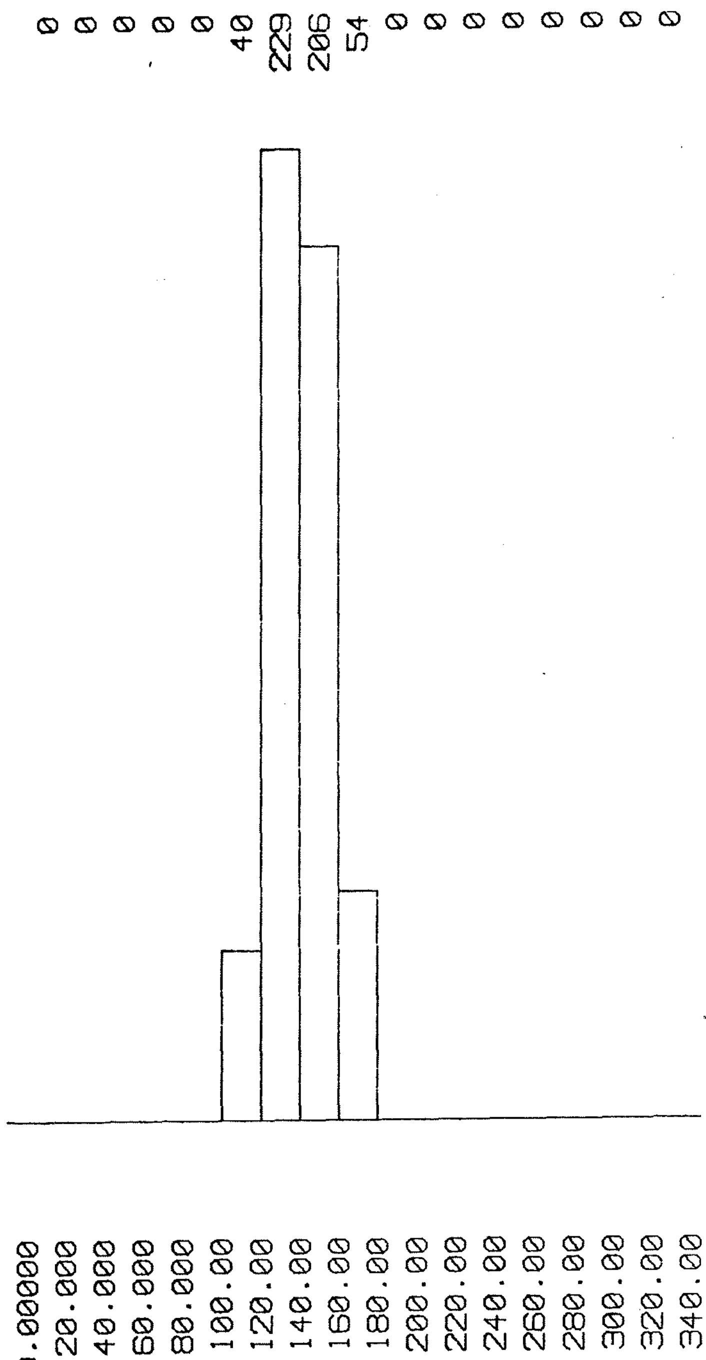
GAMMA RAY
API UNITS

TOTAL NUMBER OF VALUES = 751

ORID-1-A

8863.00 - 9238.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 15. Histogram of Gamma Ray Intensity (8863 - 9238 ft.)



MINIMUM VALUE = 110.24
MAXIMUM VALUE = 173.10
MEAN VALUE = 139.53
VARIANCE = 188.93
DEVIATION = 13.745
1 INCH = 45.800 VALUES

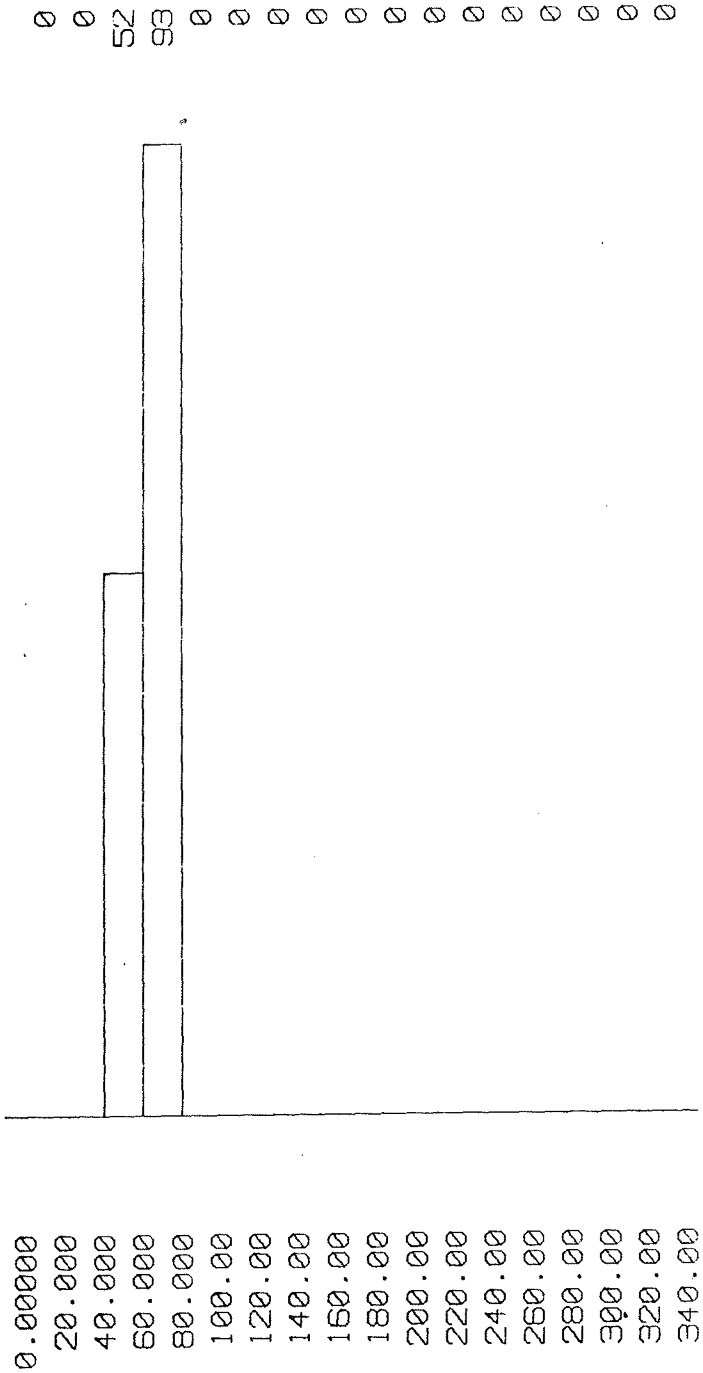
GAMMA RAY
API UNITS

TOTAL NUMBER OF VALUES = 529

ORID-1-A

5296.00 - 5560.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 4. Histogram of Gamma Ray Intensity (5296 - 5560 ft.)



MINIMUM VALUE = 55.287
MAXIMUM VALUE = 78.638
MEAN VALUE = 60.876
VARIANCE = 6.2182
DEVIATION = 2.4936
1 INCH = 18.600 VALUES

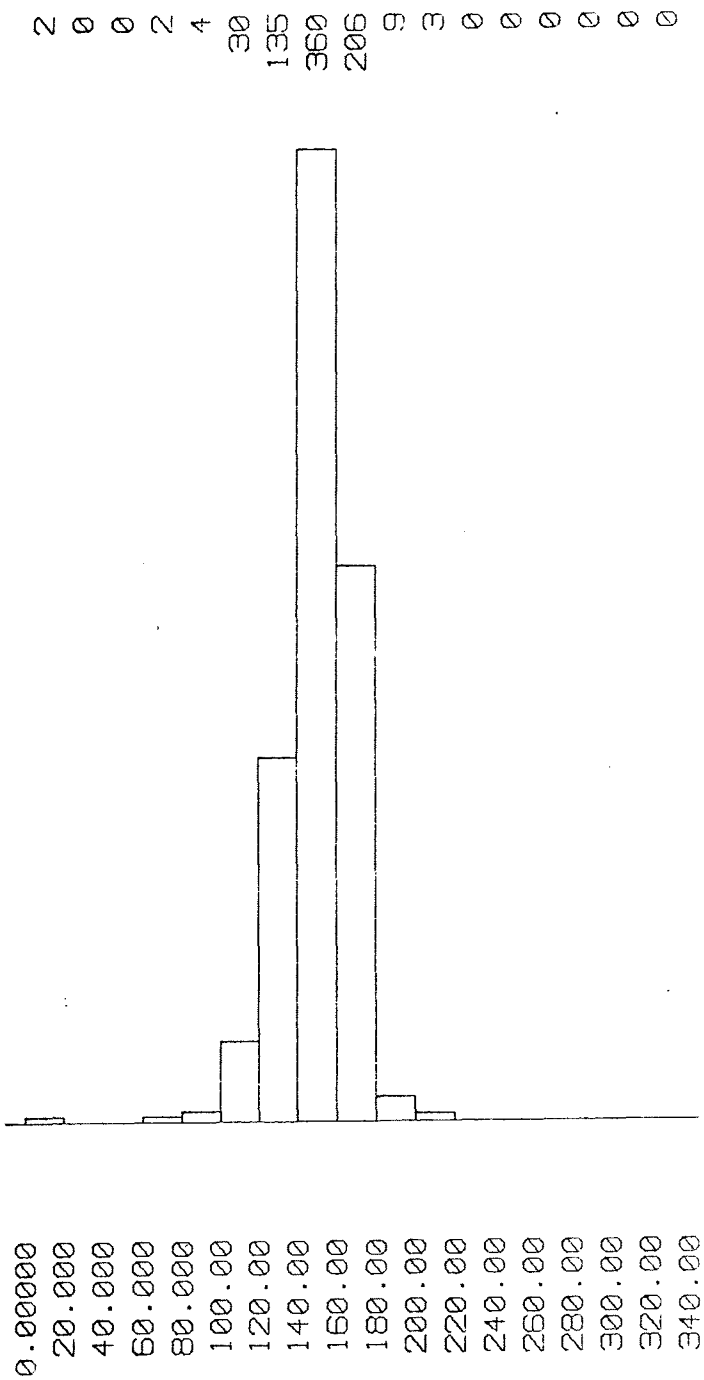
GAMMA RAY
API UNITS

TOTAL NUMBER OF VALUES = 145

ORID-1-A

5572.00 - 5644.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 5. Histogram of Gamma Ray Intensity (5572 - 5644 ft.)



MINIMUM VALUE = 0.00000
MAXIMUM VALUE = 219.66
MEAN VALUE = 150.31
VARIANCE = 341.68
DEVIATION = 18.485
1 INCH = 72.000 VALUES

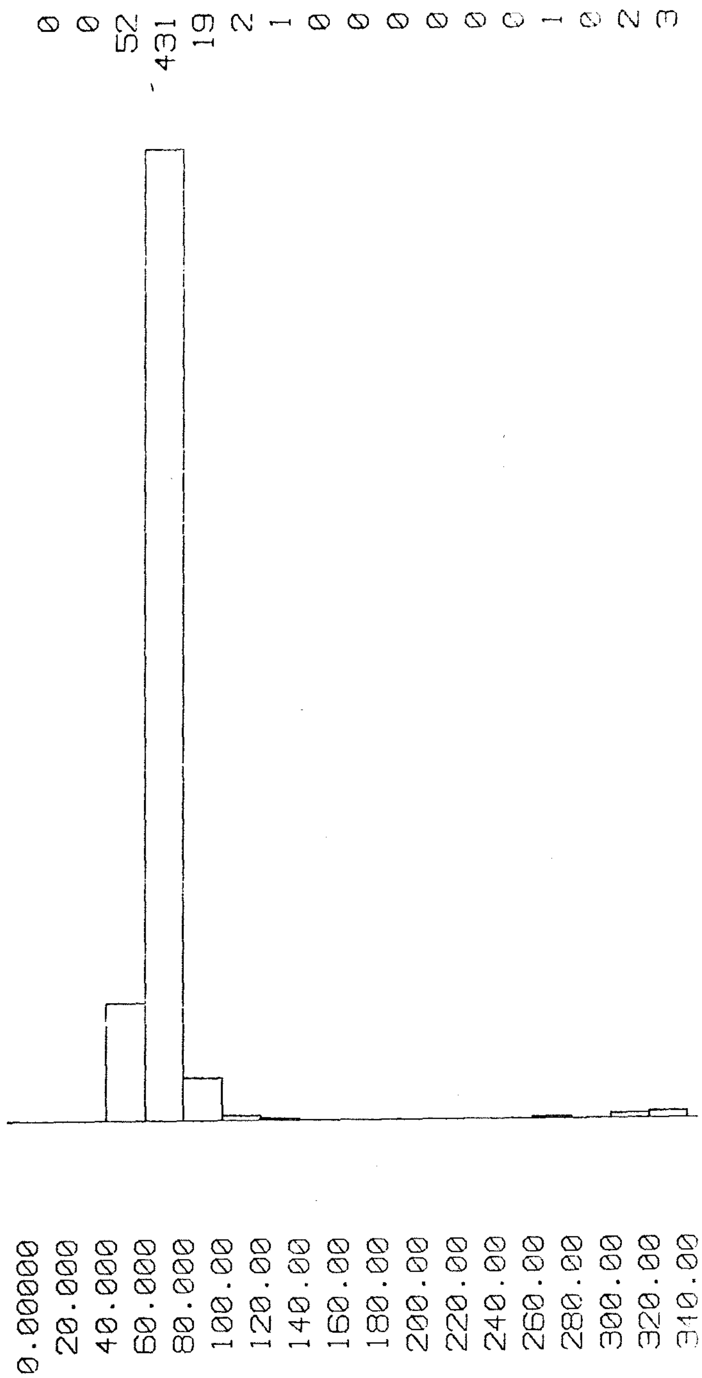
GAMMA RAY
API UNITS

TOTAL NUMBER OF VALUES = 751

ORID-1-A

5651.00 - 6026.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 6. Histogram of Gamma Ray Intensity (5651 - 6026 ft.)



MINIMUM VALUE = 54.204
MAXIMUM VALUE = 325.89
MEAN VALUE = 69.818
VARIANCE = 755.96
DEVIATION = 27.495
1 INCH = 86.200 VALUES

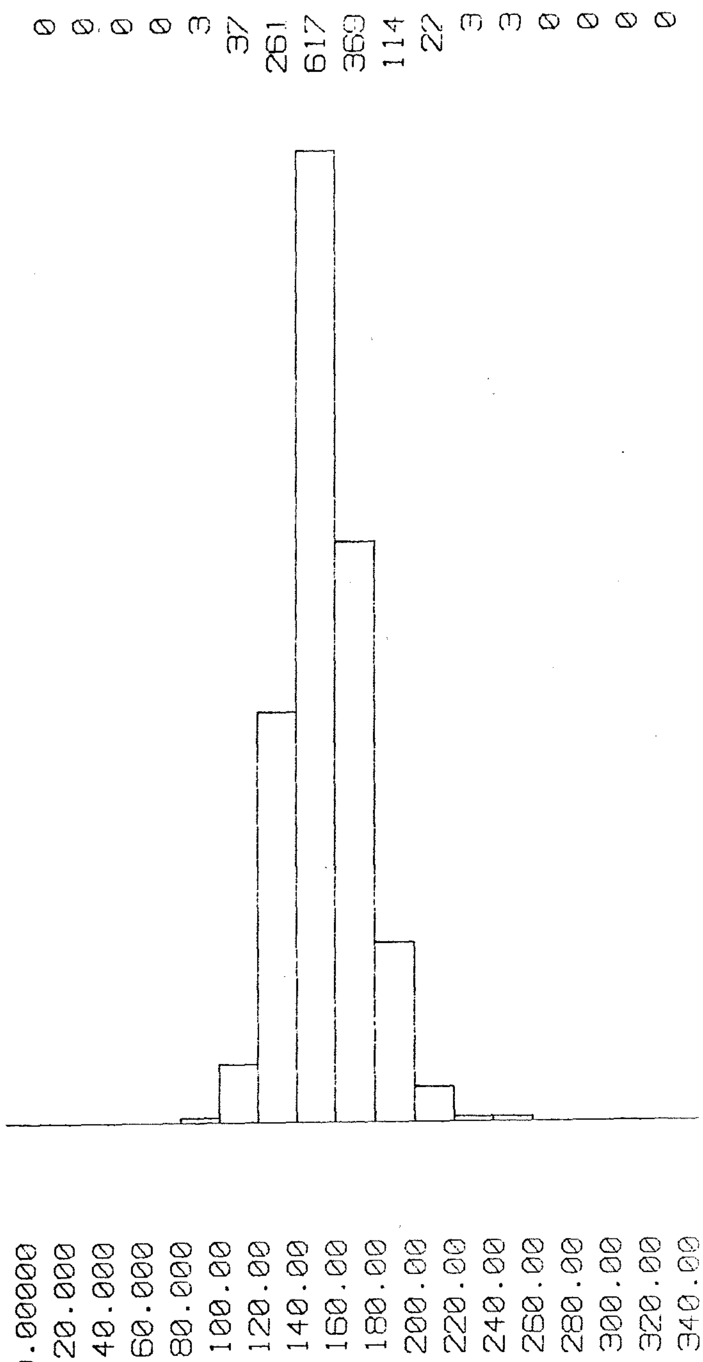
GAMMA RAY
API UNITS

TOTAL NUMBER OF VALUES = 511

ORID-1-A

6031.00 - 6286.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 7. Histogram of Gamma Ray Intensity (6031 - 6286 ft.)



MINIMUM VALUE = 96.602
MAXIMUM VALUE = 256.53
MEAN VALUE = 154.45
VARIANCE = 397.15
DEVIATION = 19.929
1 INCH = 123.40 VALUES

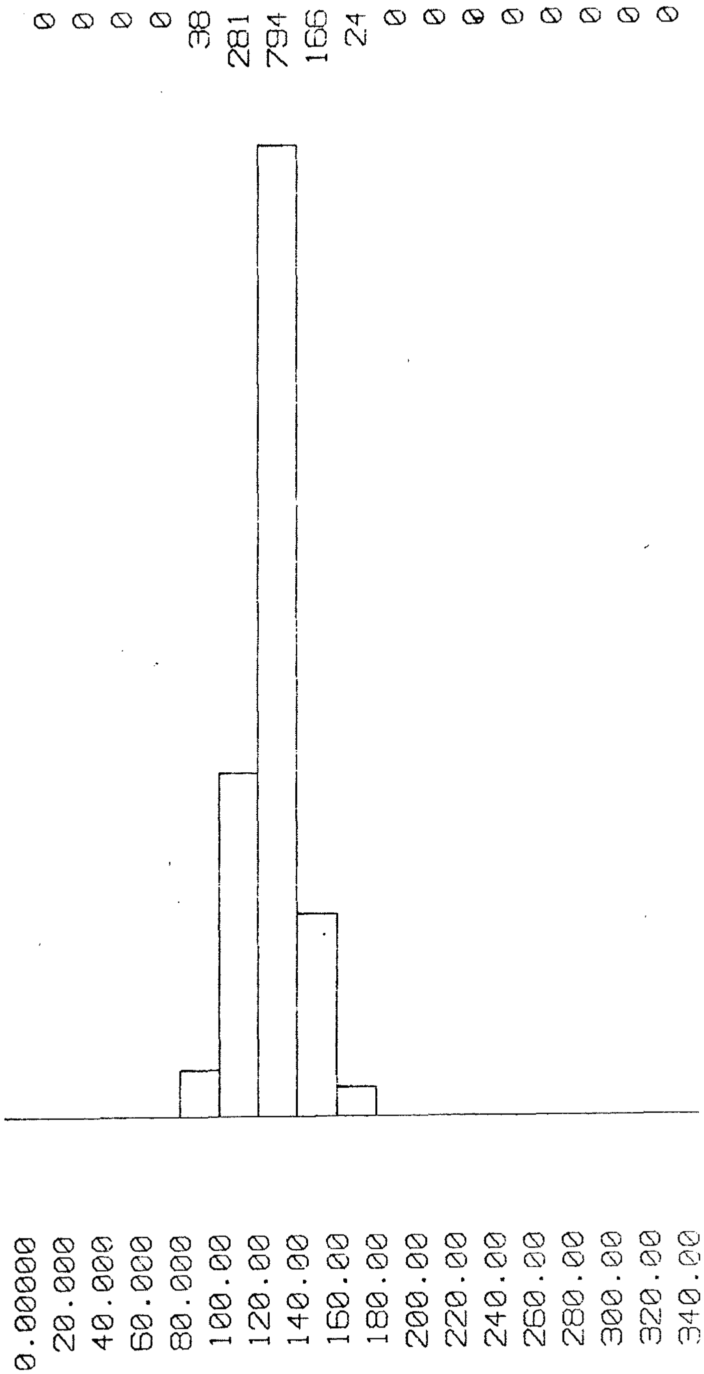
GAMMA RAY
API UNITS

TOTAL NUMBER OF VALUES = 1429

ORID-1-A

6294.00 - 7008.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 8. Histogram of Gamma Ray Intensity (6294 - 7008 ft.)



MINIMUM VALUE = 85.600
MAXIMUM VALUE = 174.87
MEAN VALUE = 127.47
VARIANCE = 181.95
DEVIATION = 13.489
1 INCH = 158.80 VALUES

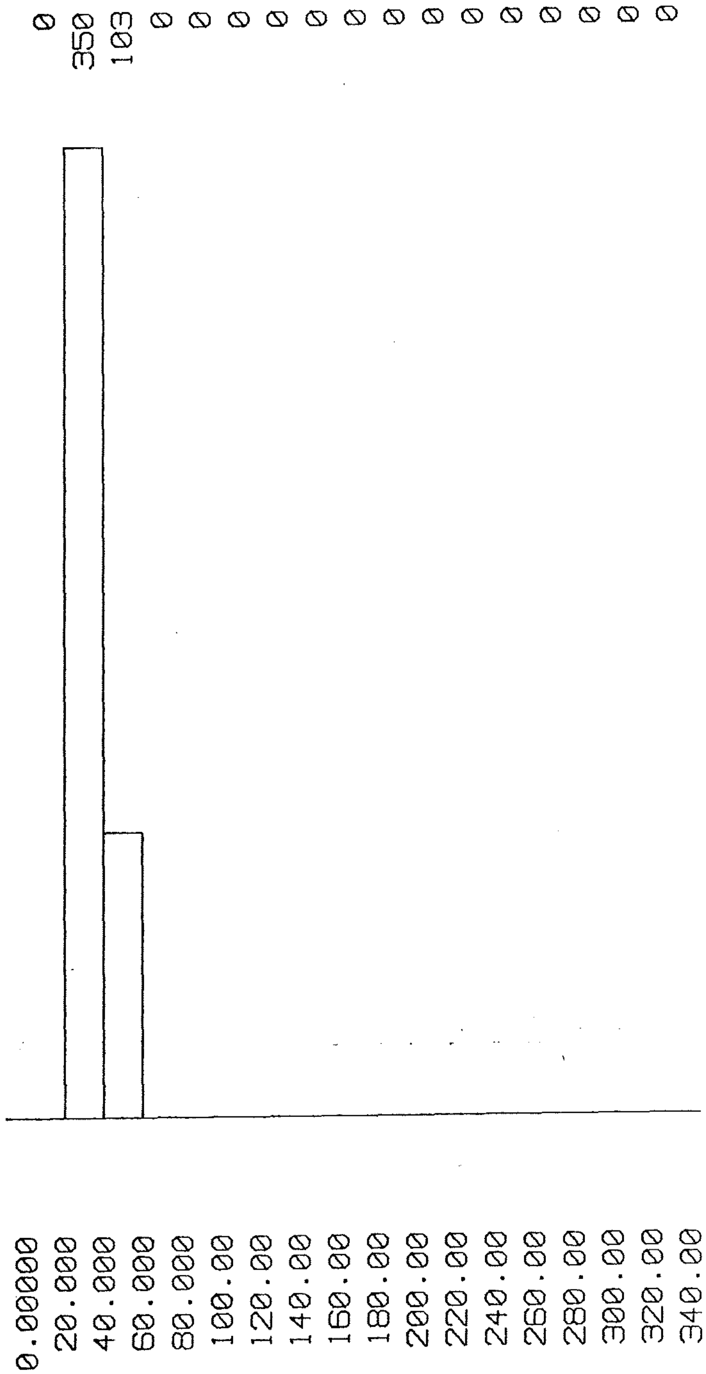
GAMMA RAY
API UNITS

TOTAL NUMBER OF VALUES = 1303

ORID-1-A

7147.00 - 7798.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 10. Histogram of Gamma Ray Intensity (7147 - 7798 ft.)



MINIMUM VALUE = 32.056
MAXIMUM VALUE = 56.000
MEAN VALUE = 38.817
VARIANCE = 19.446
DEVIATION = 4.4097
1 INCH = 70.000 VALUES

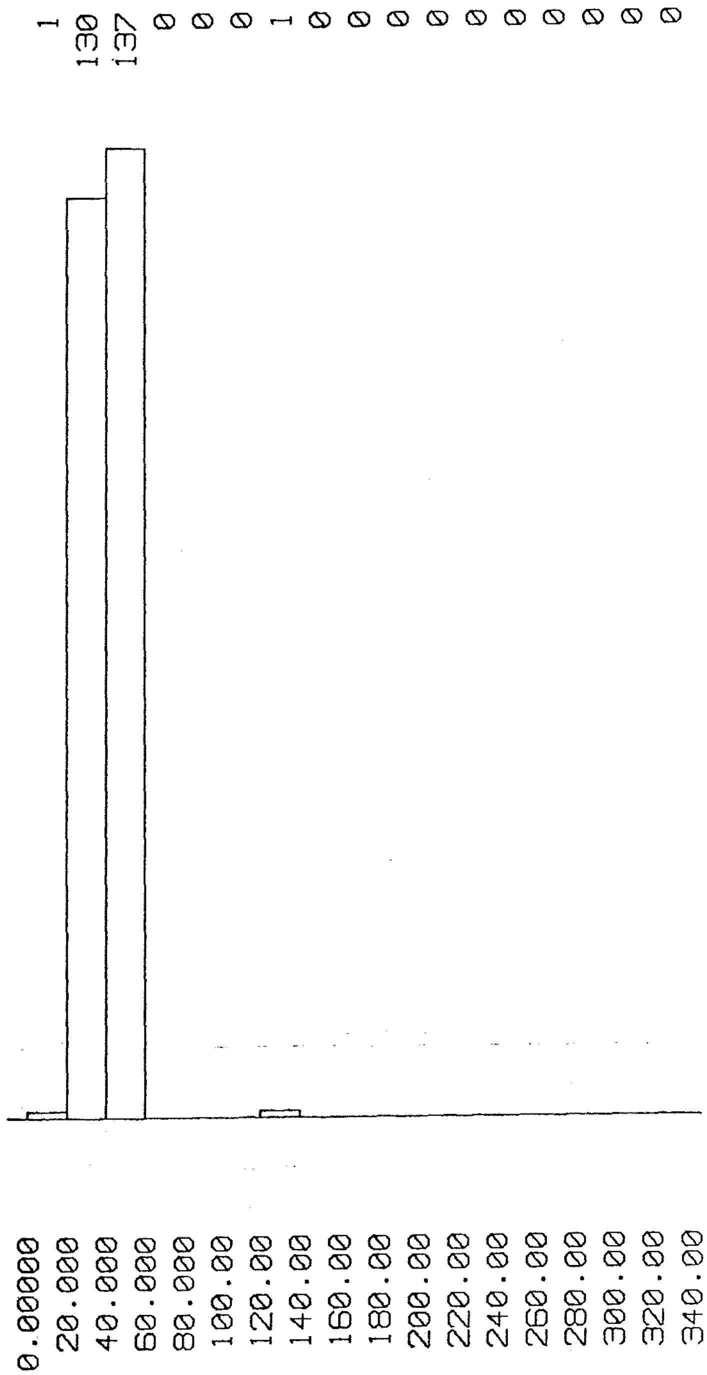
GAMMA RAY
API UNITS

TOTAL NUMBER OF VALUES = 453

ORID-1-A

8600.00 - 8826.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 14. Histogram of Gamma Ray Intensity (8600 - 8826 ft.)



MINIMUM VALUE = 0.00000
MAXIMUM VALUE = 120.85
MEAN VALUE = 38.790
VARIANCE = 71.116
DEVIATION = 8.4331
1 INCH = 27.400 VALUES

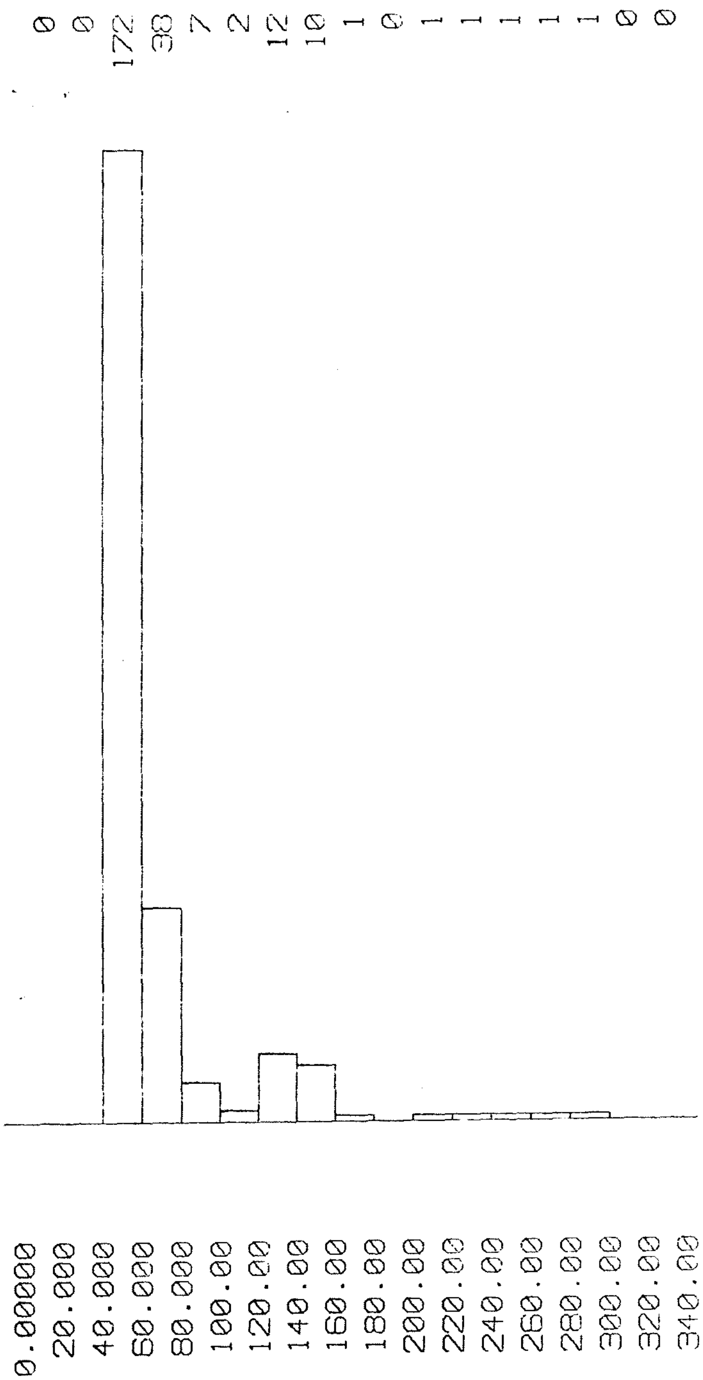
GAMMA RAY
API UNITS

TOTAL NUMBER OF VALUES = 269

ORID-1-A

8466.00 - 8600.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 13. Histogram of Gamma Ray Intensity (8466 - 8600 ft.)



MINIMUM VALUE = 48.800
MAXIMUM VALUE = 281.37
MEAN VALUE = 69.225
VARIANCE = 1337.4
DEVIATION = 36.570
1 INCH = 34.400 VALUES

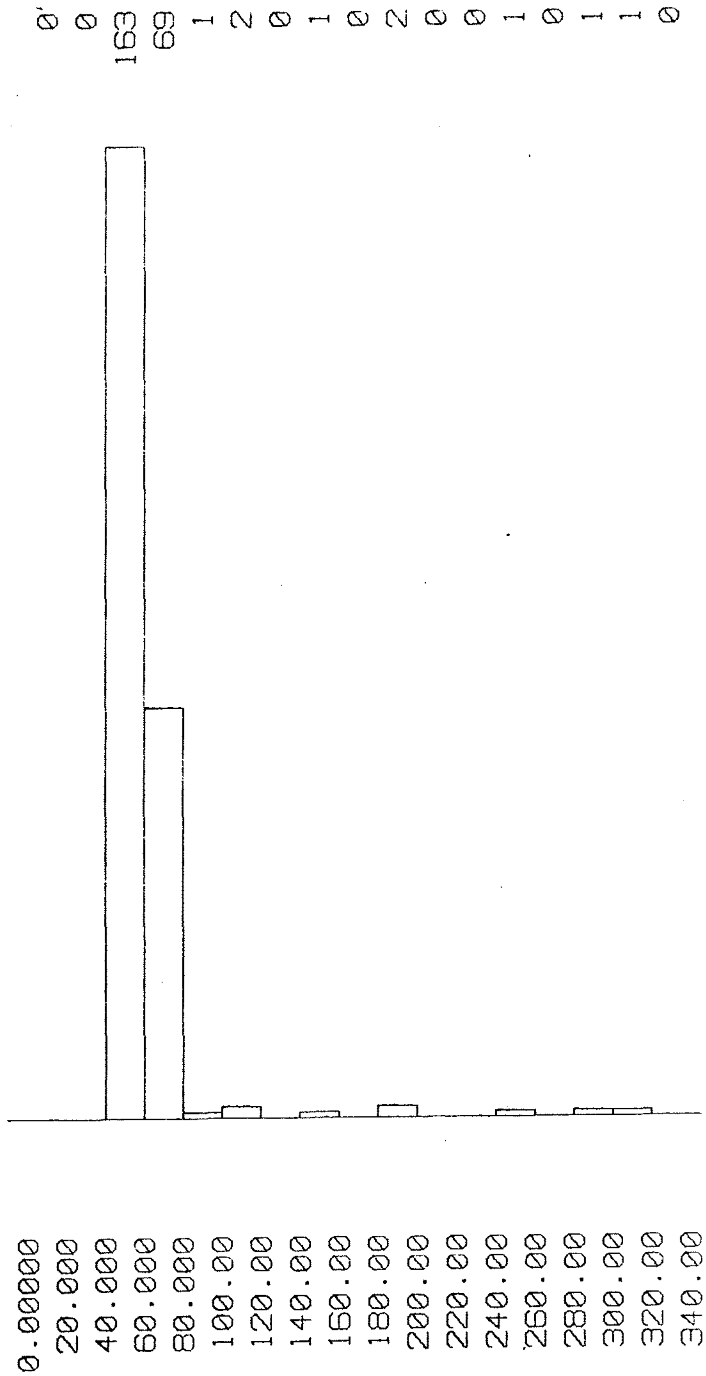
GAMMA RAY
API UNITS

TOTAL NUMBER OF VALUES = 247

ORID-1-A

7803.00 - 7926.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 11. Histogram of Gamma Ray Intensity (7803 - 7926 ft.)



MINIMUM VALUE = 52.000
MAXIMUM VALUE = 307.53
MEAN VALUE = 63.244
VARIANCE = 832.97
DEVIATION = 28.861
1 INCH = 32.600 VALUES

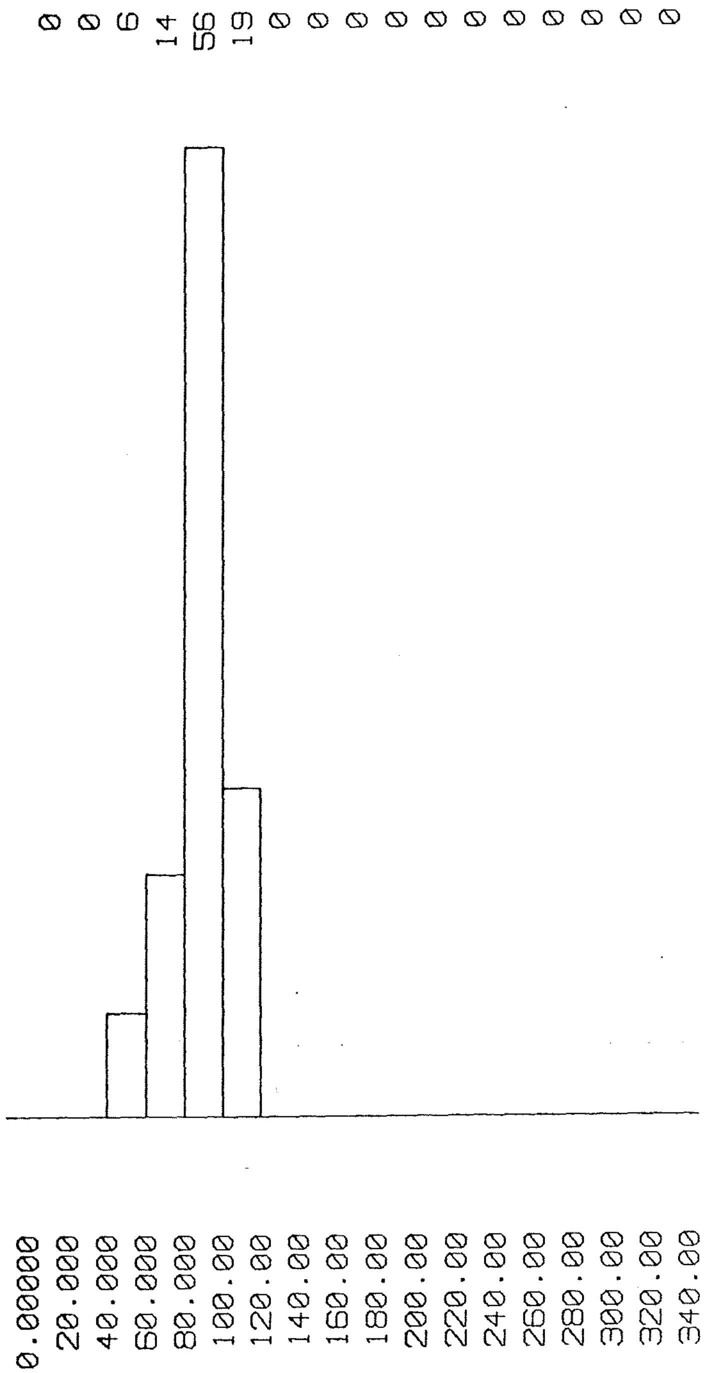
GAMMA RAY
API UNITS

TOTAL NUMBER OF VALUES = 241

ORID-1-A

7015.00 - 7135.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 9. Histogram of Gamma Ray Intensity (7015 - 7135 ft.)



MINIMUM VALUE = 45.691
MAXIMUM VALUE = 117.90
MEAN VALUE = 88.970
VARIANCE = 202.17
DEVIATION = 14.219
1 INCH = 11.200 VALUES

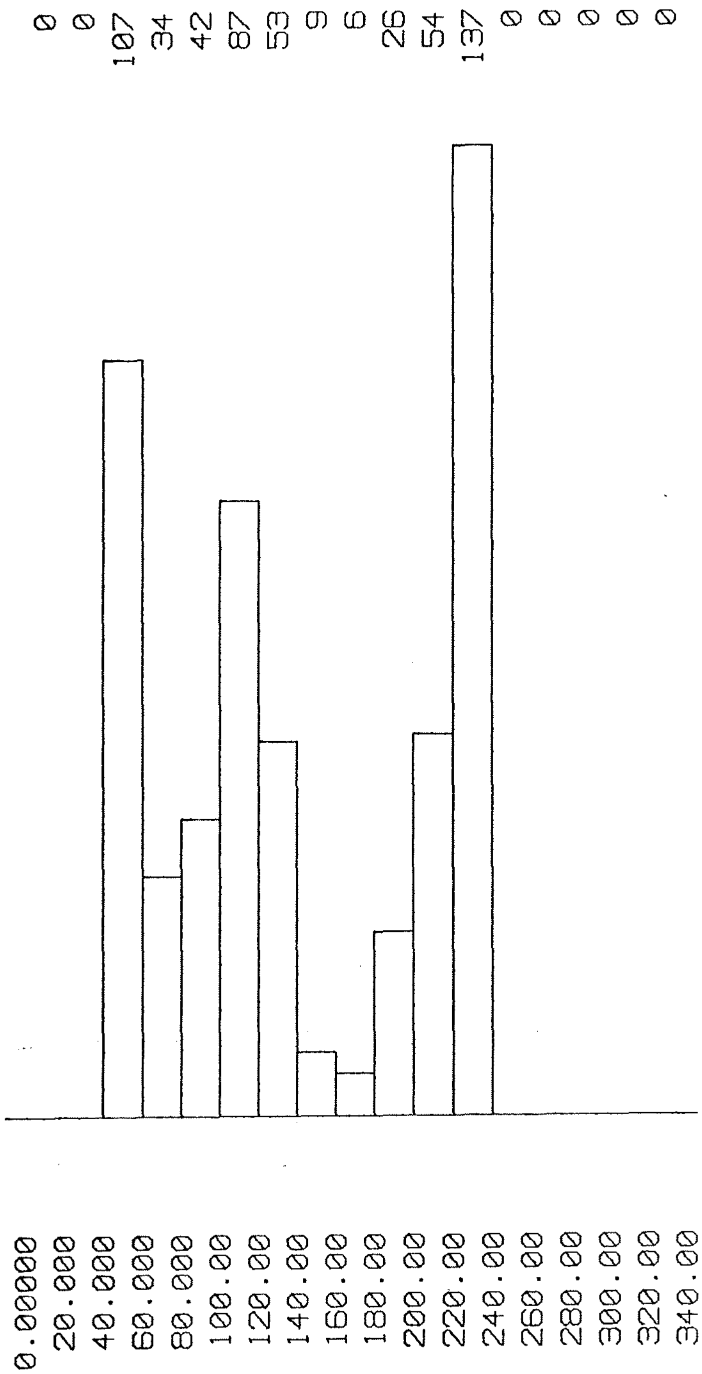
GAMMA RAY
API UNITS

TOTAL NUMBER OF VALUES = 95

ORID-1-A

9253.00 - 9300.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 16. Histogram of Gamma Ray Intensity (9253 - 9300 ft.)



MINIMUM VALUE = 45.183
MAXIMUM VALUE = 238.40
MEAN VALUE = 141.94
VARIANCE = 4829.1
DEVIATION = 69.492
1 INCH = 27.400 VALUES

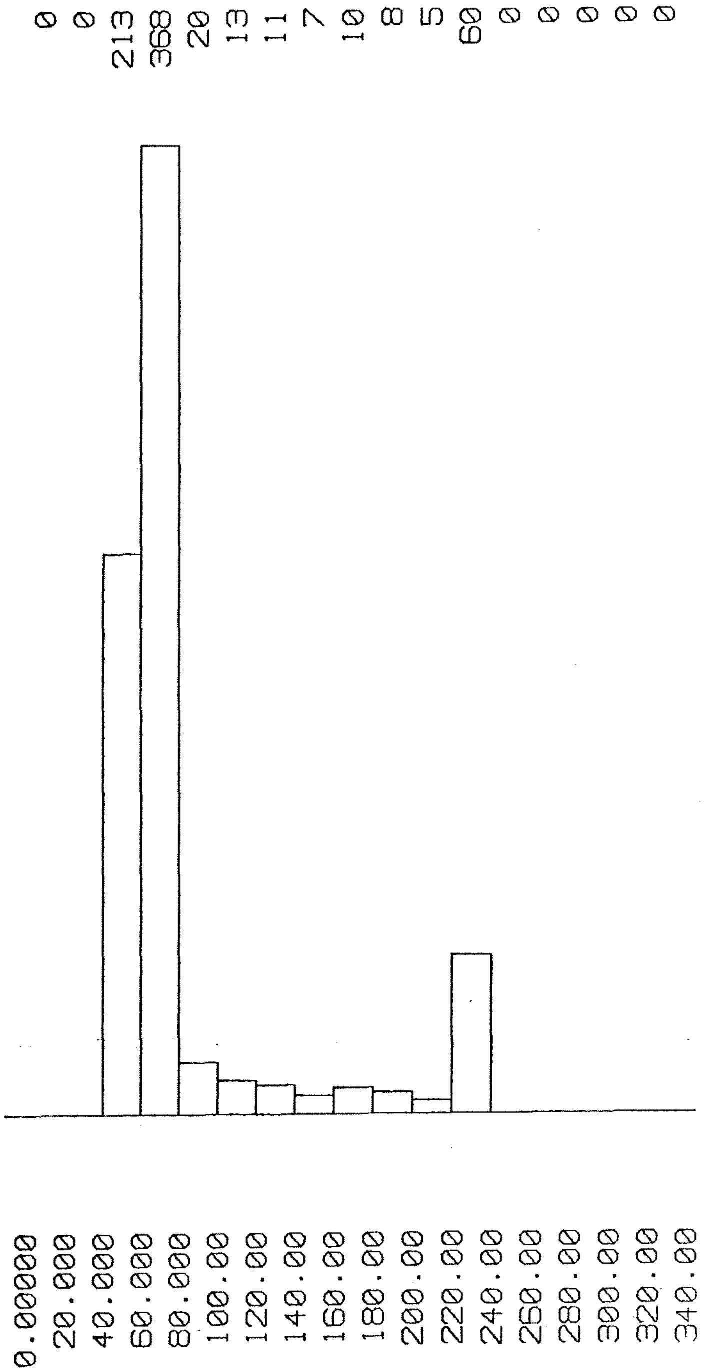
GAMMA RAY
API UNITS

TOTAL NUMBER OF VALUES = 555

ORID-1-A

9300.00 - 9577.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 17. Histogram of Gamma Ray Intensity (9300 - 9577 ft.)



MINIMUM VALUE = 40.122
MAXIMUM VALUE = 238.40
MEAN VALUE = 84.672
VARIANCE = 2746.6
DEVIATION = 52.408
1 INCH = 73.600 VALUES

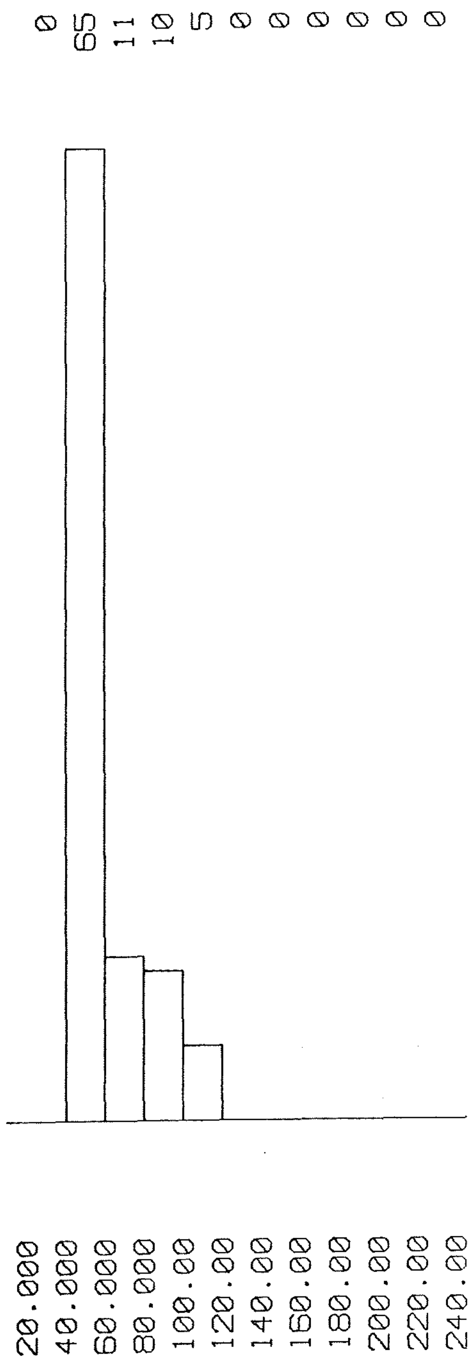
GAMMA RAY
API UNITS

TOTAL NUMBER OF VALUES = 715

ORID-1-A

9581.00 - 9938.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 18. Histogram of Gamma Ray Intensity (9581 - 9938 ft.)



MINIMUM VALUE = 50.600
MAXIMUM VALUE = 106.43
MEAN VALUE = 62.171
VARIANCE = 268.24
DEVIATION = 16.378
1 INCH = 13.000 VALUES

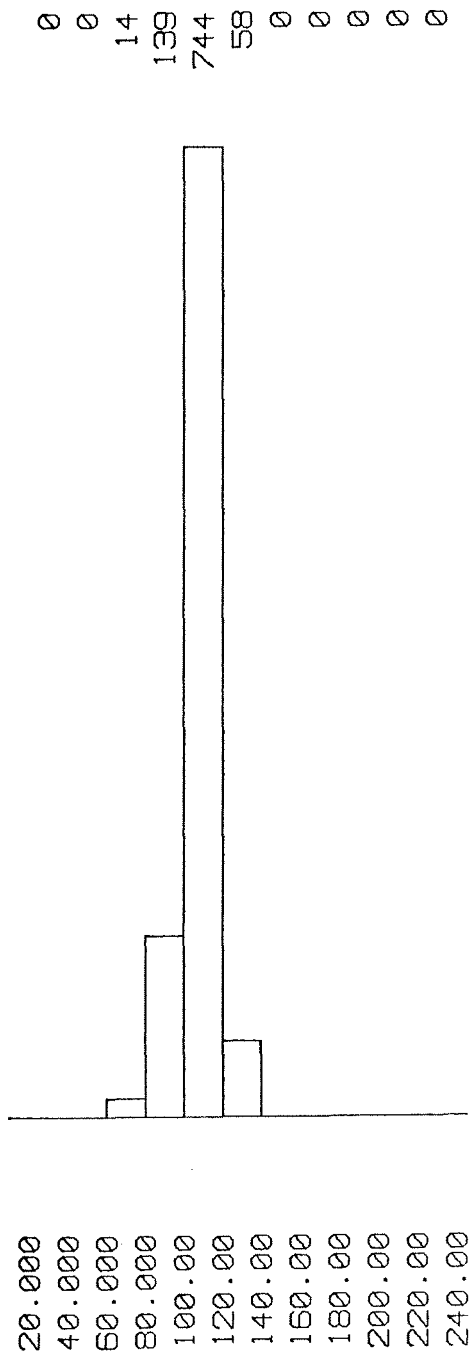
TRANSIT TIME
MICROSEC/FT

TOTAL NUMBER OF VALUES = 91

ORID-1-A

4571.00 - 4616.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 19. Histogram of Interval Transit Time (4571 - 4616 ft.)



MINIMUM VALUE = 68.491
MAXIMUM VALUE = 133.72
MEAN VALUE = 108.77
VARIANCE = 89.142
DEVIATION = 9.4415
1 INCH = 148.80 VALUES

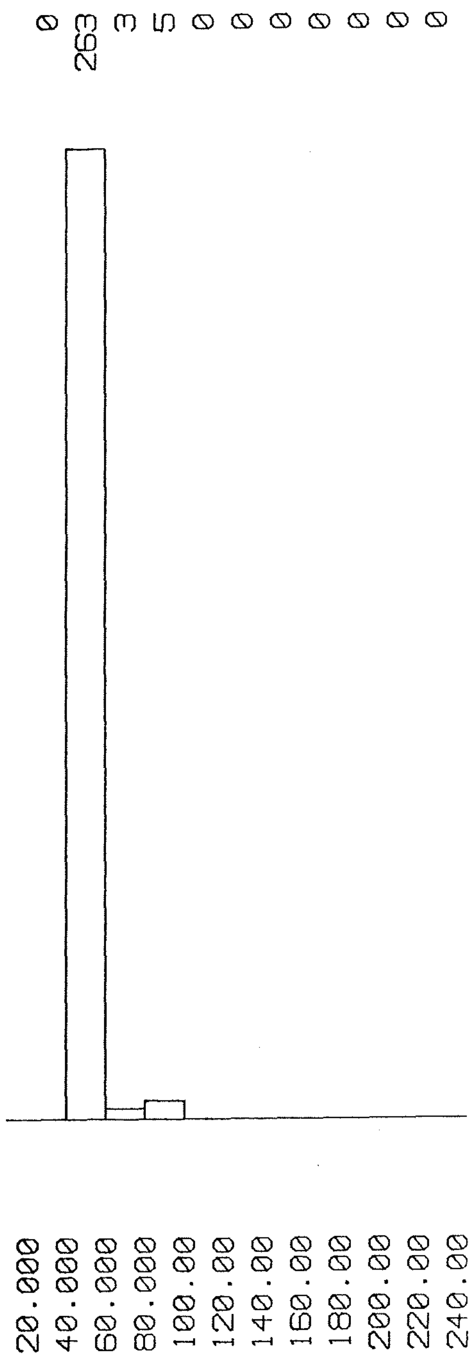
TRANSIT TIME
MICROSEC/FT

TOTAL NUMBER OF VALUES = 955

ORID-1-A

4660.00 - 5137.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 20. Histogram of Interval Transit Time (4660 - 5137 ft.)



MINIMUM VALUE = 51.876
MAXIMUM VALUE = 89.704
MEAN VALUE = 54.882
VARIANCE = 22.800
DEVIATION = 4.7750
1 INCH = 52.600 VALUES

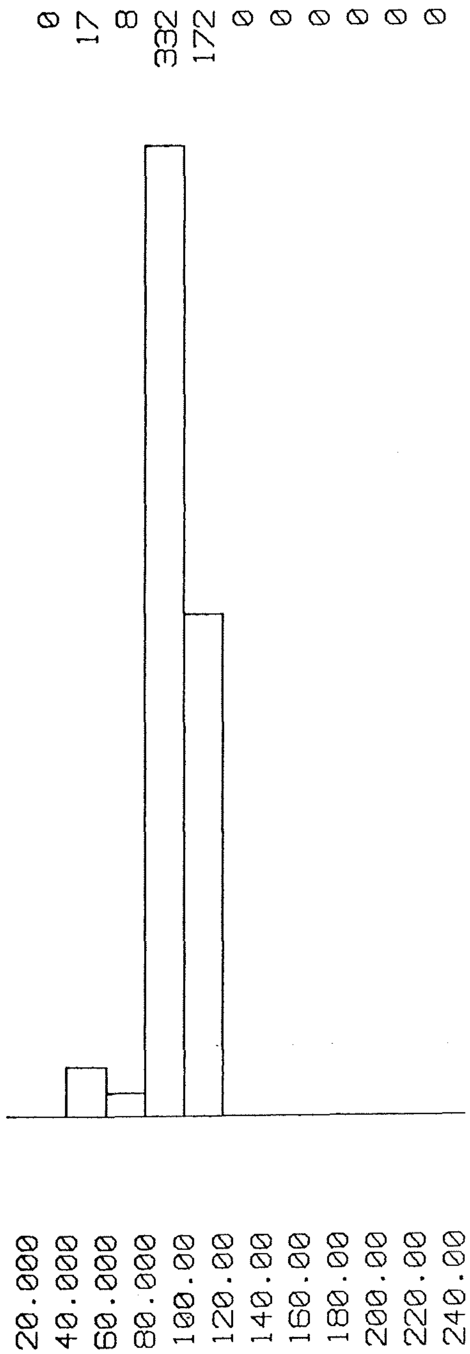
TRANSIT TIME
MICROSEC/FT

TOTAL NUMBER OF VALUES = 271

ORID-1-A

5152.00 - 5287.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 21. Histogram of Interval Transit Time (5152 - 5287 ft.)



MINIMUM VALUE = 50.761
MAXIMUM VALUE = 113.21
MEAN VALUE = 94.823
VARIANCE = 119.12
DEVIATION = 10.914
1 INCH = 66.400 VALUES

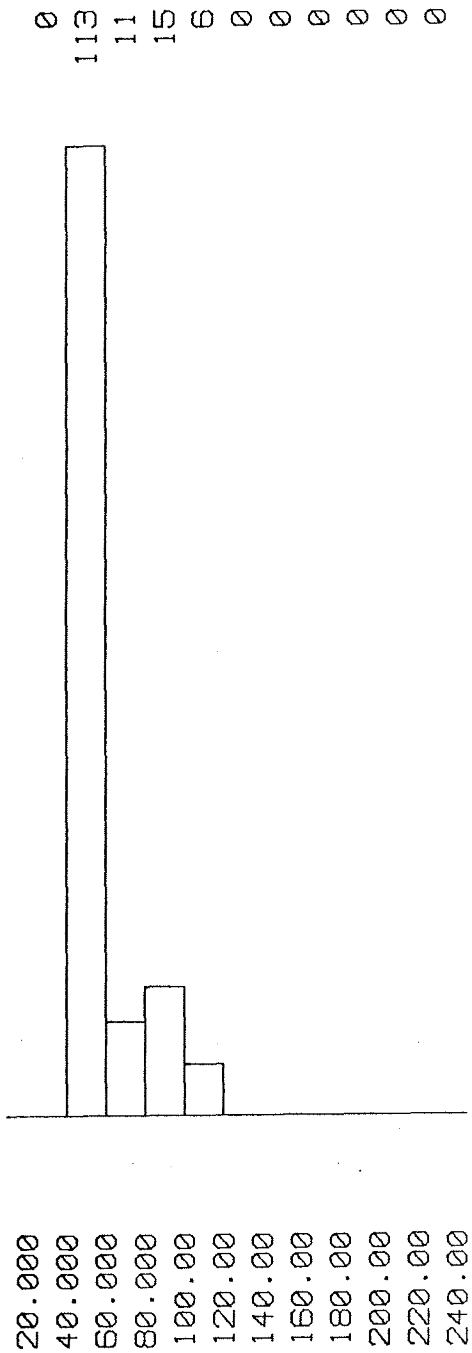
TRANSIT TIME
MICROSEC/FT

TOTAL NUMBER OF VALUES = 529

ORID-1-A

5296.00 - 5560.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 22. Histogram of Interval Transit Time (5296 - 5560 ft.)



MINIMUM VALUE = 50.645
MAXIMUM VALUE = 101.92
MEAN VALUE = 62.171
VARIANCE = 230.51
DEVIATION = 15.182
1 INCH = 22.600 VALUES

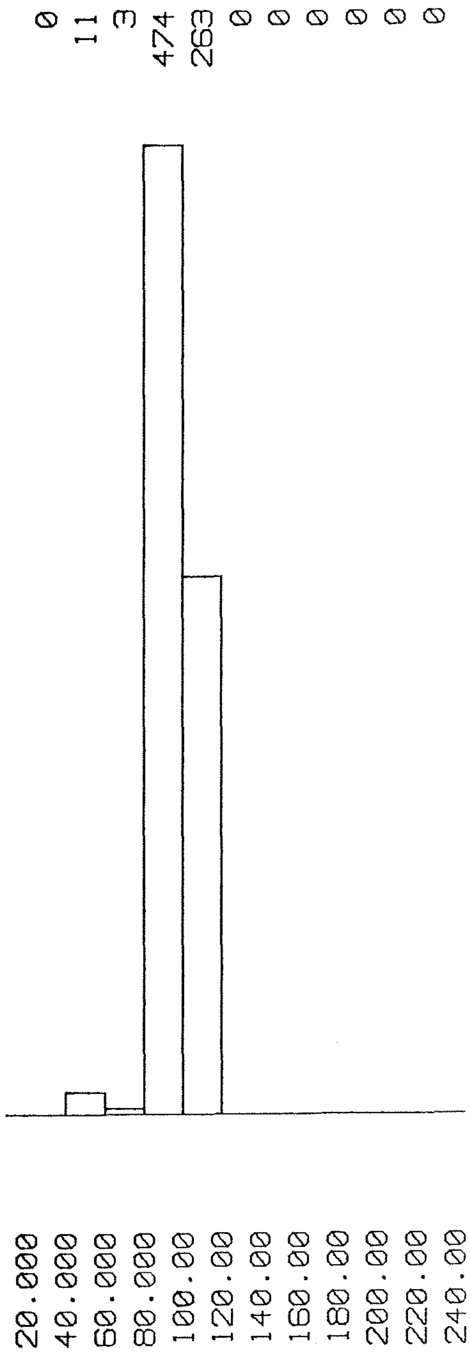
TRANSIT TIME
MICROSEC/FT

TOTAL NUMBER OF VALUES = 145

ORID-1-A

5572.00 - 5644.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 23. Histogram of Interval Transit Time (5572 - 5644 ft.)



MINIMUM VALUE = 54.251
MAXIMUM VALUE = 116.60
MEAN VALUE = 96.320
VARIANCE = 59.661
DEVIATION = 7.7240
1 INCH = 94.800 VALUES

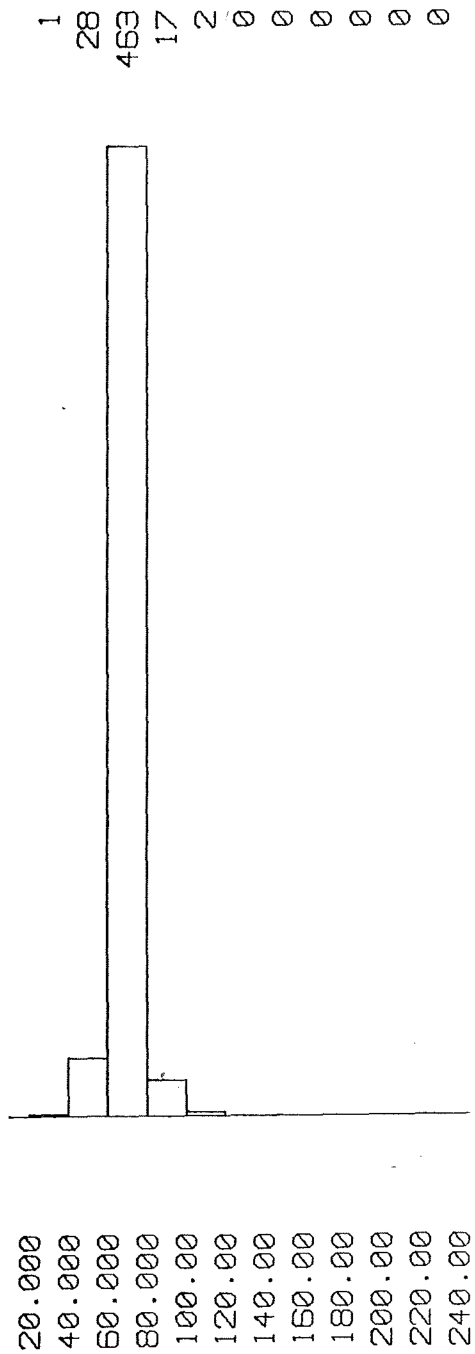
TRANSIT TIME
MICROSEC/FT

TOTAL NUMBER OF VALUES = 751

ORID-1-A

5651.00 - 6026.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 24. Histogram of Interval Transit Time (5651 - 6026 ft.)



MINIMUM VALUE = 39.954
MAXIMUM VALUE = 101.51
MEAN VALUE = 66.316
VARIANCE = 46.433
DEVIATION = 6.8142
1 INCH = 92.600 VALUES

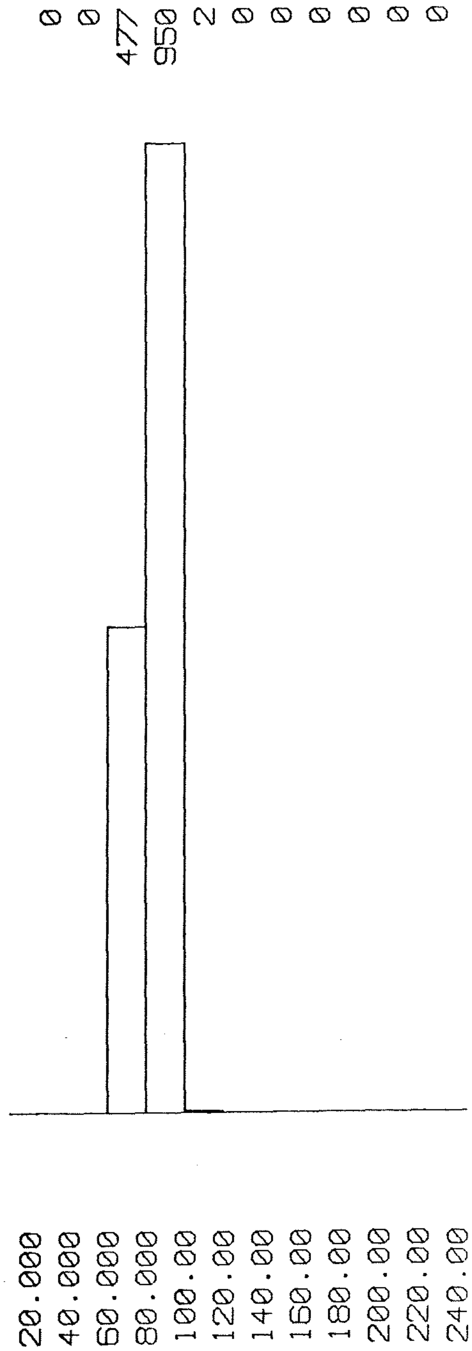
TRANSIT TIME
MICROSEC/FT

TOTAL NUMBER OF VALUES = 511

ORID-1-A

6031.00 - 6286.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 25. Histogram of Interval Transit Time (6031 - 6286 ft.)



MINIMUM VALUE = 71.473
MAXIMUM VALUE = 100.35
MEAN VALUE = 84.197
VARIANCE = 45.506
DEVIATION = 6.7458
1 INCH = 190.00 VALUES

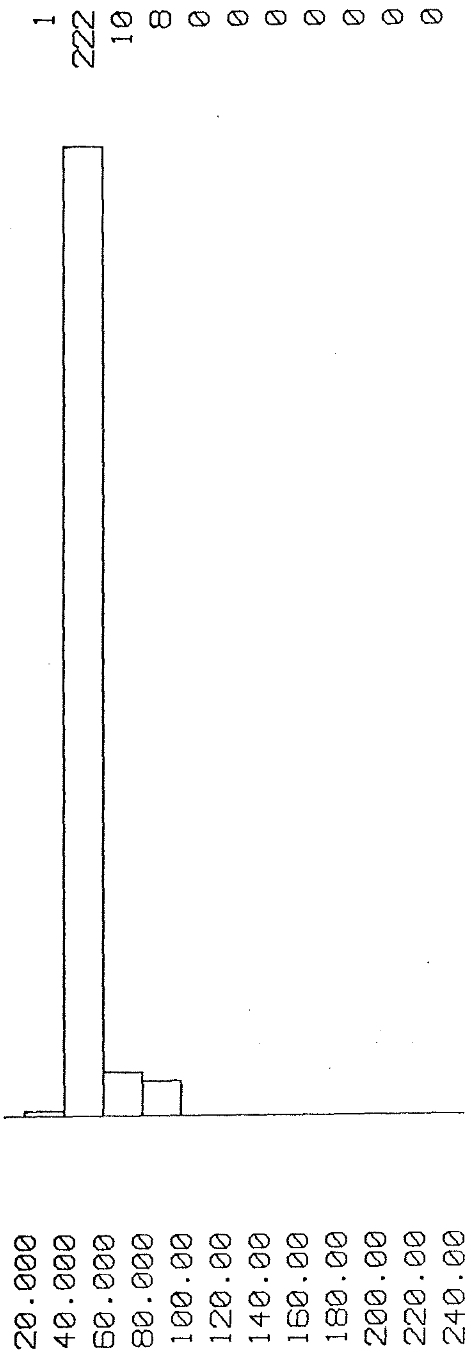
TRANSIT TIME
MICROSEC/FT

TOTAL NUMBER OF VALUES = 1429

ORID-1-A

6294.00 - 7008.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 26. Histogram of Interval Transit Time (6294 - 7008 ft.)



MINIMUM VALUE = 39.372
MAXIMUM VALUE = 94.578
MEAN VALUE = 53.742
VARIANCE = 71.557
DEVIATION = 8.4591
1 INCH = 44.400 VALUES

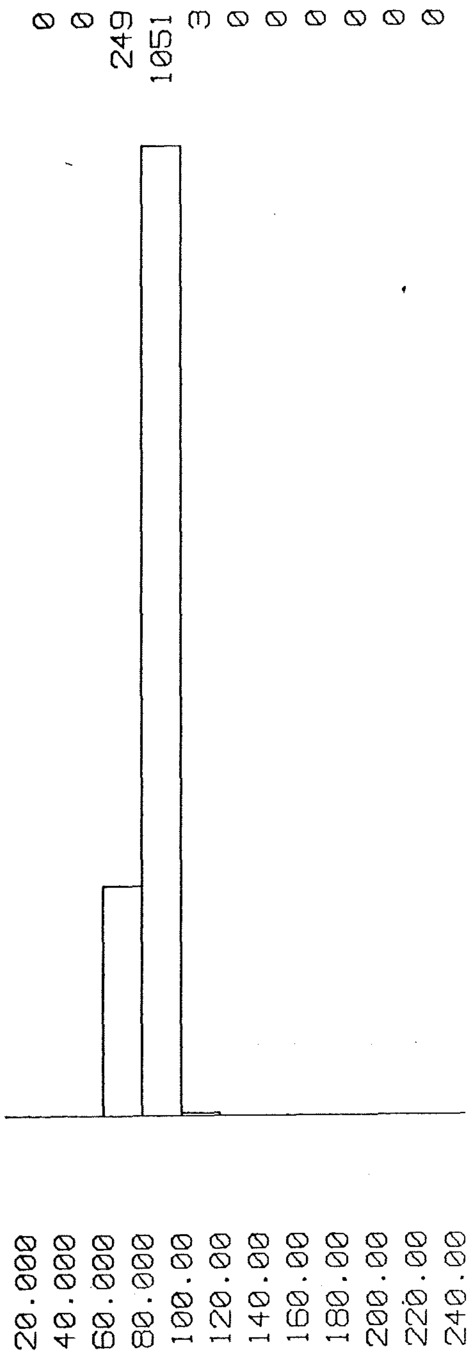
TRANSIT TIME
MICROSEC/FT

TOTAL NUMBER OF VALUES = 241

ORID-1-A

7015.00 - 7135.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 27. Histogram of Interval Transit Time (7015 - 7135 ft.)



MINIMUM VALUE = 68.718
MAXIMUM VALUE = 100.36
MEAN VALUE = 85.690
VARIANCE = 27.360
DEVIATION = 5.2307
1 INCH = 210.20 VALUES

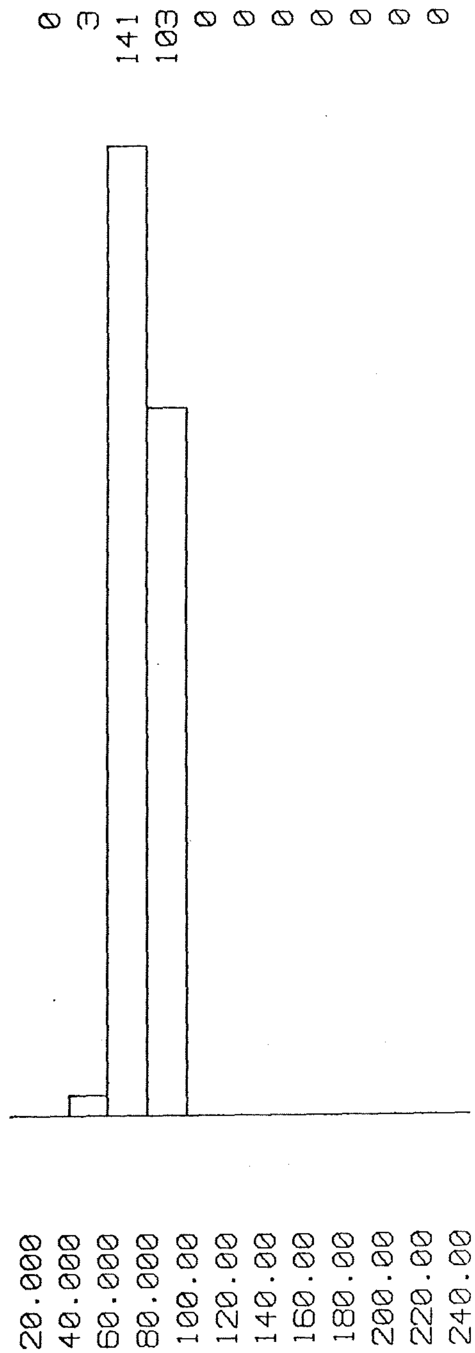
TRANSIT TIME
MICROSEC/FT

TOTAL NUMBER OF VALUES = 1303

ORID-1-A

7147.00 - 7798.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 28. Histogram of Interval Transit Time (7147 - 7798 ft.)



MINIMUM VALUE = 56.634
MAXIMUM VALUE = 96.803
MEAN VALUE = 78.433
VARIANCE = 57.066
DEVIATION = 7.5542
1 INCH = 28.200 VALUES

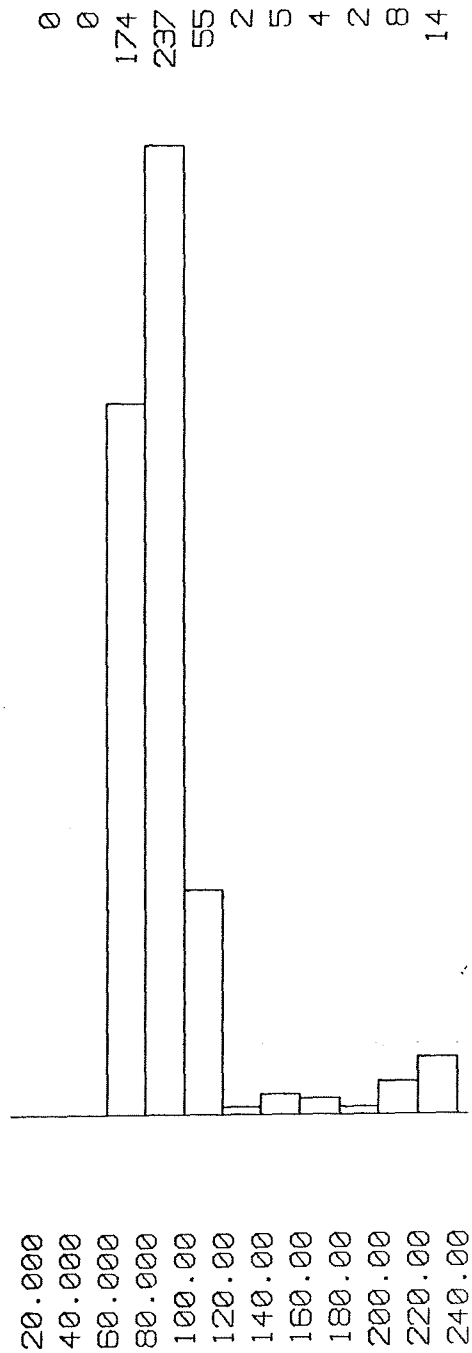
TRANSIT TIME
MICROSEC/FT

TOTAL NUMBER OF VALUES = 247

ORID-1-A

7803.00 - 7926.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 29. Histogram of Interval Transit Time (7803 - 7926 ft.)



MINIMUM VALUE = 64.127
MAXIMUM VALUE = 236.00
MEAN VALUE = 93.365
VARIANCE = 1050.6
DEVIATION = 32.413
1 INCH = 47.400 VALUES

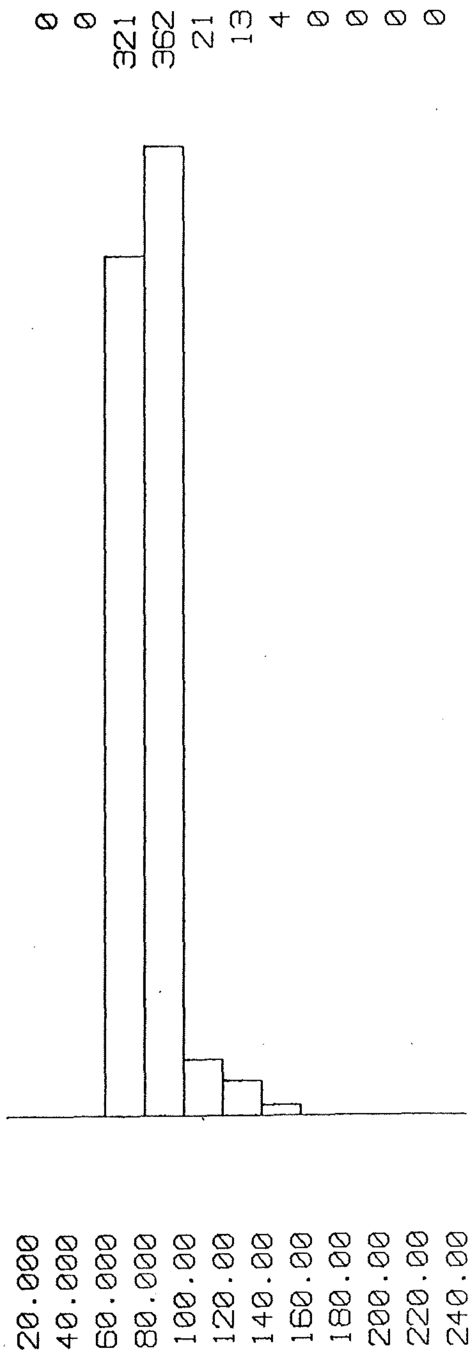
TRANSIT TIME
MICROSEC/FT

TOTAL NUMBER OF VALUES = 501

ORID-1-A

8154.00 - 8404.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 30. Histogram of Interval Transit Time (8154 - 8404 ft.)



MINIMUM VALUE = 61.125
MAXIMUM VALUE = 147.05
MEAN VALUE = 81.903
VARIANCE = 168.55
DEVIATION = 12.983
1 INCH = 72.400 VALUES

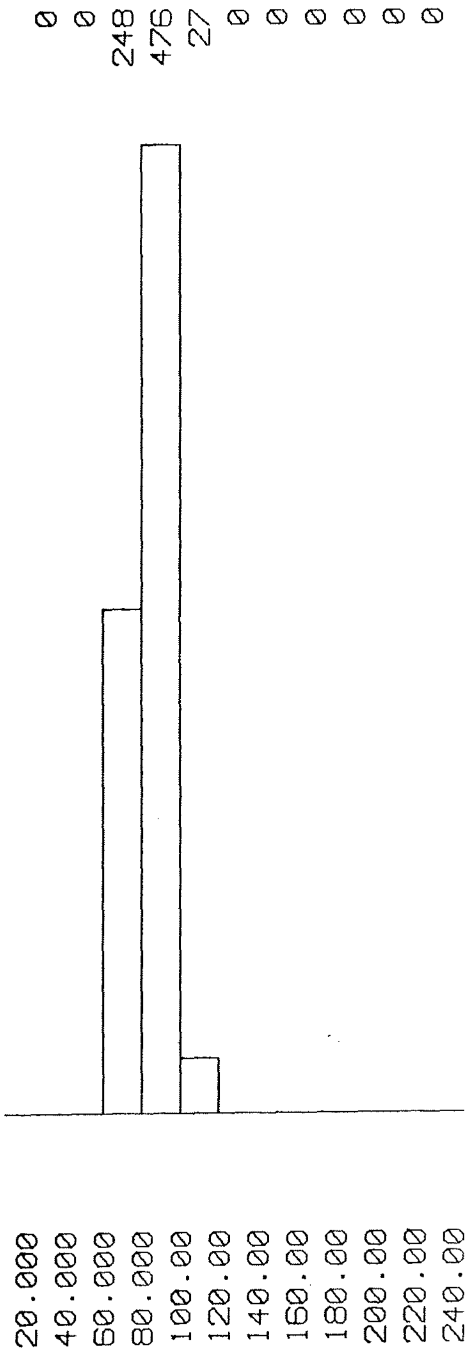
TRANSIT TIME
MICROSEC/FT

TOTAL NUMBER OF VALUES = 721

ORID-1-A

8466.00 - 8826.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 31. Histogram of Interval Transit Time (8466 - 8826 ft.)



MINIMUM VALUE = 61.687
MAXIMUM VALUE = 107.93
MEAN VALUE = 83.498
VARIANCE = 97.166
DEVIATION = 9.8573
1 INCH = 95.200 VALUES

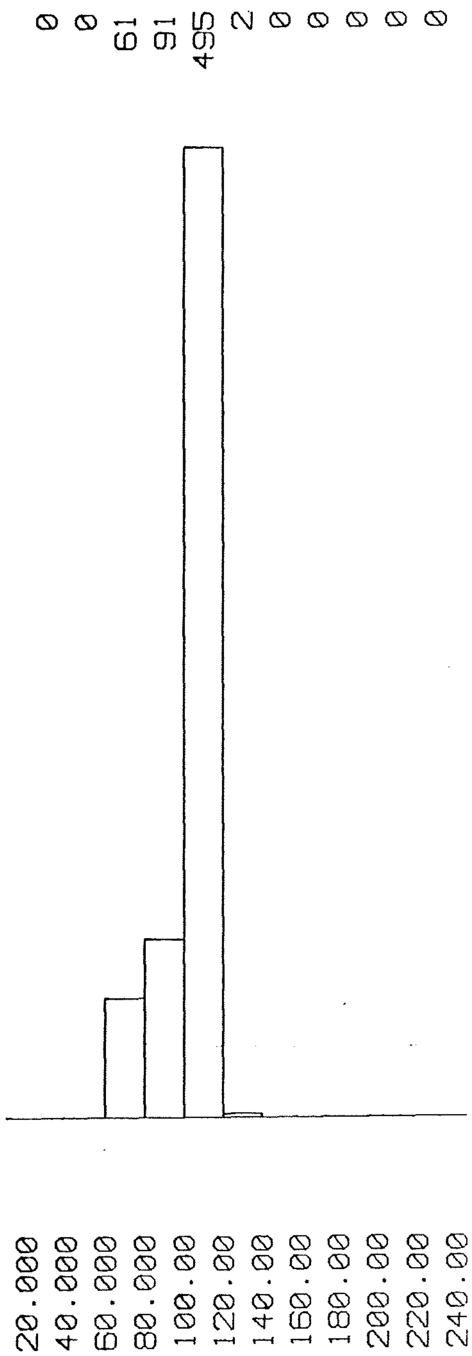
TRANSIT TIME
MICROSEC/FT

TOTAL NUMBER OF VALUES = 751

ORID-1-A

8863.00 - 9238.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 32. Histogram of Interval Transit Time (8863 - 9238 ft.)



MINIMUM VALUE = 62.926
MAXIMUM VALUE = 121.46
MEAN VALUE = 103.29
VARIANCE = 166.54
DEVIATION = 12.905
1 INCH = 99.000 VALUES

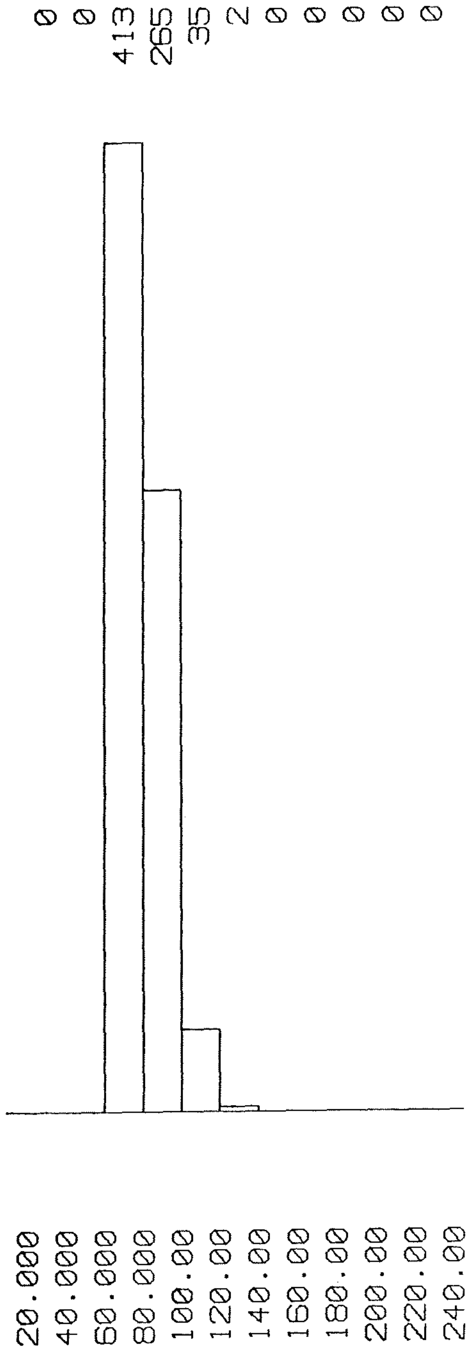
TRANSIT TIME
MICROSEC/FT

TOTAL NUMBER OF VALUES = 649

ORID-1-A

9253.00 - 9577.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 33. Histogram of Interval Transit Time (9253 - 9577 ft.)



MINIMUM VALUE = 63.285
MAXIMUM VALUE = 120.47
MEAN VALUE = 79.587
VARIANCE = 125.30
DEVIATION = 11.194
1 INCH = 82.600 VALUES

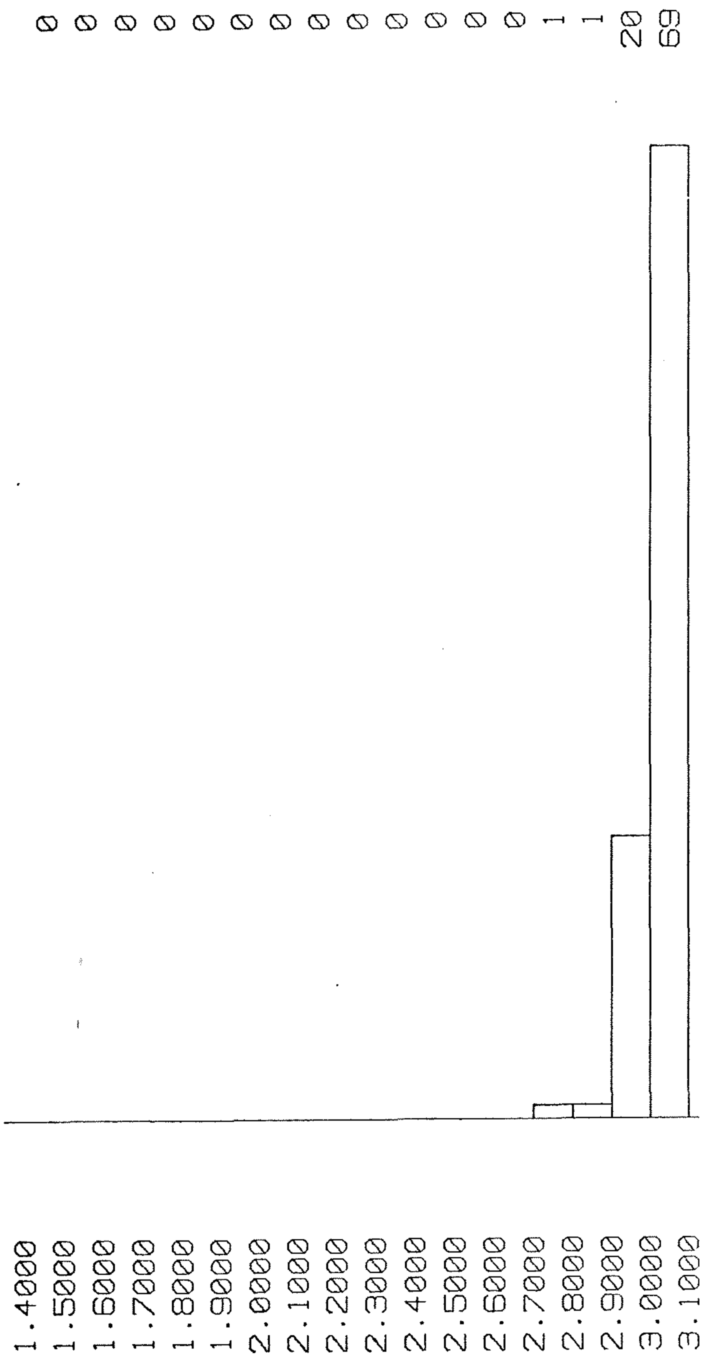
TRANSIT TIME
MICROSEC/FT

TOTAL NUMBER OF VALUES = 715

ORID-1-A

9581.00 - 9938.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 34. Histogram of Interval Transit Time (9581 - 9938 ft.)



MINIMUM VALUE = 2.7528
MAXIMUM VALUE = 3.0100
MEAN VALUE = 2.9933
VARIANCE = 0.13811E-02
DEVIATION = 0.37164E-01
1 INCH = 13.800 VALUES

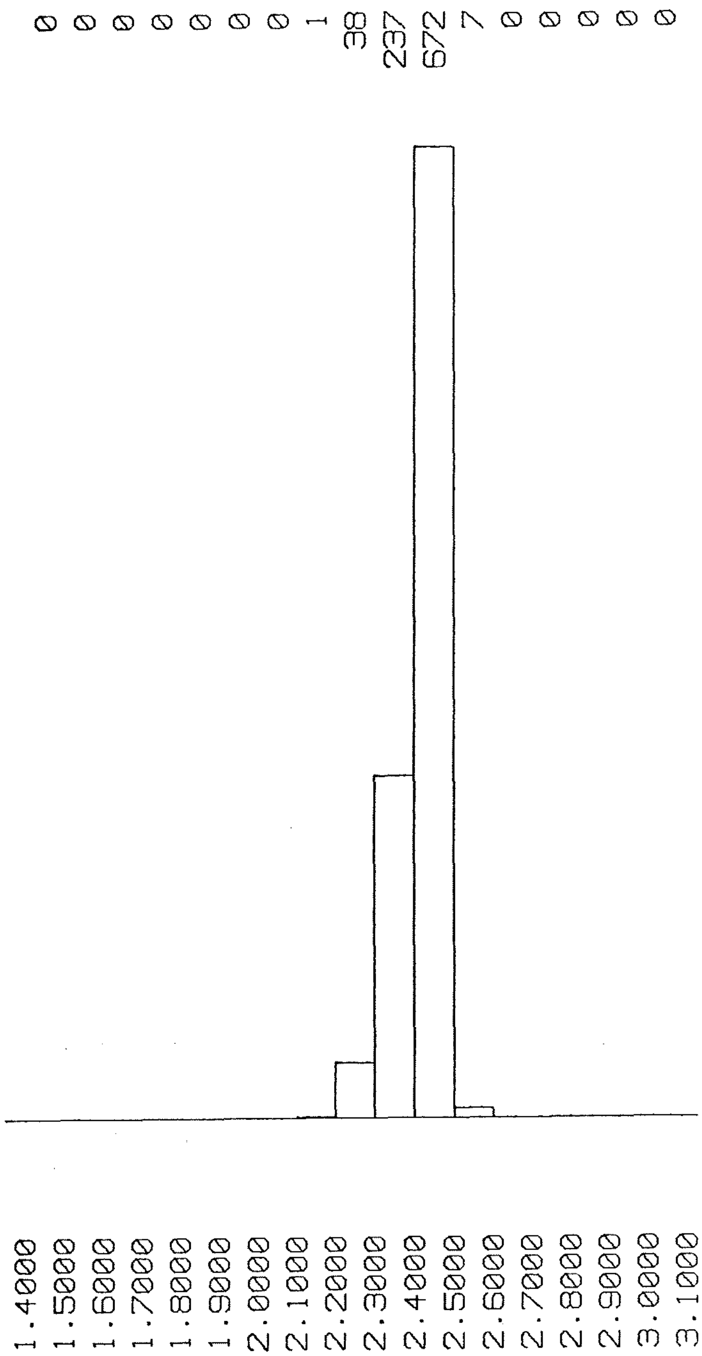
BULK DENSITY
GRAMS/CC

TOTAL NUMBER OF VALUES = 91

ORID-1-A

4571.00 - 4616.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 35. Histogram of Bulk Density (4571 - 4616 ft.)



MINIMUM VALUE = 2.1805
MAXIMUM VALUE = 2.5333
MEAN VALUE = 2.4185
VARIANCE = 0.27823E-02
DEVIATION = 0.52747E-01
1 INCH = 134.40 VALUES

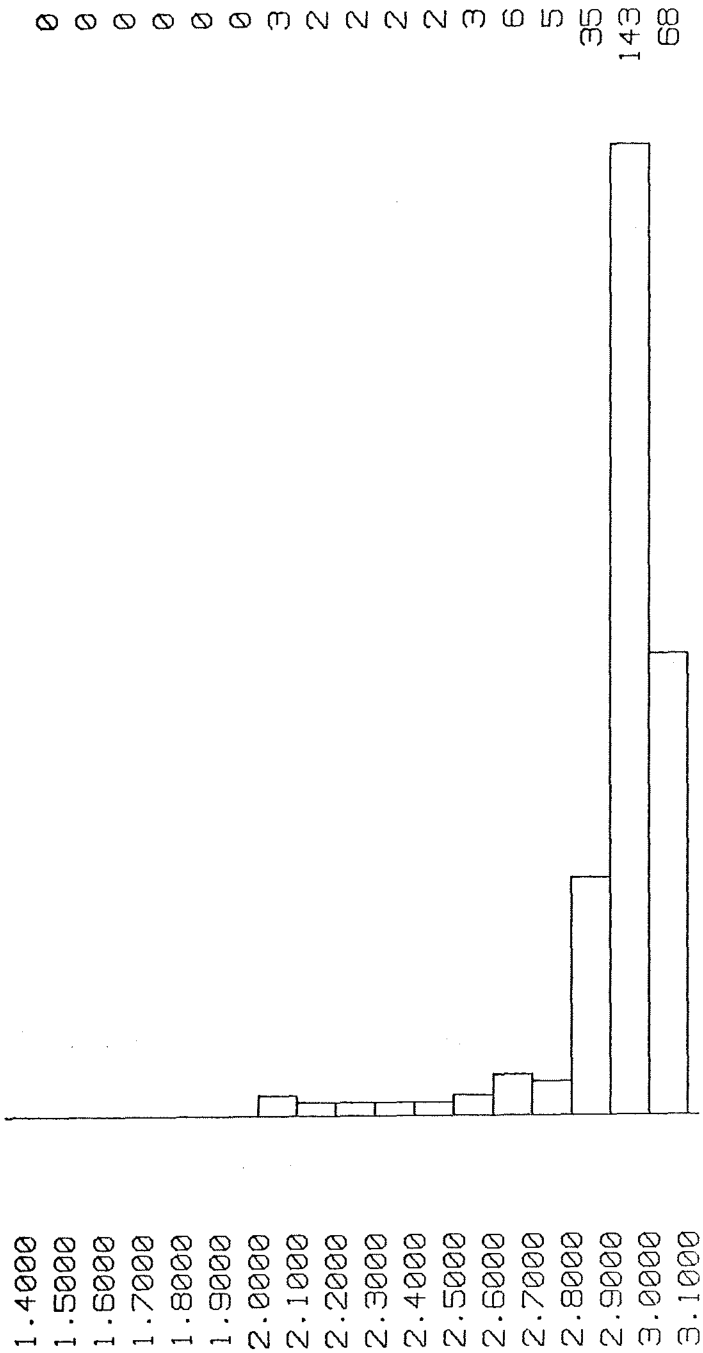
BULK DENSITY
GRAMS/CC

TOTAL NUMBER OF VALUES = 955

ORID-1-A

4660.00 - 5137.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 36. Histogram of Bulk Density (4660 - 5137 ft.)



MINIMUM VALUE = 2.0040
MAXIMUM VALUE = 3.0100
MEAN VALUE = 2.9104
VARIANCE = 0.27458E-01
DEVIATION = 0.16570
1 INCH = 28.600 VALUES

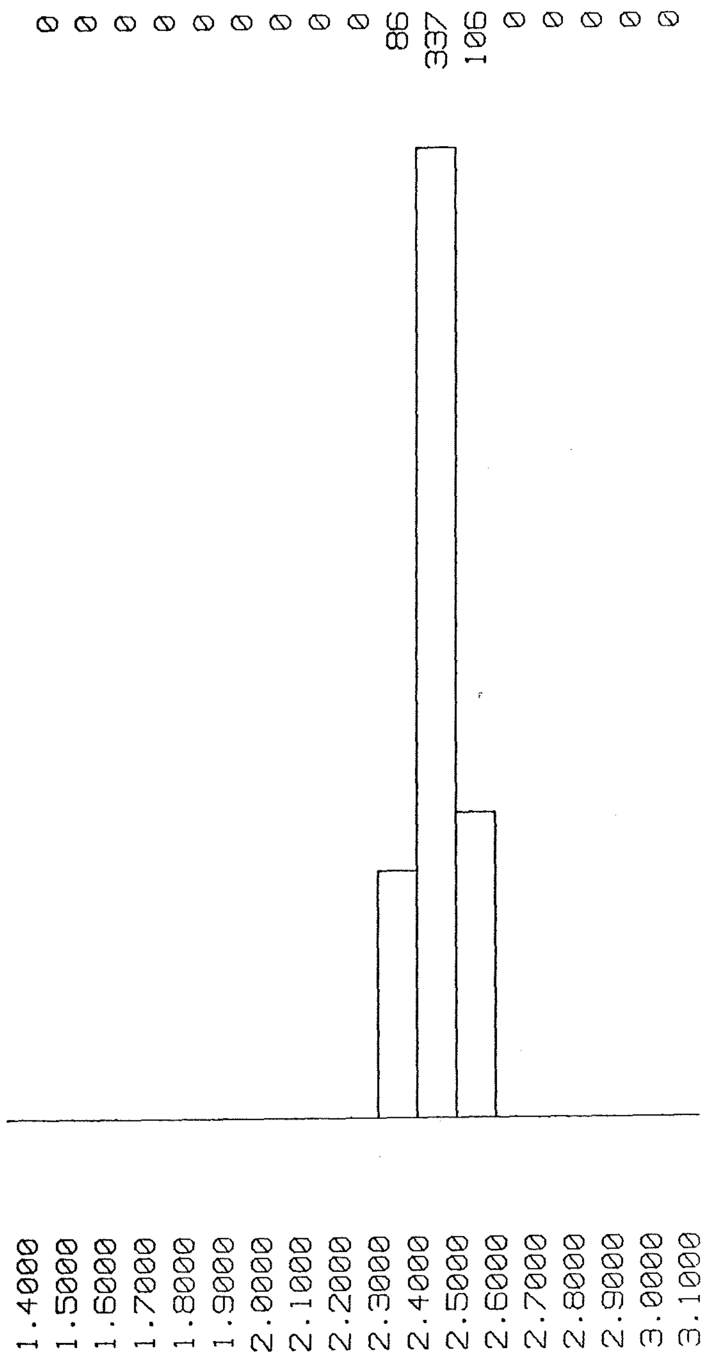
BULK DENSITY
GRAMS/CC

TOTAL NUMBER OF VALUES = 271

ORID-1-A

5152.00 - 5287.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 37. Histogram of Bulk Density (5152 - 5287 ft.)



MINIMUM VALUE = 2.3135
MAXIMUM VALUE = 2.5890
MEAN VALUE = 2.4558
VARIANCE = 0.33159E-02
DEVIATION = 0.57584E-01
1 INCH = 67.400 VALUES

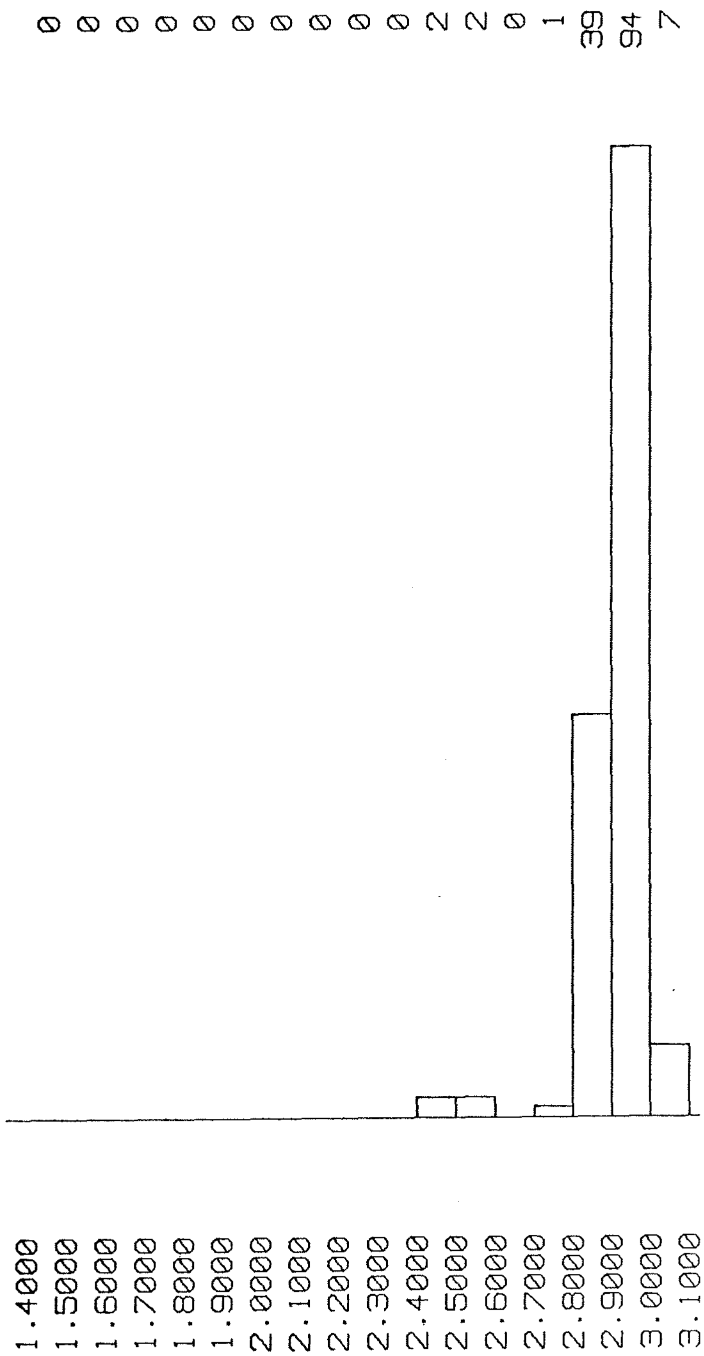
BULK DENSITY
GRAMS/CC

TOTAL NUMBER OF VALUES = 529

ORID-1-A

5296.00 - 5560.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 38. Histogram of Bulk Density (5296 - 5560 ft.)



MINIMUM VALUE = 2.4524
MAXIMUM VALUE = 3.0096
MEAN VALUE = 2.9191
VARIANCE = 0.75390E-02
DEVIATION = 0.86827E-01
1 INCH = 18.800 VALUES

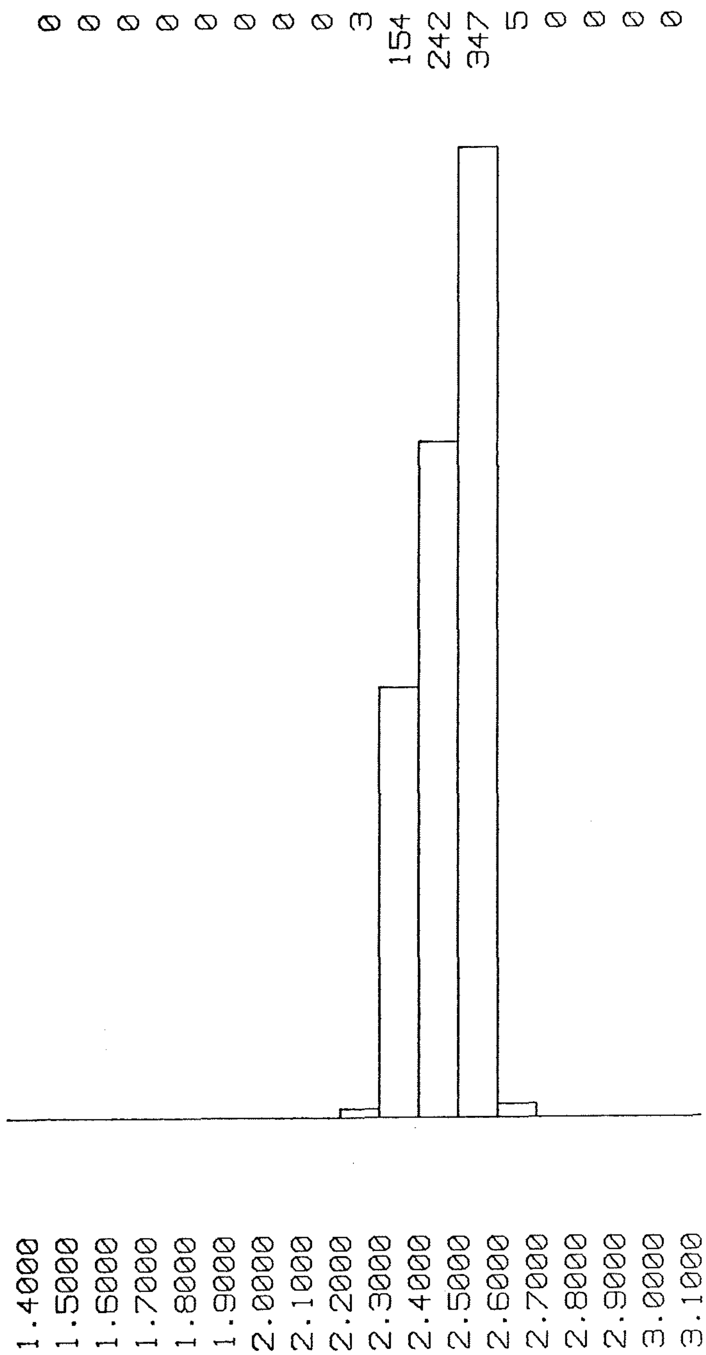
BULK DENSITY
GRAMS/CC

TOTAL NUMBER OF VALUES = 145

ORID-1-A

5572.00 - 5644.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 39. Histogram of Bulk Density (5572 - 5644 ft.)



MINIMUM VALUE = 2.2787
MAXIMUM VALUE = 2.6177
MEAN VALUE = 2.4793
VARIANCE = 0.62272E-02
DEVIATION = 0.78912E-01
1 INCH = 69.400 VALUES

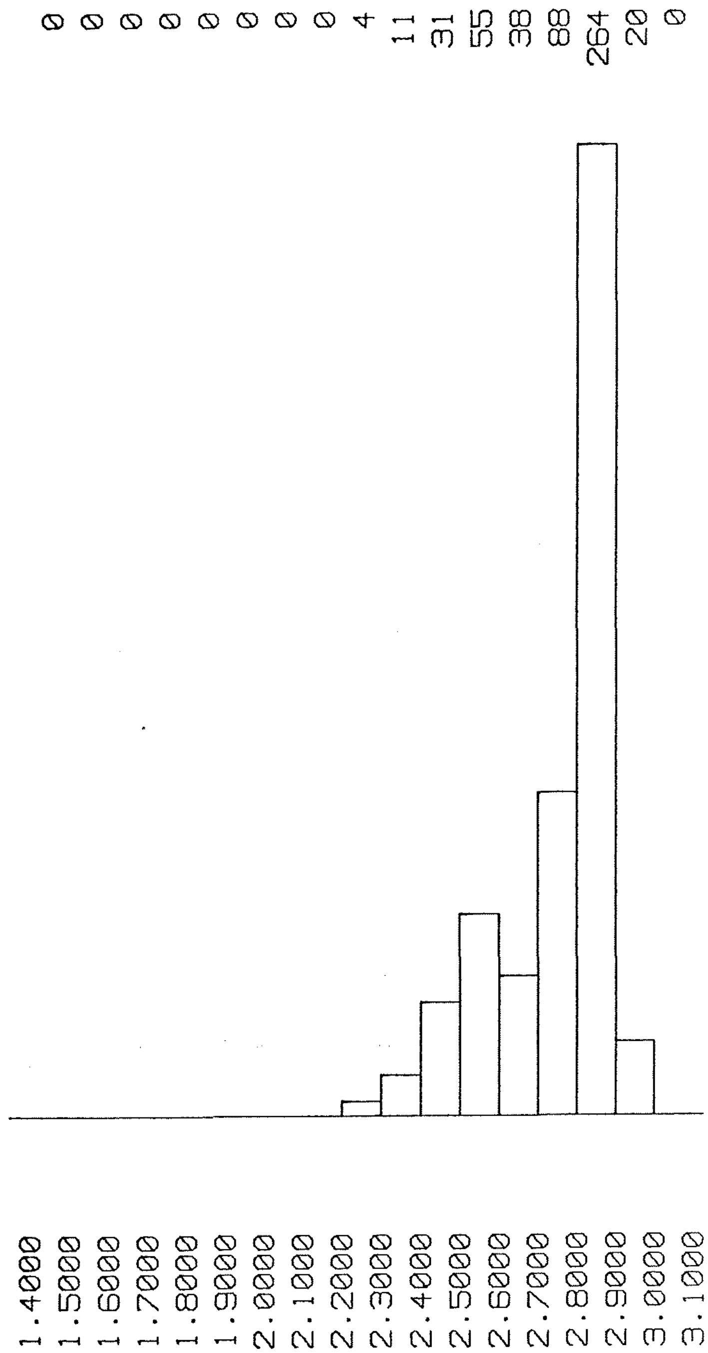
BULK DENSITY
GRAMS/CC

TOTAL NUMBER OF VALUES = 751

ORID-1-A

5651.00 - 6026.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

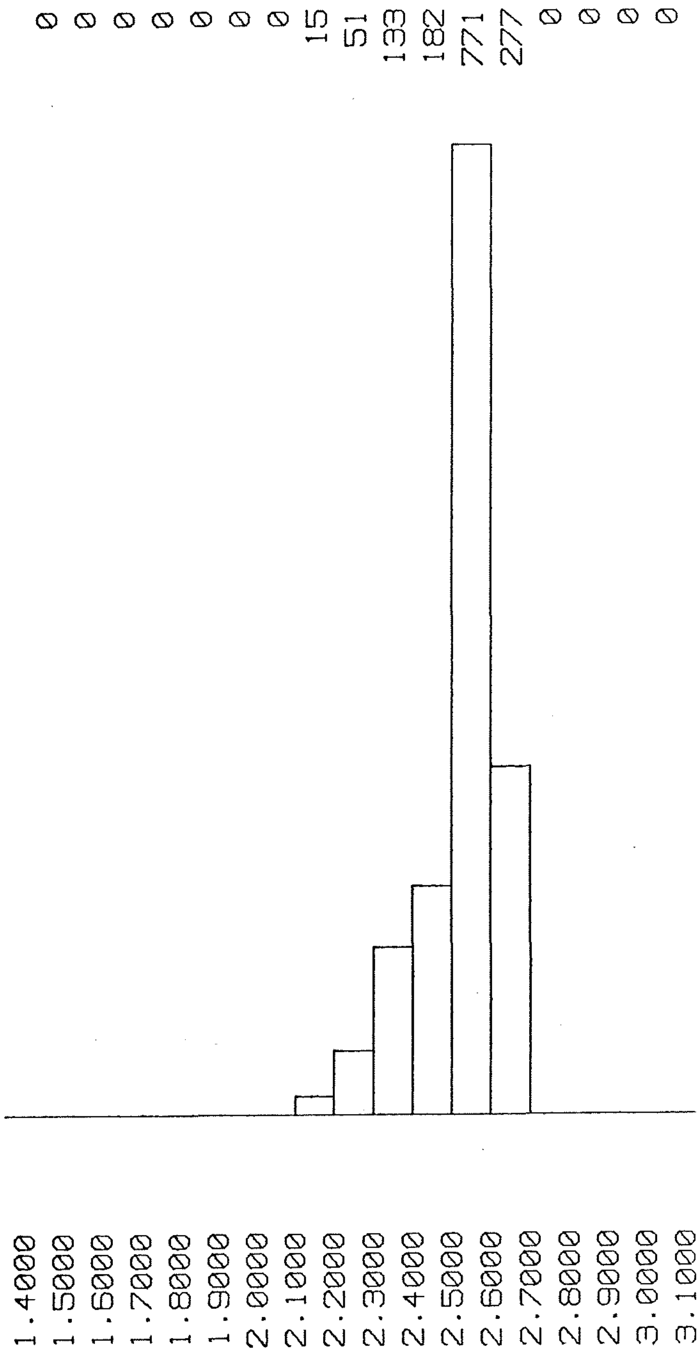
FIGURE 40. Histogram of Bulk Density (5651 - 6026 ft.)



MINIMUM VALUE = 2.2798
MAXIMUM VALUE = 2.9407
MEAN VALUE = 2.7496 BULK DENSITY
VARIANCE = 0.22225E-01 GRAMS/CC
DEVIATION = 0.14908
1 INCH = 52.800 VALUES TOTAL NUMBER OF VALUES = 511

ORID-1-A 6031.00 - 6286.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 41. Histogram of Bulk Density (6031 - 6286 ft.)



MINIMUM VALUE = 2.1454
MAXIMUM VALUE = 2.6696
MEAN VALUE = 2.5207
VARIANCE = 0.10182E-01
DEVIATION = 0.10091
1 INCH = 154.20 VALUES

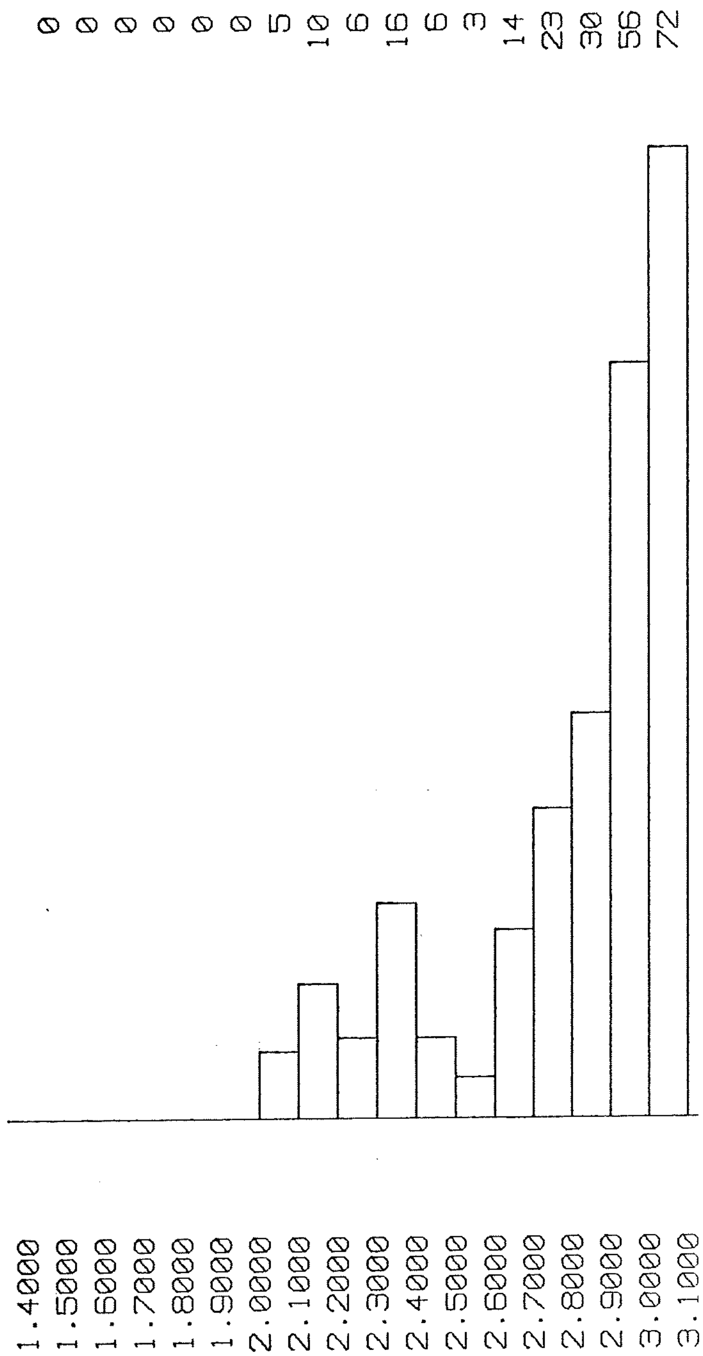
BULK DENSITY
GRAMS/CC

TOTAL NUMBER OF VALUES = 1429

ORID-1-A

6294.00 - 7008.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 42. Histogram of Bulk Density (6294 - 7008 ft.)



MINIMUM VALUE = 2.0040
MAXIMUM VALUE = 3.0080
MEAN VALUE = 2.7944
VARIANCE = 0.75002E-01
DEVIATION = 0.27387
1 INCH = 14.400 VALUES

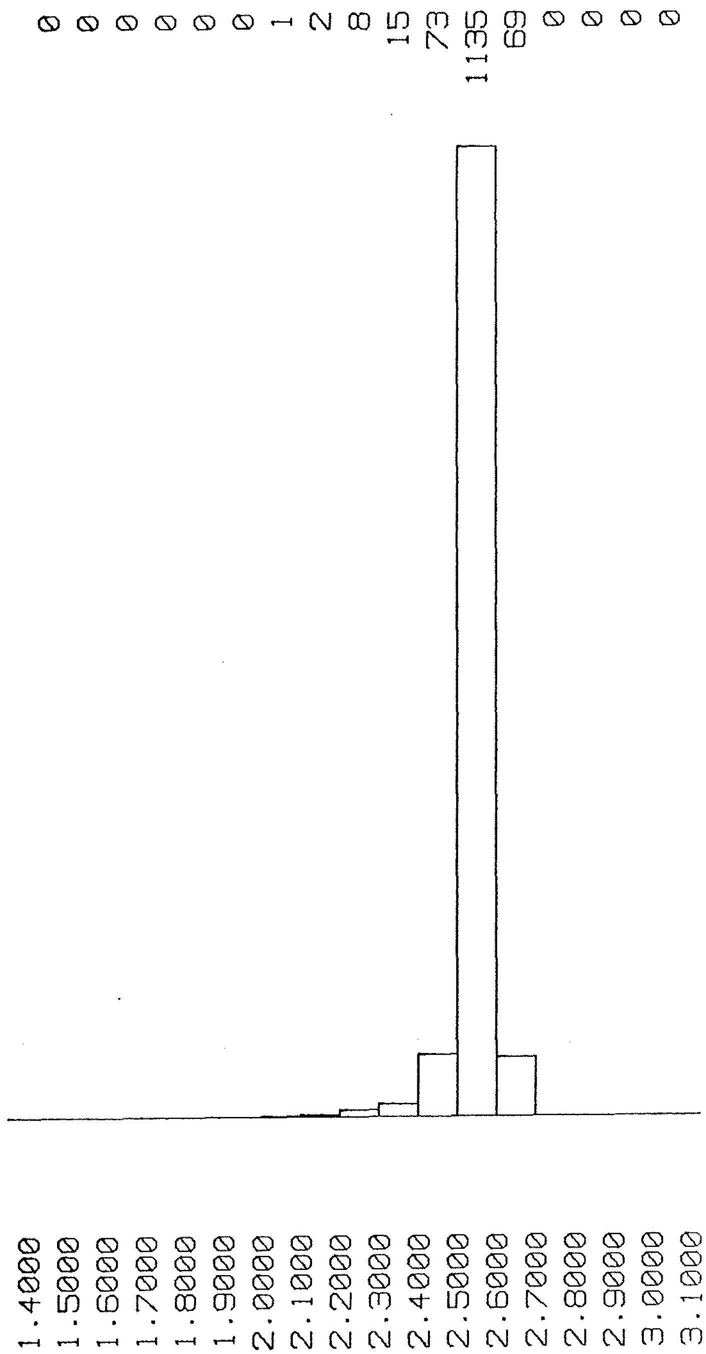
BULK DENSITY
GRAMS/CC

TOTAL NUMBER OF VALUES = 241

ORID-1-A

7015.00 - 7135.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 43. Histogram of Bulk Density (7015 - 7135 ft.)



MINIMUM VALUE = 2.0921
MAXIMUM VALUE = 2.6377
MEAN VALUE = 2.5492
VARIANCE = 0.29821E-02
DEVIATION = 0.54609E-01
1 INCH = 227.00 VALUES

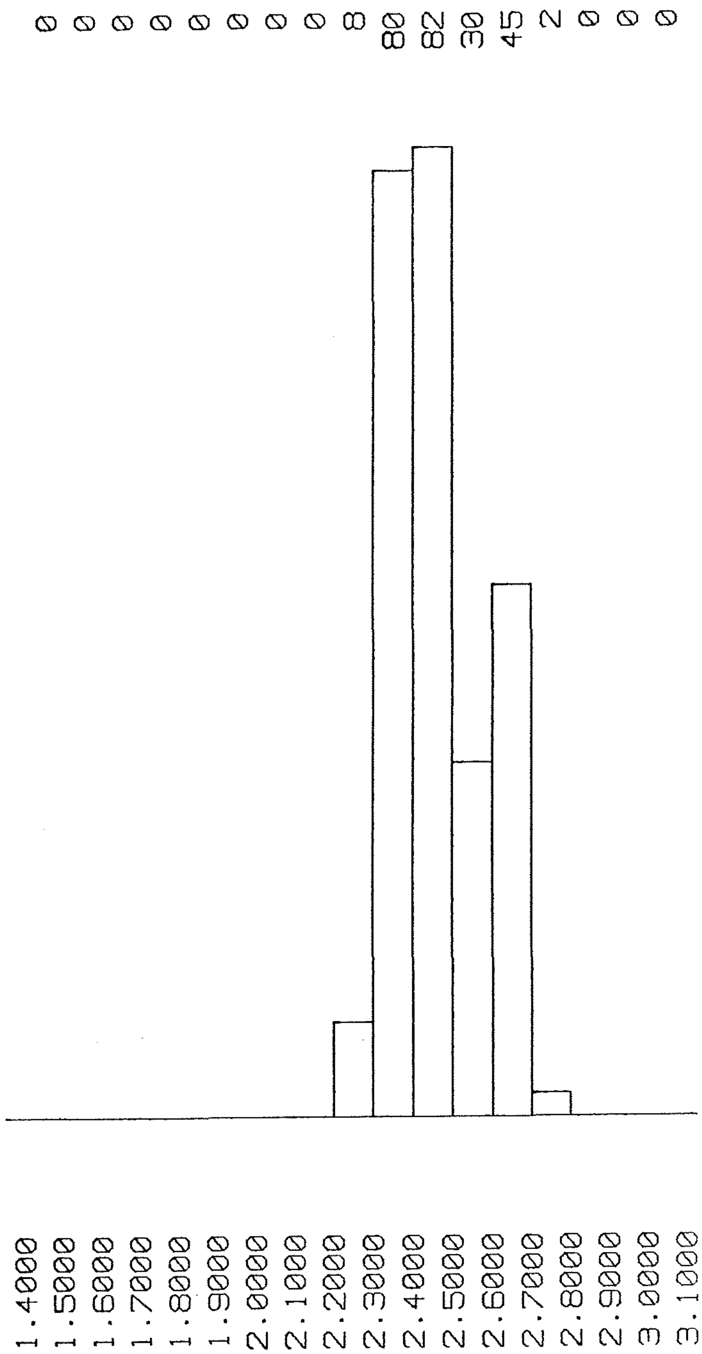
BULK DENSITY
GRAMS/CC

TOTAL NUMBER OF VALUES = 1303

ORID-1-A

7147.00 - 7798.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 44. Histogram of Bulk Density (7147 - 7798 ft.)



MINIMUM VALUE = 2.2244
MAXIMUM VALUE = 2.7040
MEAN VALUE = 2.4589
VARIANCE = 0.13115E-01
DEVIATION = 0.11452
1 INCH = 16.400 VALUES

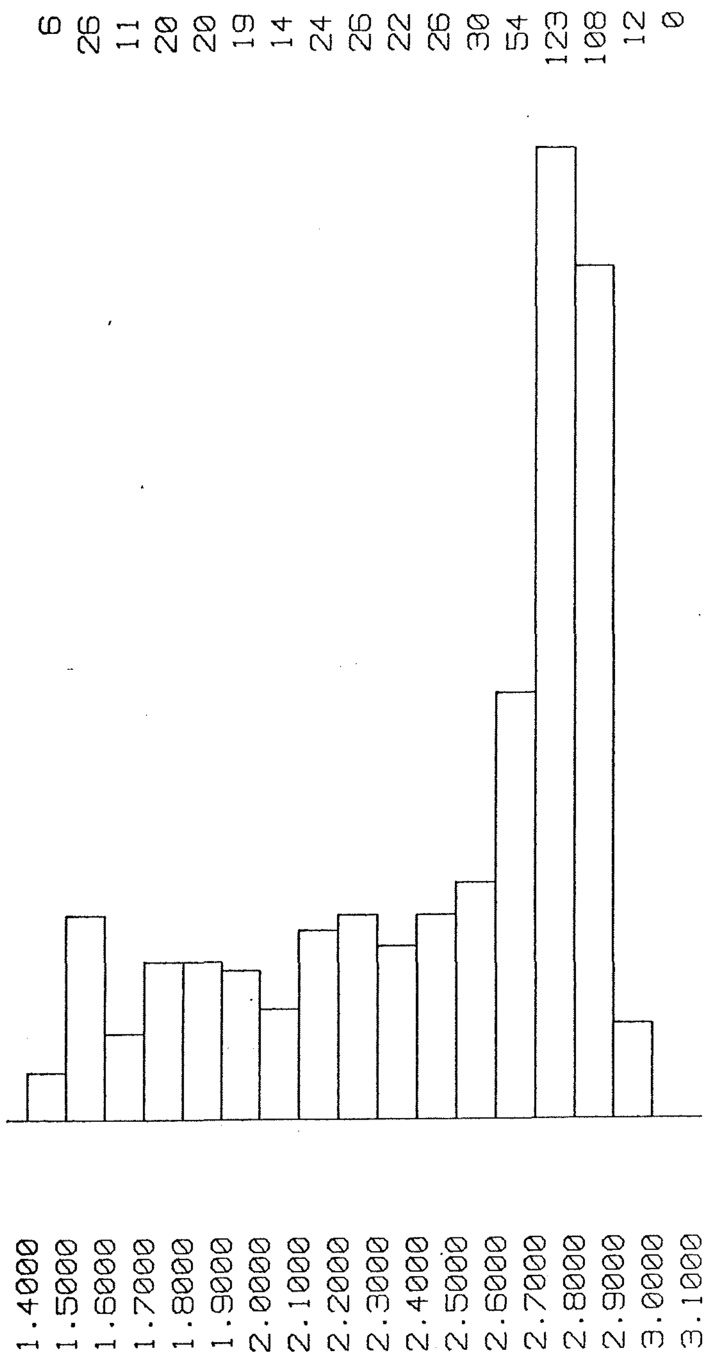
BULK DENSITY
GRAMS/CC

TOTAL NUMBER OF VALUES = 247

ORID-1-A

7803.00 - 7926.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 45. Histogram of Bulk Density (7803 - 7926 ft.)



MINIMUM VALUE = 1.4859
MAXIMUM VALUE = 2.9406
MEAN VALUE = 2.4589
VARIANCE = 0.17308
DEVIATION = 0.41603
1 INCH = 24.600 VALUES

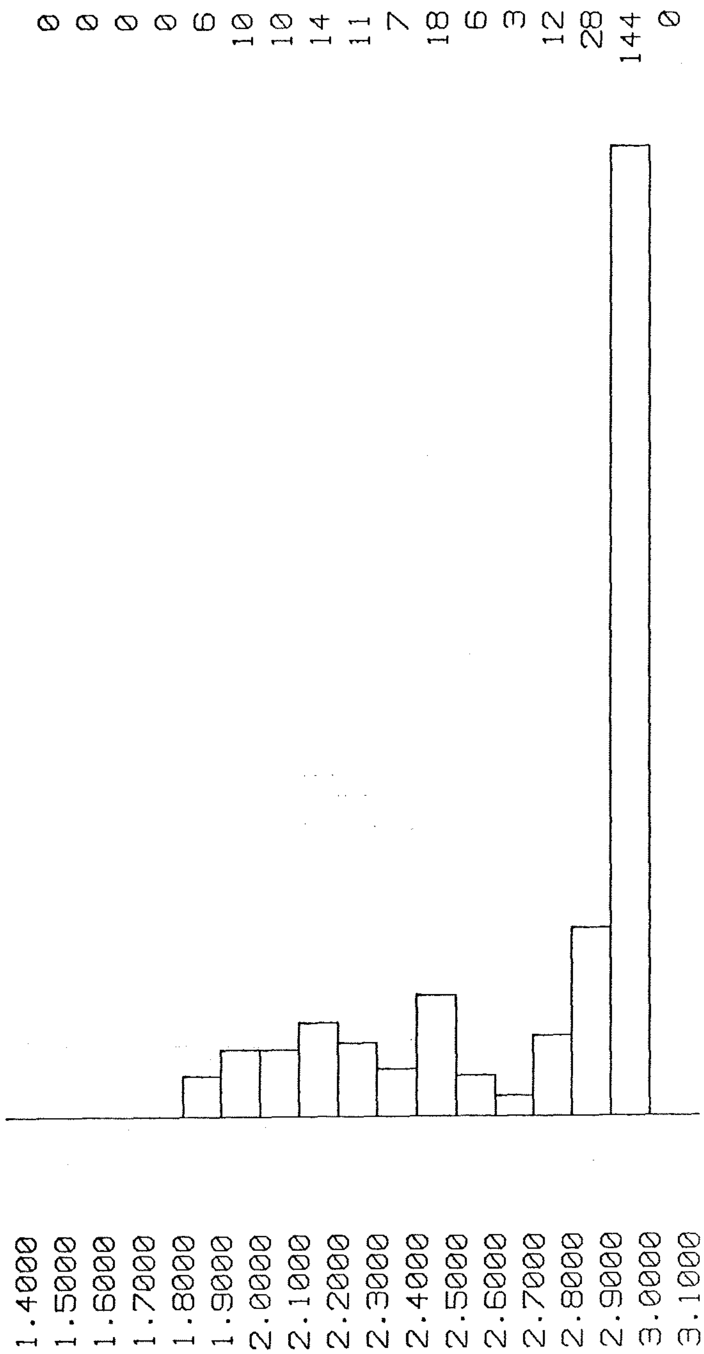
BULK DENSITY
GRAMS/CC

TOTAL NUMBER OF VALUES = 541

ORID-1-A

8134.00 - 8404.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 46. Histogram of Bulk Density (8134 - 8404 ft.)



MINIMUM VALUE = 1.8408
MAXIMUM VALUE = 2.9990
MEAN VALUE = 2.7049
VARIANCE = 0.12051
DEVIATION = 0.34715
1 INCH = 28.800 VALUES

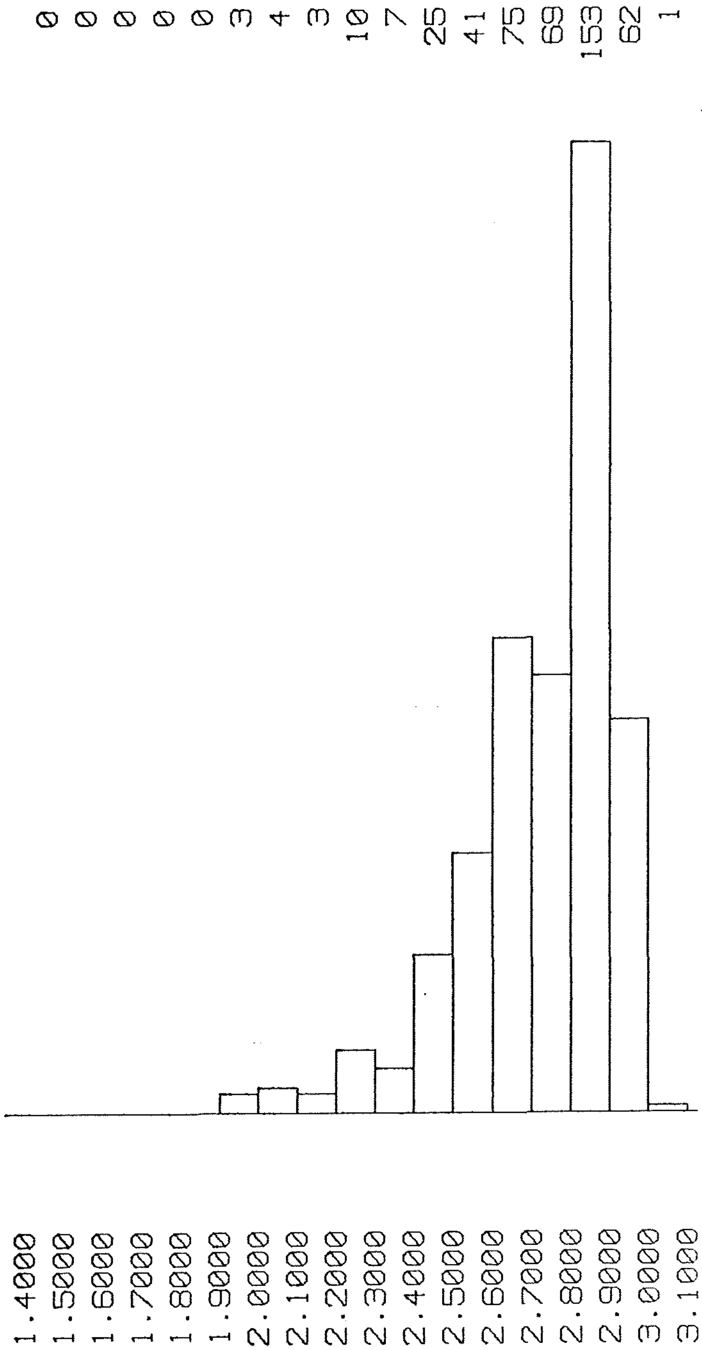
BULK DENSITY
GRAMS/CC

TOTAL NUMBER OF VALUES = 269

ORID-1-A

8466.00 - 8600.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 47. Histogram of Bulk Density (8466 - 8600 ft.)



MINIMUM VALUE = 1.9018
MAXIMUM VALUE = 3.0002
MEAN VALUE = 2.7270
VARIANCE = 0.37976E-01
DEVIATION = 0.19487
1 INCH = 30.600 VALUES

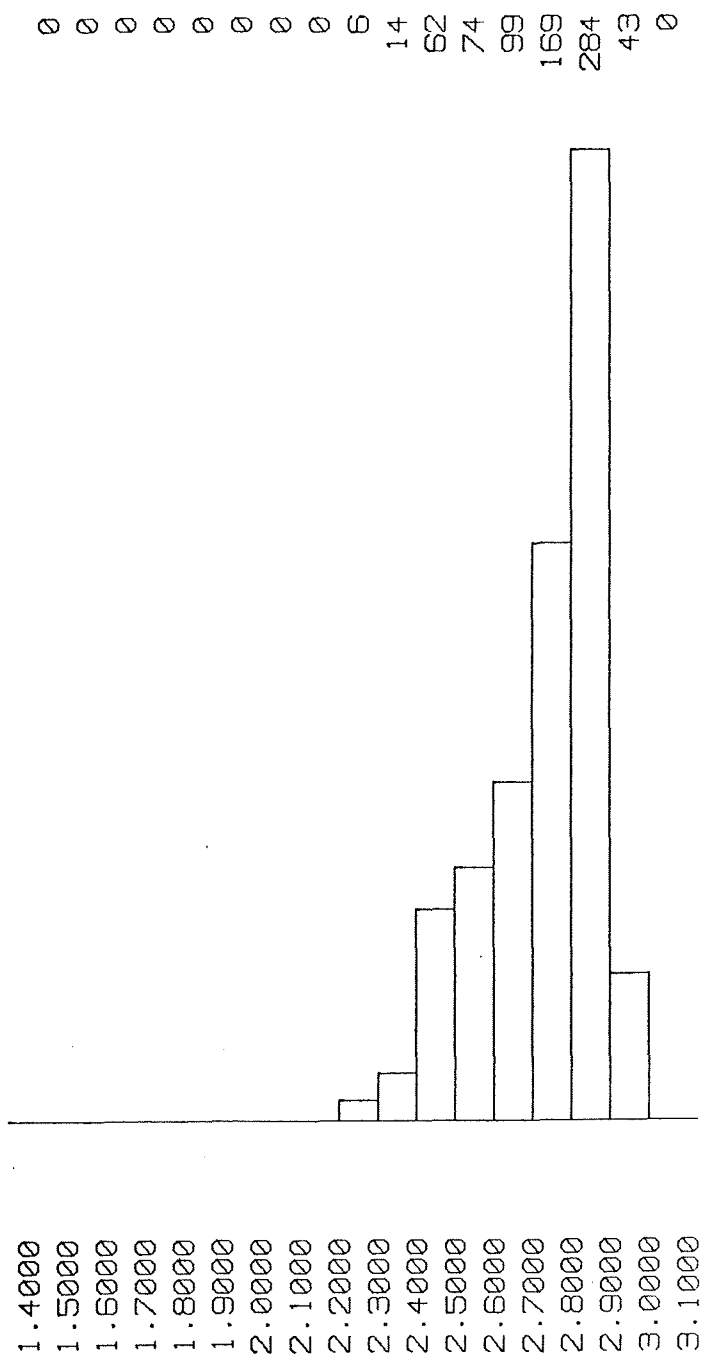
BULK DENSITY
GRAMS/CC

TOTAL NUMBER OF VALUES = 453

ORID-1-A

8600.00 - 8826.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 48. Histogram of Bulk Density (8600 - 8826 ft.)

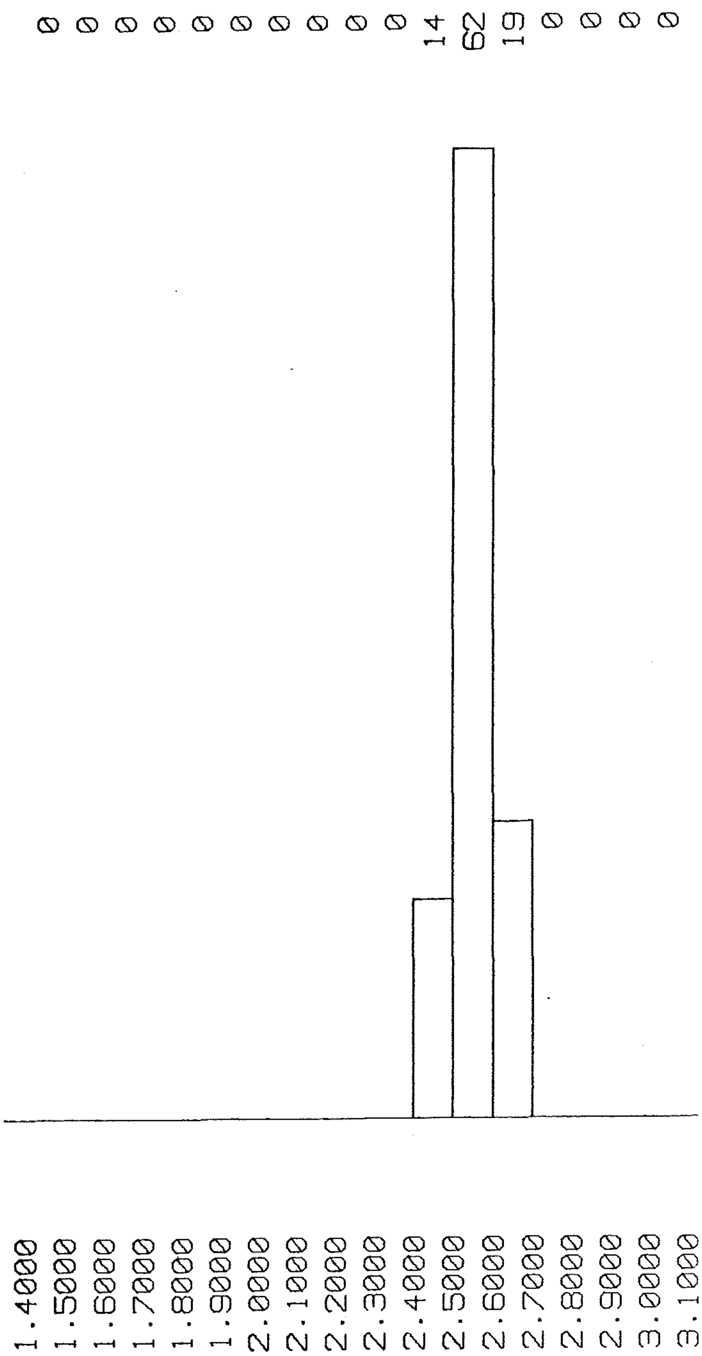


MINIMUM VALUE = 2.2487
MAXIMUM VALUE = 2.9515
MEAN VALUE = 2.7314 BULK DENSITY
VARIANCE = 0.22778E-01 GRAMS/CC
DEVIATION = 0.15092
1 INCH = 56.800 VALUES TOTAL NUMBER OF VALUES = 751

ORID-1-A

8863.00 - 9238.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 49. Histogram of Bulk Density (8863 - 9238 ft.)



MINIMUM VALUE = 2.4802
MAXIMUM VALUE = 2.6309
MEAN VALUE = 2.5522
VARIANCE = 0.18032E-02
DEVIATION = 0.42465E-01
1 INCH = 12.400 VALUES

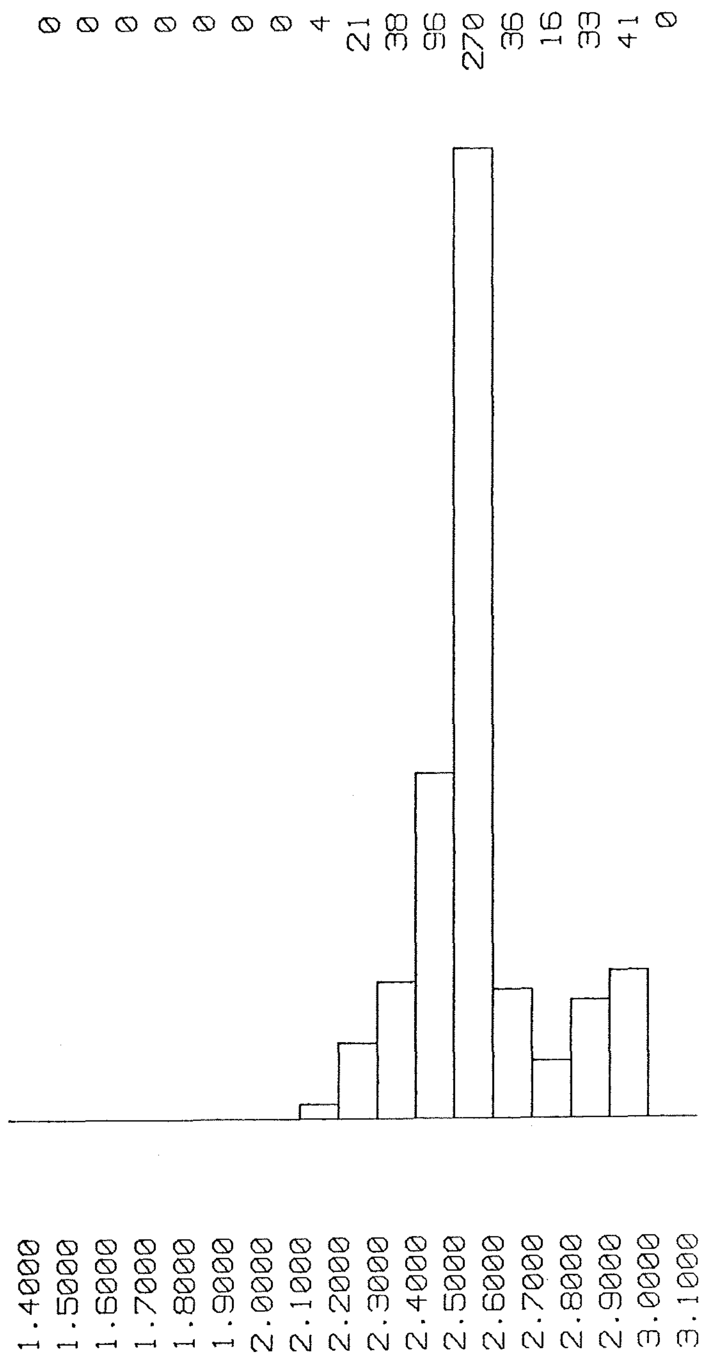
BULK DENSITY
GRAMS/CC

TOTAL NUMBER OF VALUES = 95

ORID-1-A

9253.00 - 9300.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

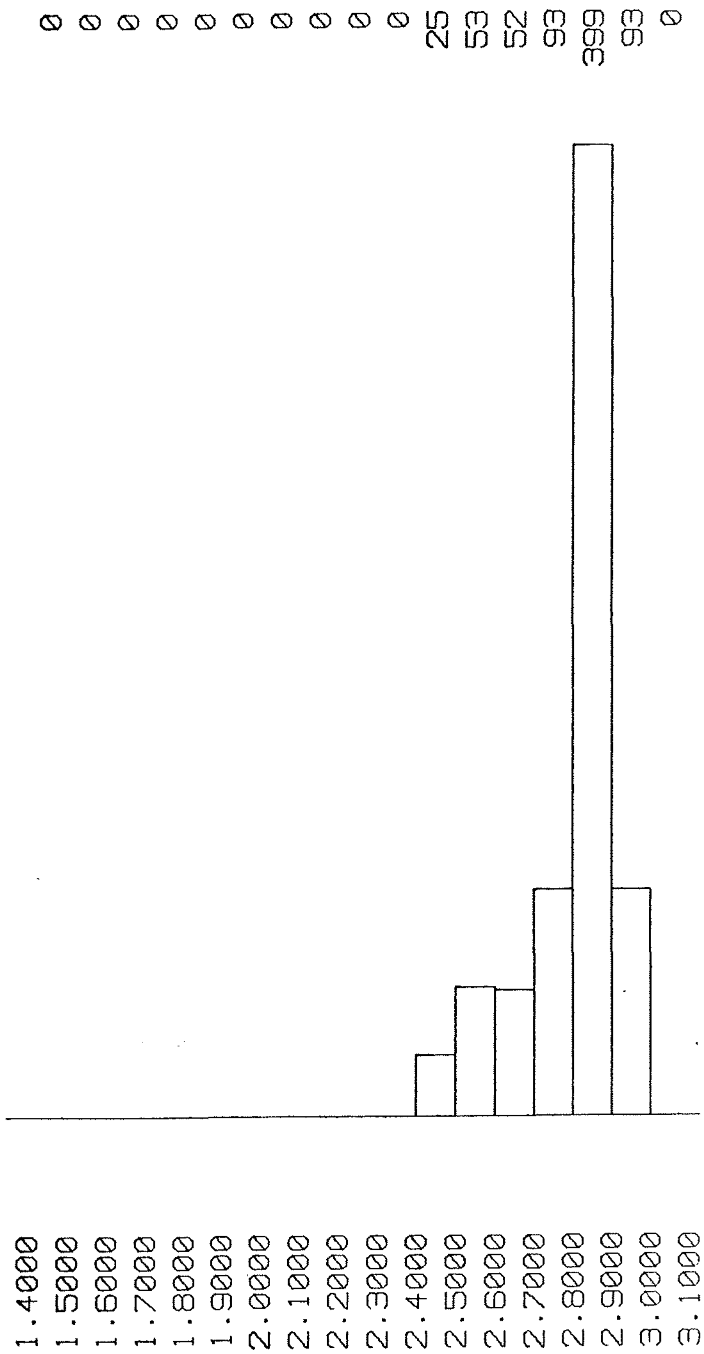
FIGURE 50. Histogram of Bulk Density (9253 - 9300 ft.)



MINIMUM VALUE = 2.1250
MAXIMUM VALUE = 2.9650
MEAN VALUE = 2.5634 BULK DENSITY
VARIANCE = 0.26266E-01 GRAMS/CC
DEVIATION = 0.16207
1 INCH = 54.000 VALUES TOTAL NUMBER OF VALUES = 555

ORID-1-A 9300.00 - 9577.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 51. Histogram of Bulk Density (9300 - 9577 ft.)



MINIMUM VALUE = 2.4104
MAXIMUM VALUE = 2.9500
MEAN VALUE = 2.8007
VARIANCE = 0.14828E-01
DEVIATION = 0.12177
1 INCH = 79.800 VALUES

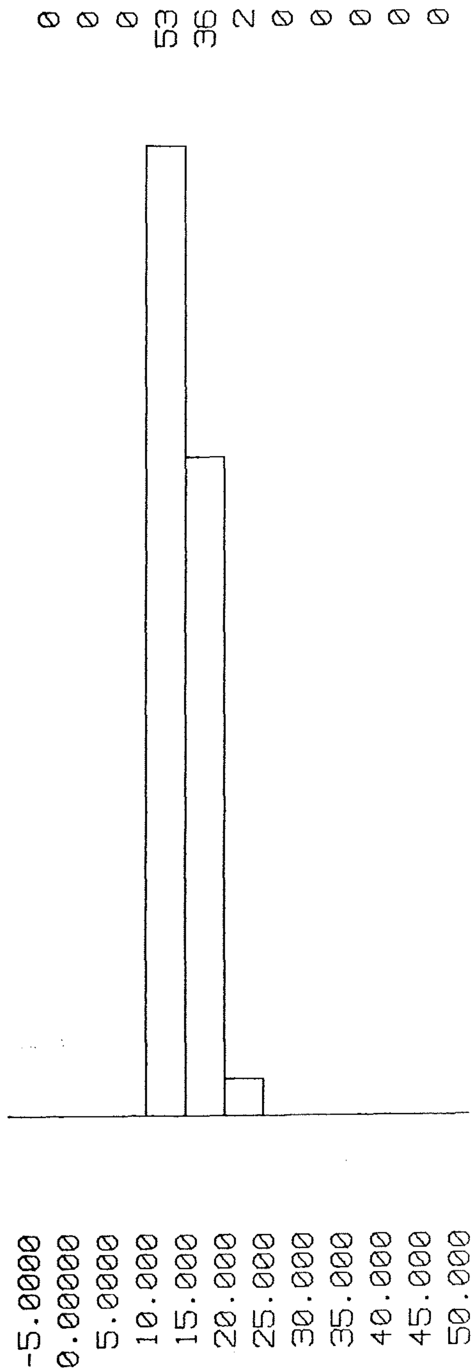
BULK DENSITY
GRAMS/CC

TOTAL NUMBER OF VALUES = 715

ORID-1-A

9581.00 - 9938.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 52. Histogram of Bulk Density (9581 - 9938 ft.)



MINIMUM VALUE = 10.570
MAXIMUM VALUE = 20.620
MEAN VALUE = 14.105
VARIANCE = 6.1342
DEVIATION = 2.4767
1 INCH = 10.600 VALUES

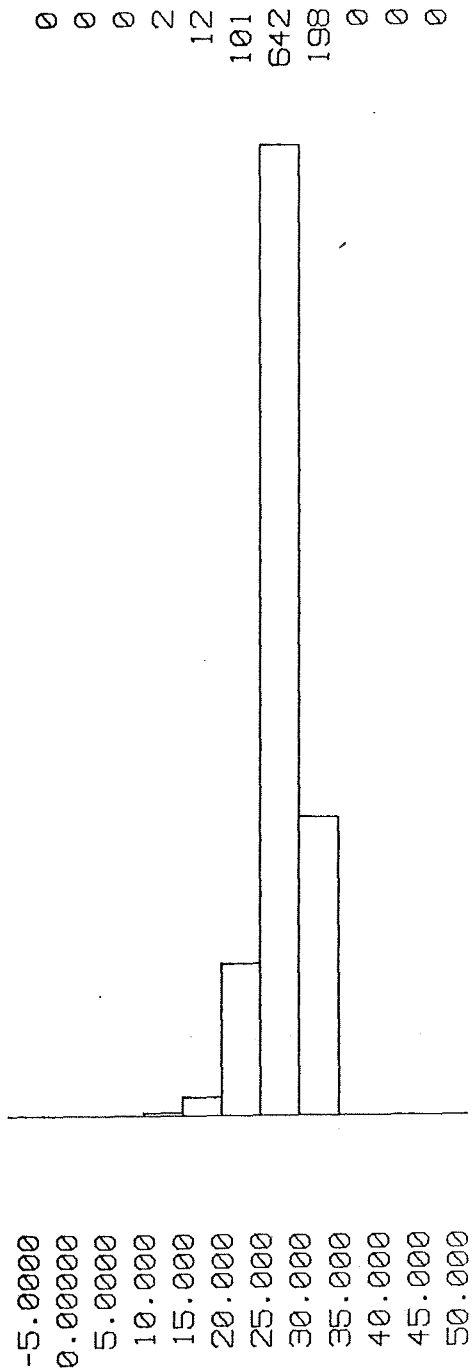
NEUTRON POROSITY
PERCENT

TOTAL NUMBER OF VALUES = 91

ORID-1-A

4571.00 - 4616.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 53. Histogram of Neutron Porosity (4517 - 4616 ft.)



MINIMUM VALUE = 14.787
MAXIMUM VALUE = 34.881
MEAN VALUE = 27.571
VARIANCE = 8.0494
DEVIATION = 2.8372
1 INCH = 128.40 VALUES

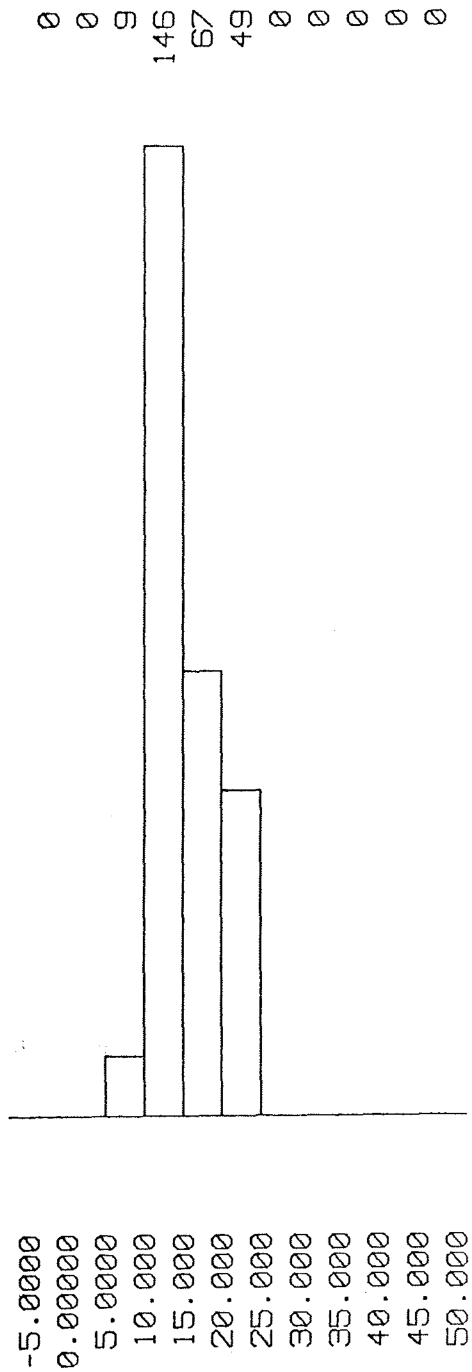
NEUTRON POROSITY
PERCENT

TOTAL NUMBER OF VALUES = 955

ORID-1-A

4660.00 - 5137.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 54. Histogram of Neutron Porosity (4660 - 5137 ft.)



MINIMUM VALUE = 9.5000
MAXIMUM VALUE = 24.500
MEAN VALUE = 15.547
VARIANCE = 14.369
DEVIATION = 3.7907
1 INCH = 29.200 VALUES

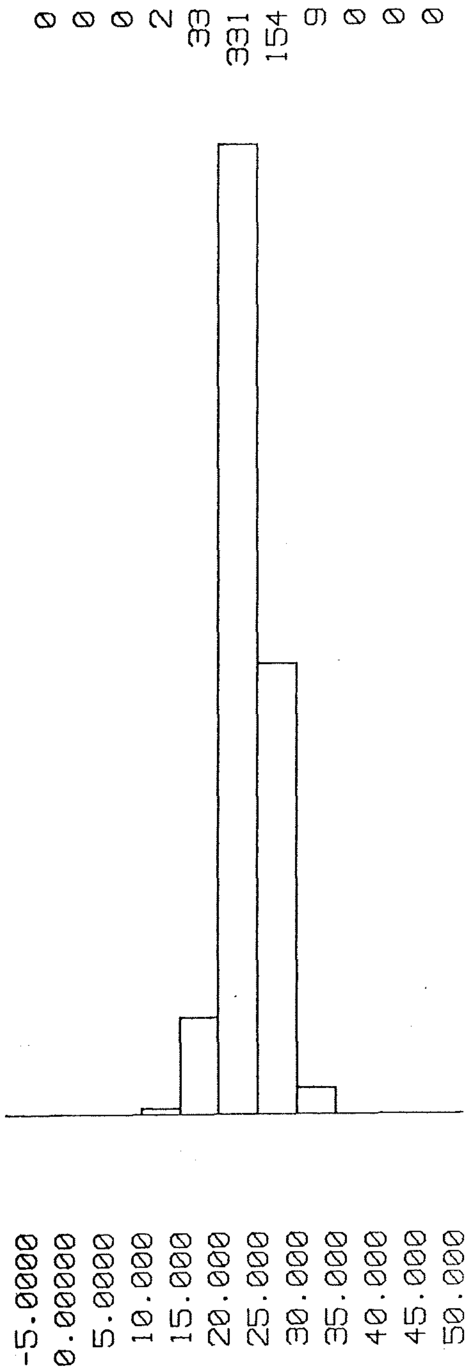
NEUTRON POROSITY
PERCENT

TOTAL NUMBER OF VALUES = 271

ORID-1-A

5152.00 - 5287.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 55. Histogram of Neutron Porosity (5152 - 5287 ft.)



MINIMUM VALUE = 14.825
MAXIMUM VALUE = 30.920
MEAN VALUE = 23.653
VARIANCE = 7.7634
DEVIATION = 2.7863
1 INCH = 66.200 VALUES

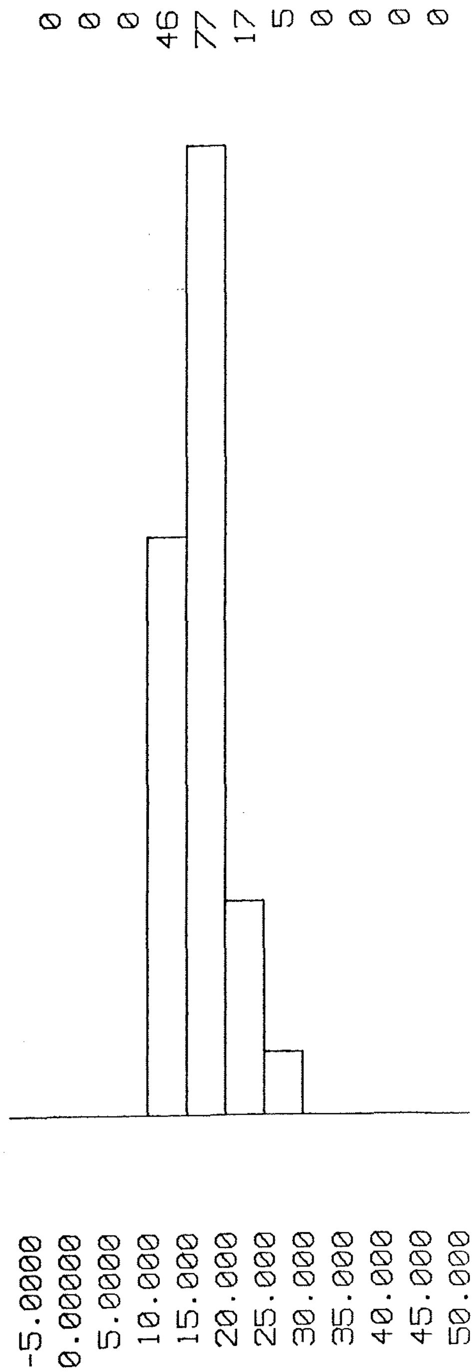
NEUTRON POROSITY
PERCENT

TOTAL NUMBER OF VALUES = 529

ORID-1-A

5296.00 - 5560.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 56. Histogram of Neutron Porosity (5296 - 5560 ft.)



MINIMUM VALUE = 10.460
MAXIMUM VALUE = 28.940
MEAN VALUE = 16.540
VARIANCE = 12.374
DEVIATION = 3.5176
1 INCH = 15.400 VALUES

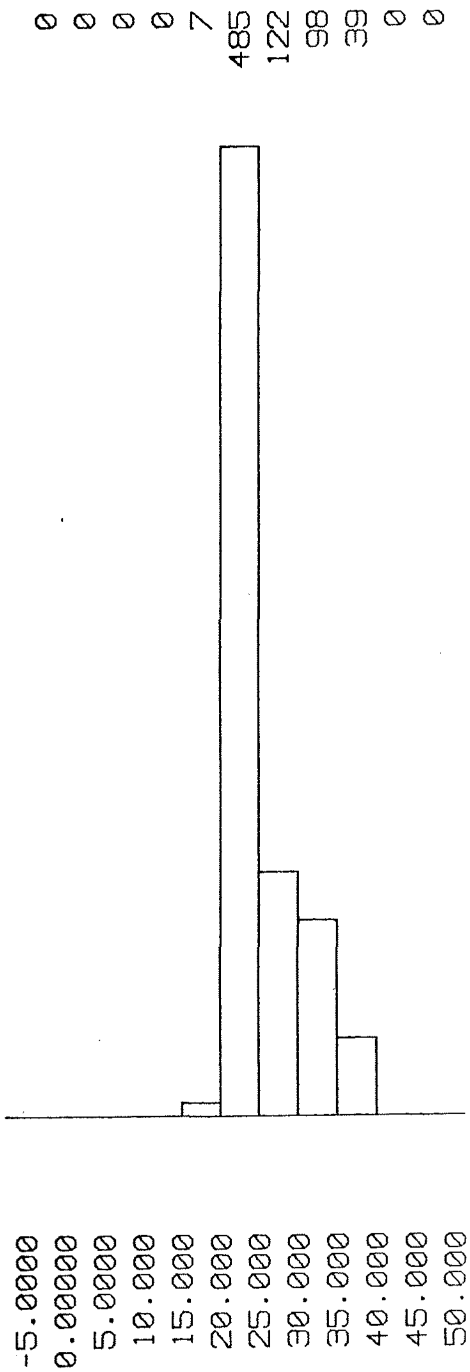
NEUTRON POROSITY
PERCENT

TOTAL NUMBER OF VALUES = 145

ORID-1-A

5572.00 - 5644.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 57. Histogram of Neutron Porosity (5572 - 5644 ft.)



MINIMUM VALUE = 18.620
MAXIMUM VALUE = 37.370
MEAN VALUE = 25.376
VARIANCE = 19.724
DEVIATION = 4.4411
1 INCH = 97.000 VALUES

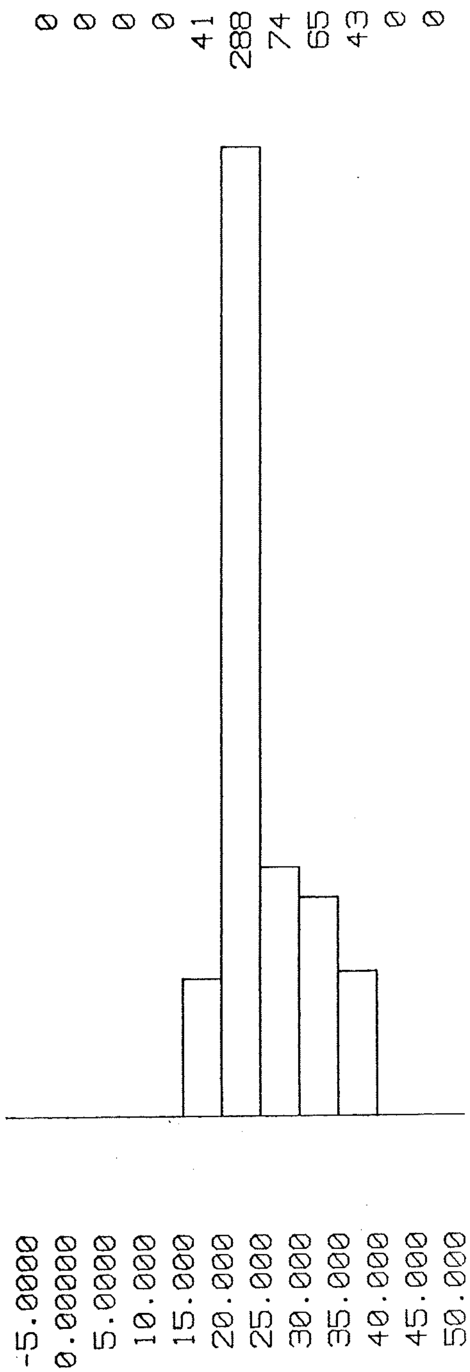
NEUTRON POROSITY
PERCENT

TOTAL NUMBER OF VALUES = 751

ORID-1-A

5651.00 - 6026.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 58. Histogram of Neutron Porosity (5651 - 6026 ft.)



MINIMUM VALUE = 15.320
MAXIMUM VALUE = 38.820
MEAN VALUE = 25.056
VARIANCE = 28.908
DEVIATION = 5.3766
1 INCH = 57.600 VALUES

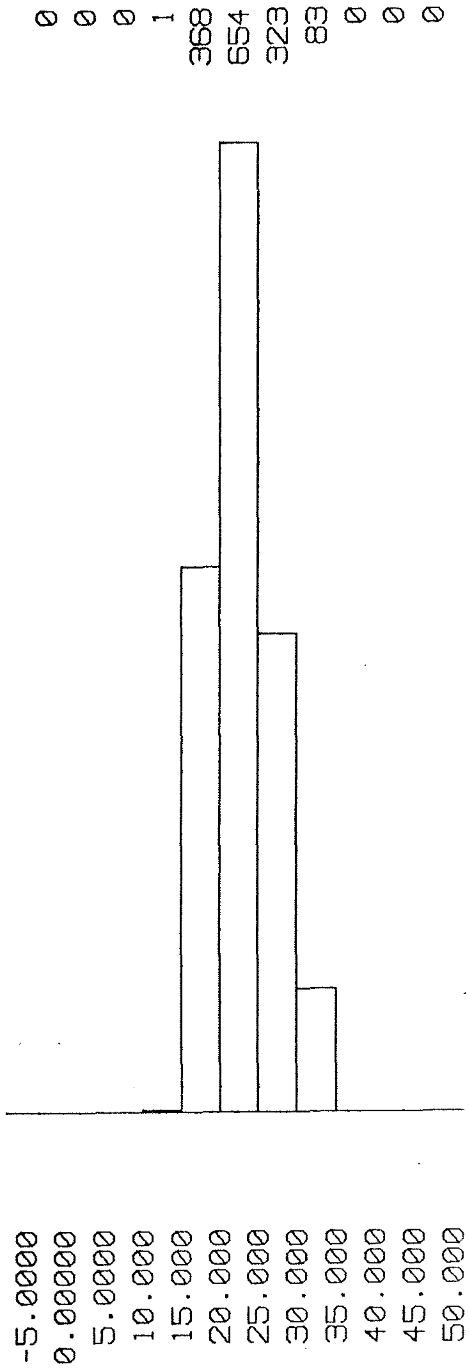
NEUTRON POROSITY
PERCENT

TOTAL NUMBER OF VALUES = 511

ORID-1-A

6031.00 - 6286.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 59. Histogram of Neutron Porosity (6031 - 6286 ft.)



MINIMUM VALUE = 14.914
MAXIMUM VALUE = 33.360
MEAN VALUE = 22.883
VARIANCE = 15.685
DEVIATION = 3.9604
1 INCH = 130.80 VALUES

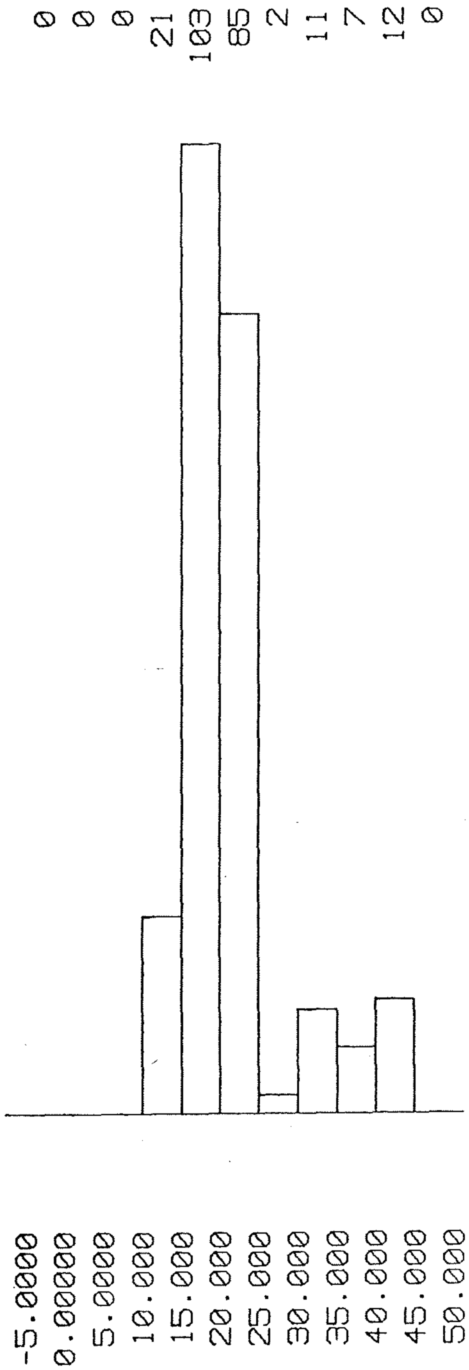
NEUTRON POROSITY
PERCENT

TOTAL NUMBER OF VALUES = 1429

ORID-1-A

6294.00 - 7008.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 60. Histogram of Neutron Porosity (6294 - 7008 ft.)



MINIMUM VALUE = 10.703
MAXIMUM VALUE = 44.819
MEAN VALUE = 21.509
VARIANCE = 49.890
DEVIATION = 7.0633
1 INCH = 20.600 VALUES

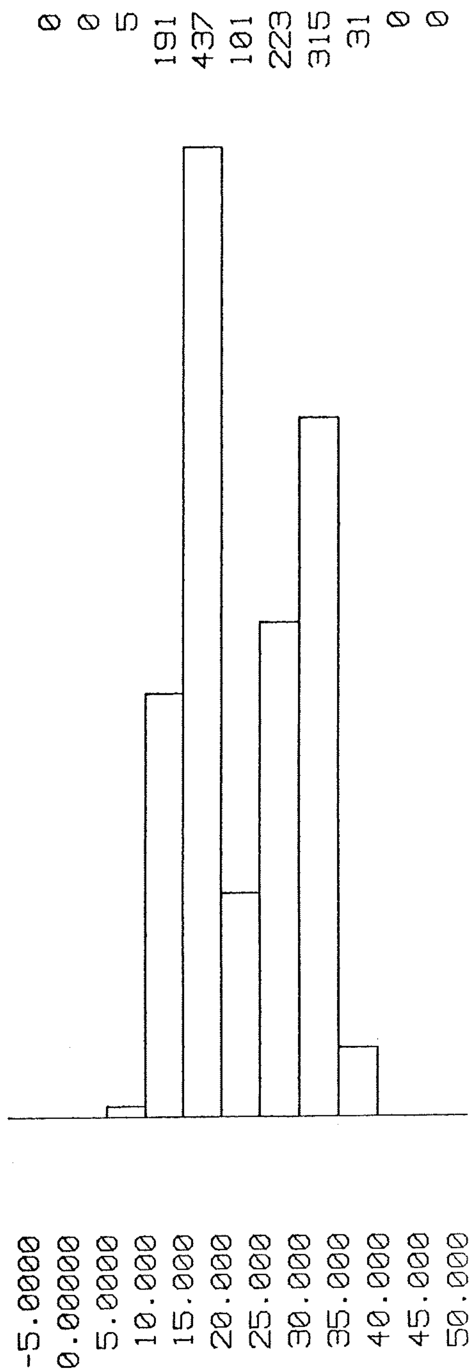
NEUTRON POROSITY
PERCENT

TOTAL NUMBER OF VALUES = 241

ORID-1-A

7015.00 - 7135.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 61. Histogram of Neutron Porosity (7015 - 7135 ft.)



MINIMUM VALUE = 9.0000
MAXIMUM VALUE = 38.695
MEAN VALUE = 23.165
VARIANCE = 56.301
DEVIATION = 7.5034
1 INCH = 87.400 VALUES

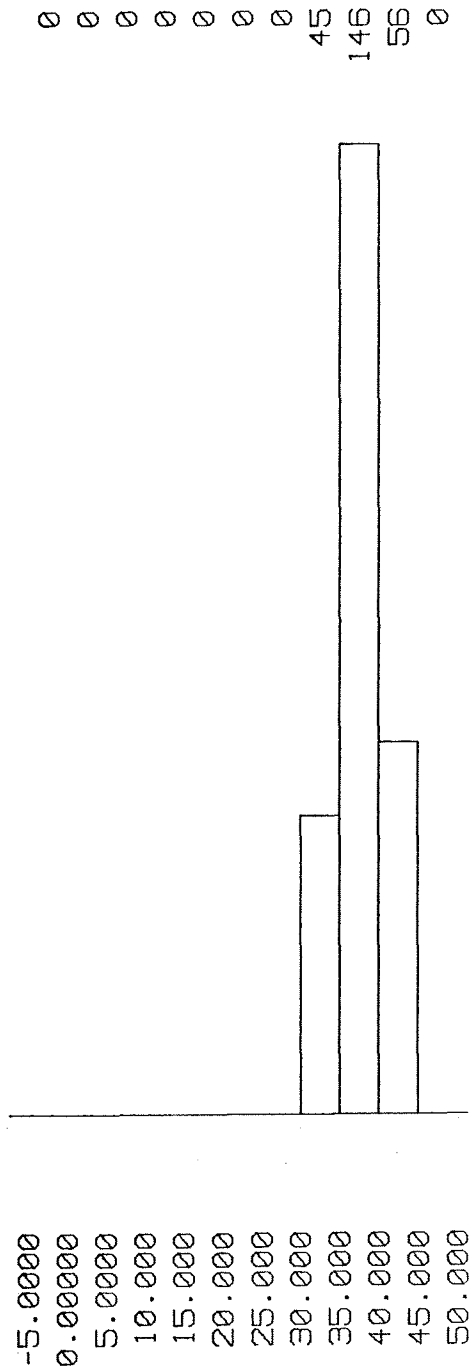
NEUTRON POROSITY
PERCENT

TOTAL NUMBER OF VALUES = 1303

ORID-1-A

7147.00 - 7798.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 62. Histogram of Neutron Porosity (7147 - 7798 ft.)



MINIMUM VALUE = 32.040
MAXIMUM VALUE = 44.154
MEAN VALUE = 37.670
VARIANCE = 7.9700
DEVIATION = 2.8231
1 INCH = 29.200 VALUES

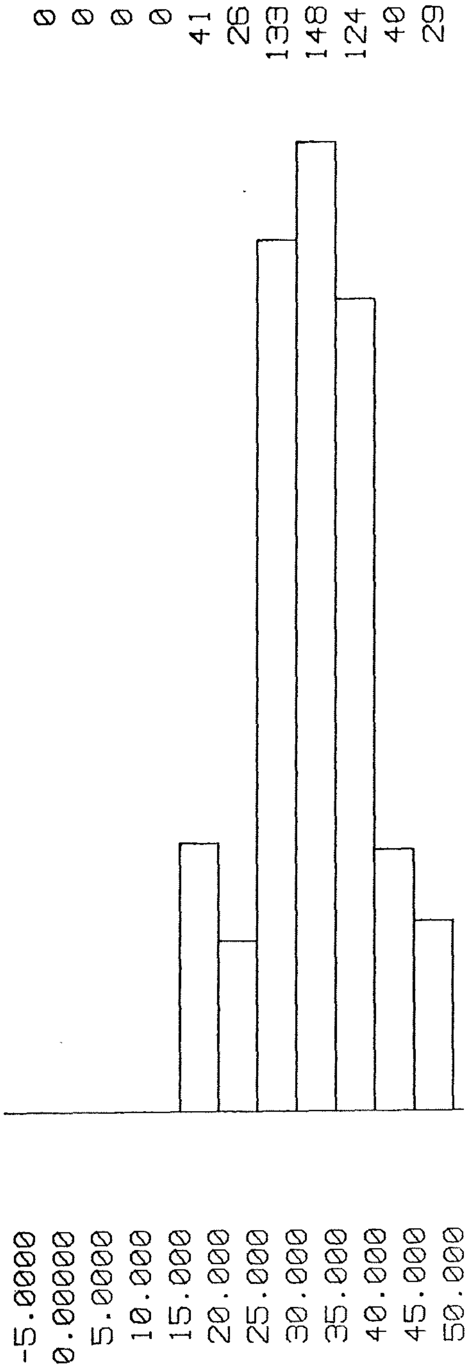
NEUTRON POROSITY
PERCENT

TOTAL NUMBER OF VALUES = 247

ORID-1-A

7803.00 - 7926.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 63. Histogram of Neutron Porosity (7803 - 7926 ft.)



MINIMUM VALUE = 15.812
MAXIMUM VALUE = 45.240
MEAN VALUE = 32.198
VARIANCE = 50.676
DEVIATION = 7.1187
1 INCH = 29.600 VALUES

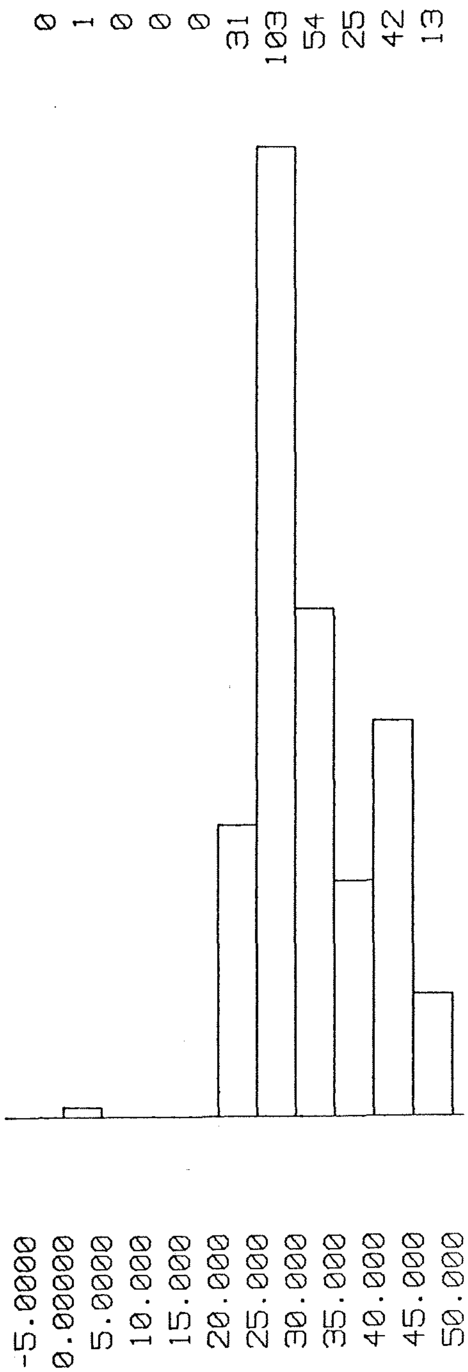
NEUTRON POROSITY
PERCENT

TOTAL NUMBER OF VALUES = 541

ORID-1-A

8134.00 - 8404.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 64. Histogram of Neutron Porosity (8134- 8404 ft.)



MINIMUM VALUE = 0.00000
MAXIMUM VALUE = 45.600
MEAN VALUE = 31.591
VARIANCE = 51.528
DEVIATION = 7.1783
1 INCH = 20.600 VALUES

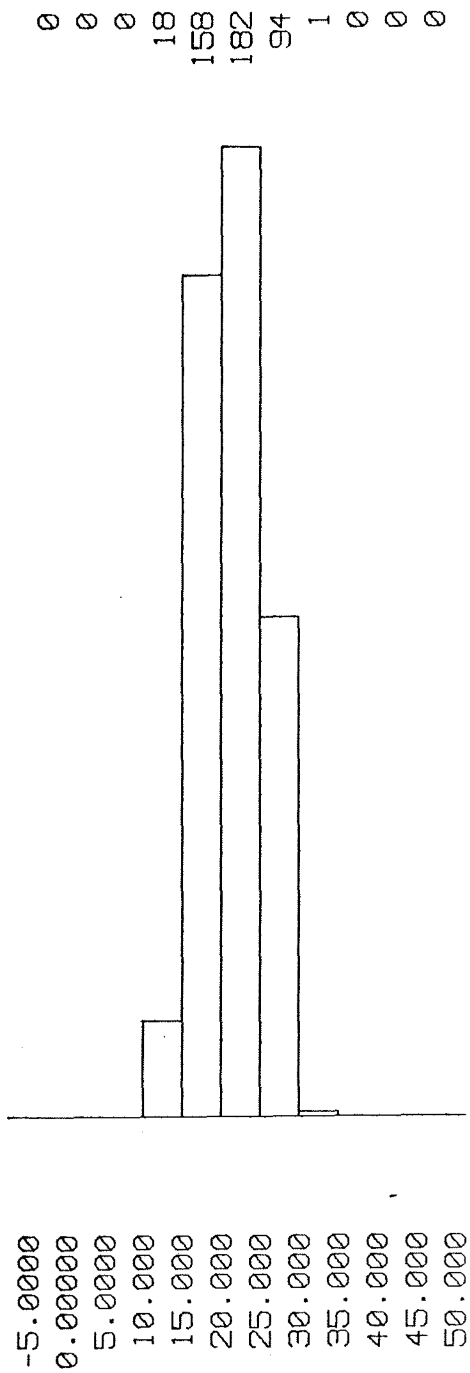
NEUTRON POROSITY
PERCENT

TOTAL NUMBER OF VALUES = 269

ORID-1-A

8466.00 - 8600.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 65. Histogram of Neutron Porosity (8466 - 8600 ft.)



MINIMUM VALUE = 13.220
MAXIMUM VALUE = 30.031
MEAN VALUE = 21.337
VARIANCE = 14.730
DEVIATION = 3.8379
1 INCH = 36.400 VALUES

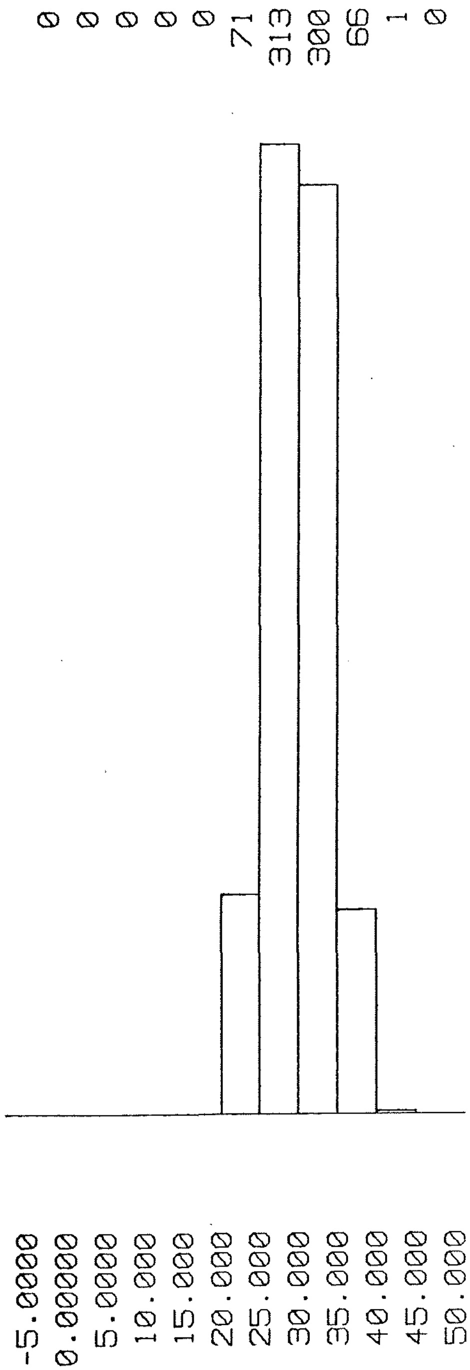
NEUTRON POROSITY
PERCENT

TOTAL NUMBER OF VALUES = 453

ORID-1-A

8600.00 - 8826.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 66. Histogram of Neutron Porosity (8600 - 8826 ft.)



MINIMUM VALUE = 21.450
MAXIMUM VALUE = 40.080
MEAN VALUE = 29.874
VARIANCE = 13.198
DEVIATION = 3.6329
1 INCH = 62.600 VALUES

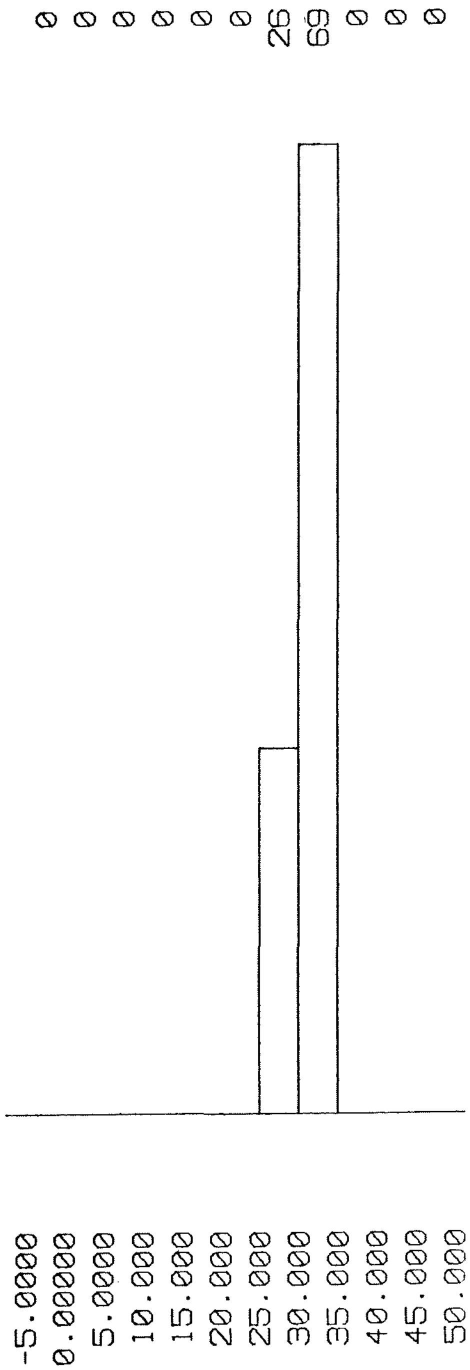
NEUTRON POROSITY
PERCENT

TOTAL NUMBER OF VALUES = 751

ORID-1-A

8863.00 - 9238.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 67. Histogram of Neutron Porosity (8863 - 9238 ft.)



MINIMUM VALUE = 28.800
MAXIMUM VALUE = 33.825
MEAN VALUE = 30.819
VARIANCE = 1.3698
DEVIATION = 1.1704
1 INCH = 13.800 VALUES

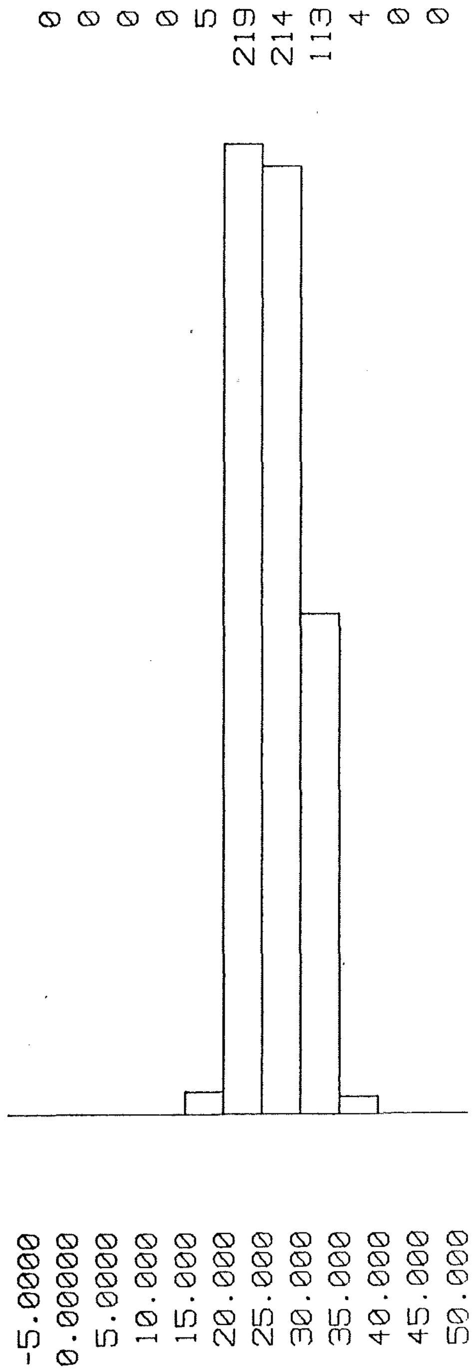
NEUTRON POROSITY
PERCENT

TOTAL NUMBER OF VALUES = 95

ORID-1-A

9253.00 - 9300.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 68. Histogram of Neutron Porosity (9253 - 9300 ft.)



MINIMUM VALUE = 18.892
MAXIMUM VALUE = 35.960
MEAN VALUE = 26.648
VARIANCE = 14.167
DEVIATION = 3.7639
1 INCH = 43.800 VALUES

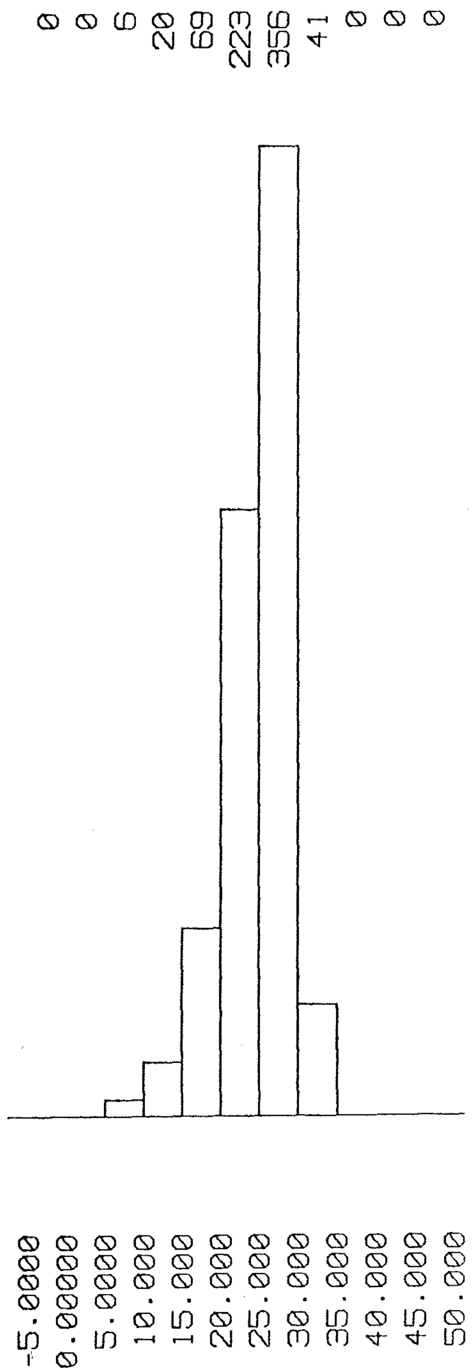
NEUTRON POROSITY
PERCENT

TOTAL NUMBER OF VALUES = 555

ORID-1-A

9300.00 - 9577.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 69. Histogram of Neutron Porosity (9300 - 9577 ft.)



MINIMUM VALUE = 9.0200
MAXIMUM VALUE = 33.668
MEAN VALUE = 24.655
VARIANCE = 18.584
DEVIATION = 4.3110
1 INCH = 71.200 VALUES

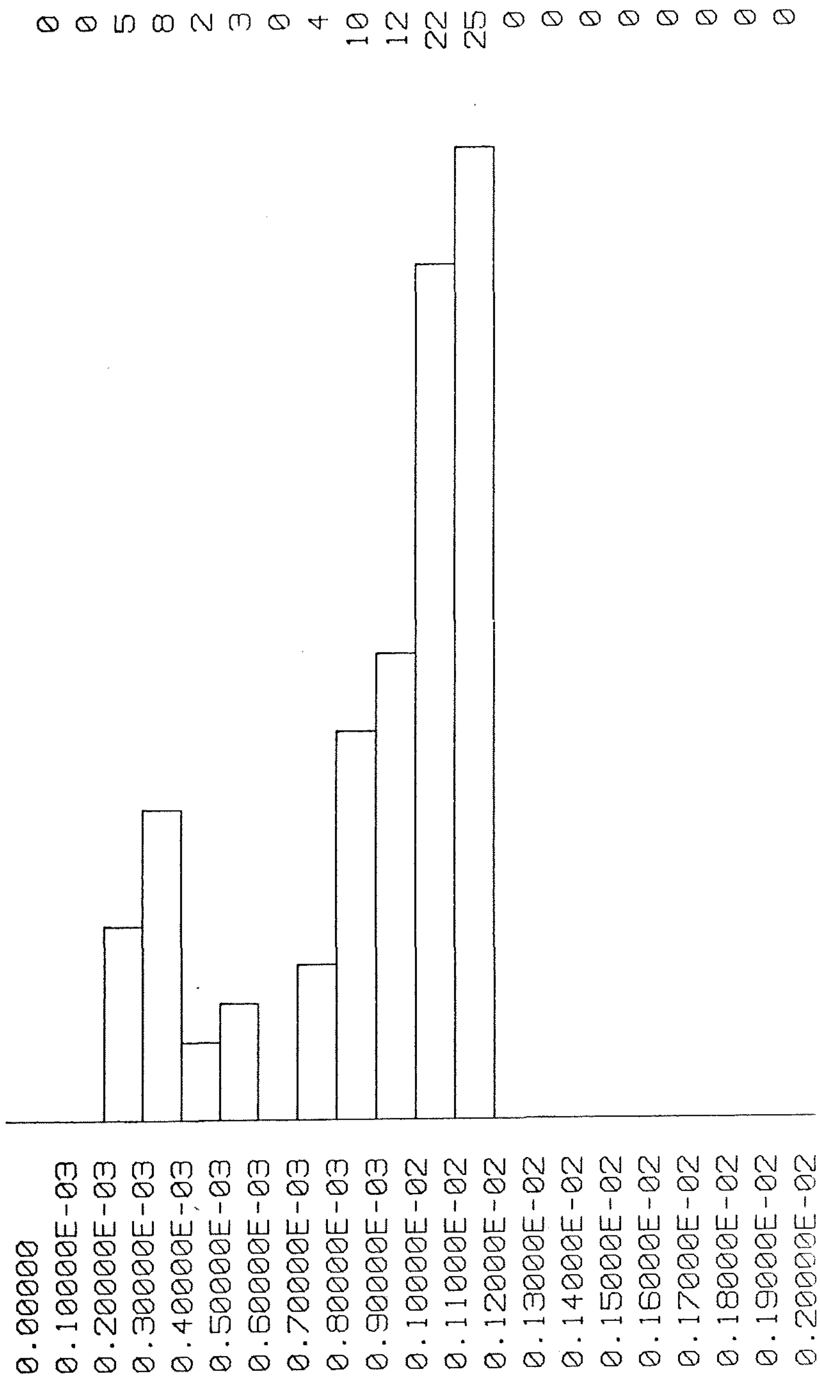
NEUTRON POROSITY
PERCENT

TOTAL NUMBER OF VALUES = 715

ORID-1-A

9581.00 - 9938.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 70. Histogram of Neutron Porosity (9581 - 9938 ft.)



MINIMUM VALUE = 0.24303E-03
MAXIMUM VALUE = 0.11741E-02
MEAN VALUE = 0.88862E-03
VARIANCE = 0.83292E-07
DEVIATION = 0.28860E-03
1 INCH = 5.0000 VALUES

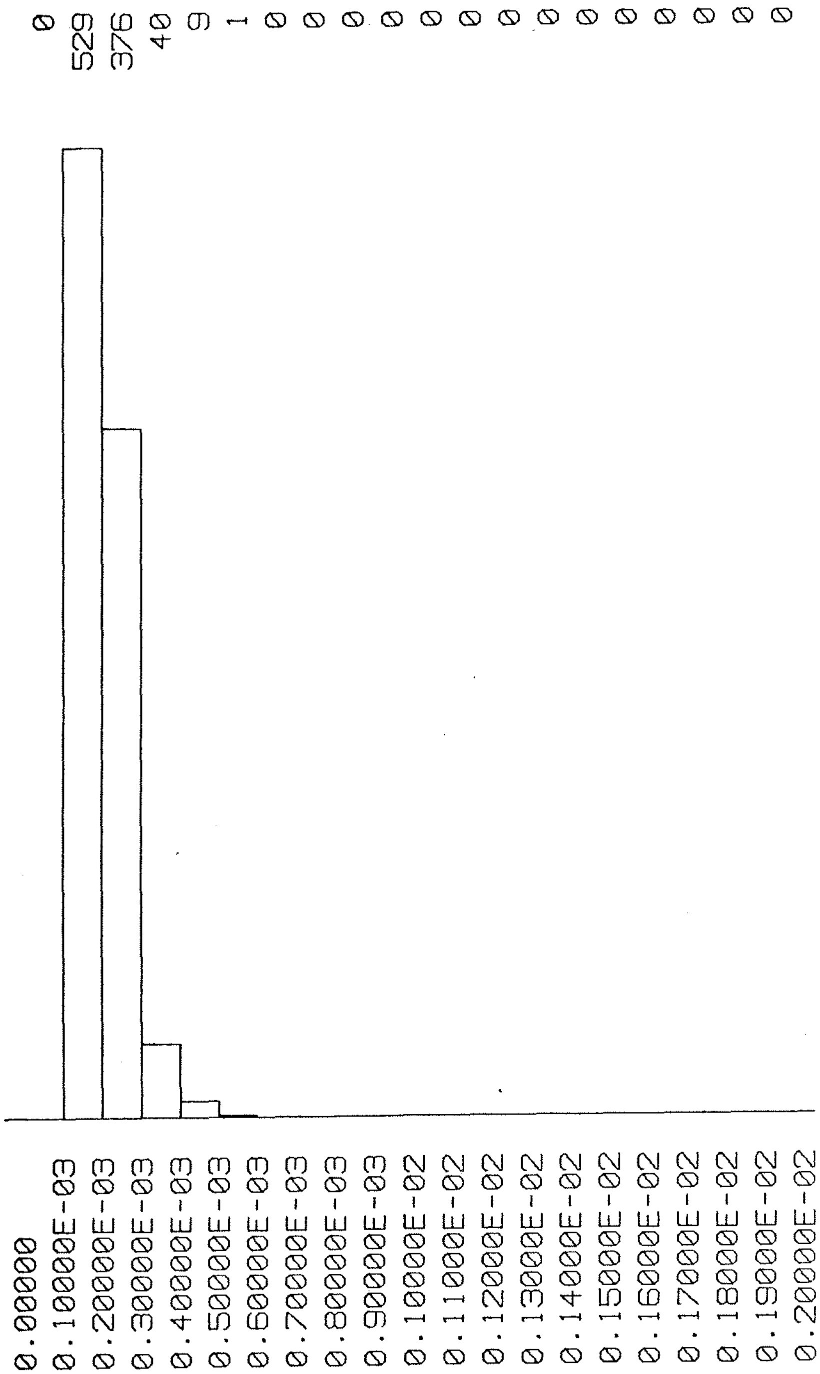
BULK DENSITY / DELTA T**
GRAM-FT2/CC-MICROSEC2

TOTAL NUMBER OF VALUES = 91

ORID-1-A

4571.00 - 4616.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 71. Histogram of Mechanical Strength Index (4571 - 4616 ft.)



MINIMUM VALUE = 0.13423E-03
MAXIMUM VALUE = 0.53095E-03
MEAN VALUE = 0.21013E-03
VARIANCE = 0.21982E-08
DEVIATION = 0.46885E-04
1 INCH = 105.80 VALUES

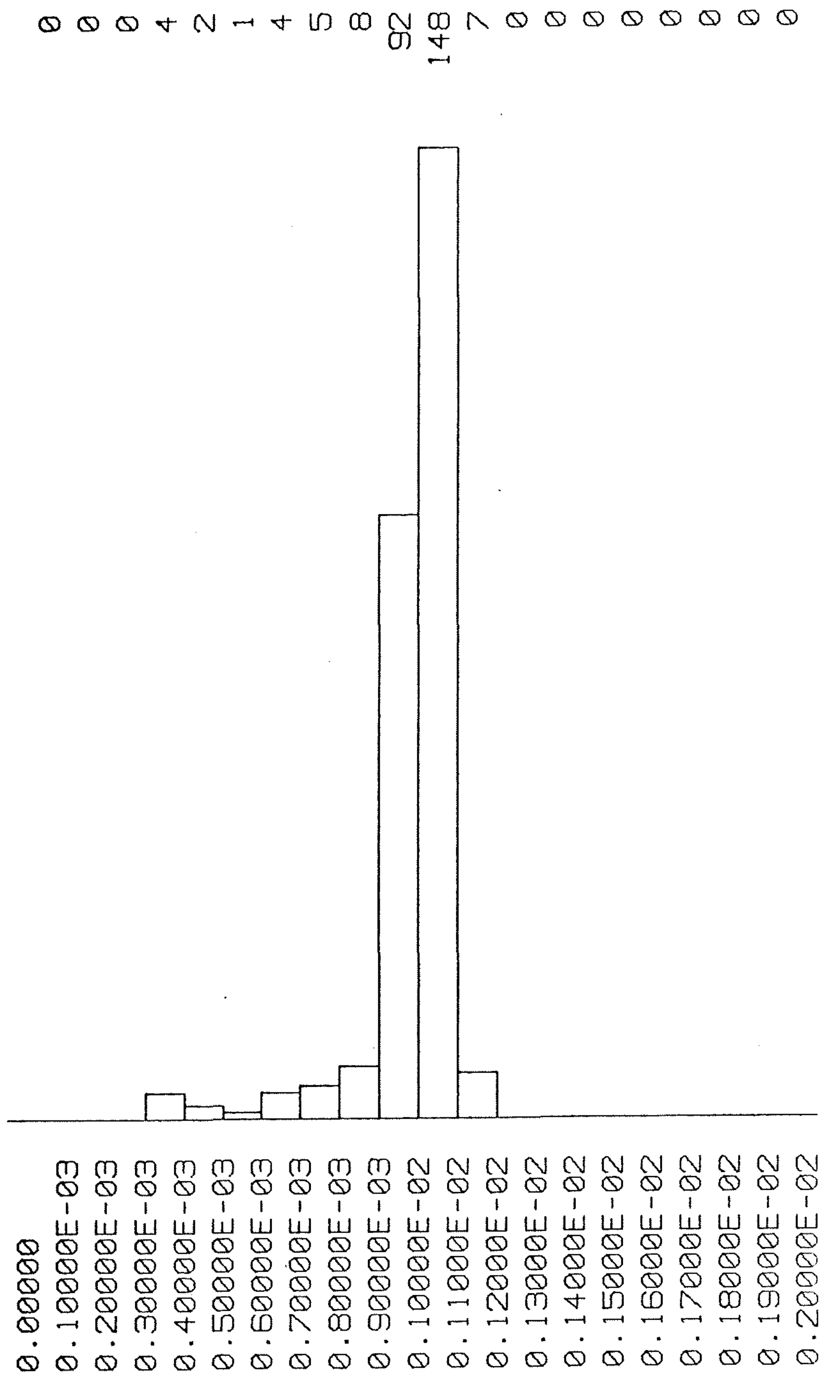
BULK DENSITY / DELTA T**
GRAM-FT2/CC-MICROSEC2

TOTAL NUMBER OF VALUES = 955

ORID-1-A

4660.00 - 5137.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 72. Histogram of Mechanical Strength Index (4660 - 5137 ft.)



MINIMUM VALUE = 0.33458E-03
MAXIMUM VALUE = 0.11124E-02
MEAN VALUE = 0.98110E-03
VARIANCE = 0.14420E-07
DEVIATION = 0.12009E-03
1 INCH = 29.600 VALUES

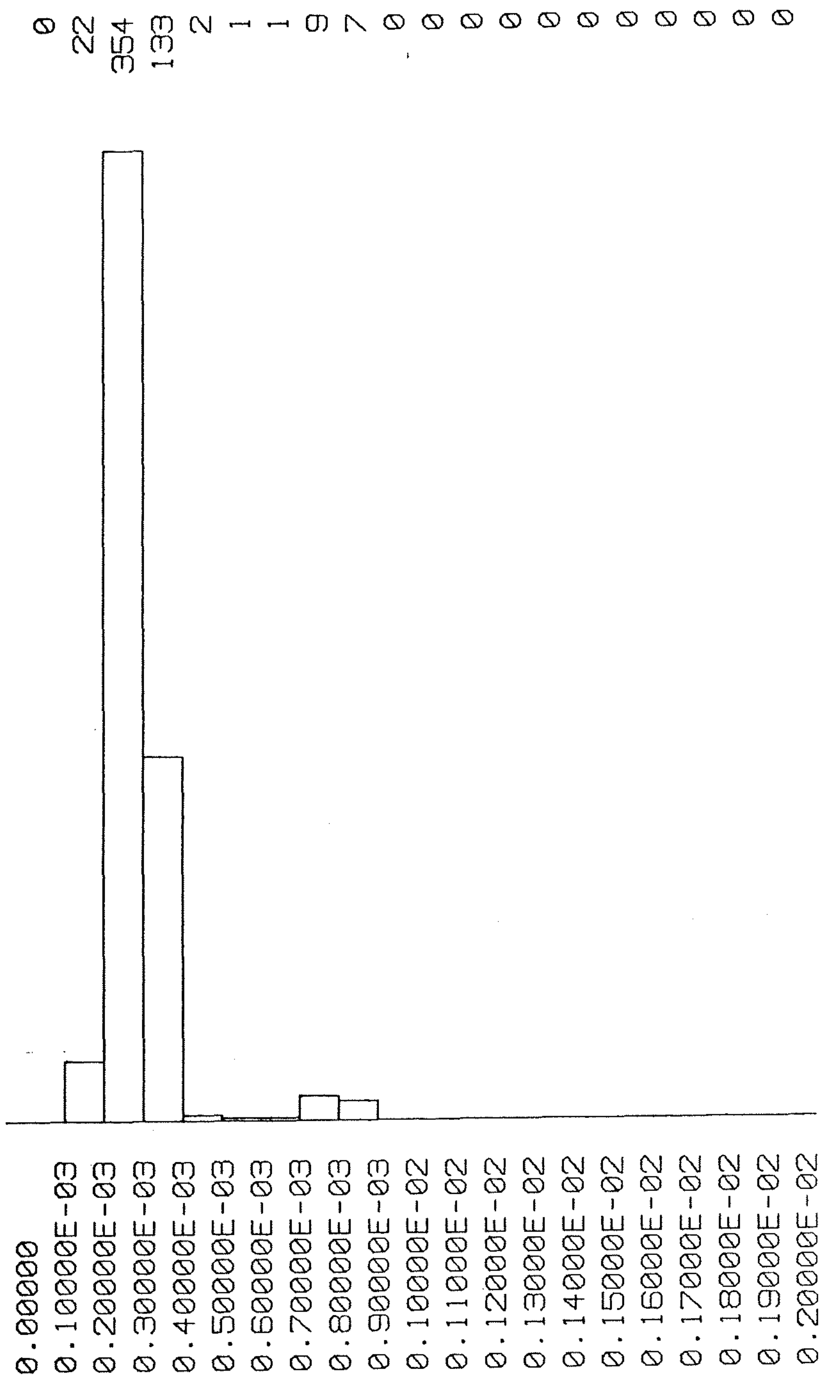
BULK DENSITY / DELTA T**
GRAM-FT2/CC-MICROSEC2

TOTAL NUMBER OF VALUES = 271

ORID-1-A

5152.00 - 5287.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 73. Histogram of Mechanical Strength Index (5152 - 5287 ft.)



MINIMUM VALUE = 0.19198E-03
MAXIMUM VALUE = 0.89863E-03
MEAN VALUE = 0.28915E-03
VARIANCE = 0.11158E-07
DEVIATION = 0.10563E-03
1 INCH = 70.800 VALUES

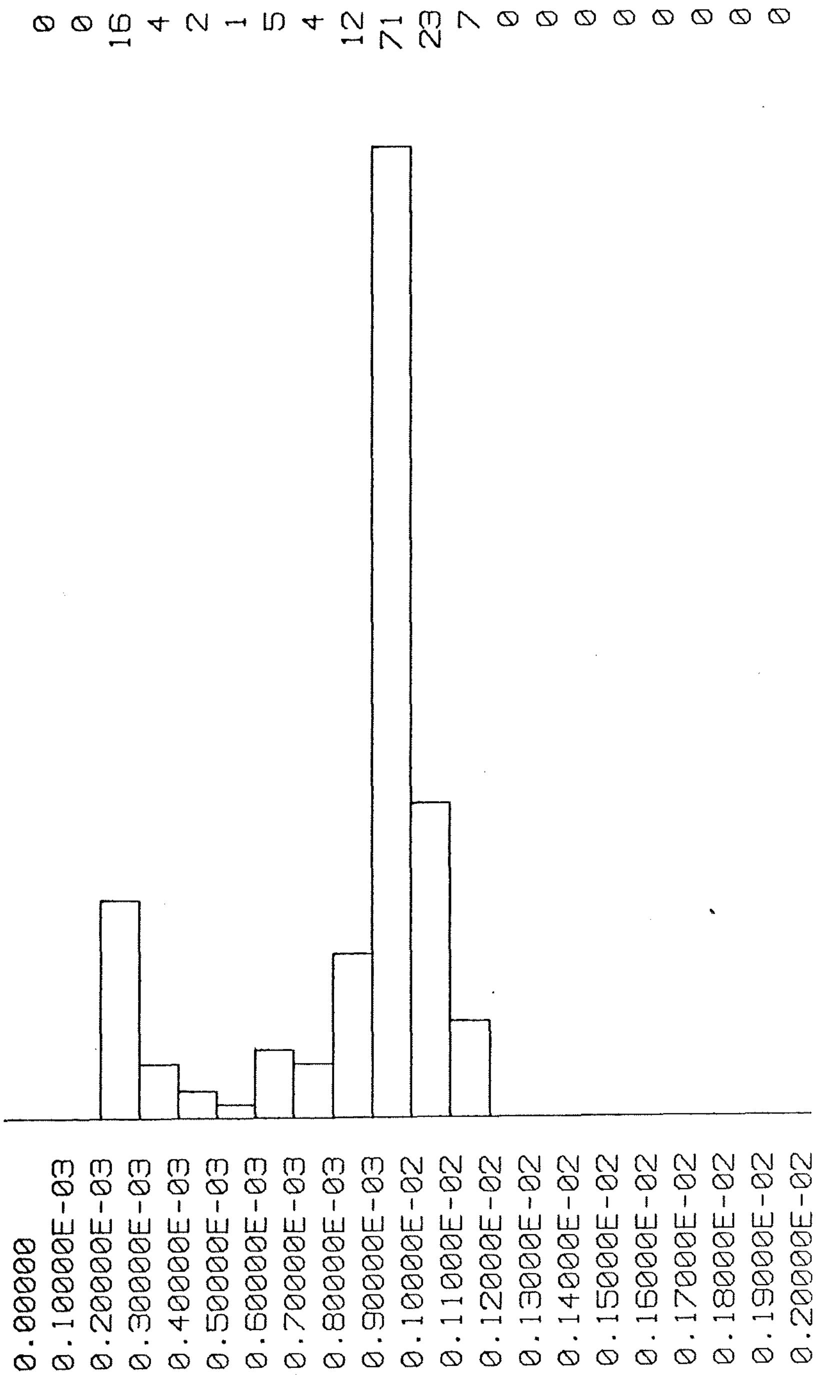
BULK DENSITY / DELTA T**
GRAM-FT2/CC-MICROSEC2

TOTAL NUMBER OF VALUES = 529

ORID-1-A

5296.00 - 5560.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 74. Histogram of Mechanical Strength Index (5296 - 5560 ft.)



MINIMUM VALUE = 0.25228E-03
MAXIMUM VALUE = 0.11599E-02
MEAN VALUE = 0.84940E-03
VARIANCE = 0.62891E-07
DEVIATION = 0.25078E-03
1 INCH = 14.200 VALUES

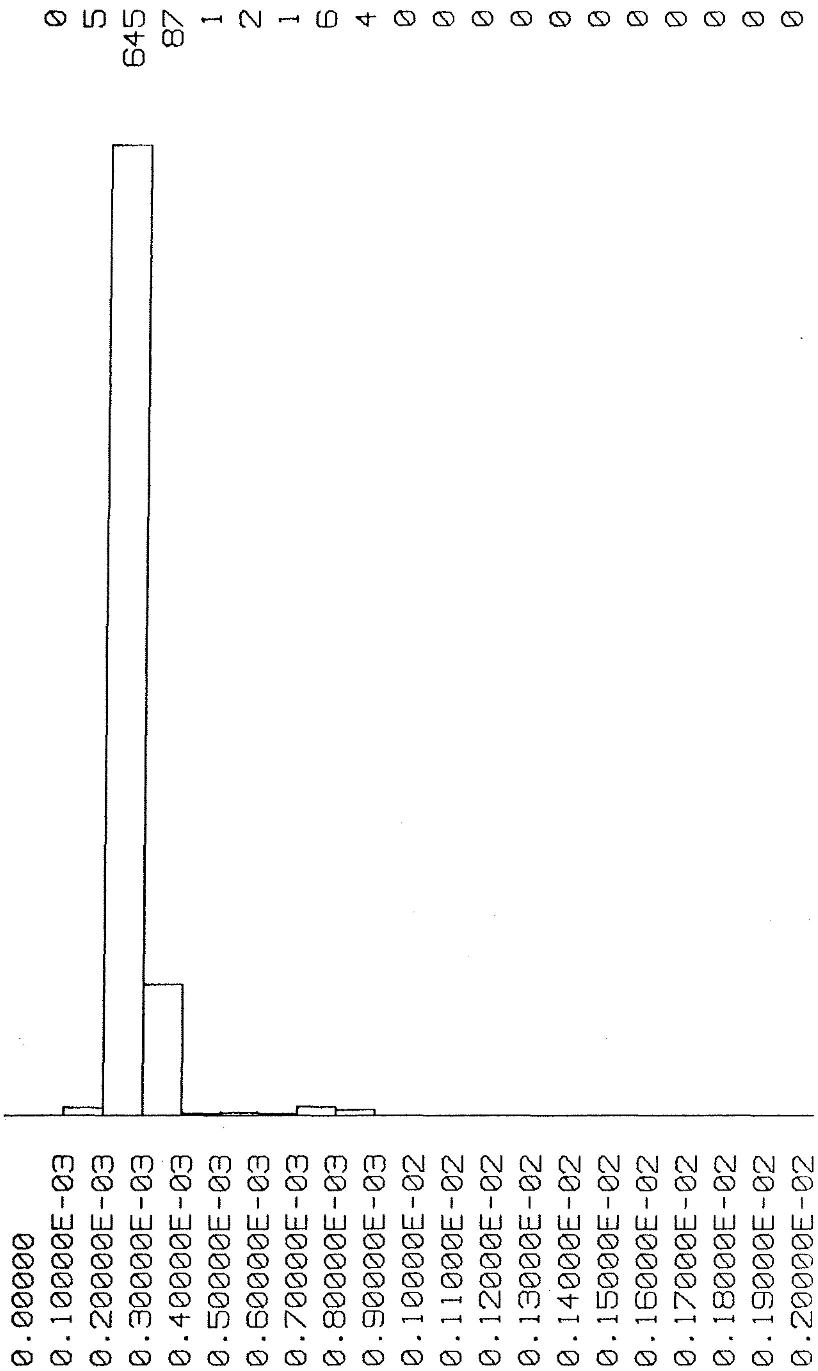
BULK DENSITY / DELTA T**
GRAM-FT2/CC-MICROSEC2

TOTAL NUMBER OF VALUES = 145

ORID-1-A

5572.00 - 5644.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 75 - Histogram of Mechanical Strength Index (5572 - 5644 ft.)



MINIMUM VALUE = 0.17911E-03
MAXIMUM VALUE = 0.84657E-03
MEAN VALUE = 0.27418E-03
VARIANCE = 0.48099E-08
DEVIATION = 0.69353E-04

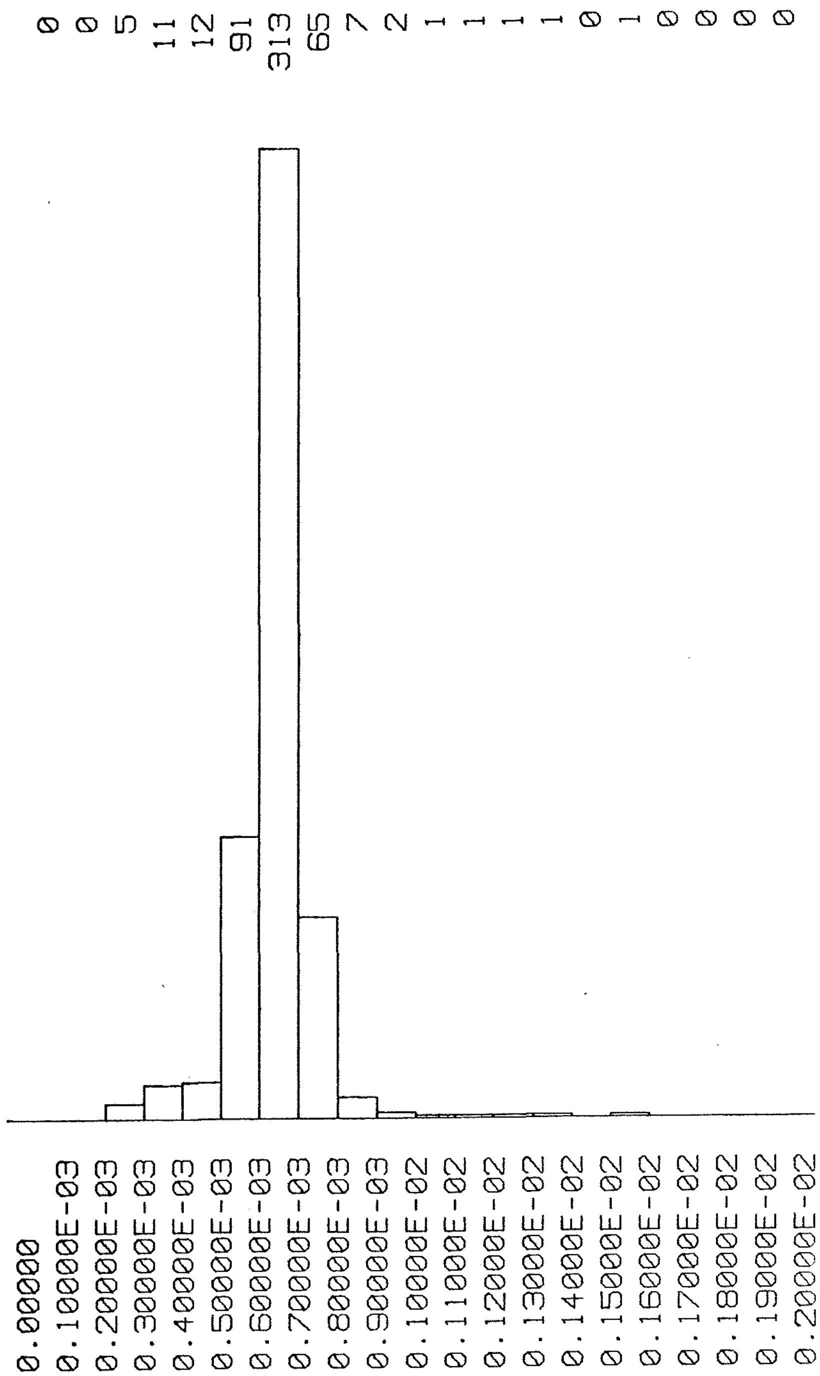
BULK DENSITY / DELTA T**
GRAM-FT2/CC-MICROSEC2

1 INCH = 129.00 VALUES TOTAL NUMBER OF VALUES = 751

ORID-1-A

5651.00 - 6026.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 76. Histogram of Mechanical Strength Index (5651 - 6026 ft.)



MINIMUM VALUE = 0.27061E-03
MAXIMUM VALUE = 0.15879E-02
MEAN VALUE = 0.63969E-03
VARIANCE = 0.12177E-07
DEVIATION = 0.11035E-03
1 INCH = 62.600 VALUES

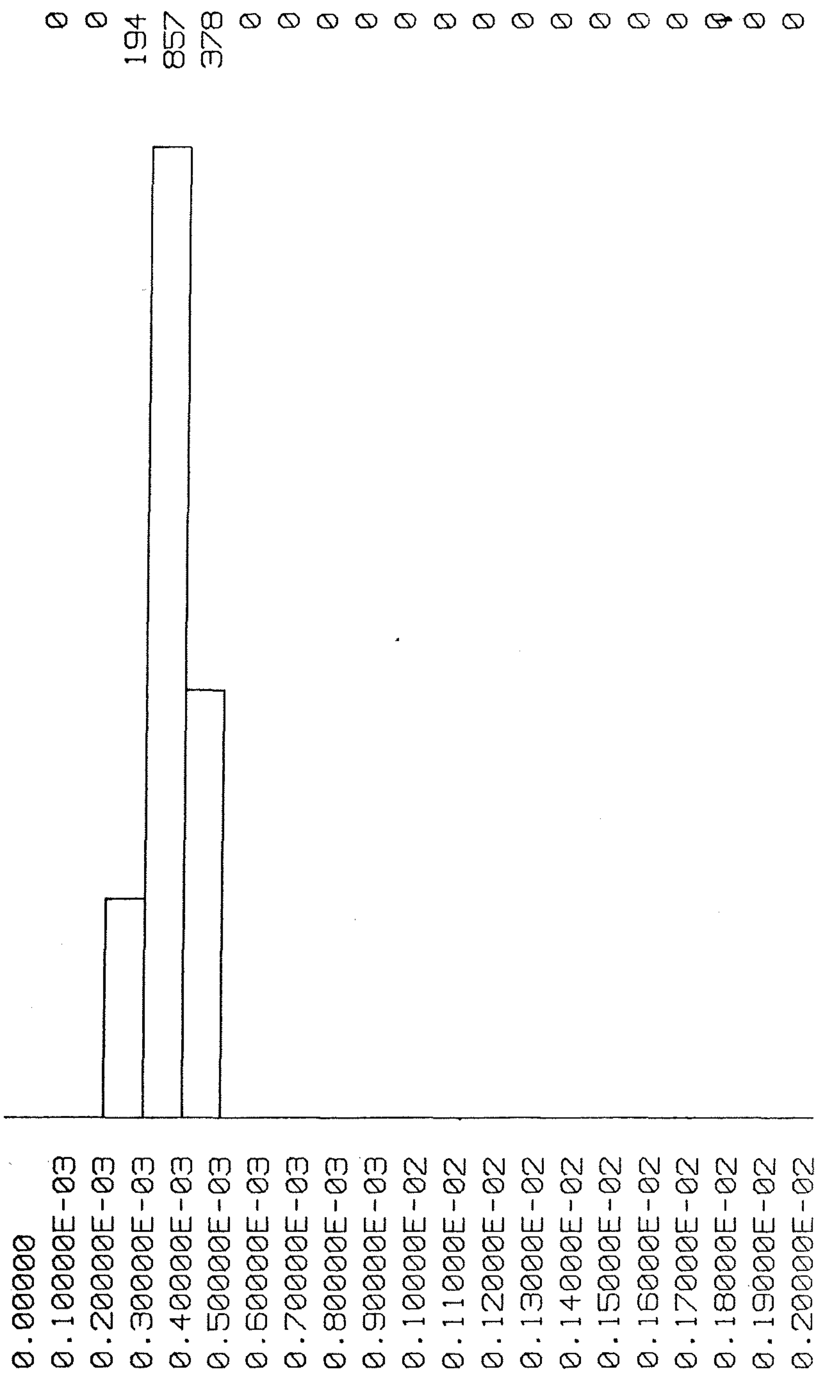
BULK DENSITY / DELTA T**
GRAM-FT2/CC-MICROSEC2

TOTAL NUMBER OF VALUES = 511

ORID-1-A

6031.00 - 6286.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 77. Histogram of Mechanical Strength Index (6031 - 6286 ft.)

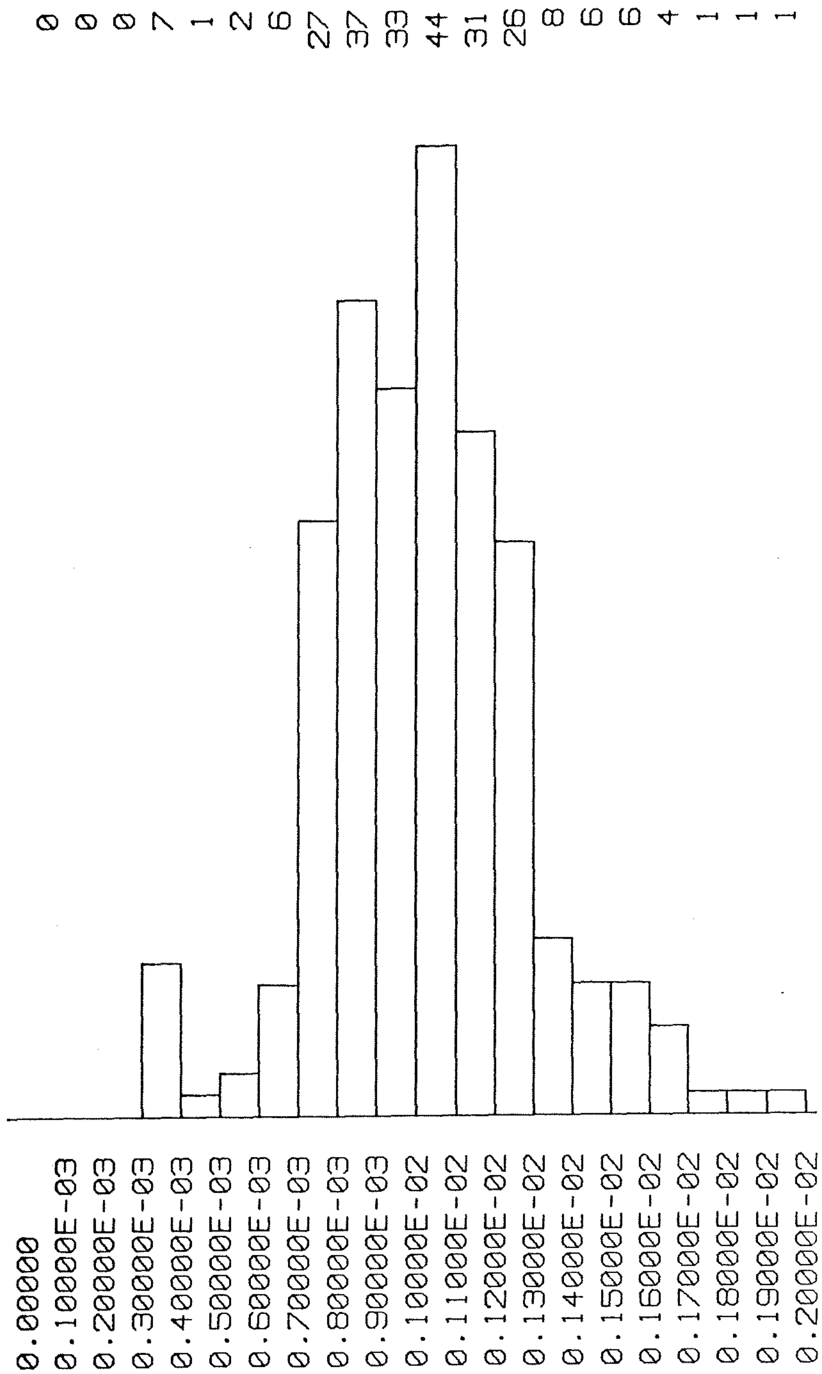


MINIMUM VALUE = 0.26027E-03
MAXIMUM VALUE = 0.49683E-03
MEAN VALUE = 0.36139E-03 BULK DENSITY / DELTA T**
VARIANCE = 0.28287E-08 GRAM-FT2/CC-MICROSEC2
DEVIATION = 0.53186E-04
1 INCH = 171.40 VALUES TOTAL NUMBER OF VALUES = 1429

ORID-1-A

6294.00 - 7008.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 78. Histogram of Mechanical Strength Index (6294 - 7008 ft.)



MINIMUM VALUE = 0.33333E-03
MAXIMUM VALUE = 0.19379E-02
MEAN VALUE = 0.10192E-02
VARIANCE = 0.69381E-07
DEVIATION = 0.26340E-03
1 INCH = 8.8000 VALUES

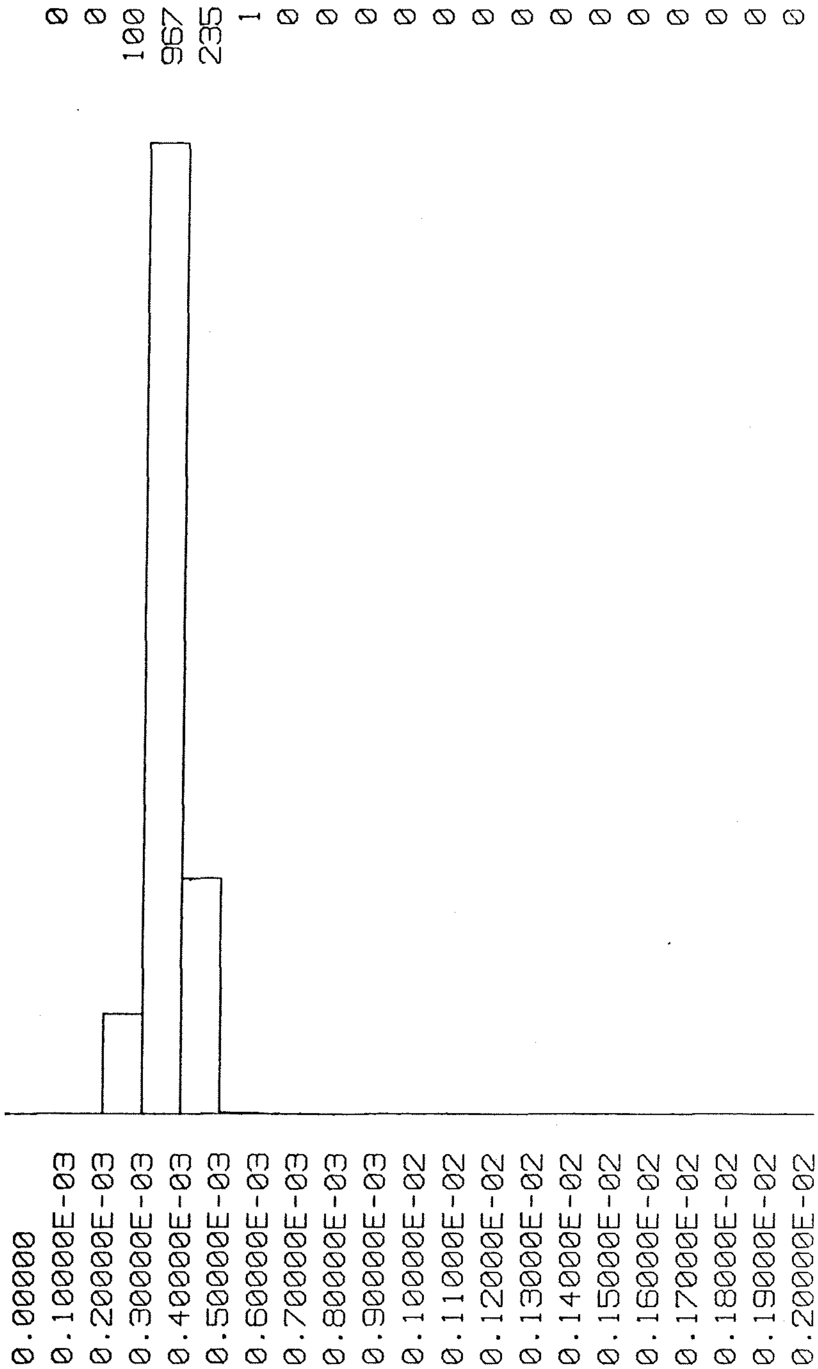
BULK DENSITY / DELTA T**
GRAM-FT2/CC-MICROSEC2

TOTAL NUMBER OF VALUES = 241

ORID-1-A

7015.00 - 7135.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 79. Histogram of Mechanical Strength Index (7015 - 7135 ft.)



MINIMUM VALUE = 0.23576E-03
MAXIMUM VALUE = 0.53414E-03
MEAN VALUE = 0.35115E-03
VARIANCE = 0.20104E-08
DEVIATION = 0.44838E-04
1 INCH = 193.40 VALUES

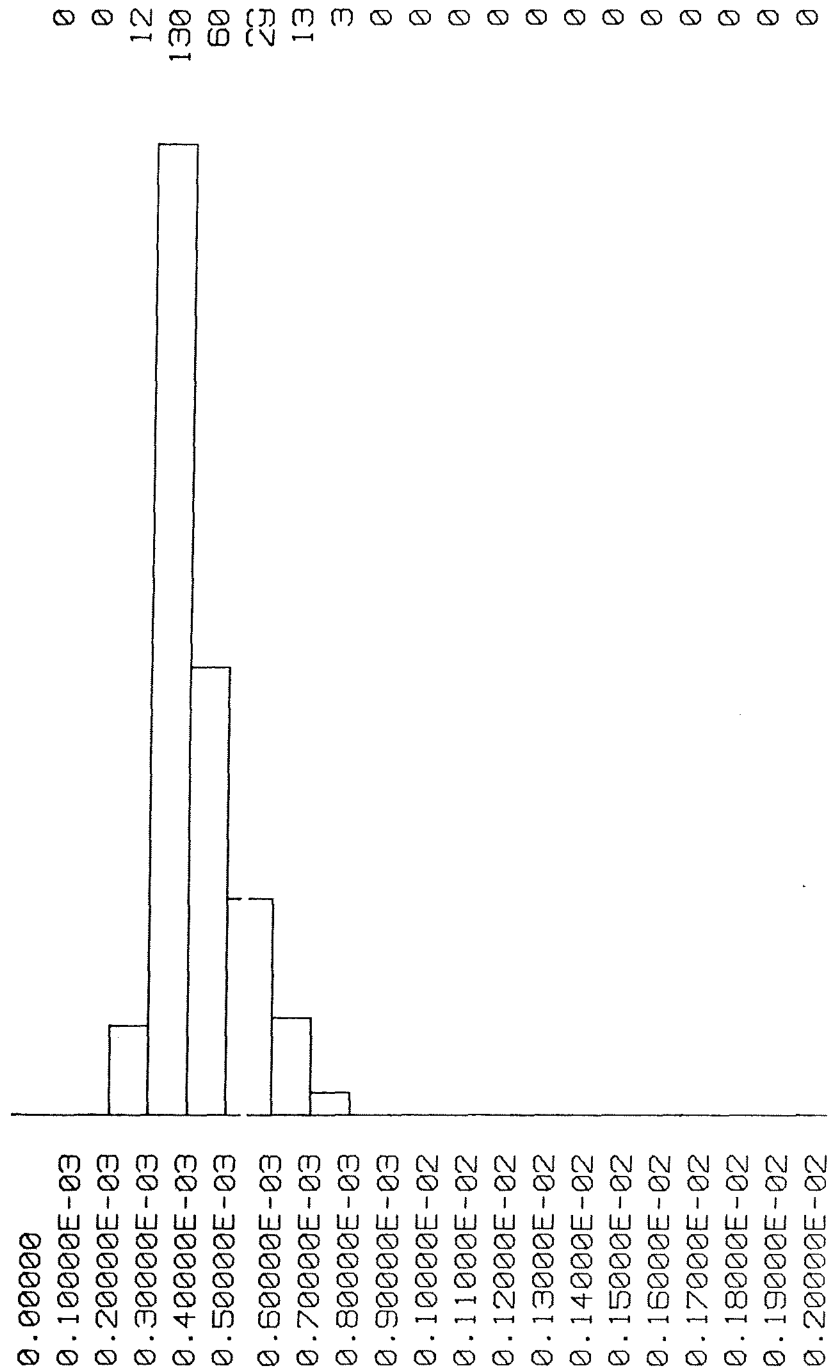
BULK DENSITY / DELTA T**
GRAM-FT2/CC-MICROSEC2

TOTAL NUMBER OF VALUES = 1303

ORID-1-A

7147.00 - 7798.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 80. Histogram of Mechanical Strength Index (7147 - 7798 ft.)



MINIMUM VALUE = 0.24812E-03
MAXIMUM VALUE = 0.77723E-03
MEAN VALUE = 0.41303E-03
VARIANCE = 0.91236E-08
DEVIATION = 0.95518E-04
1 INCH = 2[illegible].000 VALUES

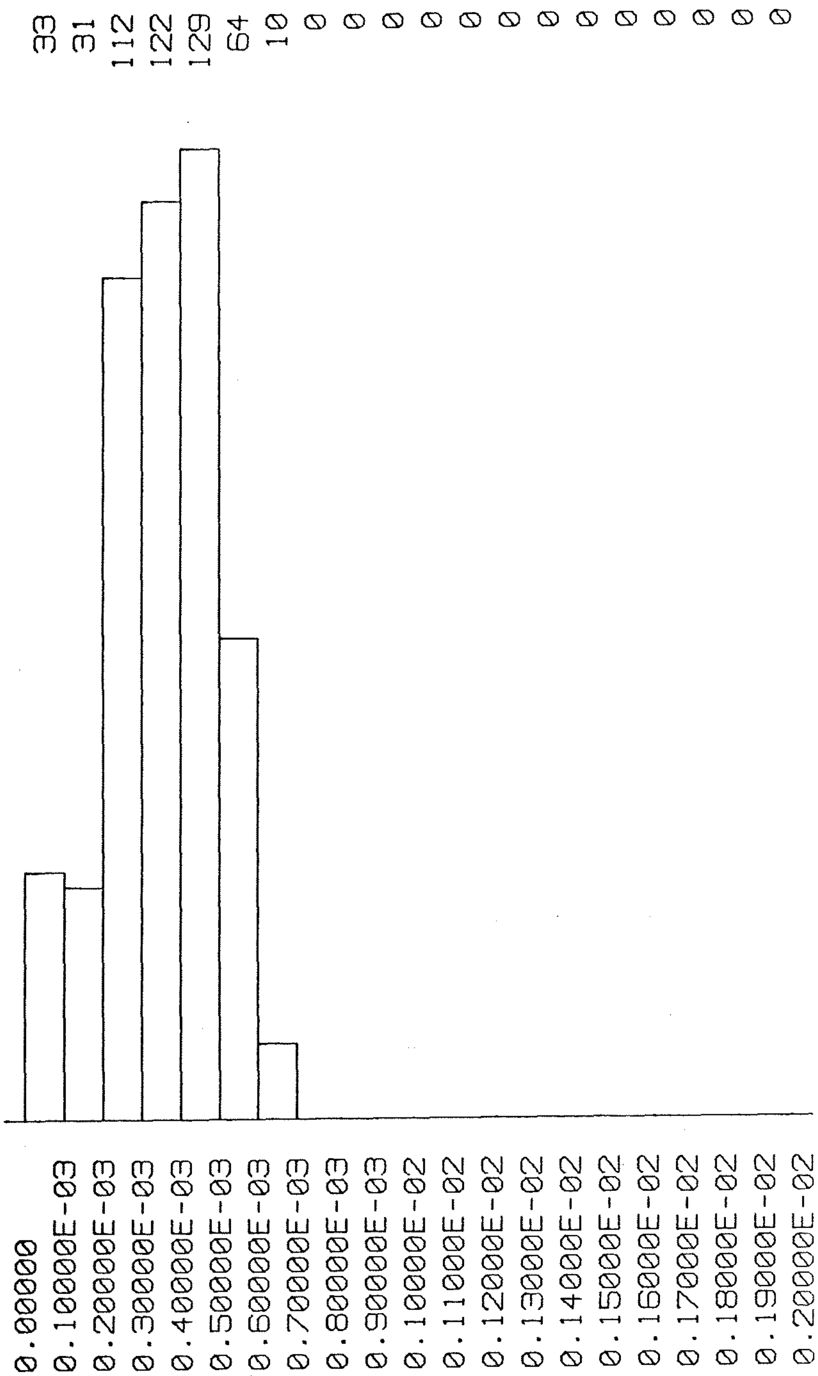
BULK DENSITY / DELTA T**
GRAM-FT2/CC-MICROSEC2

TOTAL NUMBER OF VALUES = 247

ORID-1-1A

7803.00 - 7926.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 81. Histogram of Mechanical Strength Index (7803 - 7926 ft.)



MINIMUM VALUE = 0.27349E-04
MAXIMUM VALUE = 0.63363E-03
MEAN VALUE = 0.35341E-03
VARIANCE = 0.19995E-07
DEVIATION = 0.14140E-03
1 INCH = 25.800 VALUES

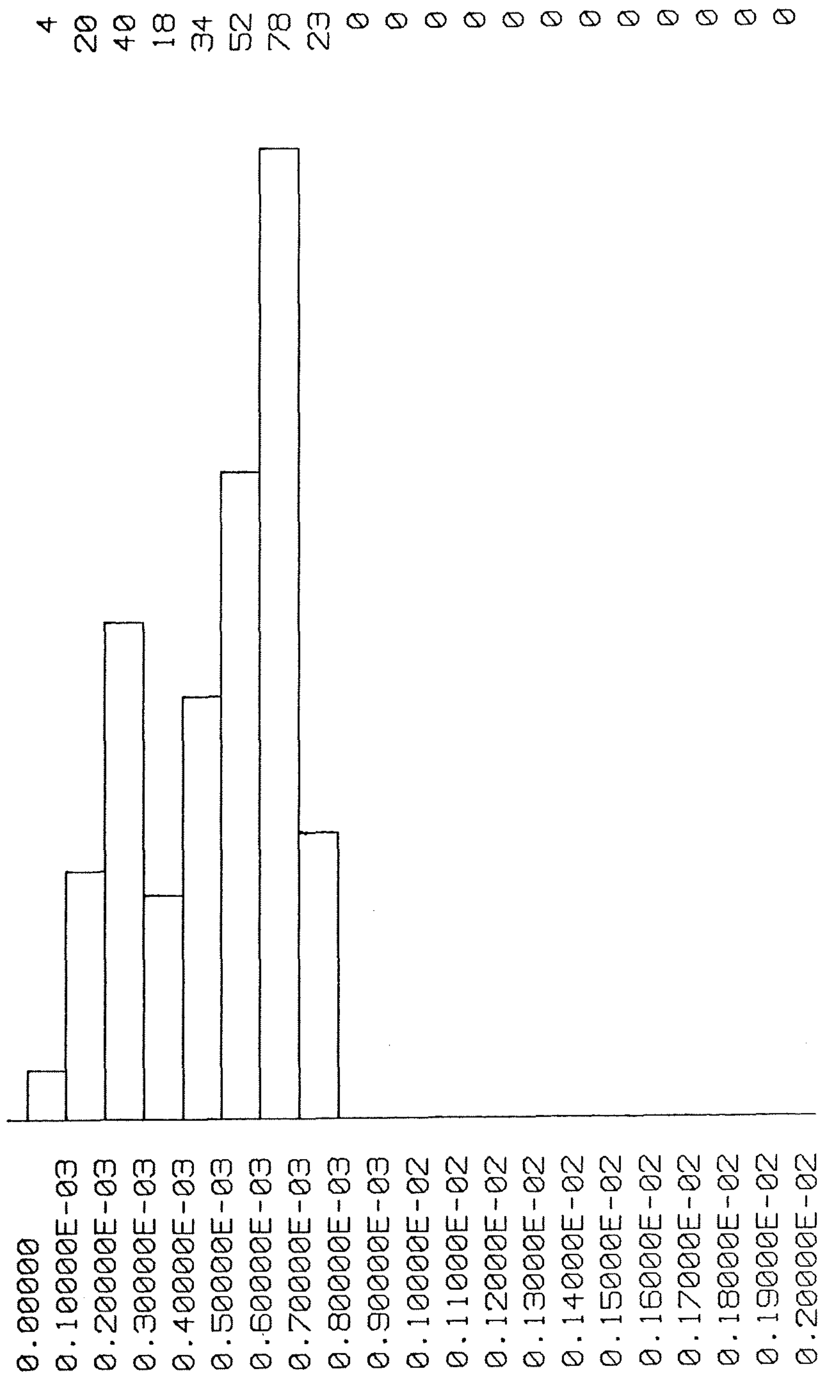
BULK DENSITY / DELTA T**
GRAM-FT2/CC-MICROSEC2

TOTAL NUMBER OF VALUES = 501

ORID-1-A

8154.00 - 8404.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 82. Histogram of Mechanical Strength Index (8154 - 8404 ft.)



MINIMUM VALUE = 0.89934E-04
MAXIMUM VALUE = 0.79968E-03
MEAN VALUE = 0.48737E-03
VARIANCE = 0.34421E-07
DEVIATION = 0.18553E-03
1 INCH = 15.600 VALUES

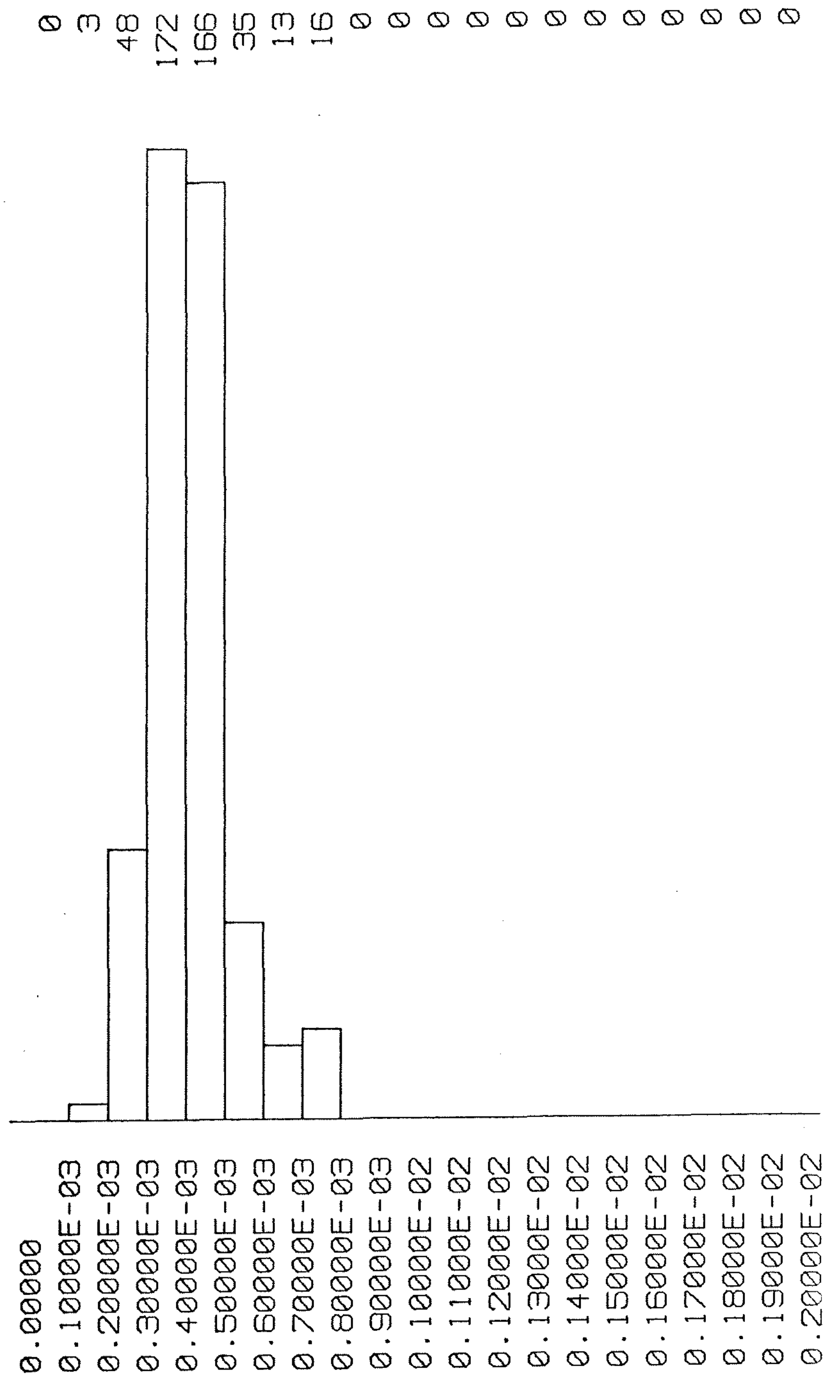
BULK DENSITY / DELTA T**
GRAM-FT2/CC-MICROSEC2

TOTAL NUMBER OF VALUES = 269

ORID-1-A

8466.00 - 8600.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 83. Histogram of Mechanical Strength Index (8466 - 8600 ft.)



MINIMUM VALUE = 0.17626E-03
MAXIMUM VALUE = 0.76557E-03
MEAN VALUE = 0.41043E-03
VARIANCE = 0.11080E-07
DEVIATION = 0.10526E-03
1 INCH = 34.400 VALUES

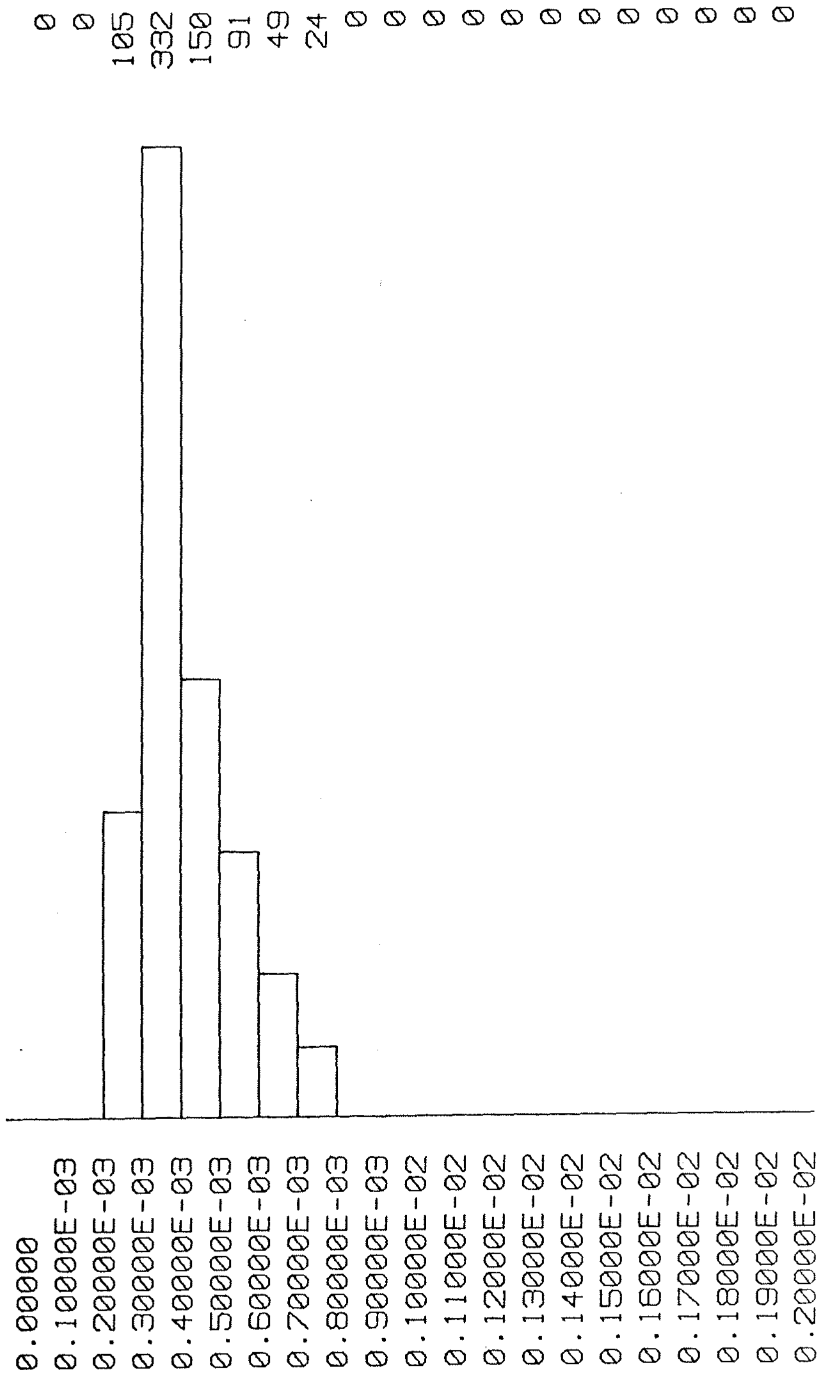
BULK DENSITY / DELTA T**
GRAM-FT2/CC-MICROSEC2

TOTAL NUMBER OF VALUES = 453

ORID-1-A

8600.00 - 8826.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 84. Histogram of Mechanical Strength Index (8600 - 8826 ft.)



MINIMUM VALUE = 0.22200E-03
MAXIMUM VALUE = 0.76185E-03
MEAN VALUE = 0.41284E-03
VARIANCE = 0.14787E-07
DEVIATION = 0.12160E-03
1 INCH = 66.400 VALUES

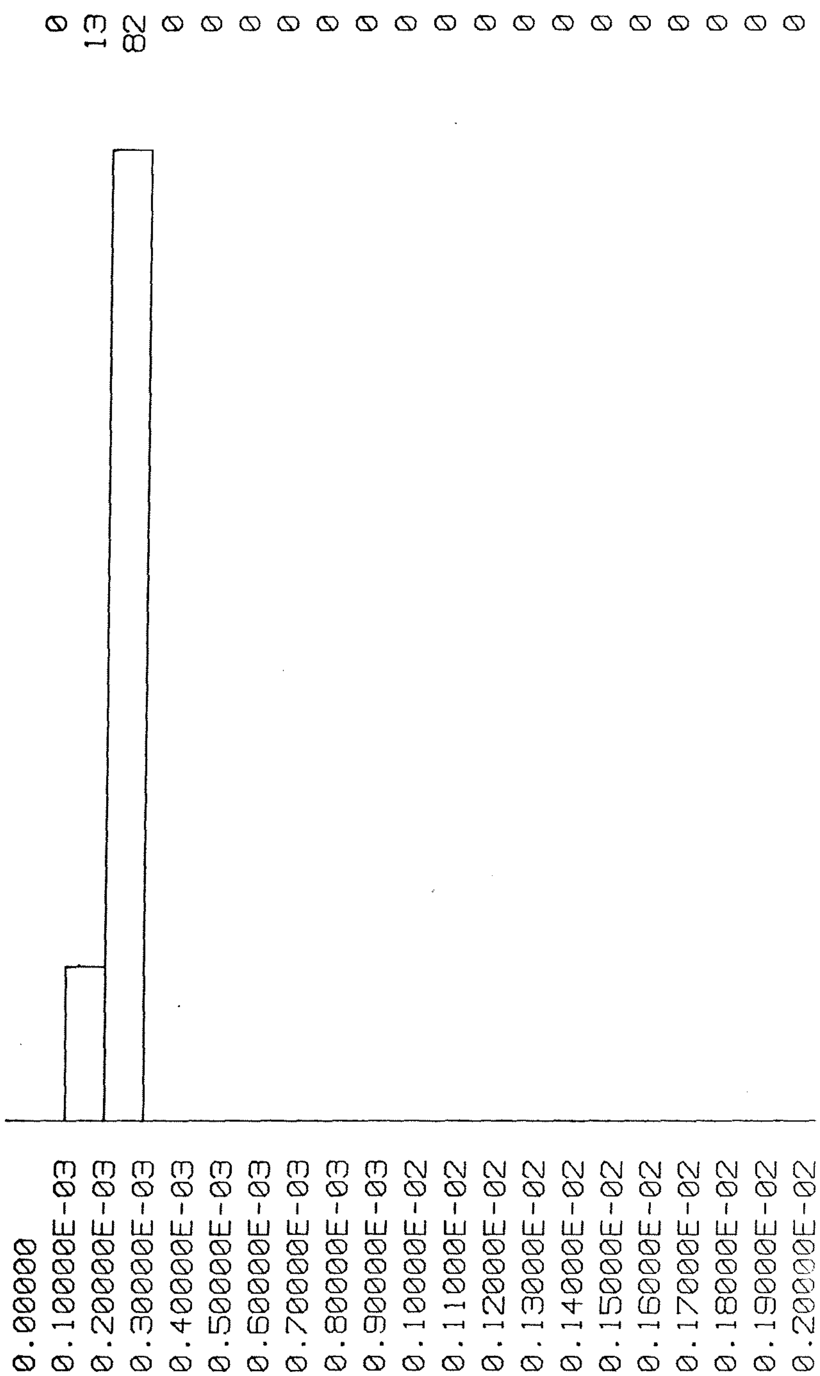
BULK DENSITY / DELTA T**
GRAM-FT2/CC-MICROSEC2

TOTAL NUMBER OF VALUES = 751

ORID-1-A

8863.00 - 9238.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 85. Histogram of Mechanical Strength Index (8863 - 9238 ft.)

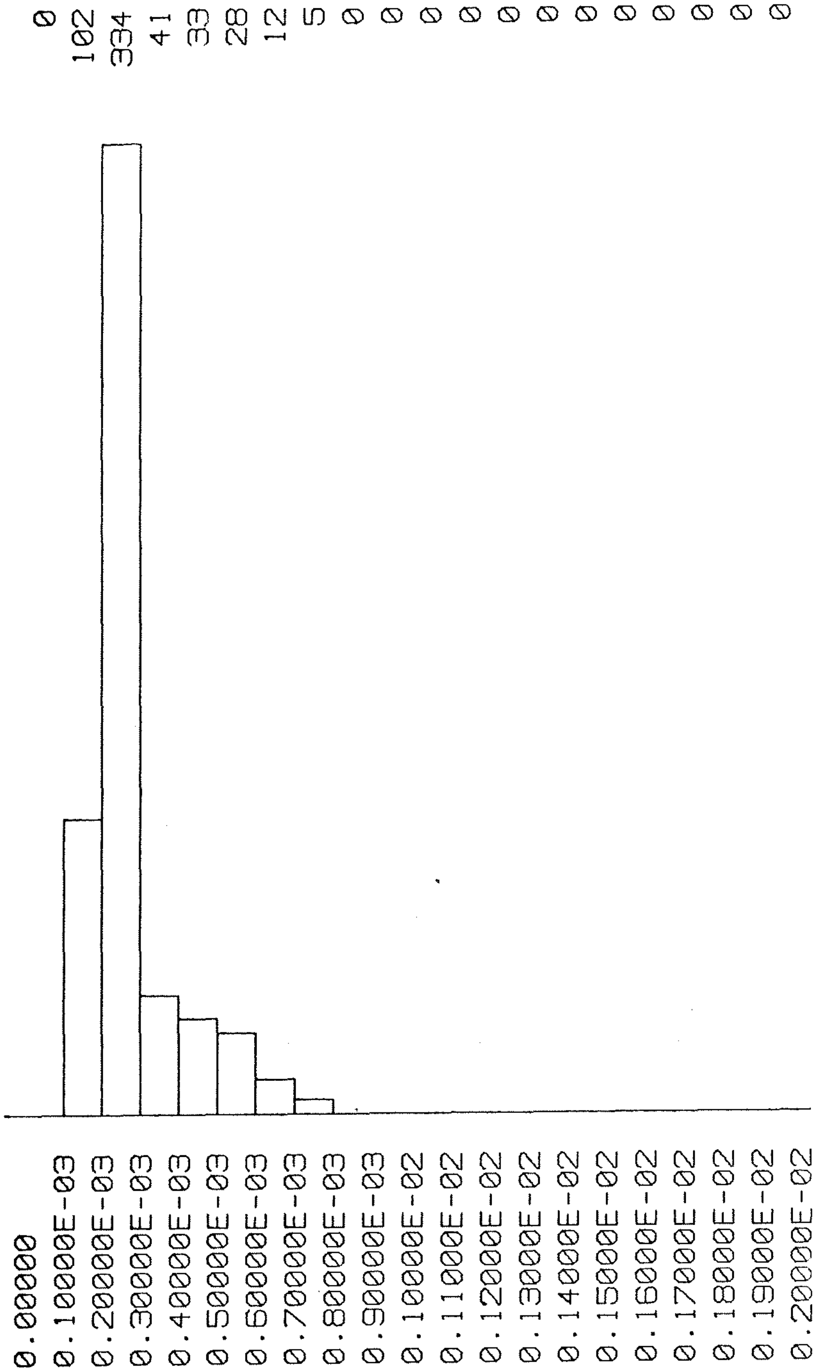


MINIMUM VALUE = 0.19027E-03
MAXIMUM VALUE = 0.27360E-03
MEAN VALUE = 0.22056E-03 BULK DENSITY / DELTA T**
VARIANCE = 0.45498E-09 GRAM-FT2/CC-MICROSEC2
DEVIATION = 0.21330E-04
1 INCH = 16.400 VALUES TOTAL NUMBER OF VALUES = 95

ORID-1-A

9253.00 - 9300.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 86. Histogram of Mechanical Strength Index (9253 - 9300 ft.)



MINIMUM VALUE = 0.14657E-03
MAXIMUM VALUE = 0.73825E-03
MEAN VALUE = 0.26670E-03
VARIANCE = 0.14200E-07
DEVIATION = 0.11916E-03
1 INCH = 66.800 VALUES

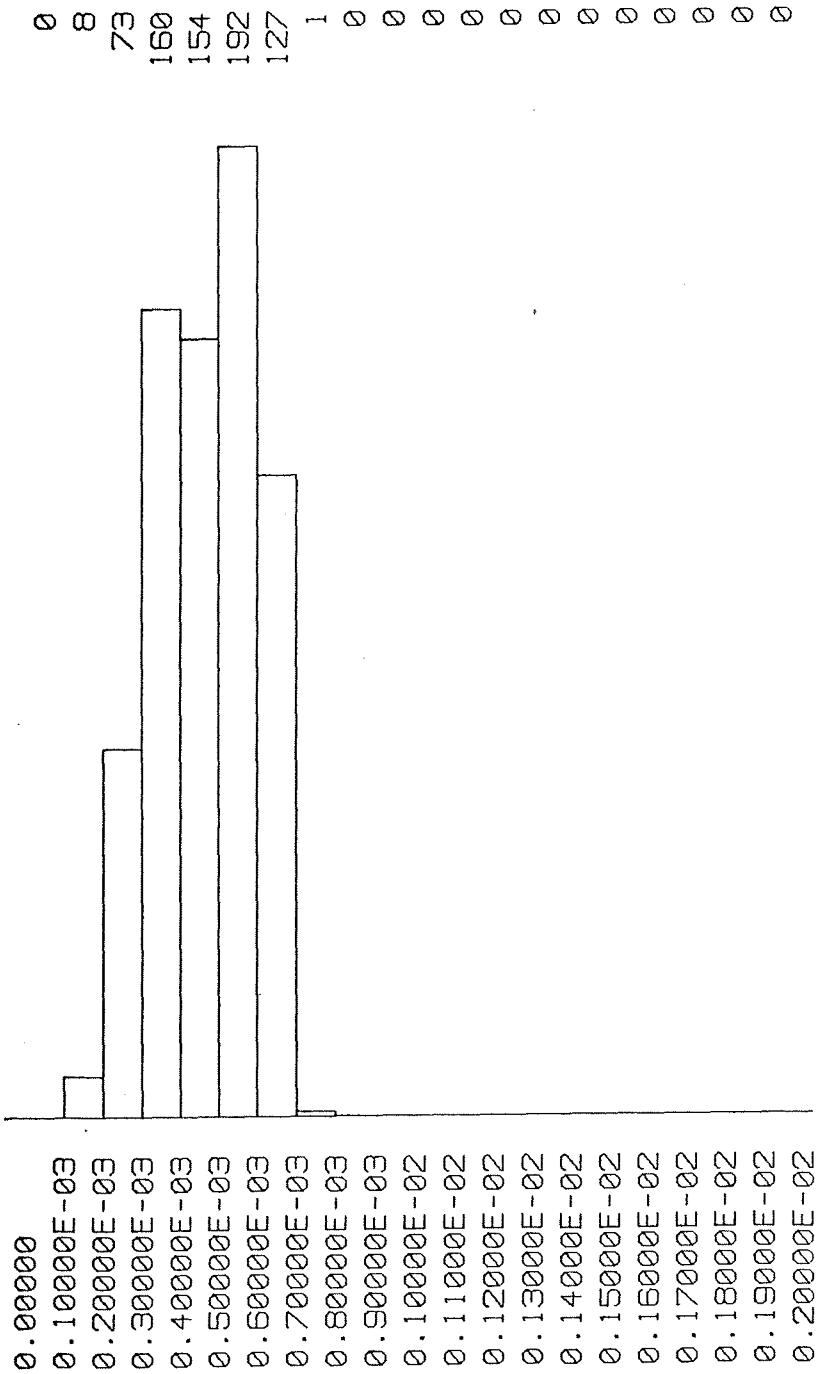
BULK DENSITY / DELTA T**
GRAM-FT2/CC-MICROSEC2

TOTAL NUMBER OF VALUES = 555

ORID-1-A

9300.00 - 9577.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 87. Histogram of Mechanical Strength Index (9300 - 9577 ft.)



MINIMUM VALUE = 0.17593E-03
MAXIMUM VALUE = 0.70994E-03
MEAN VALUE = 0.46931E-03
VARIANCE = 0.16364E-07
DEVIATION = 0.12792E-03
1 INCH = 38.400 VALUES

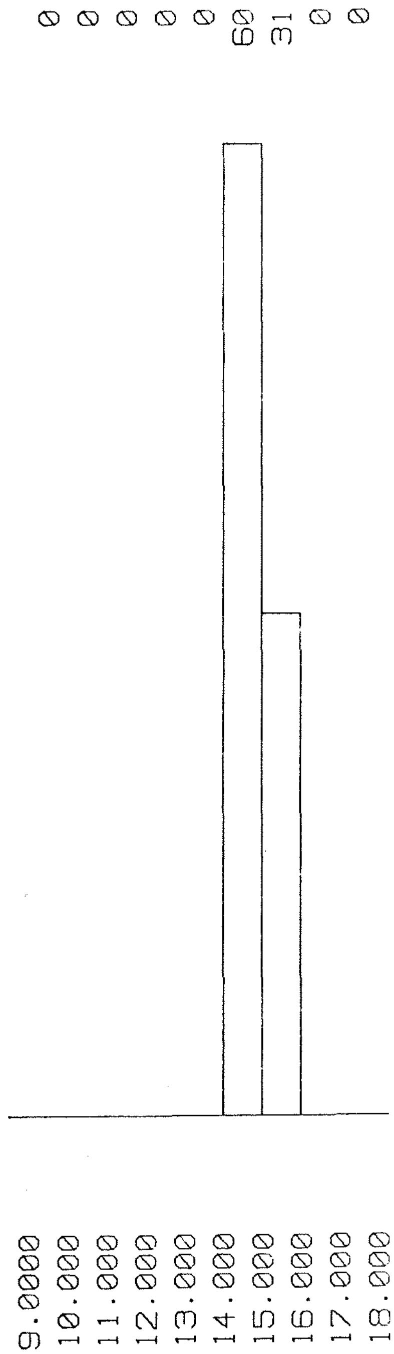
BULK DENSITY / DELTA T**
GRAM-FT2/CC-MICROSEC2

TOTAL NUMBER OF VALUES = 715

ORID-1-A

9581.00 - 9938.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 88. Histogram of Mechanical Strength Index (9581 - 9938 ft.)



MINIMUM VALUE = 14.530
MAXIMUM VALUE = 15.547
MEAN VALUE = 14.888
VARIANCE = 0.92528E-01
DEVIATION = 0.30418
1 INCH = 12.000 VALUES

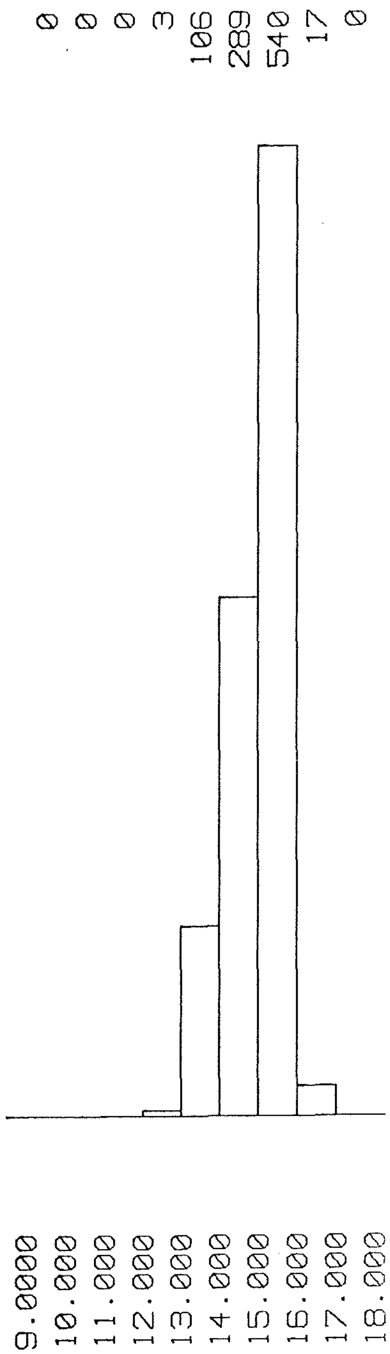
CALIPER
INCHES

TOTAL NUMBER OF VALUES = 91

ORID-1-A

4571.00 - 4616.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 89. Histogram of Caliper Reading (4571 - 4616 ft.)



MINIMUM VALUE = 12.960
MAXIMUM VALUE = 16.040
MEAN VALUE = 14.999
VARIANCE = 0.55868
DEVIATION = 0.74745
1 INCH = 108.00 VALUES

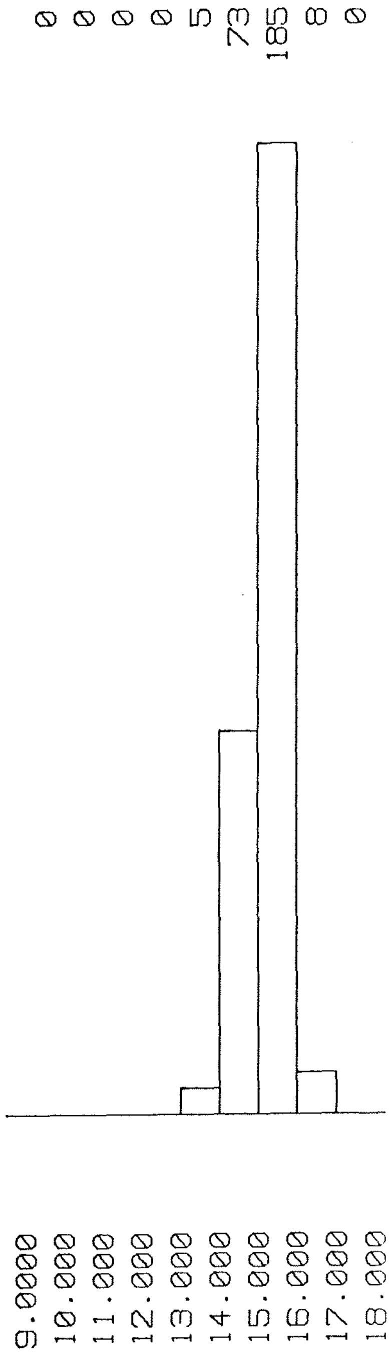
CALIPER
INCHES

TOTAL NUMBER OF VALUES = 955

ORID-1-A

4660.00 - 5137.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 90. Histogram of Caliper Reading (4660 - 5137 ft.)



MINIMUM VALUE = 13.720
MAXIMUM VALUE = 16.160
MEAN VALUE = 15.114
VARIANCE = 0.15082
DEVIATION = 0.38835
1 INCH = 37.000 VALUES

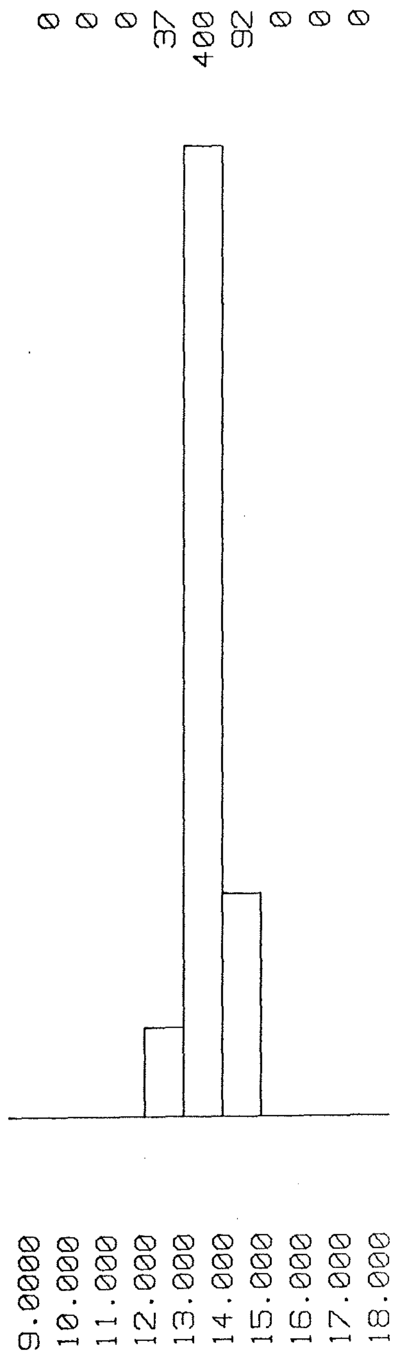
CALIPER
INCHES

TOTAL NUMBER OF VALUES = 271

ORID-1-A

5152.00 - 5287.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 91. Histogram of Caliper Reading (5152 - 5287 ft.)



MINIMUM VALUE = 12.560
MAXIMUM VALUE = 14.320
MEAN VALUE = 13.629
VARIANCE = 0.15118
DEVIATION = 0.38882
1 INCH = 80.000 VALUES

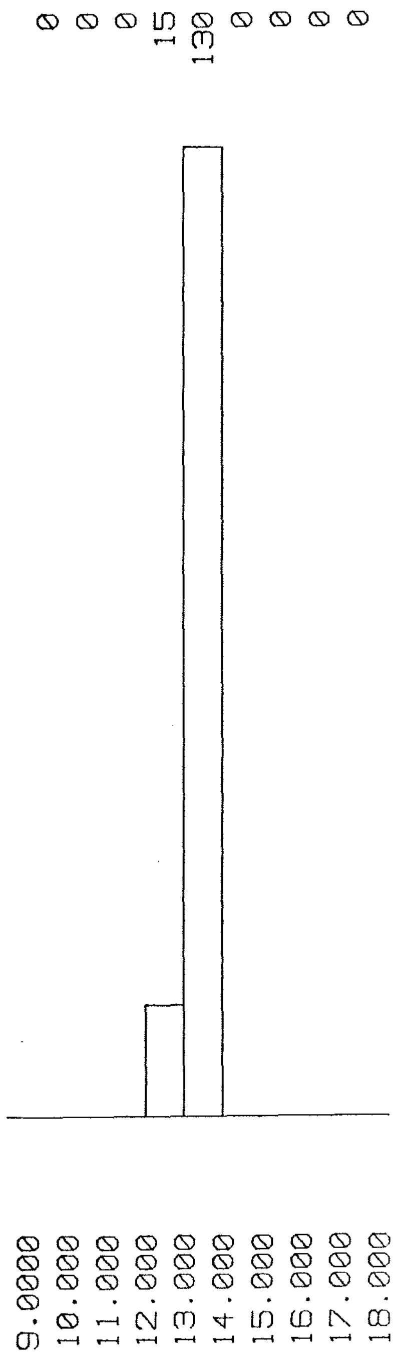
CALIPER
INCHES

TOTAL NUMBER OF VALUES = 529

ORID-1-A

5296.00 - 5560.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 92. Histogram of Caliper Reading (5296 - 5560 ft.)



MINIMUM VALUE = 12.920
MAXIMUM VALUE = 13.772
MEAN VALUE = 13.345
VARIANCE = 0.42144E-01
DEVIATION = 0.20529
1 INCH = 26.000 VALUES

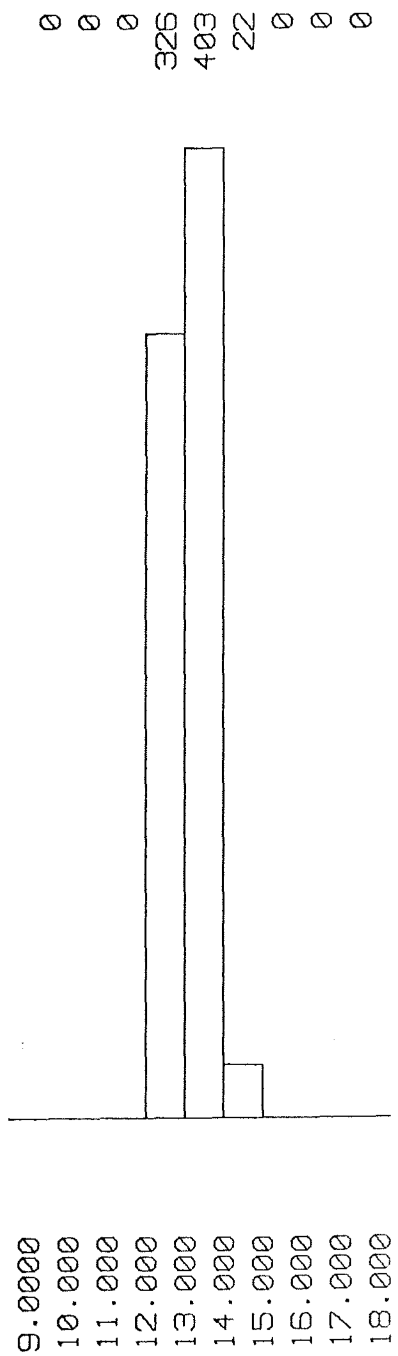
CALIPER
INCHES

TOTAL NUMBER OF VALUES = 145

ORID-1-A

5572.00 - 5644.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 93. Histogram of Caliper Reading (5572 - 5644 ft.)



MINIMUM VALUE = 12.120
MAXIMUM VALUE = 14.309
MEAN VALUE = 13.143
VARIANCE = 0.18062
DEVIATION = 0.42500
1 INCH = 80.600 VALUES

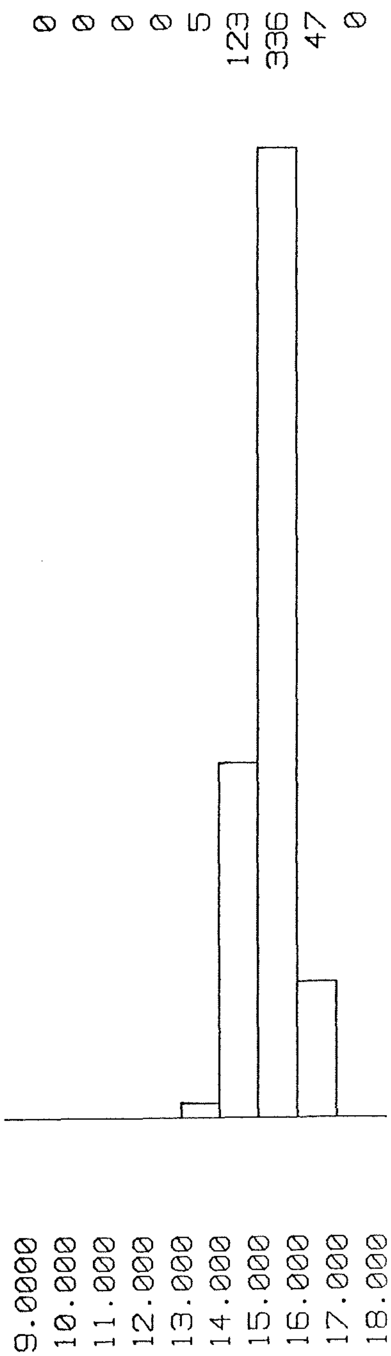
CALIPER
INCHES

TOTAL NUMBER OF VALUES = 751

ORID-1-A

5651.00 - 6026.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 94. Histogram of Caliper Reading (5651 - 6026 ft.)



MINIMUM VALUE = 13.473
MAXIMUM VALUE = 16.312
MEAN VALUE = 15.340
VARIANCE = 0.25215
DEVIATION = 0.50215
1 INCH = 67.200 VALUES

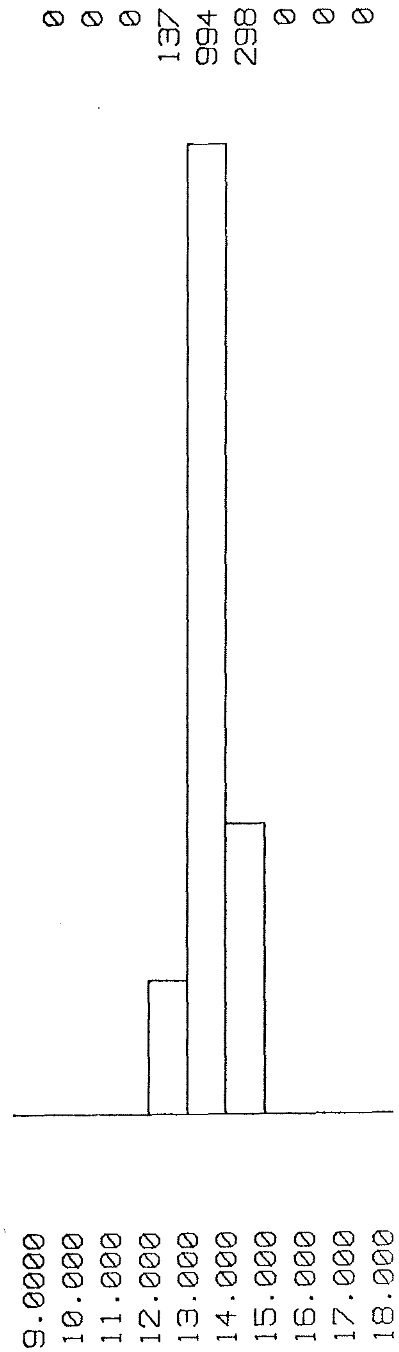
CALIPER
INCHES

TOTAL NUMBER OF VALUES = 511

ORID-1-A

6031.00 - 6286.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 95. Histogram of Caliper Reading (6031 - 6286 ft.)



MINIMUM VALUE = 12.400
MAXIMUM VALUE = 14.960
MEAN VALUE = 13.642
VARIANCE = 0.23258
DEVIATION = 0.48226
1 INCH = 198.80 VALUES

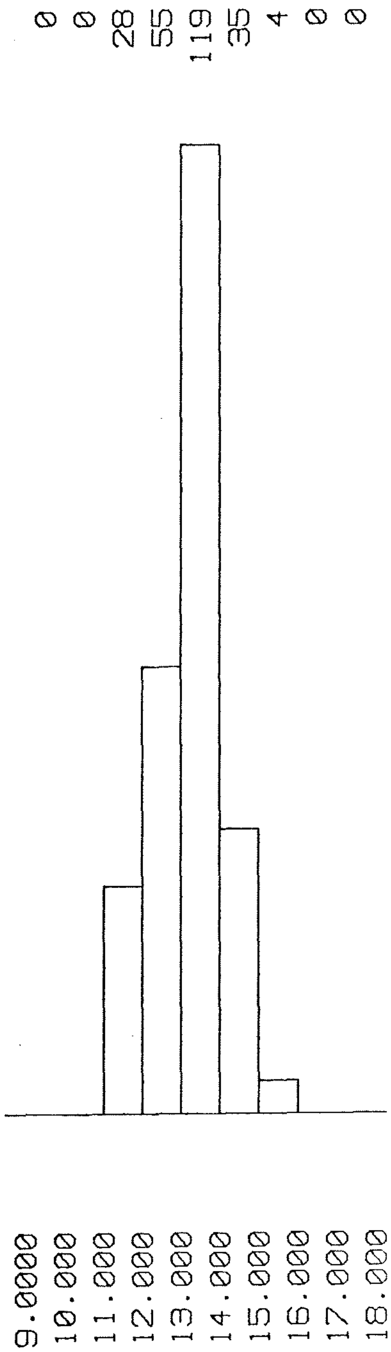
CALIPER
INCHES

TOTAL NUMBER OF VALUES = 1429

ORID-1-A

6294.00 - 7008.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 96. Histogram of Caliper Reading (6294 - 7008 ft.)



MINIMUM VALUE = 11.300
MAXIMUM VALUE = 15.130
MEAN VALUE = 13.279
VARIANCE = 0.70780
DEVIATION = 0.84131
1 INCH = 23.800 VALUES

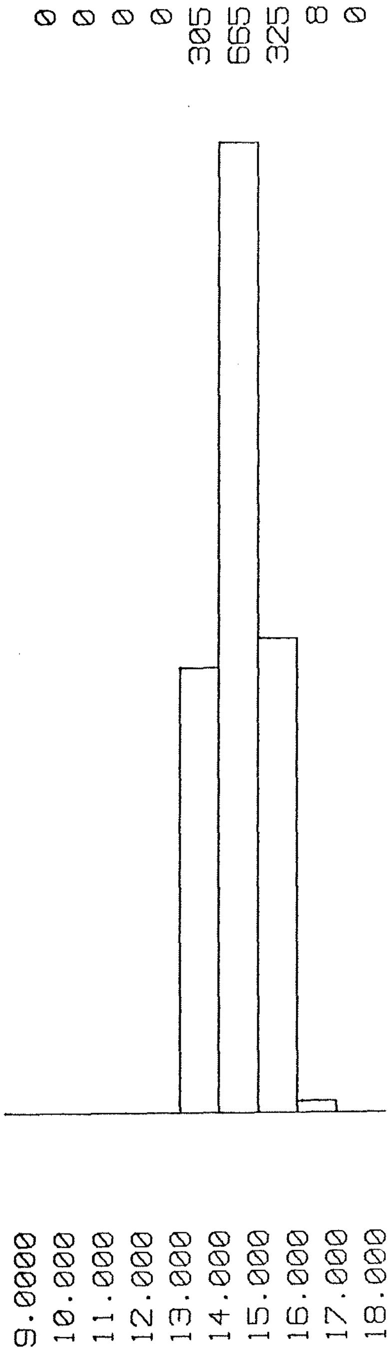
CALIPER
INCHES

TOTAL NUMBER OF VALUES = 241

ORID-1-A

7015.00 - 7135.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 97. Histogram of Caliper Reading (7015 - 7135 ft.)



MINIMUM VALUE = 13.200
MAXIMUM VALUE = 16.394
MEAN VALUE = 14.483
VARIANCE = 0.48245
DEVIATION = 0.69459
1 INCH = 133.00 VALUES

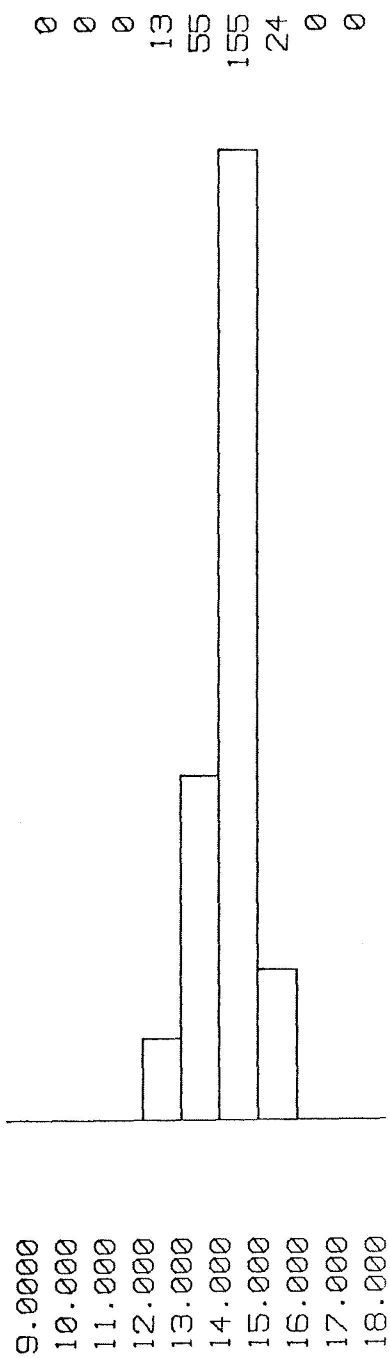
CALIPER
INCHES

TOTAL NUMBER OF VALUES = 1303

ORID-1-A

7147.00 - 7798.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 98. Histogram of Caliper Reading (7147 - 7798 ft.)



MINIMUM VALUE = 12.480
MAXIMUM VALUE = 15.760
MEAN VALUE = 14.147
VARIANCE = 0.39484
DEVIATION = 0.62837
1 INCH = 31.000 VALUES

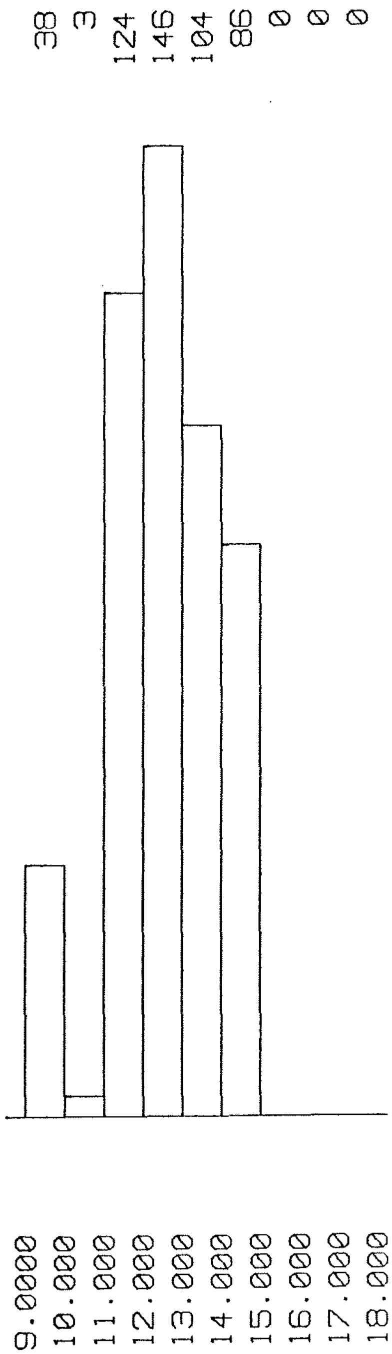
CALIPER
INCHES

TOTAL NUMBER OF VALUES = 247

ORID-1-A

7803.00 - 7926.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 99. Histogram of Caliper Reading (7803 - 7926 ft.)



MINIMUM VALUE = 9.4400
MAXIMUM VALUE = 14.677
MEAN VALUE = 12.557
VARIANCE = 1.7263
DEVIATION = 1.3139
1 INCH = 29.200 VALUES

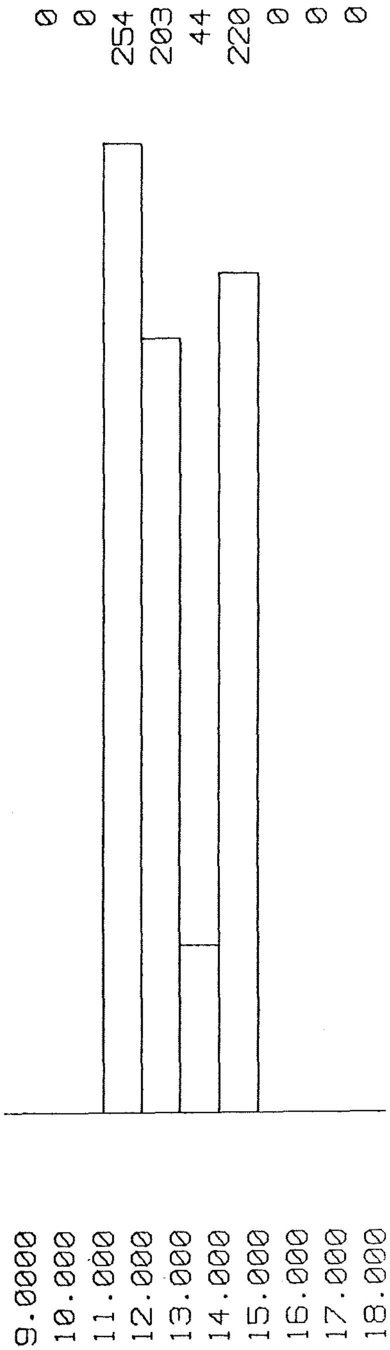
CALIPER
INCHES

TOTAL NUMBER OF VALUES = 501

ORID-1-A

8154.00 - 8404.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 100. Histogram of Caliper Reading (8154 - 8404 ft.)



MINIMUM VALUE = 11.280
MAXIMUM VALUE = 14.680
MEAN VALUE = 12.834
VARIANCE = 1.4424
DEVIATION = 1.2010
1 INCH = 50.800 VALUES

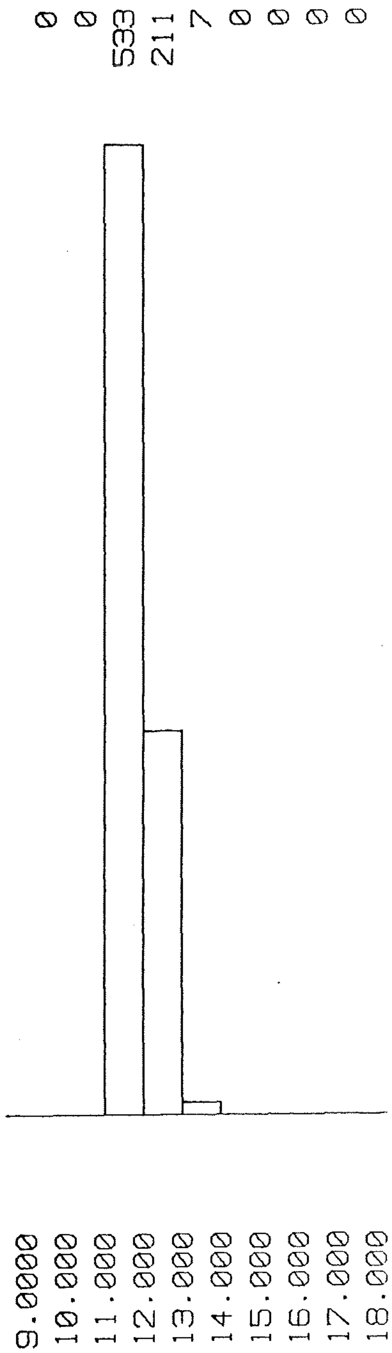
CALIPER
INCHES

TOTAL NUMBER OF VALUES = 721

ORID-1-A

8466.00 - 8826.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 101. Histogram of Caliper Reading (8466 - 8826 ft.)



MINIMUM VALUE = 11.080
MAXIMUM VALUE = 13.000
MEAN VALUE = 11.859
VARIANCE = 0.15814
DEVIATION = 0.39767
1 INCH = 106.60 VALUES

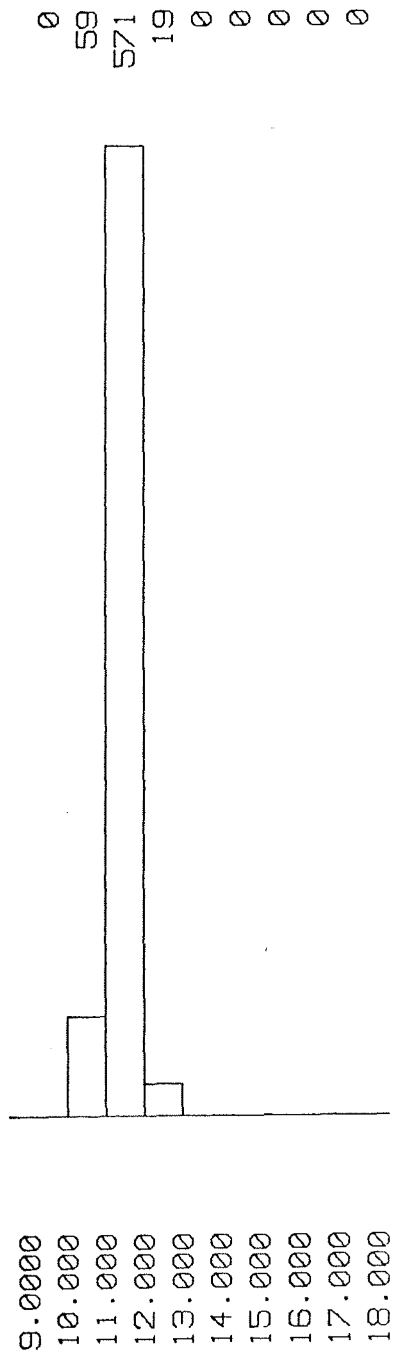
CALIPER
INCHES

TOTAL NUMBER OF VALUES = 751

ORID-1-A

8863.00 - 9238.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 102. Histogram of Caliper Reading (8863 - 9238 ft.)



MINIMUM VALUE = 10.760
MAXIMUM VALUE = 12.240
MEAN VALUE = 11.493
VARIANCE = 0.89709E-01
DEVIATION = 0.29951

CALIPER
INCHES

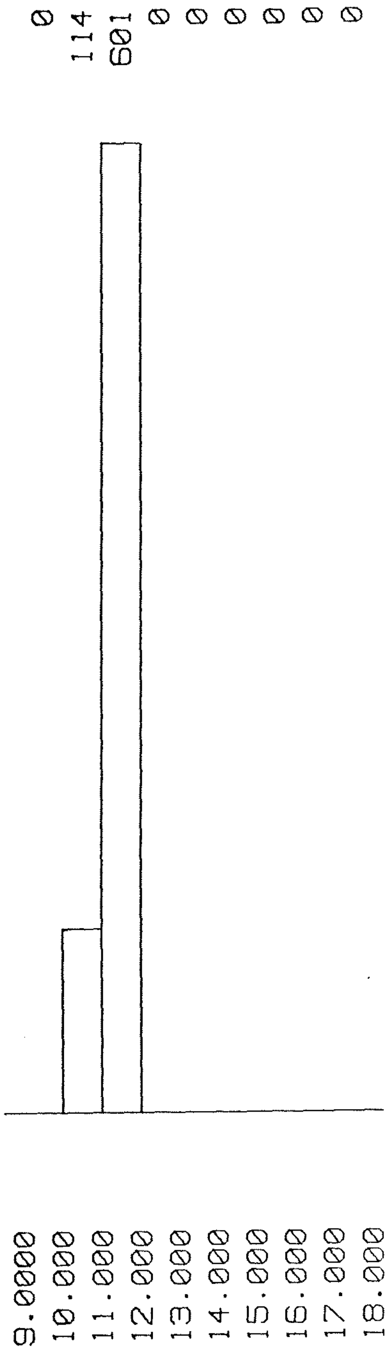
1 INCH = 114.20 VALUES

TOTAL NUMBER OF VALUES = 649

ORID-1-A

9253.00 - 9577.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 103. Histogram of Caliper Reading (9253 - 9577 ft.)



MINIMUM VALUE = 10.320
MAXIMUM VALUE = 11.880
MEAN VALUE = 11.413
VARIANCE = 0.16109
DEVIATION = 0.40137
1 INCH = 120.20 VALUES

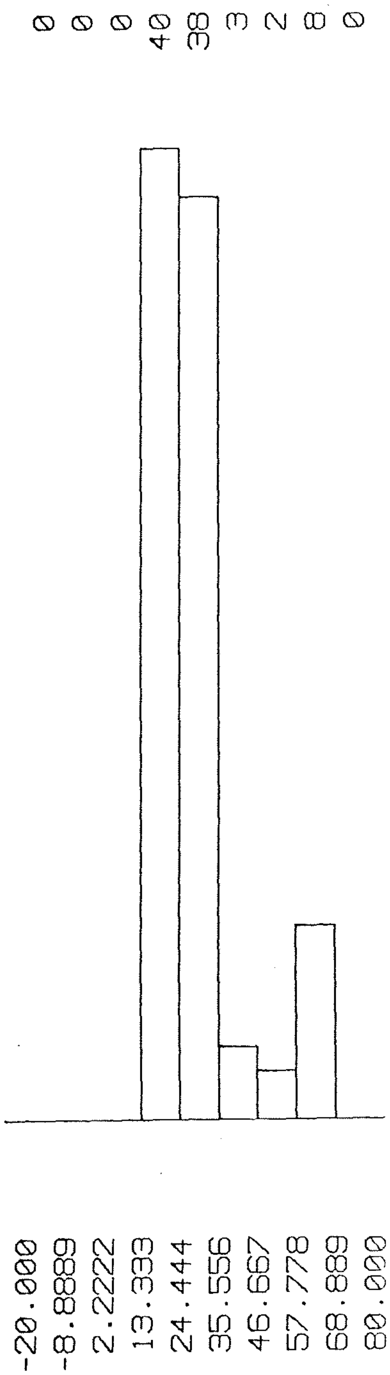
CALIPER
INCHES

TOTAL NUMBER OF VALUES = 715

ORID-1-A

9581.00 - 9938.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 104. Histogram of Caliper Reading (9581 - 9938 ft.)



MINIMUM VALUE = 14.560
MAXIMUM VALUE = 66.400
MEAN VALUE = 28.641
VARIANCE = 182.23
DEVIATION = 13.499
1 INCH = 8.0000 VALUES

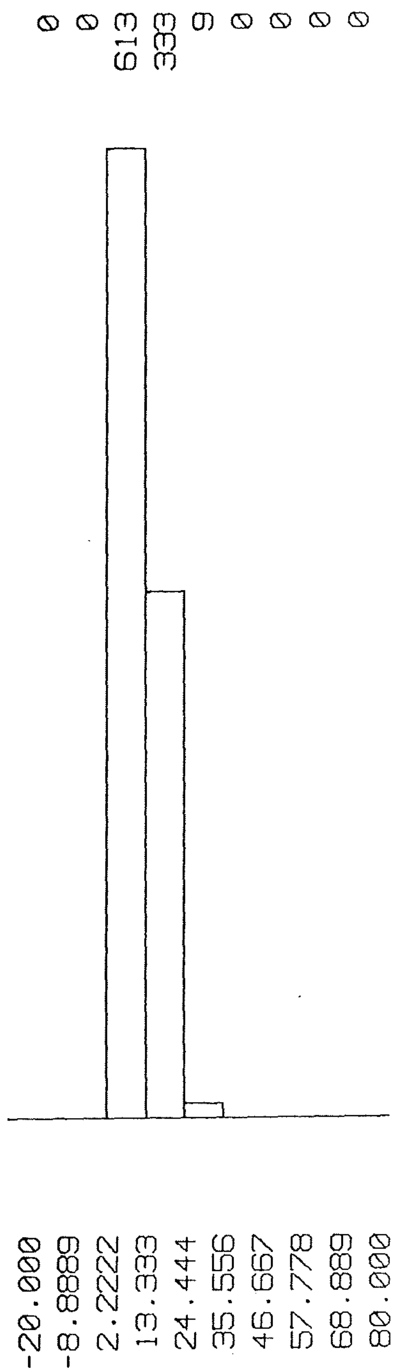
RILD
~~OHM-M~~

TOTAL NUMBER OF VALUES = 91

ORID-1-A

4571.00 - 4616.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 105. Histogram of Electrical Resistivity (4571 - 4616 ft.)



MINIMUM VALUE = 5.4272
MAXIMUM VALUE = 27.739
MEAN VALUE = 13.037
VARIANCE = 11.792
DEVIATION = 3.4339
1 INCH = 122.60 VALUES

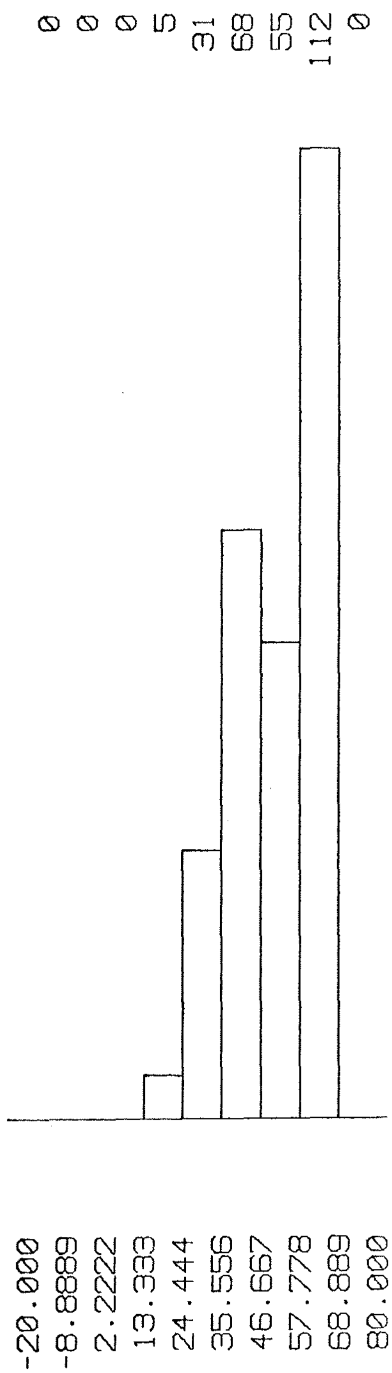
RILD
~~OHM-M~~

TOTAL NUMBER OF VALUES = 955

ORID-1-A

4660.00 - 5137.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 106. Histogram of Electrical Resistivity (4660 - 5137 ft.)



MINIMUM VALUE = 22.560
MAXIMUM VALUE = 66.720
MEAN VALUE = 52.180
VARIANCE = 167.68
DEVIATION = 12.949
1 INCH = 22.400 VALUES

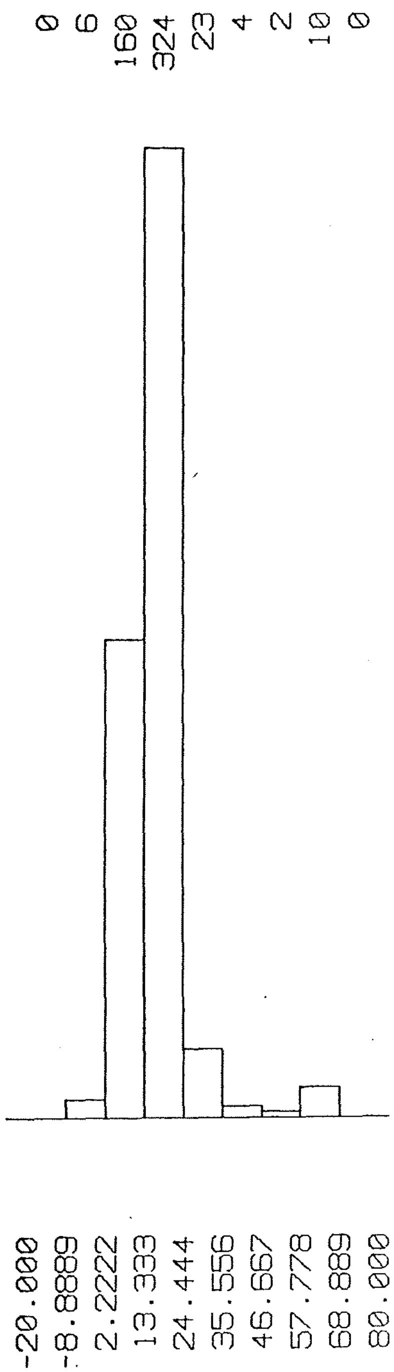
RILD
~~OHM M~~

TOTAL NUMBER OF VALUES = 271

ORID-1-A

5152.00 - 5287.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 107. Histogram of Electrical Resistivity (5152 - 5287 ft.)



MINIMUM VALUE = -.63190E-01
MAXIMUM VALUE = 66.400
MEAN VALUE = 16.384
VARIANCE = 73.320
DEVIATION = 8.5627
1 INCH = 64.800 VALUES

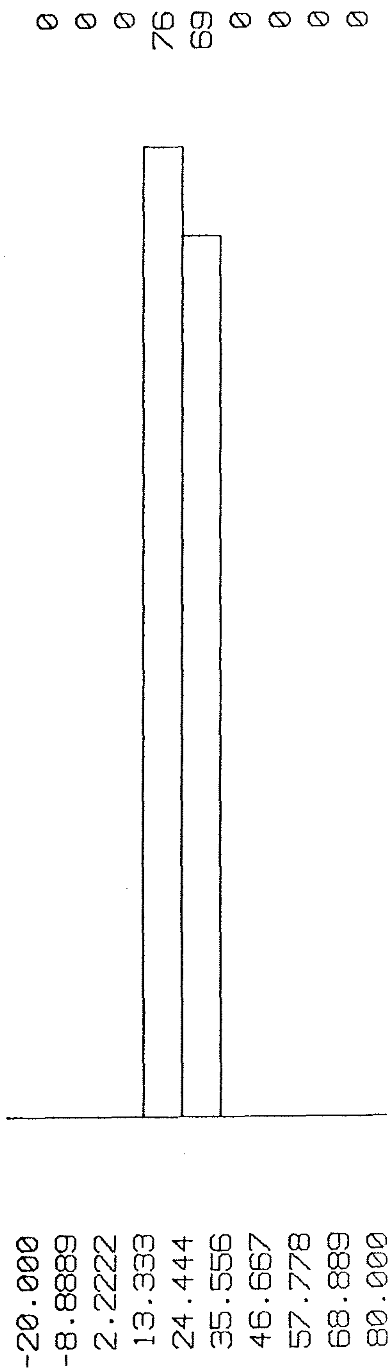
RILD
~~OHM-M~~

TOTAL NUMBER OF VALUES = 529

ORID-1-A

5296.00 - 5560.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 108 - Histogram of Electrical Resistivity (5296 - 5560 ft.)



MINIMUM VALUE = 13.774
MAXIMUM VALUE = 31.667
MEAN VALUE = 23.616
VARIANCE = 14.769
DEVIATION = 3.8430
1 INCH = 15.200 VALUES

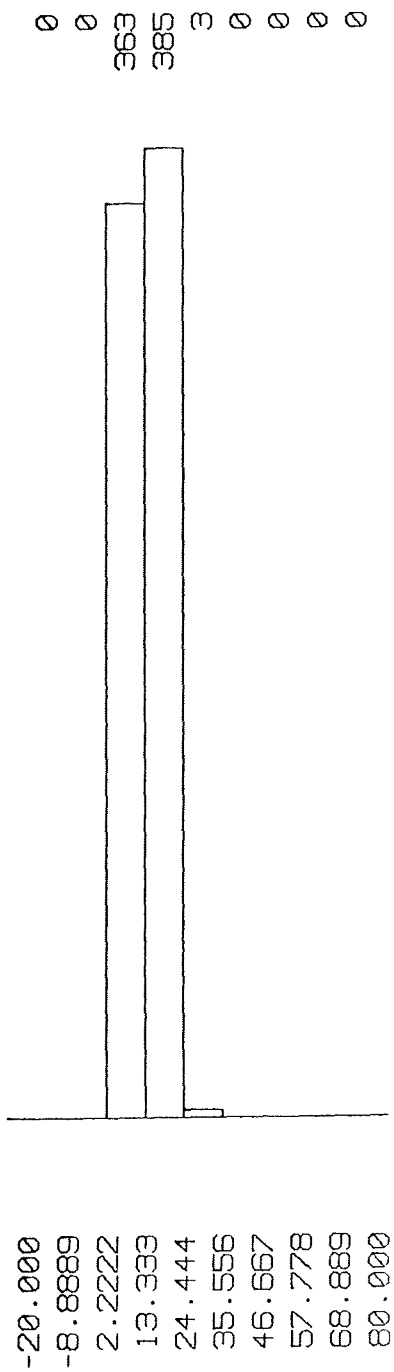
RILD
~~OHM-M~~

TOTAL NUMBER OF VALUES = 145

ORID-1-A

5572.00 - 5644.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 109. Histogram of Electrical Resistivity (5572 - 5644 ft.)



MINIMUM VALUE = 5.1200
MAXIMUM VALUE = 25.995
MEAN VALUE = 13.428
VARIANCE = 35.658
DEVIATION = 5.9714
1 INCH = 77.000 VALUES

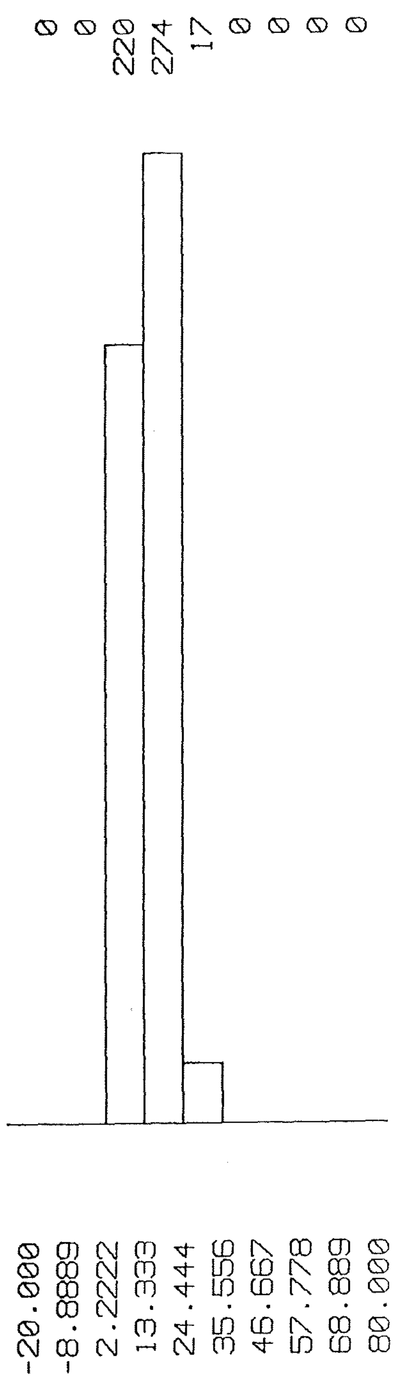
RILD
~~OHM-M~~

TOTAL NUMBER OF VALUES = 751

ORID-1-A

5651.00 - 6026.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 110. Histogram of Electrical Resistivity (5651 - 6026 ft.)



MINIMUM VALUE = 8.0000
MAXIMUM VALUE = 29.716
MEAN VALUE = 14.300
VARIANCE = 13.988
DEVIATION = 3.7400
1 INCH = 54.800 VALUES

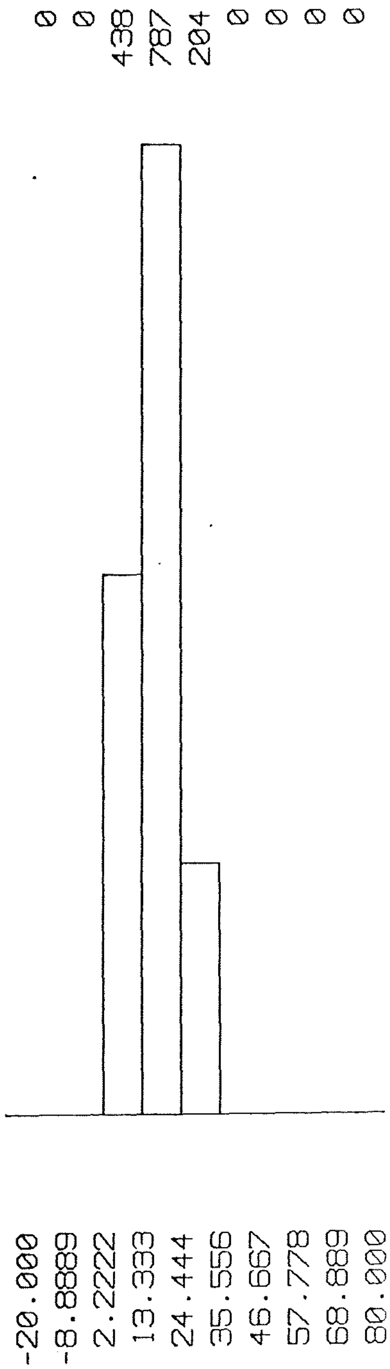
RILD
OHM-M

TOTAL NUMBER OF VALUES = 511

ORID-1-A

6031.00 - 6286.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 111. Histogram of Electrical Resistivity (6031 - 6286 ft.)



MINIMUM VALUE = 6.8800
MAXIMUM VALUE = 28.660
MEAN VALUE = 17.663
VARIANCE = 35.429
DEVIATION = 5.9522
1 INCH = 157.40 VALUES

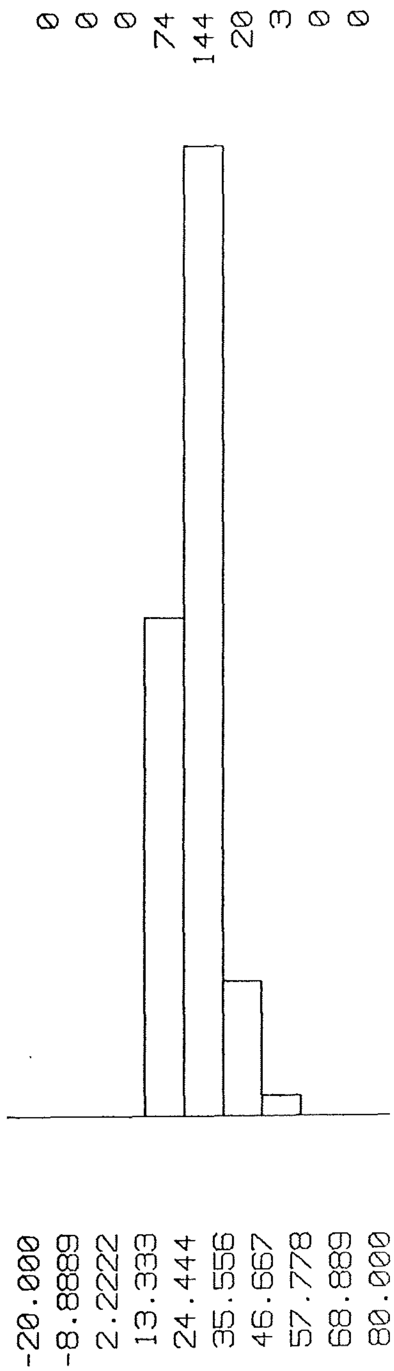
RILD
OHM-M

TOTAL NUMBER OF VALUES = 1429

ORID-1-A

6294.00 - 7008.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 112. Histogram of Electrical Resistivity (6294 - 7008 ft.)



MINIMUM VALUE = 16.851
MAXIMUM VALUE = 50.716
MEAN VALUE = 27.578
VARIANCE = 46.980
DEVIATION = 6.8542
1 INCH = 28.800 VALUES

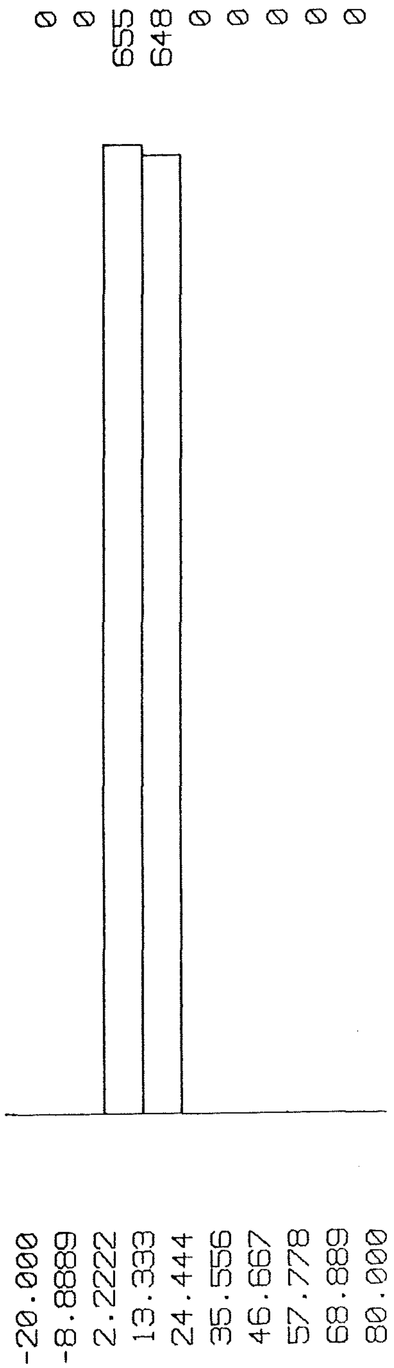
RILD
~~OHM-M~~

TOTAL NUMBER OF VALUES = 241

ORID-1-A

7015.00 - 7135.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 113. Histogram of Electrical Resistivity (7015 - 7135 ft.)



MINIMUM VALUE = 4.4800
MAXIMUM VALUE = 23.040
MEAN VALUE = 13.574
VARIANCE = 12.681
DEVIATION = 3.5610
1 INCH = 131.00 VALUES

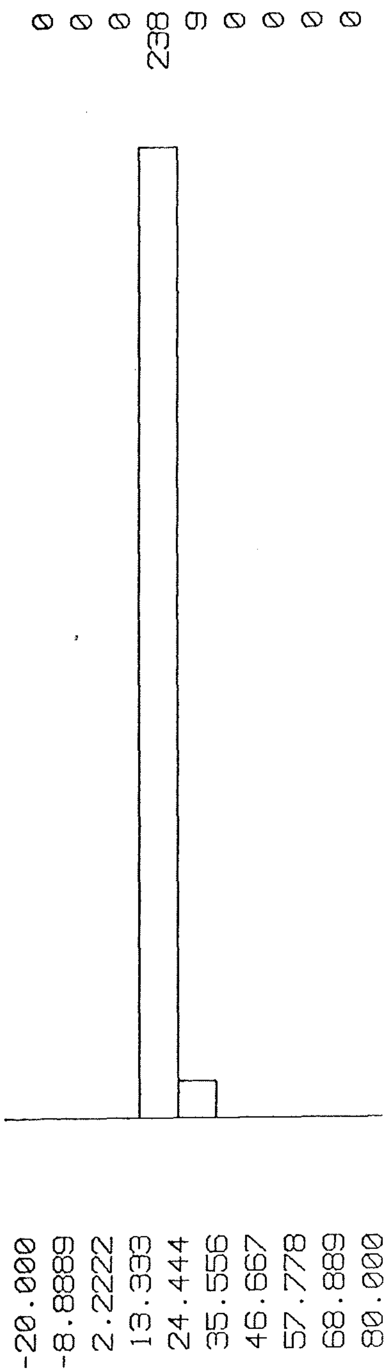
RILD
~~OHM-M~~

TOTAL NUMBER OF VALUES = 1303

ORID-1-A

7147.00 - 7798.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 114. Histogram of Electrical Resistivity (7147 - 7798 ft.)



MINIMUM VALUE = 13.920
MAXIMUM VALUE = 25.600
MEAN VALUE = 18.746
VARIANCE = 7.1023
DEVIATION = 2.6650
1 INCH = 47.600 VALUES

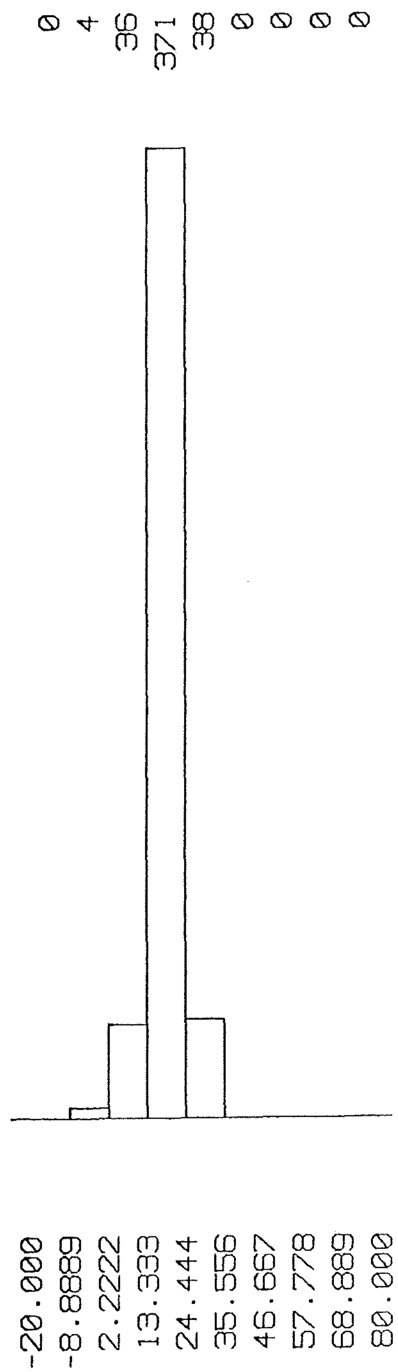
RILD
~~OHM-M~~

TOTAL NUMBER OF VALUES = 247

ORID-1-A

7803.00 - 7926.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 115. Histogram of Electrical Resistivity (7803 - 7926 ft.)



MINIMUM VALUE = -1.0679
MAXIMUM VALUE = 29.199
MEAN VALUE = 18.777
VARIANCE = 19.115
DEVIATION = 4.3720
1 INCH = 74.200 VALUES

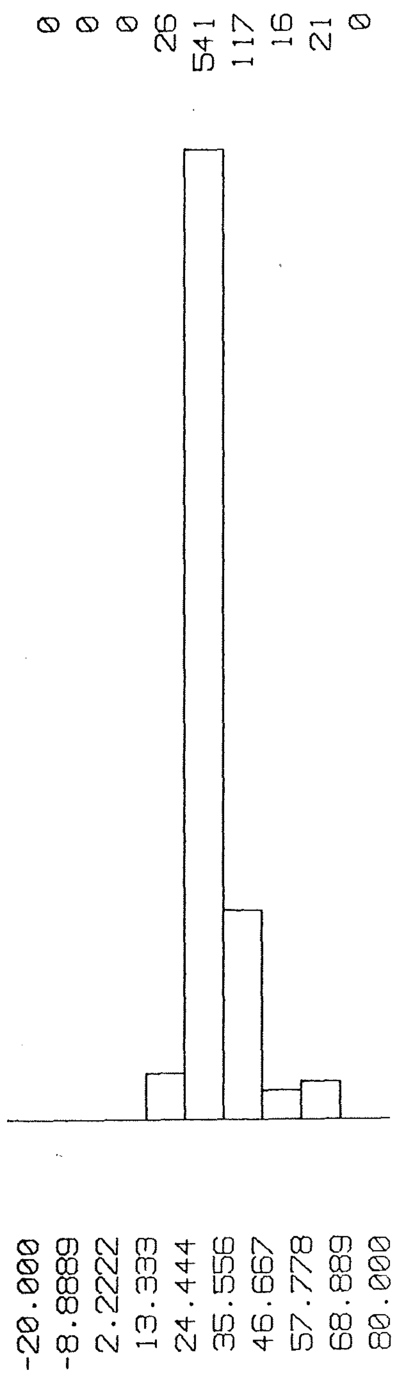
RILD
~~OHM-M~~

TOTAL NUMBER OF VALUES = 449

ORID-1-A

8180.00 - 8404.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 116. Histogram of Electrical Resistivity (8180 - 8404 ft.)



MINIMUM VALUE = 20.784
MAXIMUM VALUE = 66.543
MEAN VALUE = 32.187
VARIANCE = 62.175
DEVIATION = 7.8851
1 INCH = 108.20 VALUES

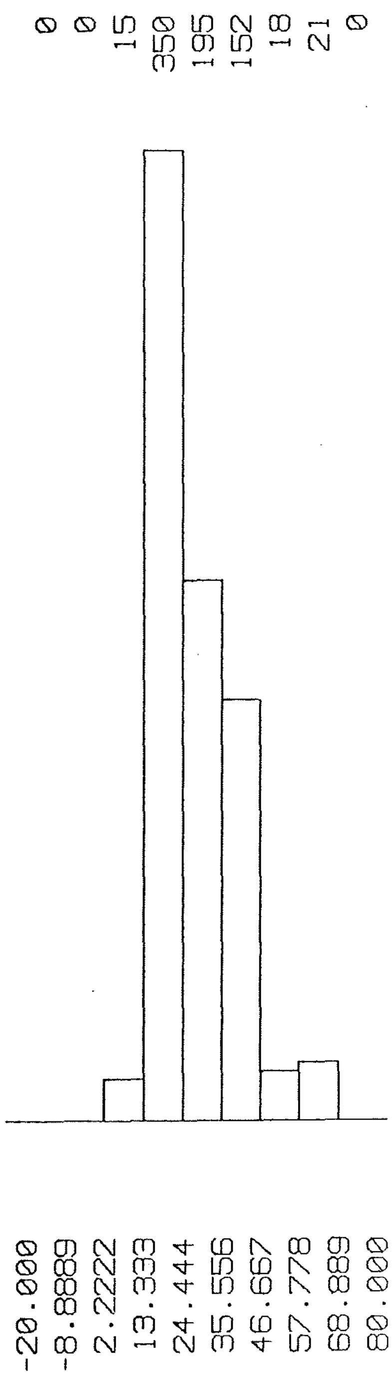
RILD
OHM-M

TOTAL NUMBER OF VALUES = 721

ORID-1-A

8466.00 - 8826.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 117. Histogram of Electrical Resistivity (8466 - 8826 ft.)



MINIMUM VALUE = 12.800
MAXIMUM VALUE = 66.240
MEAN VALUE = 27.066
VARIANCE = 125.78
DEVIATION = 11.215
1 INCH = 70.000 VALUES

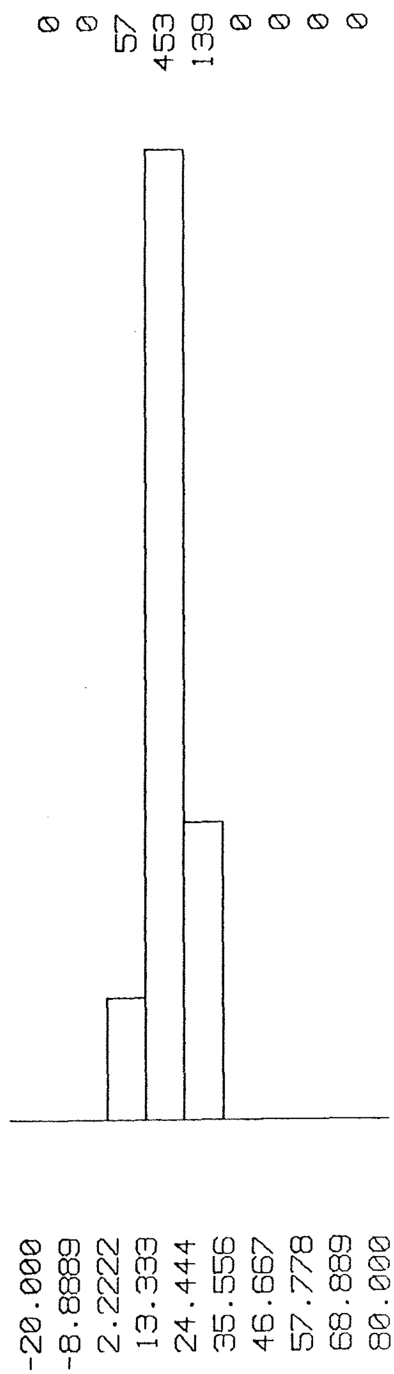
RILD
~~OHM=M~~ db

TOTAL NUMBER OF VALUES = 751

ORID-1-A

8863.00 - 9238.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 118. Histogram of Electrical Resistivity (8863 - 9238 ft.)



MINIMUM VALUE = 9.9200
MAXIMUM VALUE = 33.377
MEAN VALUE = 19.206
VARIANCE = 28.627
DEVIATION = 5.3504
1 INCH = 90.600 VALUES

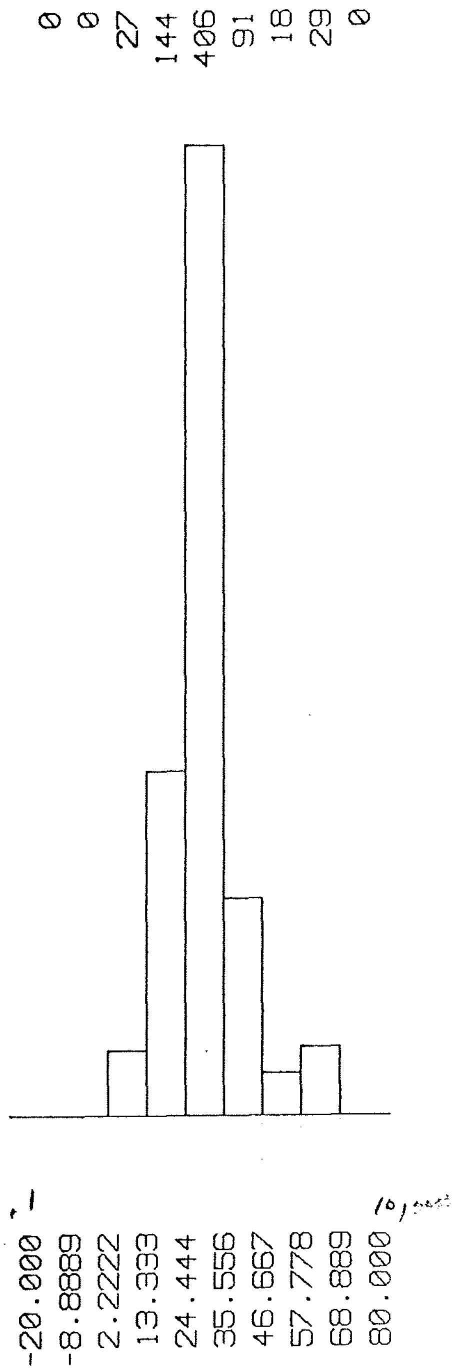
RILD
~~OHM-M~~

TOTAL NUMBER OF VALUES = 649

ORID-1-A

9253.00 - 9577.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 119. Histogram of Electrical Resistivity (9253 - 9577 ft.)



MINIMUM VALUE = 9.3600
MAXIMUM VALUE = 66.560
MEAN VALUE = 30.543
VARIANCE = 110.48
DEVIATION = 10.511
1 INCH = 81.200 VALUES

RILD
~~OHM-M~~ d

TOTAL NUMBER OF VALUES = 715

ORID-1-A

9581.00 - 9938.00 FEET
AT 0.50 DEPTH UNIT INTERVALS

FIGURE 120. Histogram of Electrical Resistivity (9581 - 9938 ft.)

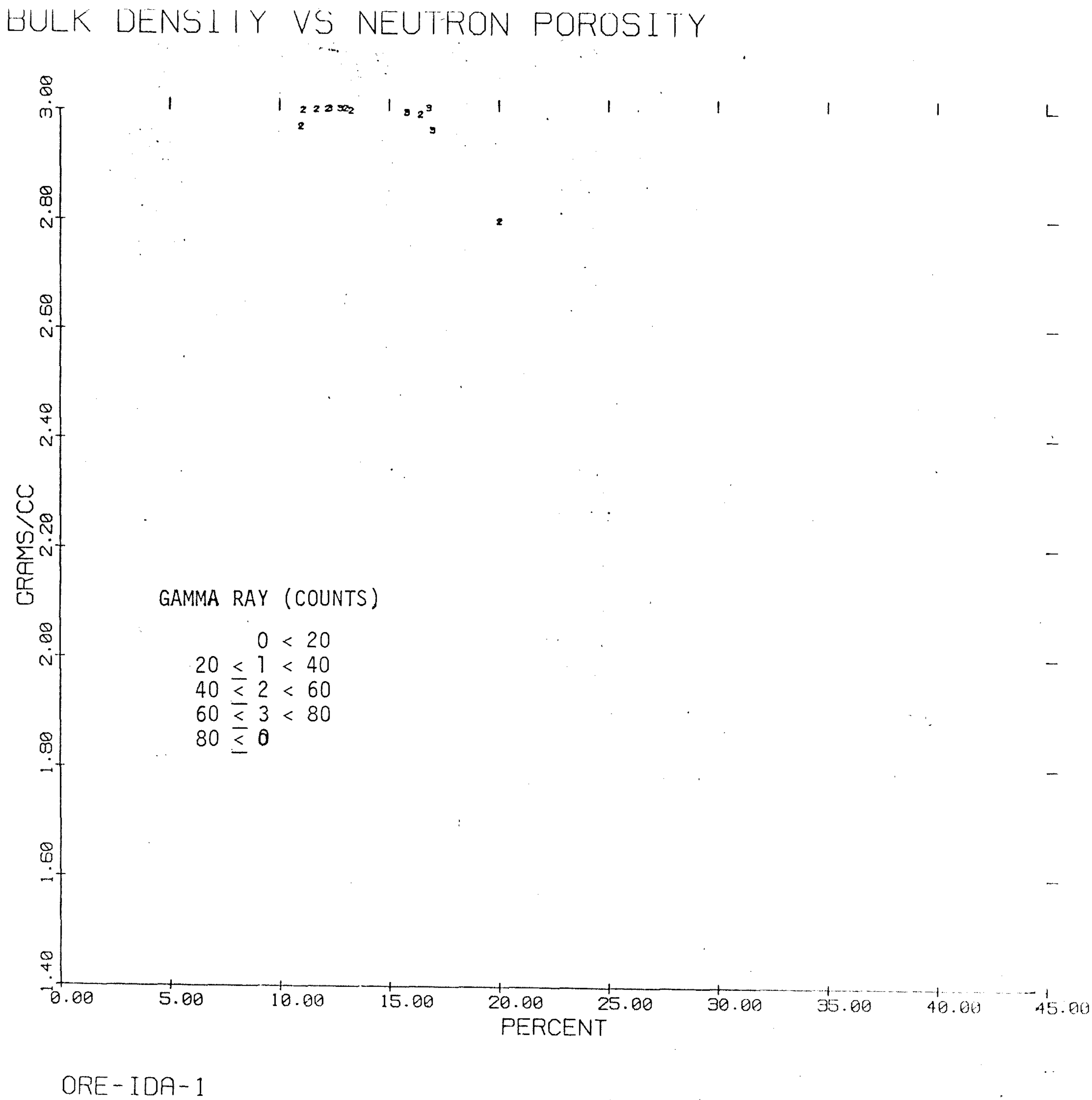


FIGURE 121. Z-Plot of Bulk Density vs. Neutron Porosity with Gamma Ray (4571 - 4610 ft.)

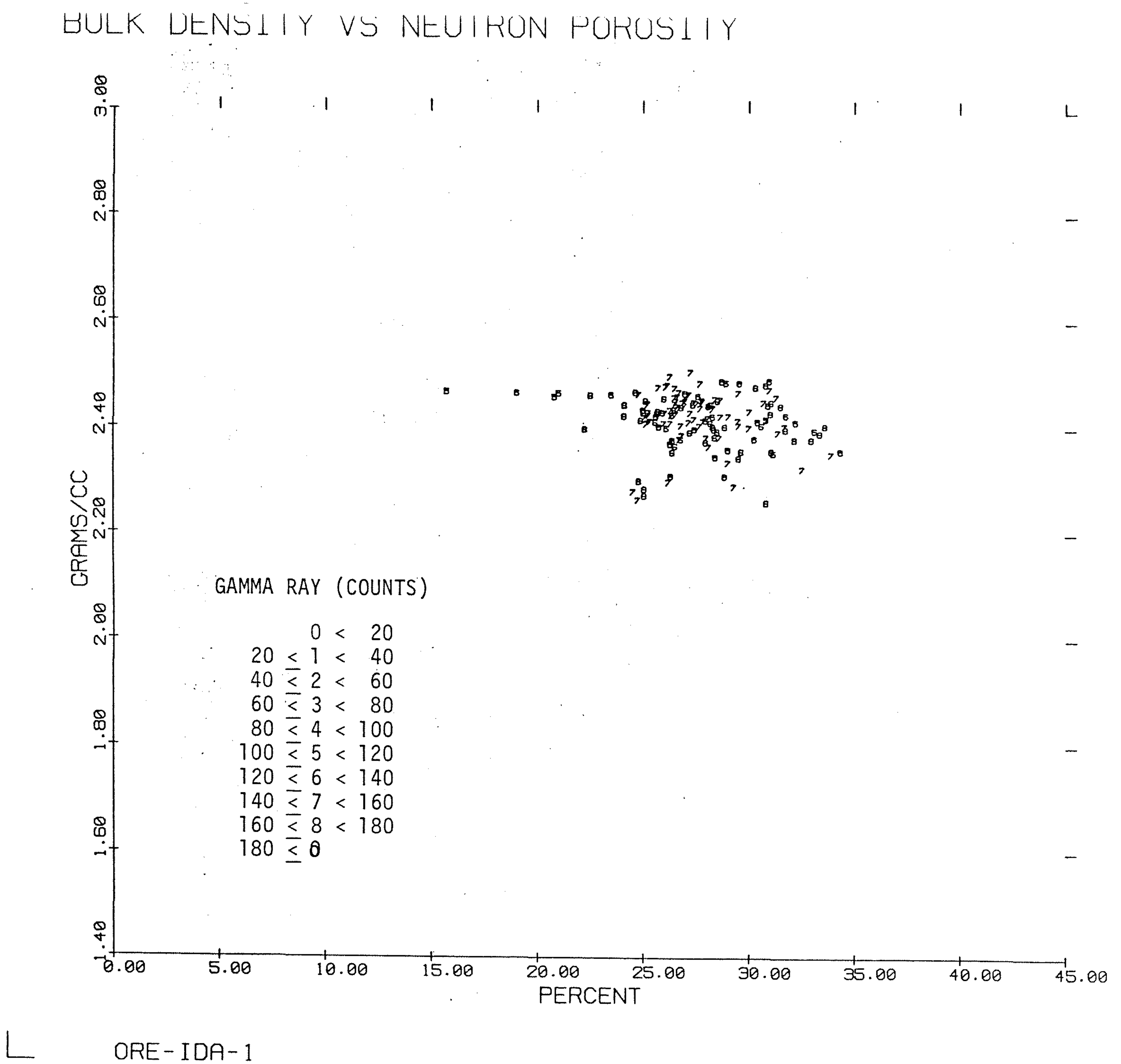


FIGURE 122. Z-Plot of Bulk Density vs. Neutron Porosity with Gamma Ray (4660 - 5137 ft.)

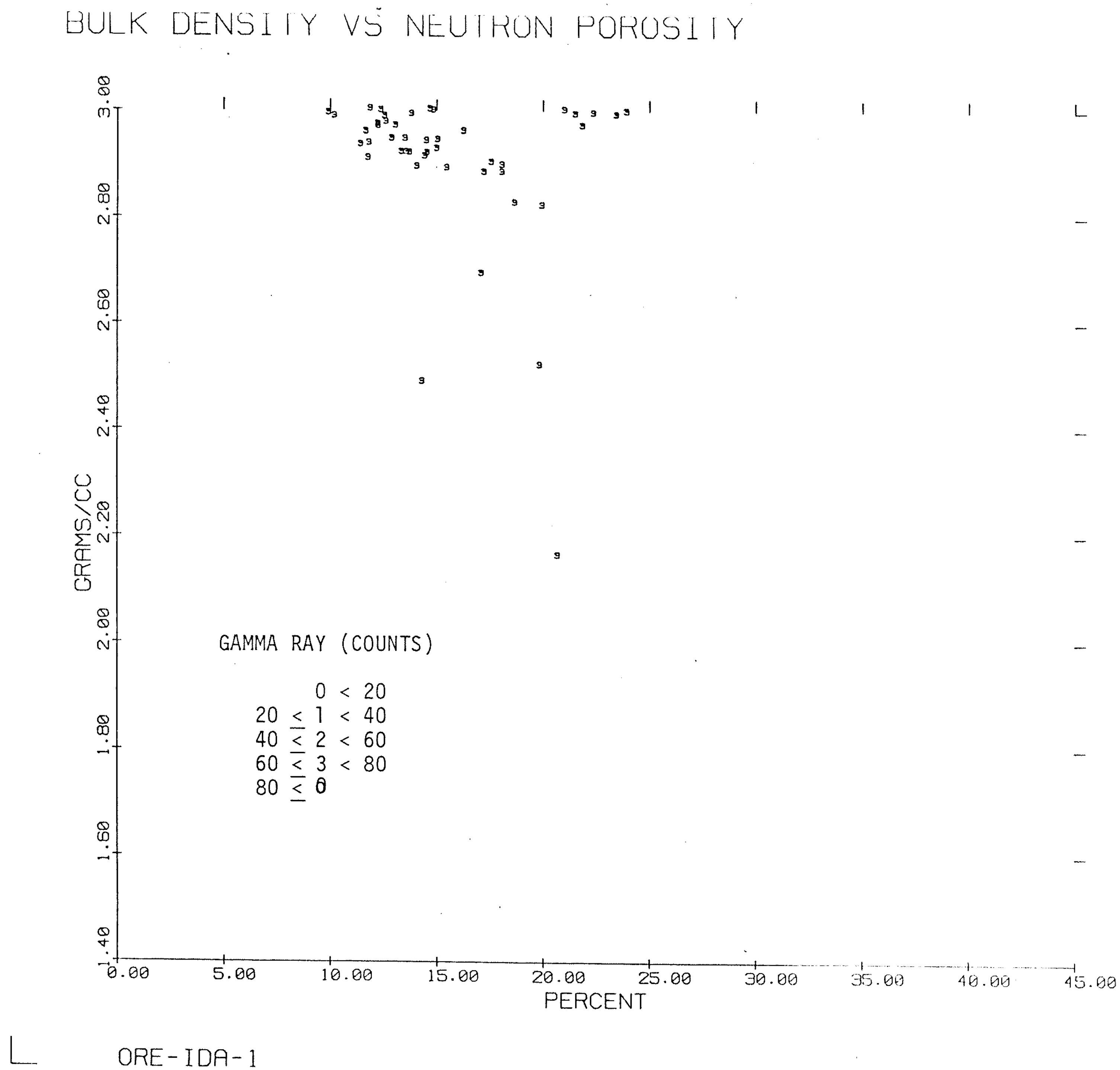


FIGURE 123. Z-Plot of Bulk Density vs. Neutron Porosity with Gamma Ray (5152 - 5287 ft.)

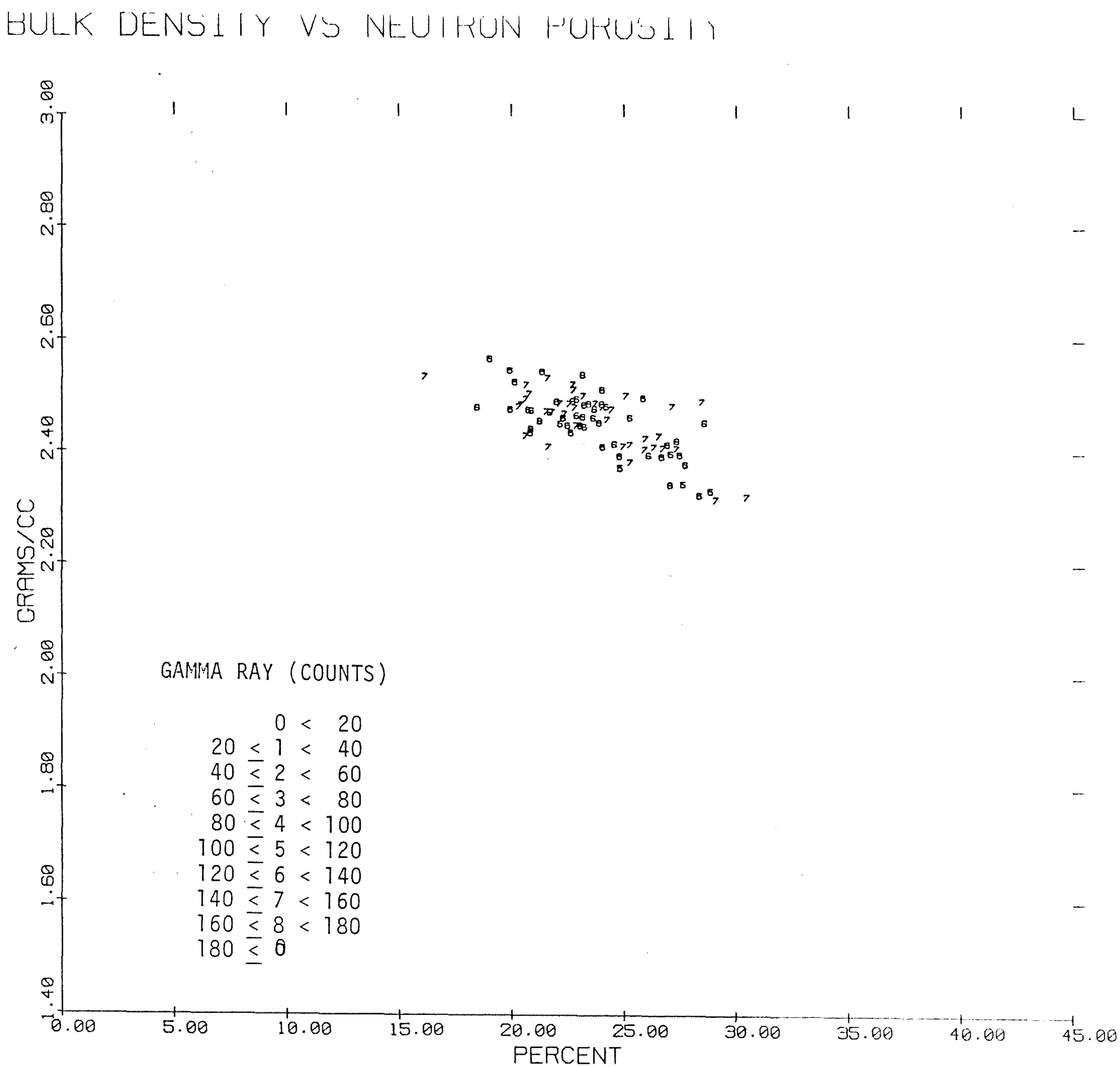


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FIGURE 124. Z-Plot of Bulk Density vs. Neutron Porosity with Gamma Ray (5296 - 5560 ft.)

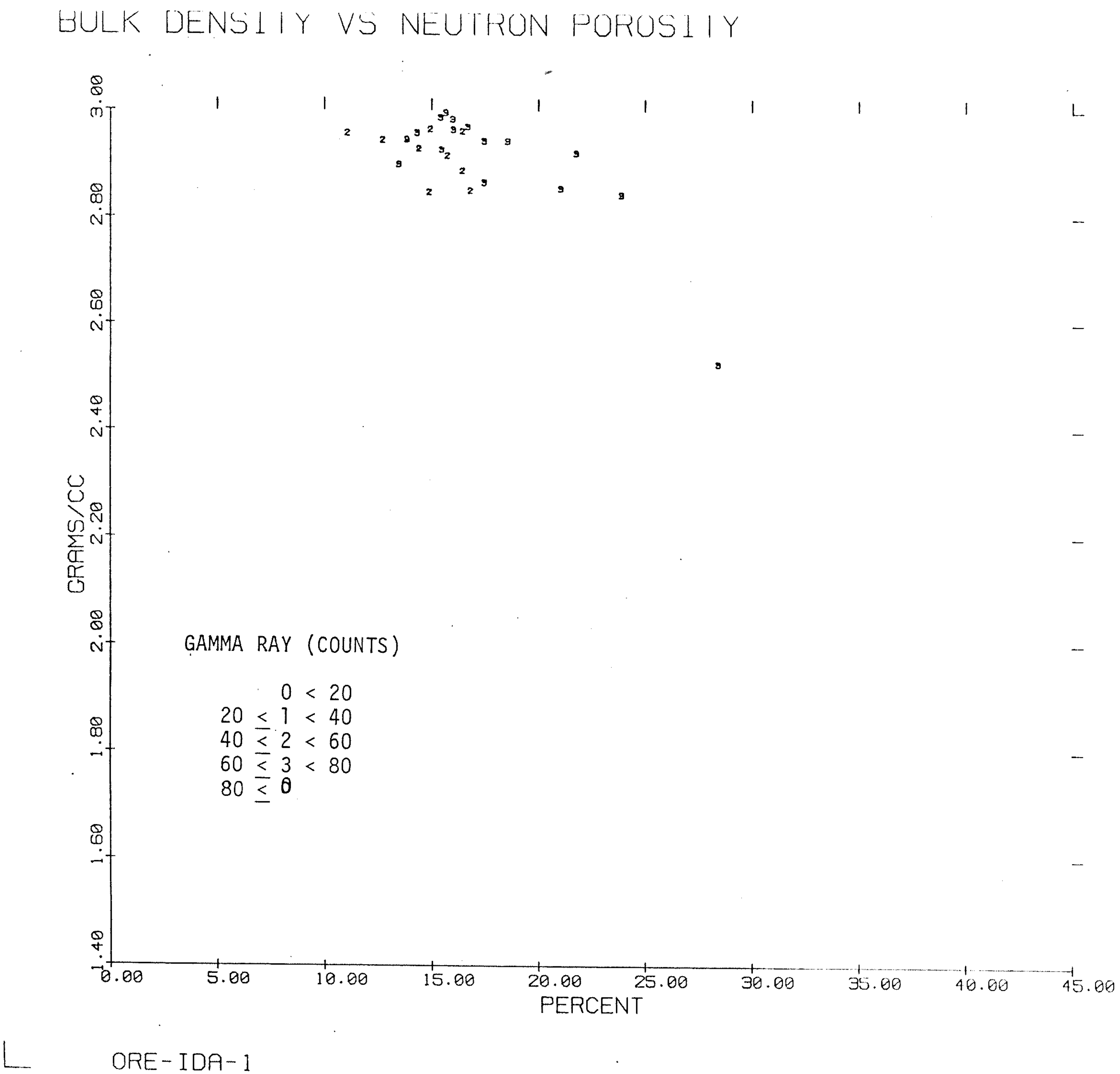

FIGURE 125. Z-Plot of Bulk Density vs. Neutron Porosity with Gamma Ray (5572 - 5644 ft.)

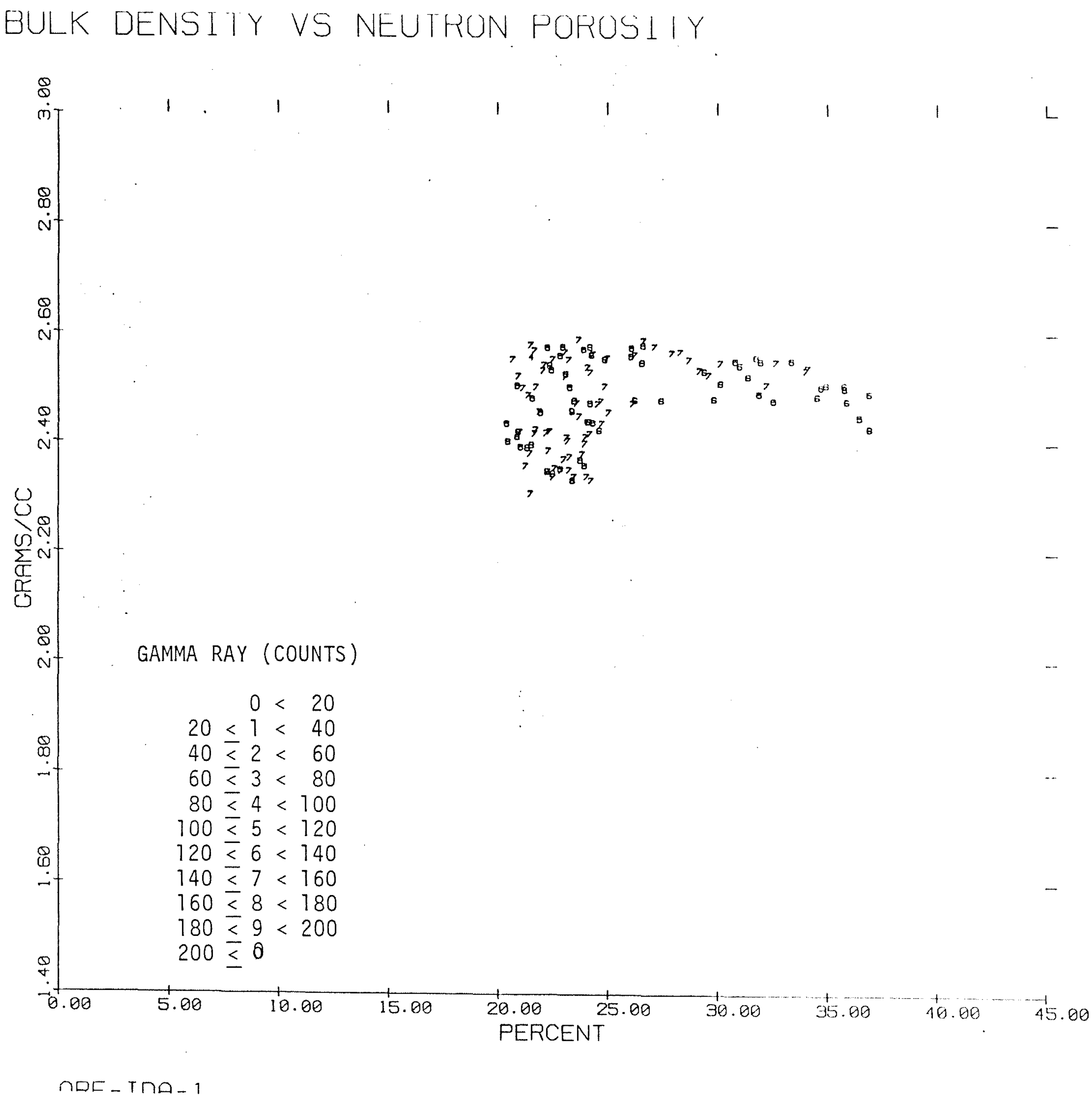

FIGURE 126. Z-Plot of Bulk Density vs. Neutron Porosity with Gamma Ray (5651 - 6026 ft.)

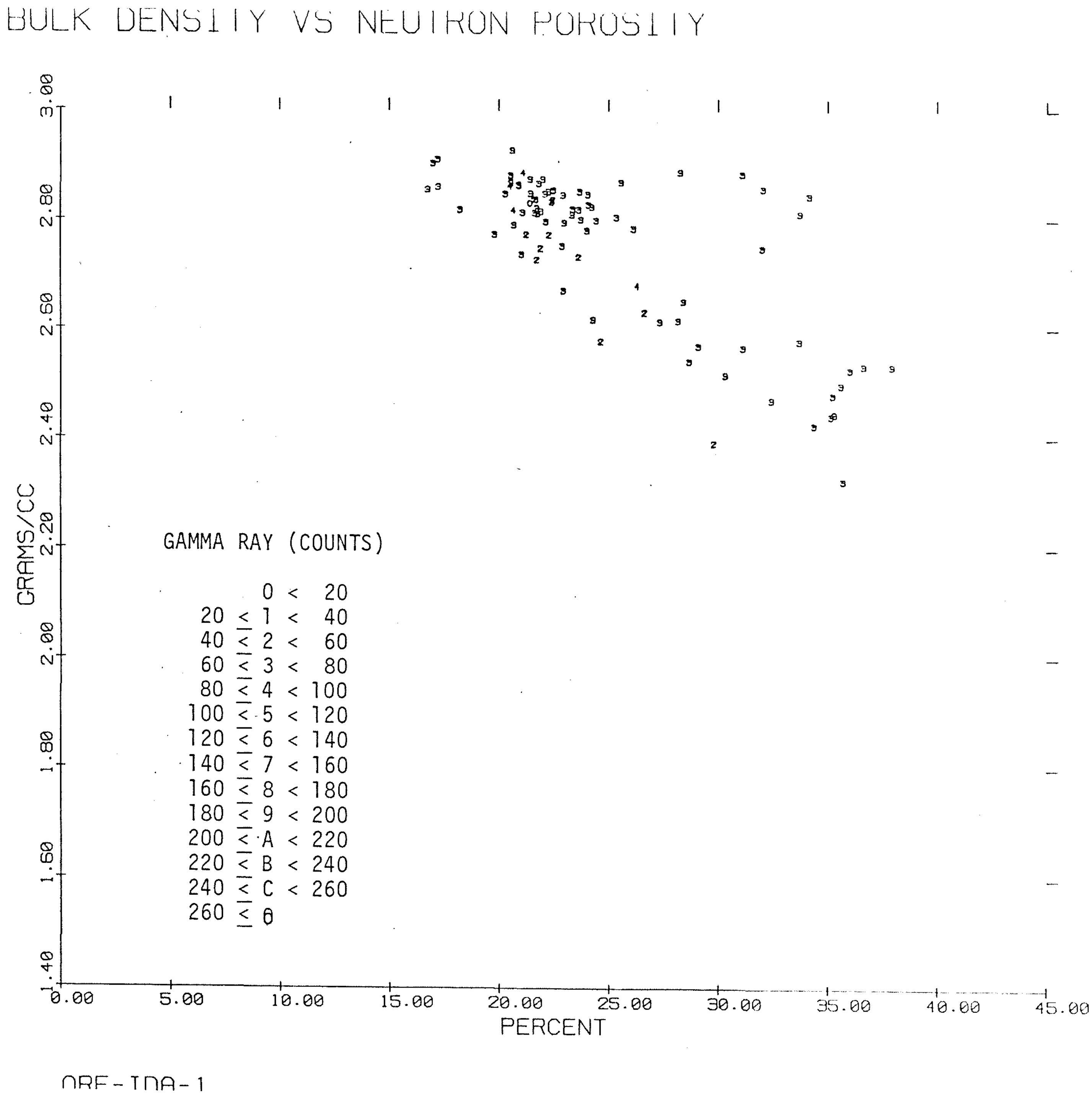

FIGURE 127. Z-Plot of Bulk Density vs. Neutron Porosity with Gamma Ray (6031 - 6286 ft.)

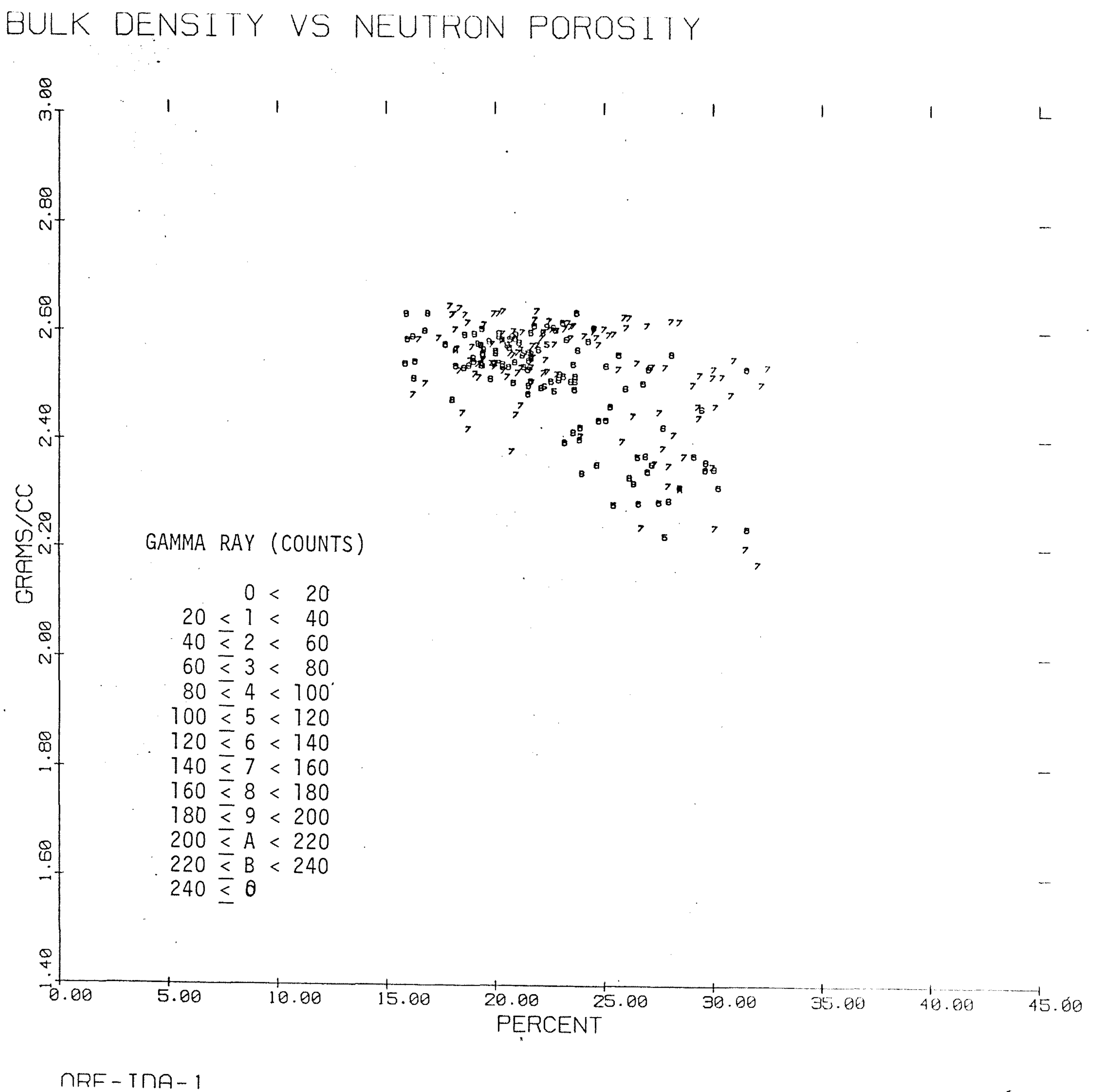

FIGURE 128. Z-Plot of Bulk Density vs. Neutron Porosity with Gamma Ray (6294 - 7008 ft.)

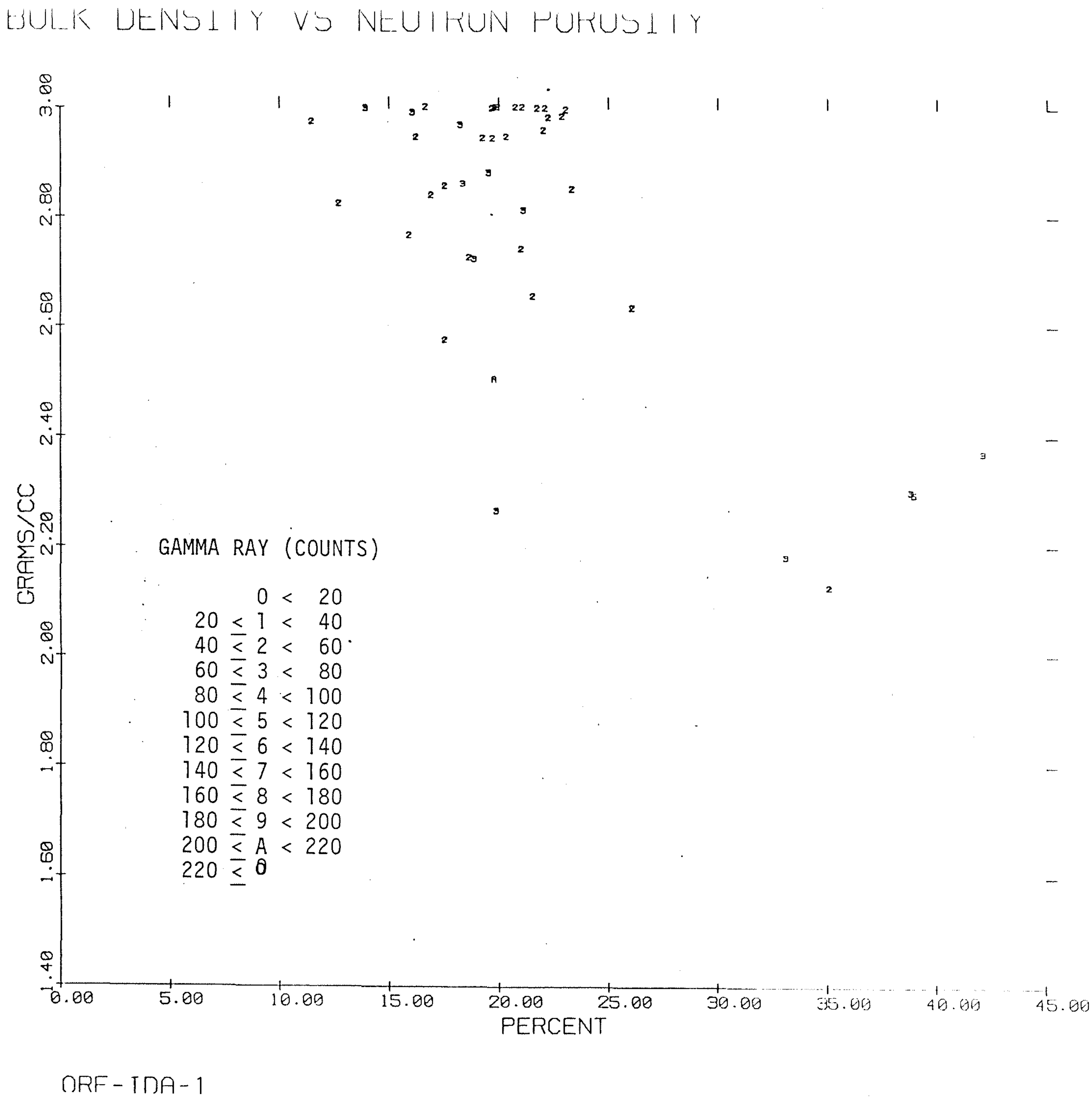

FIGURE 129. Z-Plot of Bulk Density vs. Neutron Porosity with Gamma Ray (7015 - 7135 ft.)

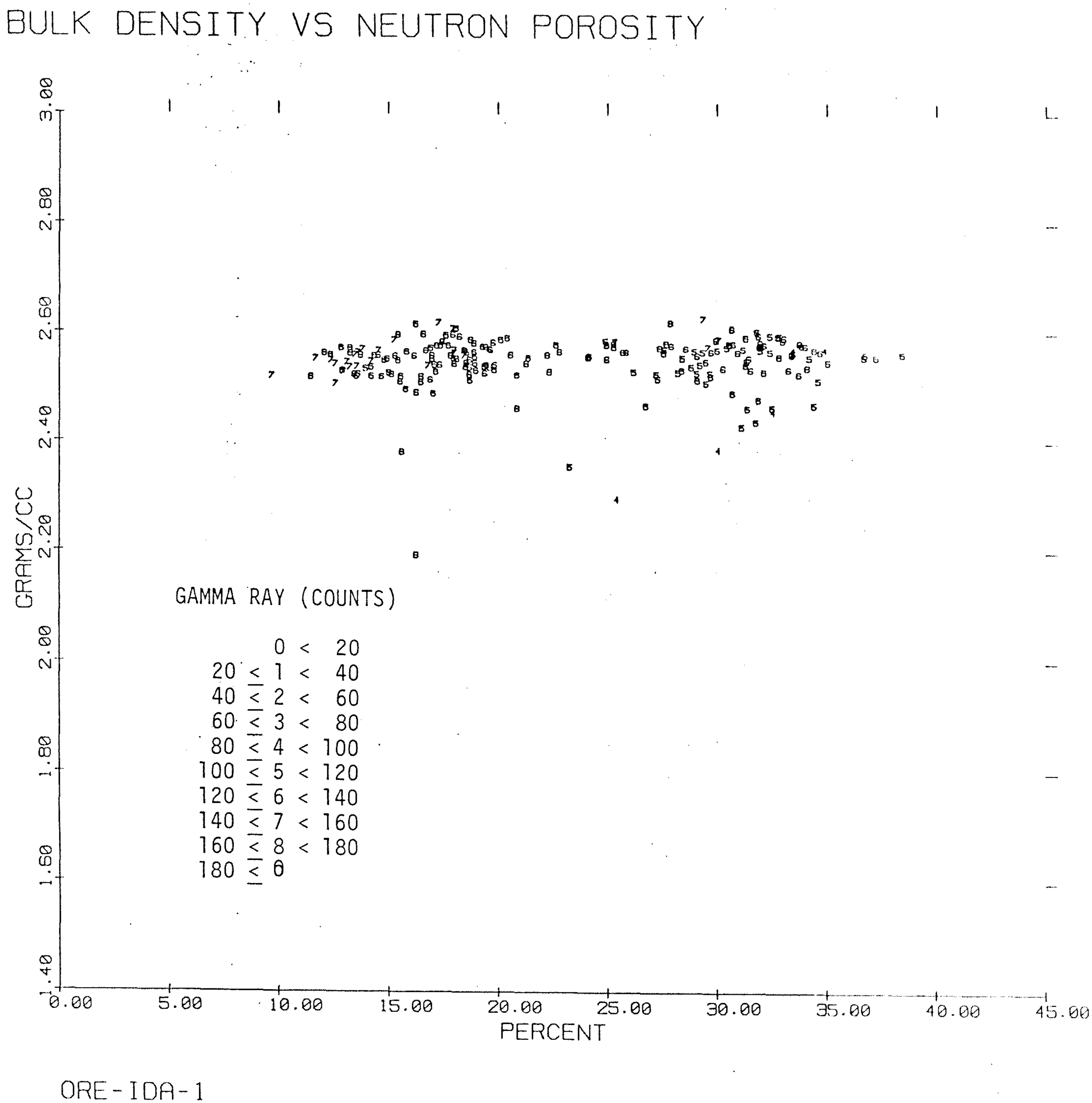

FIGURE 130. Z-Plot of Bulk Density vs. Neutron Porosity with Gamma Ray (7147 - 7798 ft.)

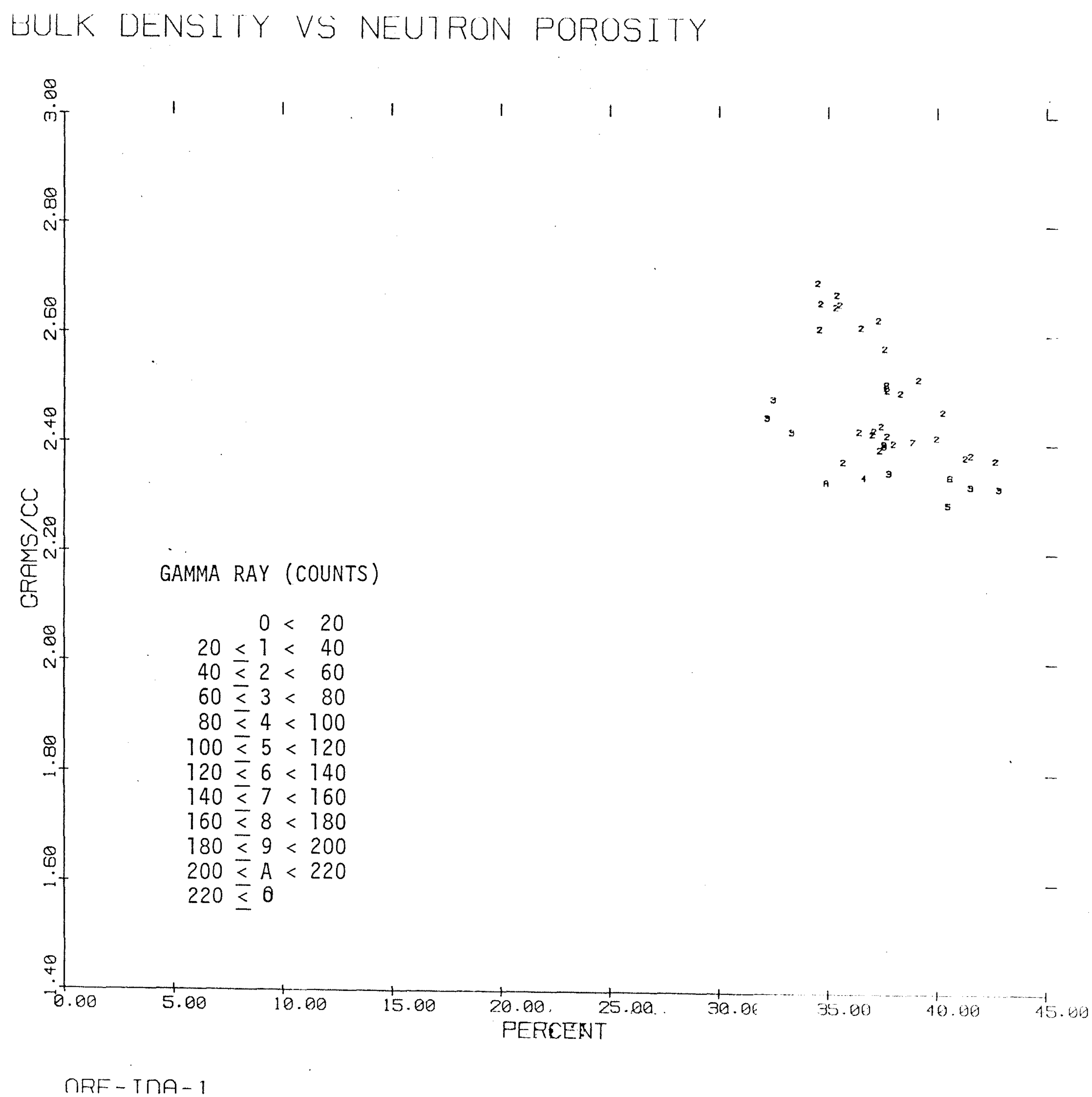

FIGURE 131. Z-Plot of Bulk Density vs. Neutron Porosity with Gamma Ray (7803 - 7926 ft.)

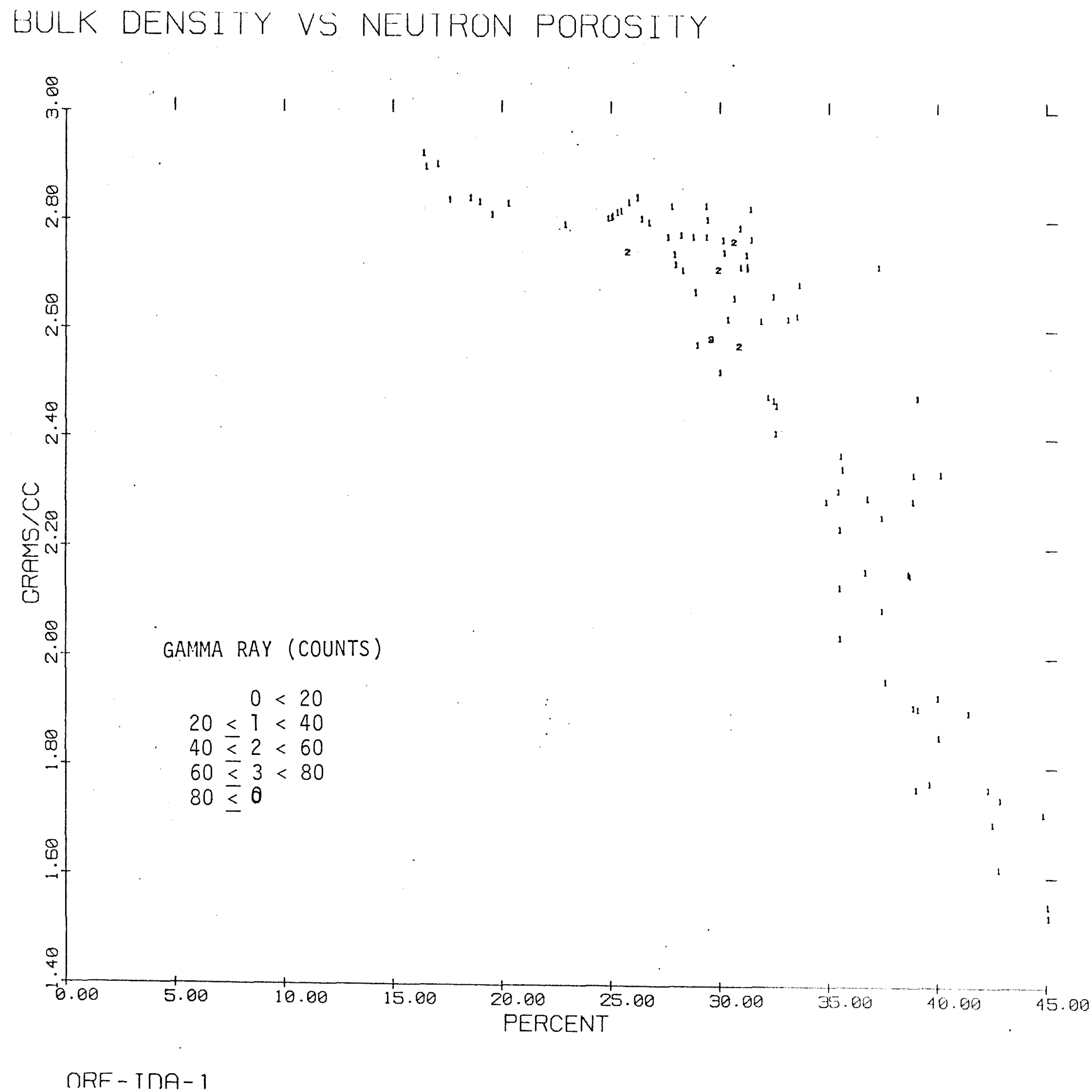

FIGURE 132. Z-Plot of Bulk Density vs. Neutron Porosity with Gamma Ray (8134 - 8404 ft.)

BULK DENSITY VS NEUTRON POROSITY

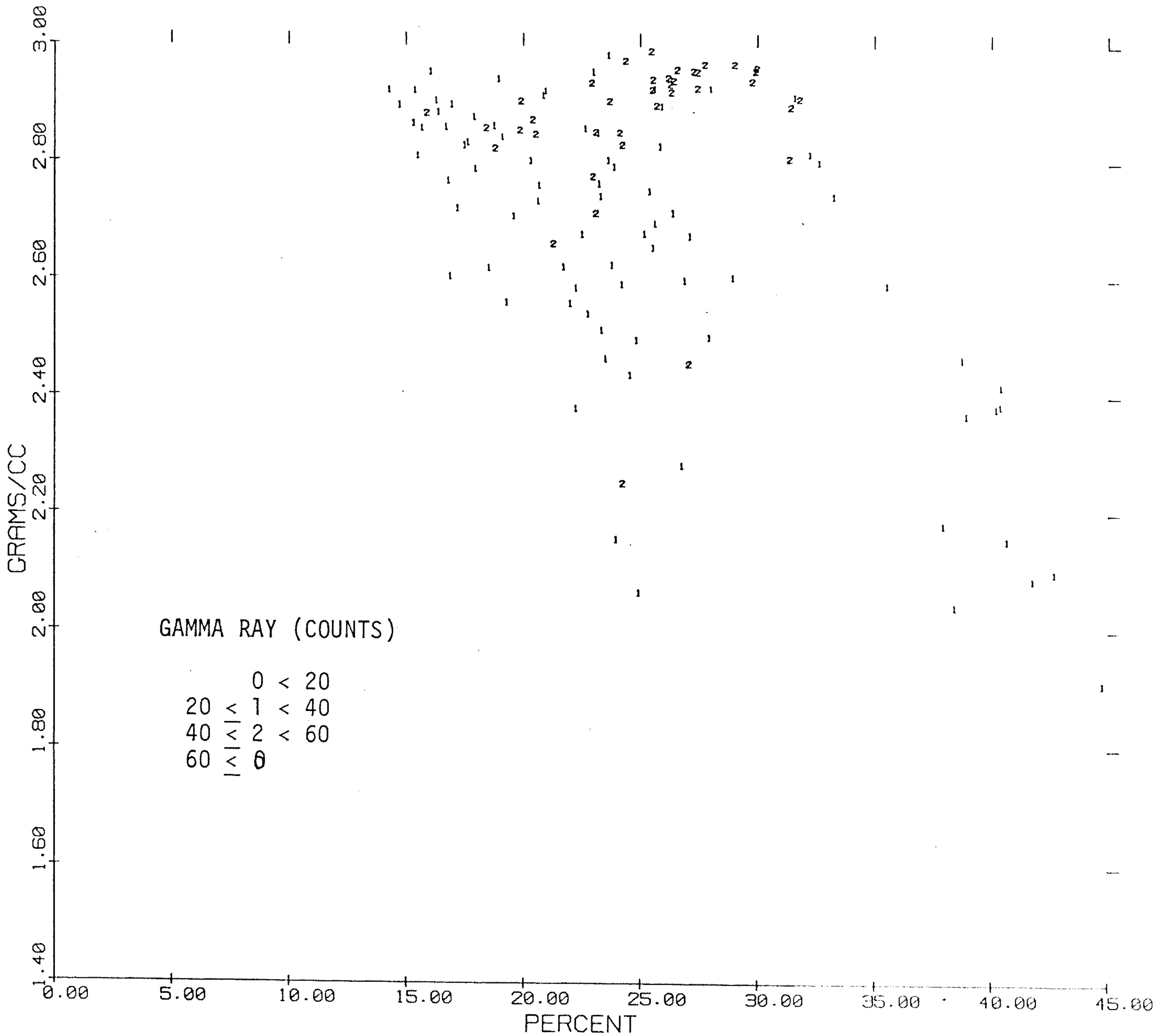

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FIGURE 133. Z-Plot of Bulk Density vs. Neutron Porosity with Gamma Ray (8466 - 8826 ft.)

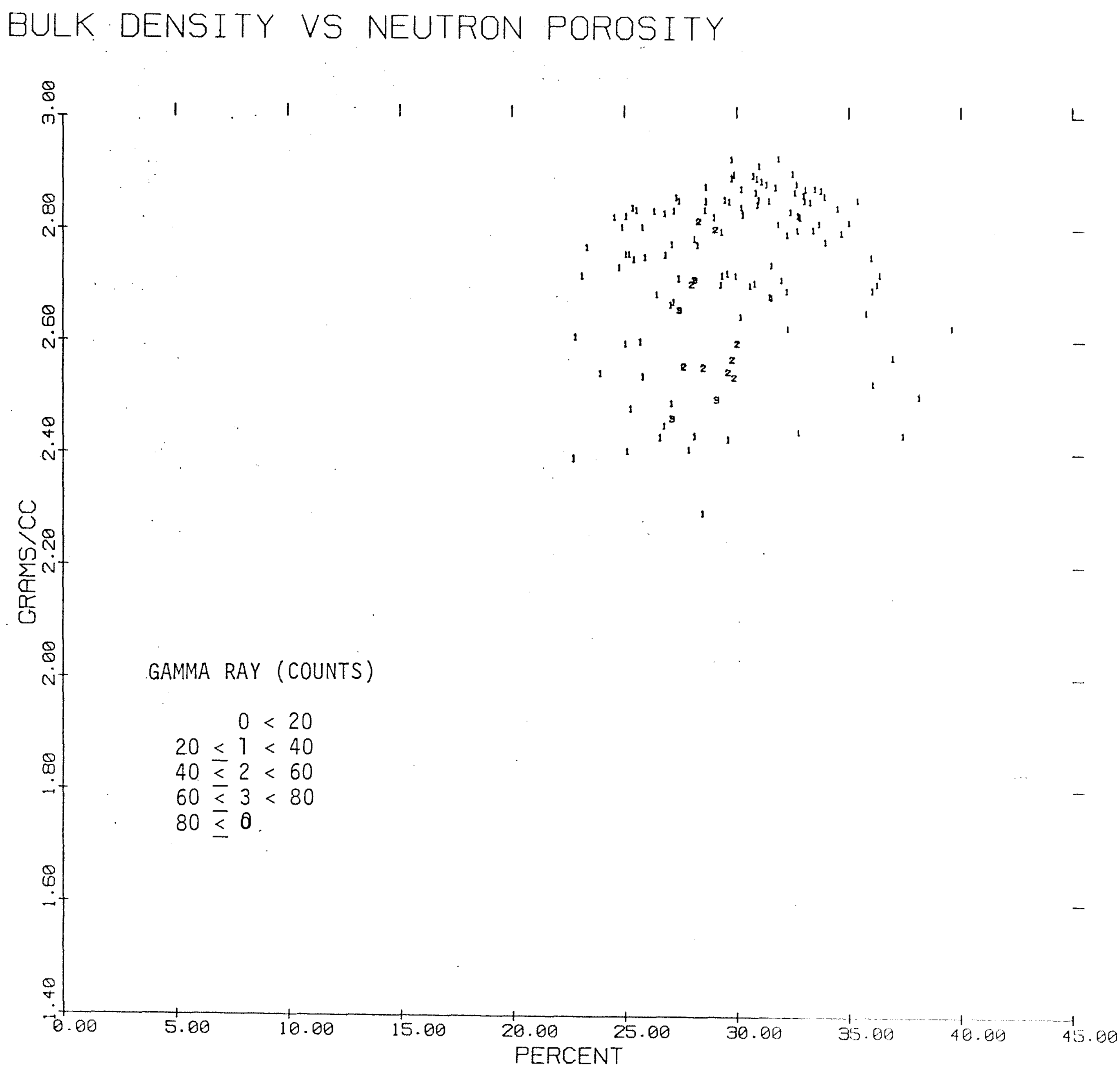

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FIGURE 134. Z-Plot of Bulk Density vs. Neutron Porosity with Gamma Ray (8863 - 9238 ft.)

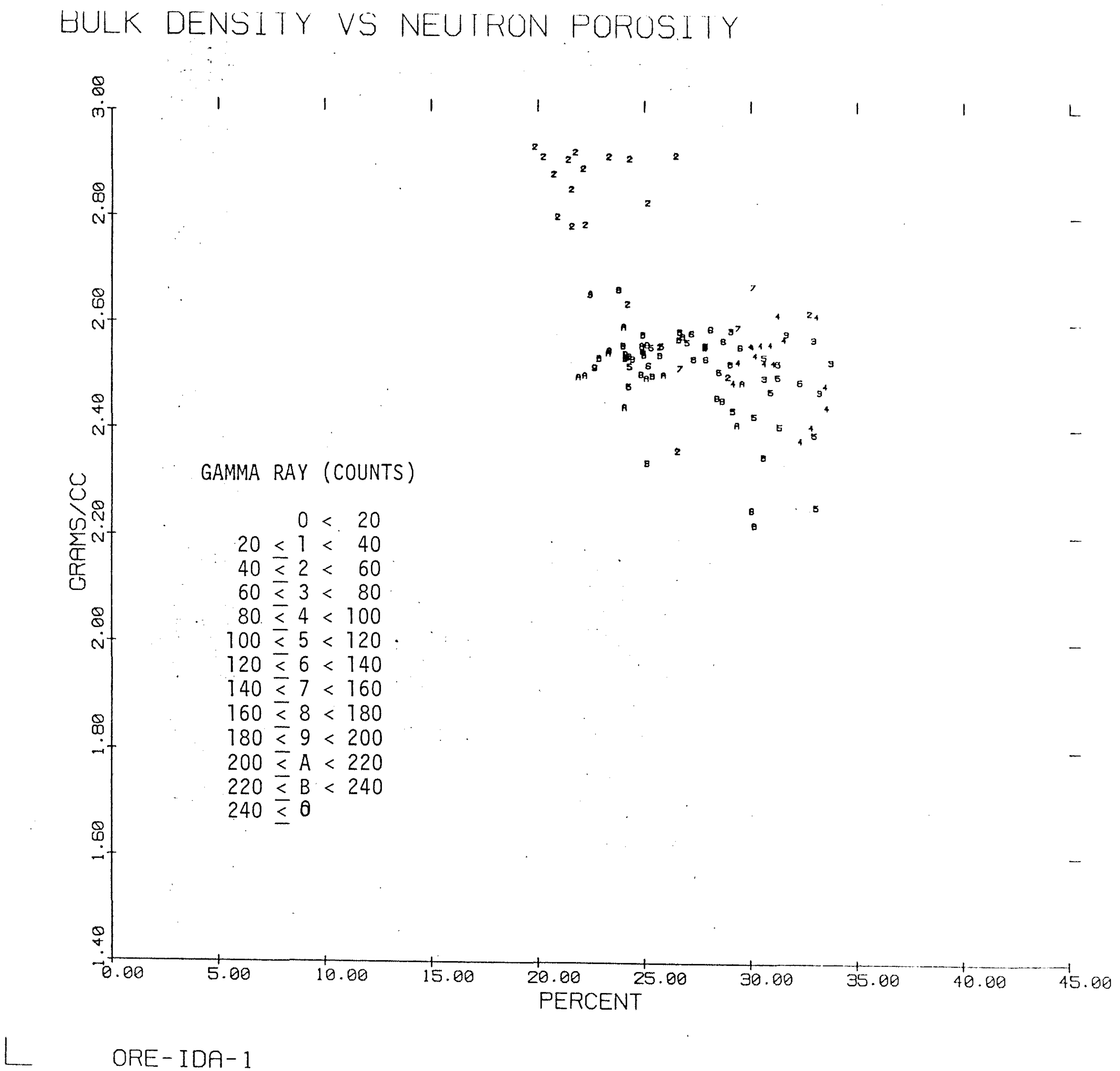

FIGURE 135. Z-Plot of Bulk Density vs. Neutron Porosity with Gamma Ray (9253 - 9577 ft.)

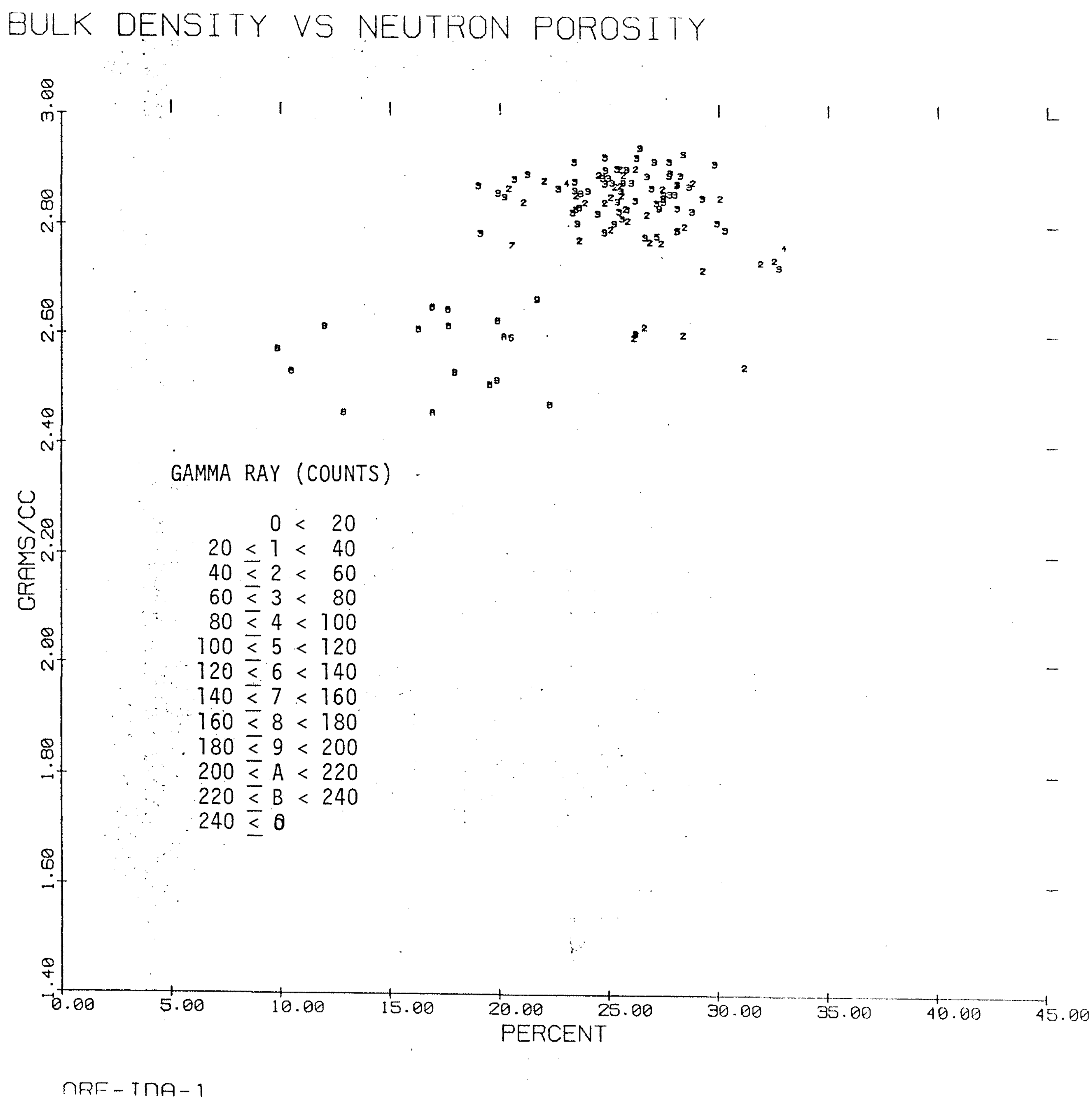

FIGURE 136. Z-Plot of Bulk Density vs. Neutron Porosity with Gamma Ray (9581 - 9938 ft.)

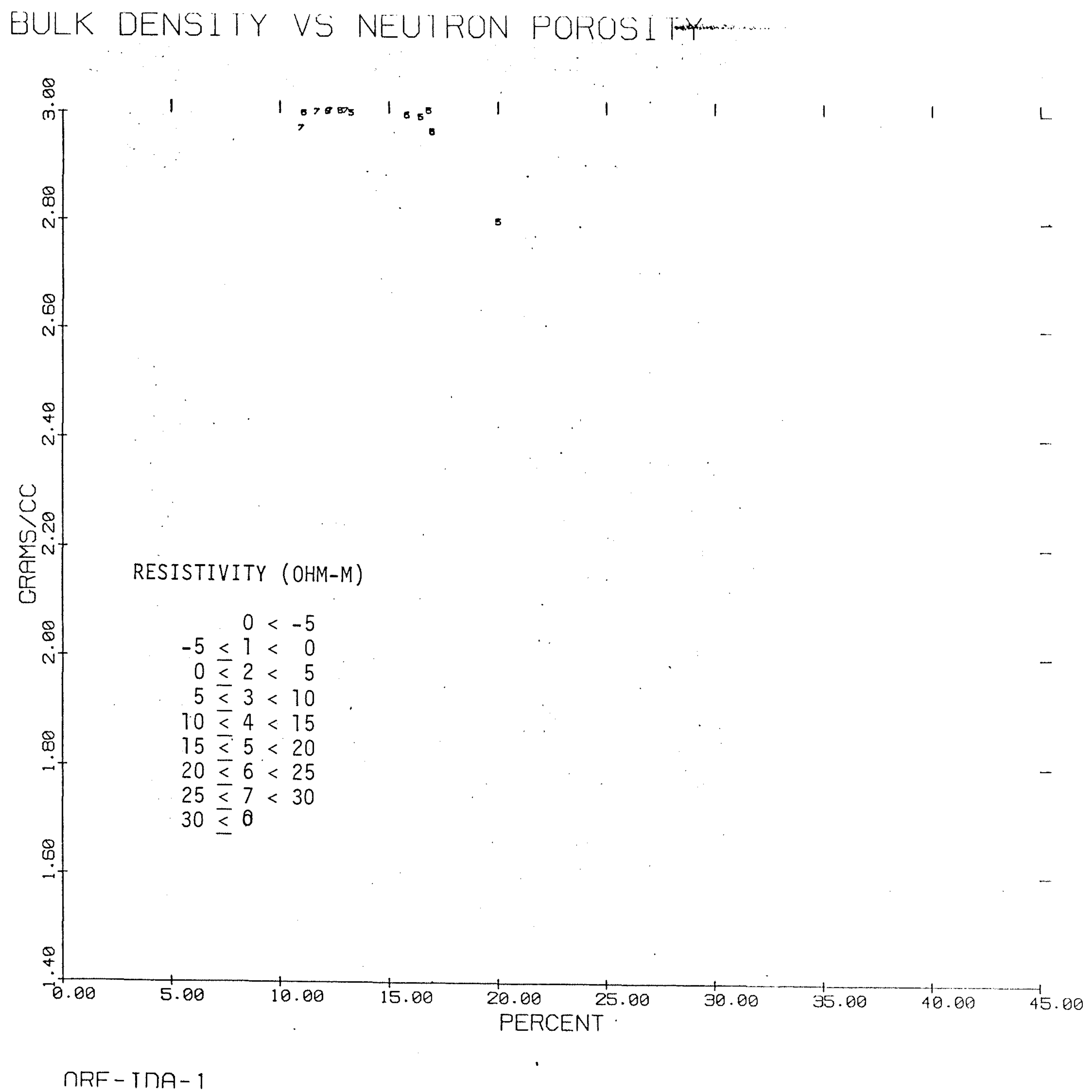

FIGURE 137. Z-Plot of Bulk Density vs. Neutron Porosity with Resistivity (4571 - 4610 ft.)

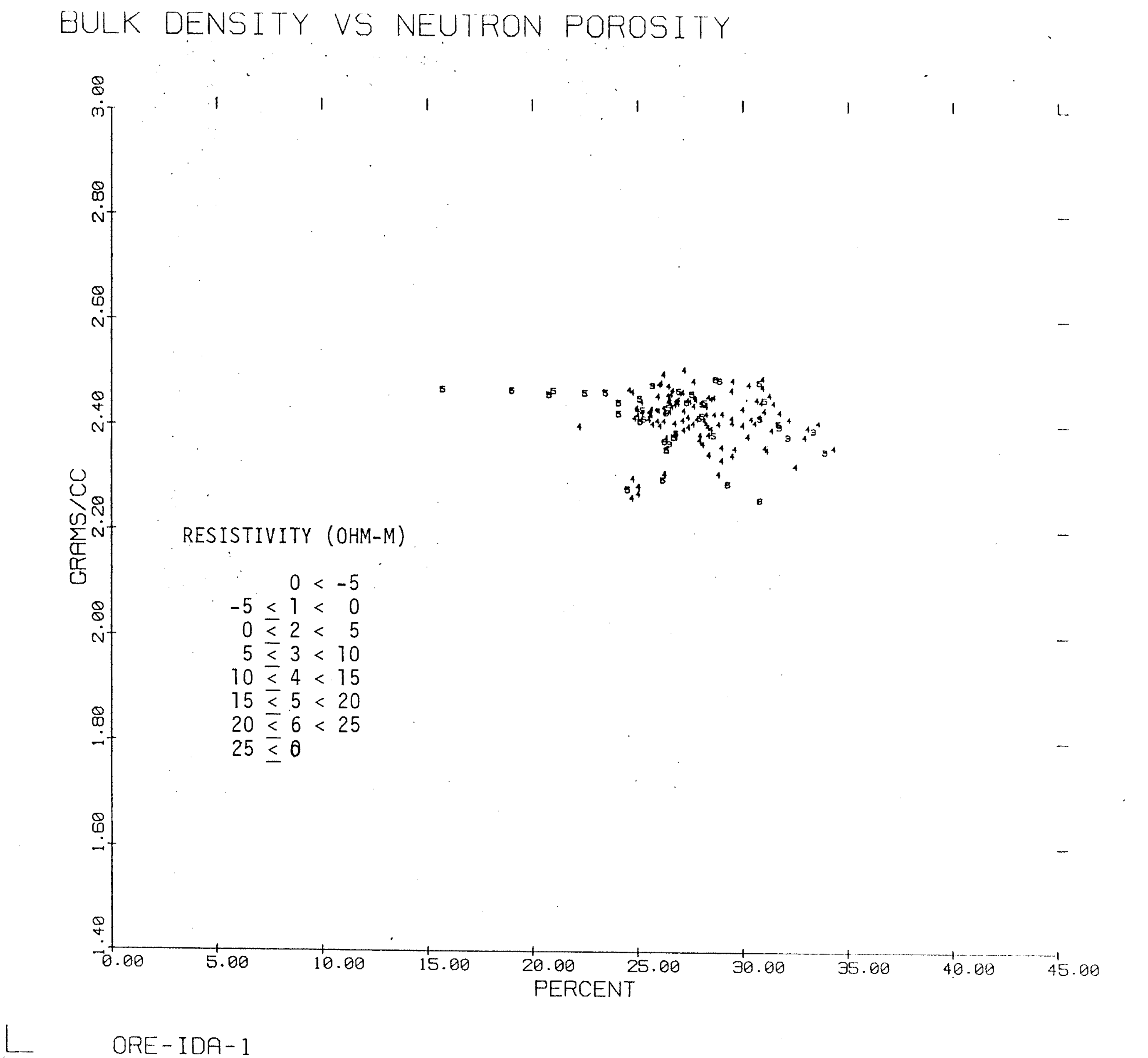

FIGURE 138. Z-Plot of Bulk Density vs. Neutron Porosity with Resistivity (4660 - 5137 ft.)

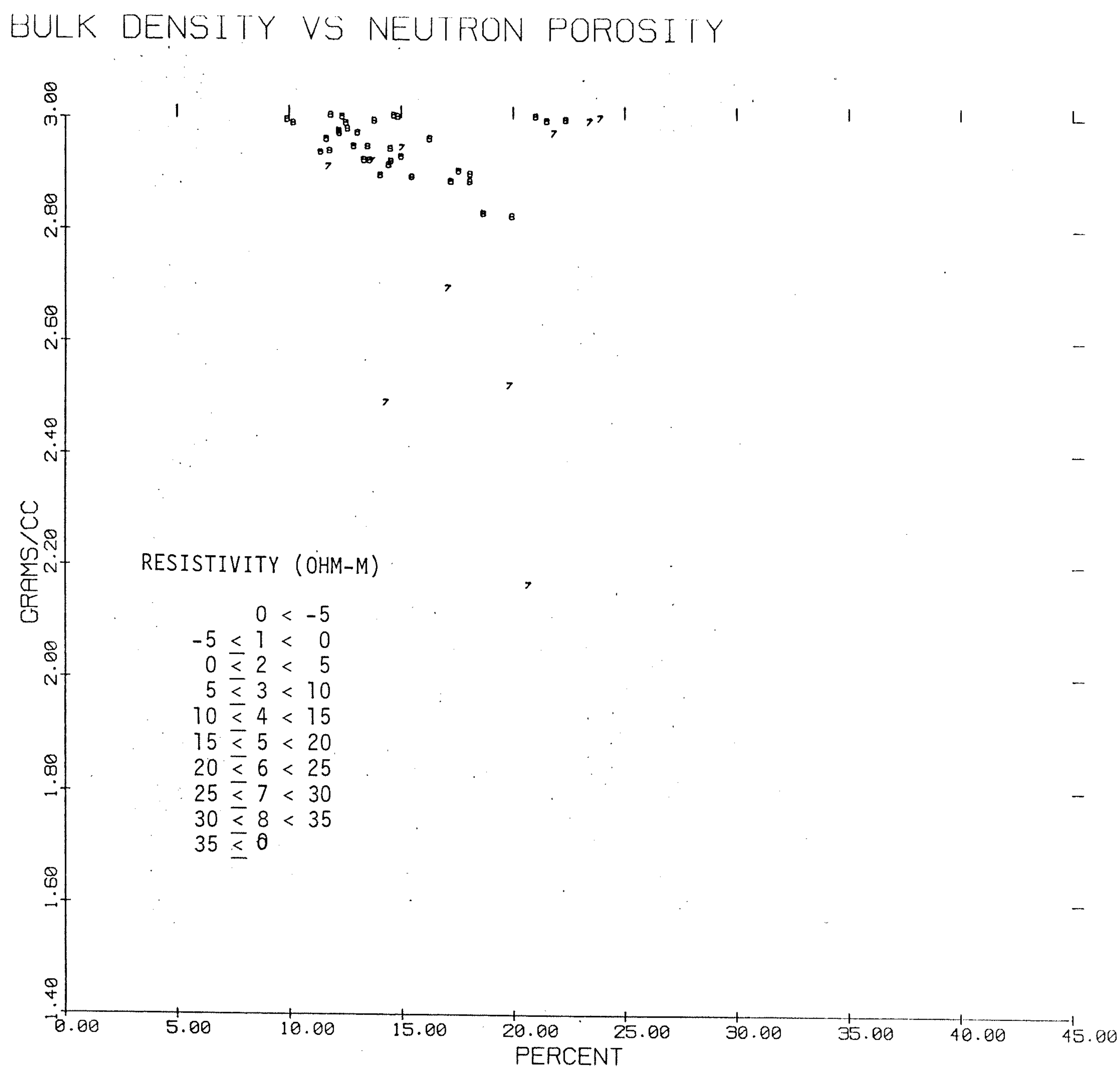

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FIGURE 139. Z-Plot of Bulk Density vs. Neutron Porosity with Resistivity (5152 - 5287 ft.)

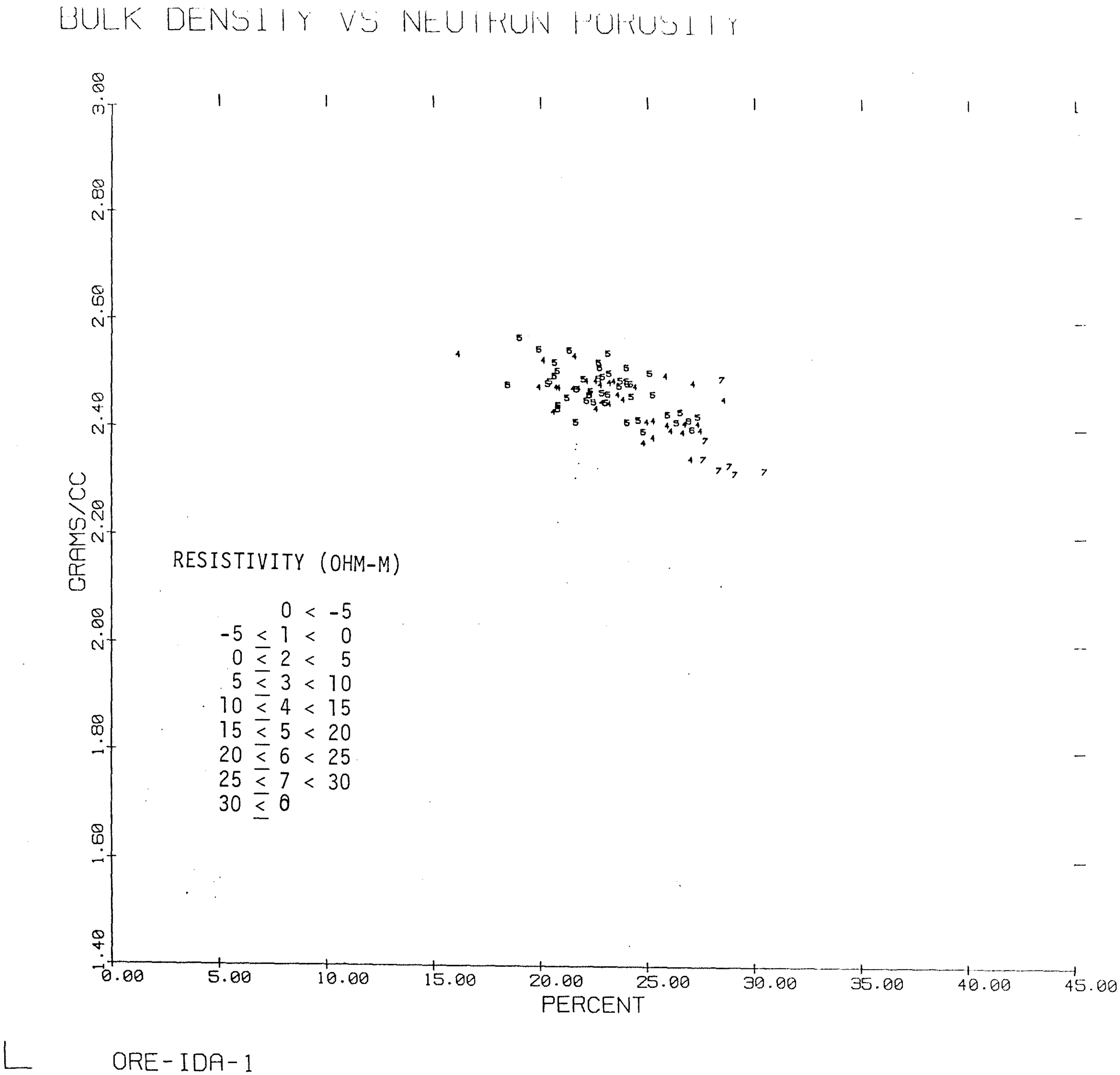

FIGURE 140. Z-Plot of Bulk Density vs. Neutron Porosity with Resistivity (5296 - 5560 ft.)

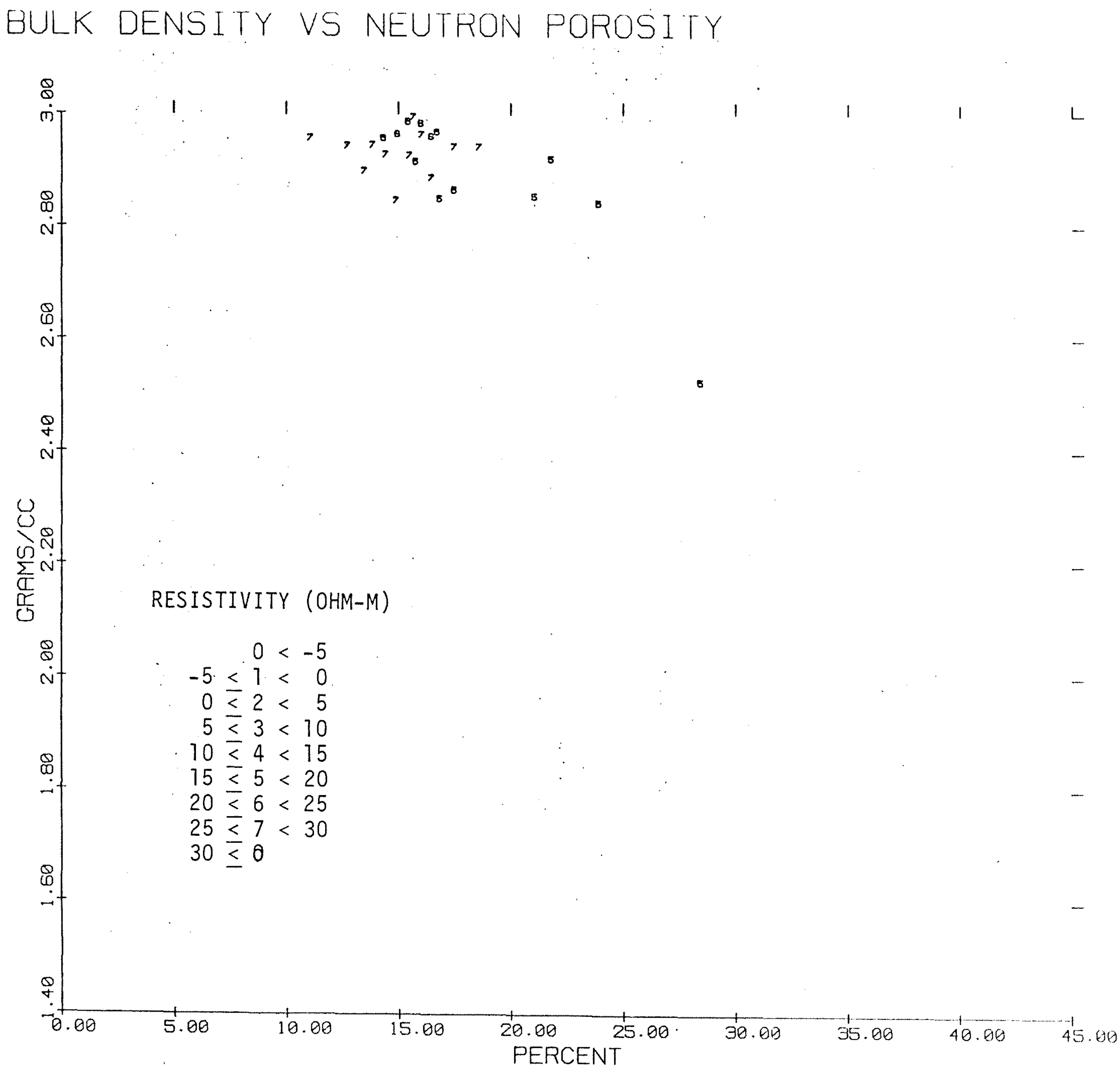

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FIGURE 141. Z-Plot of Bulk Density vs. Neutron Porosity with Resistivity (5572 - 5644 ft.)

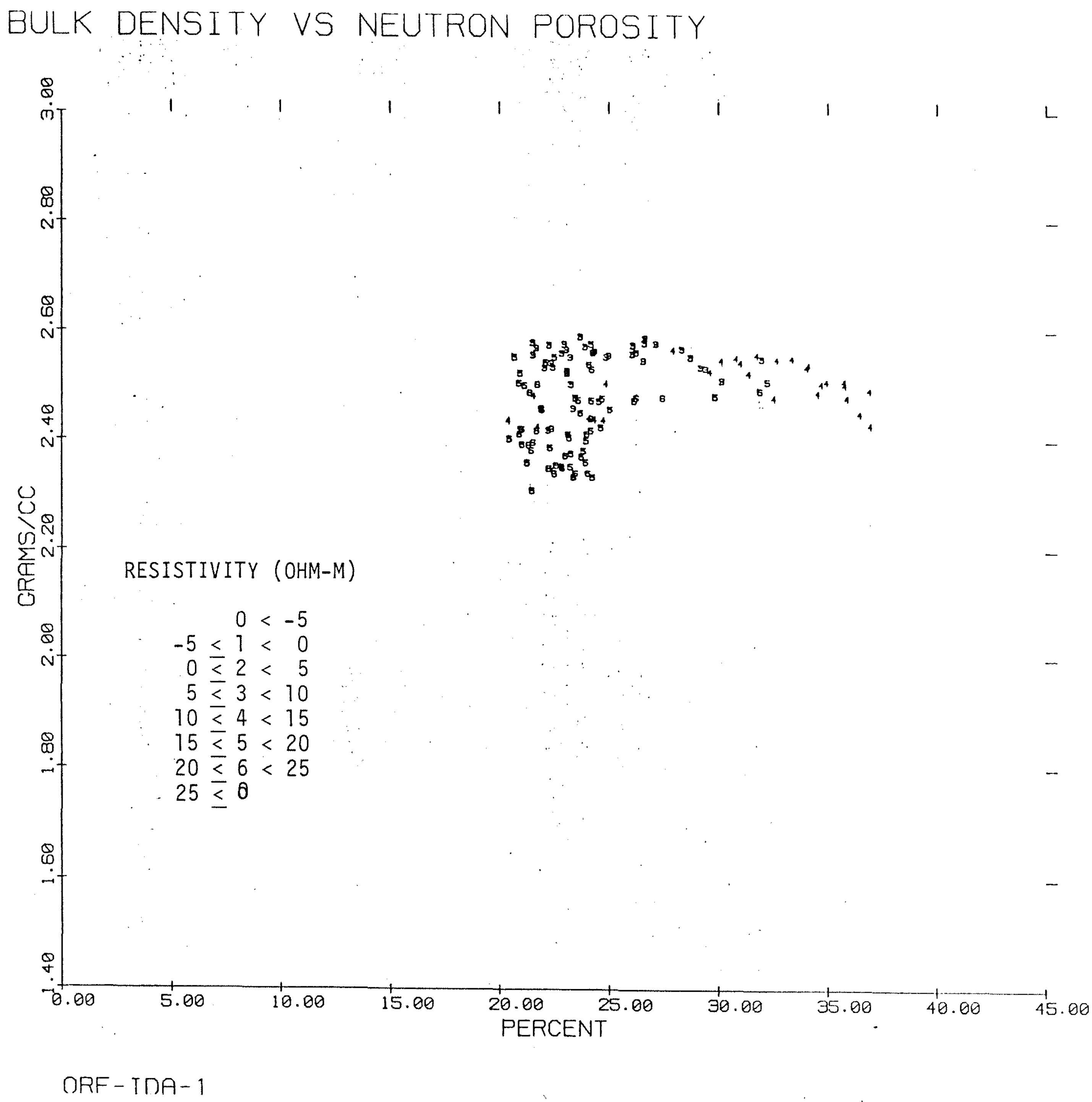

FIGURE 142. Z-Plot of Bulk Density vs. Neutron Porosity with Resistivity (5651 - 6026 ft.)

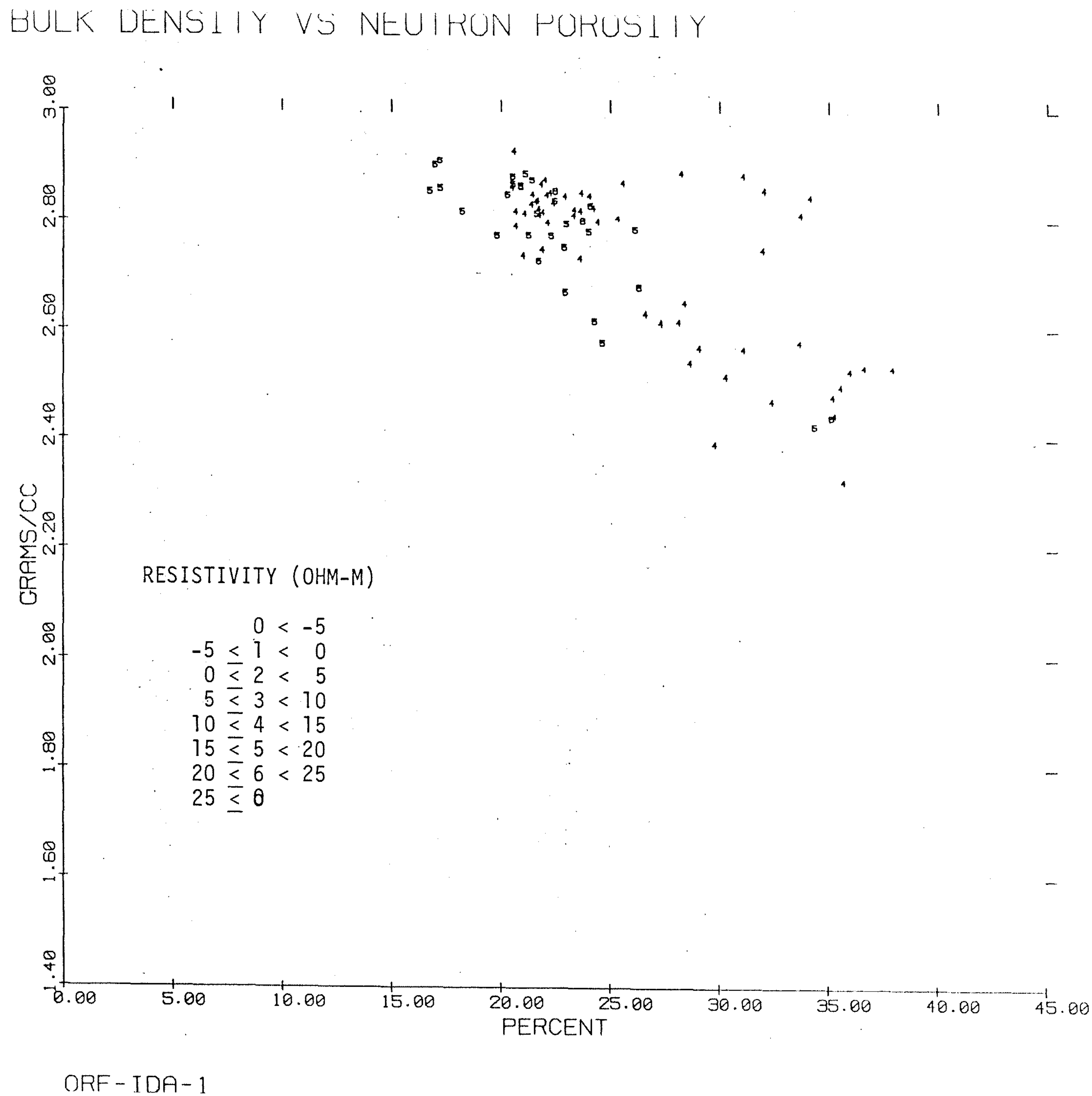

FIGURE 143. Z-Plot of Bulk Density vs. Neutron Porosity with Resistivity (6031 - 6286 ft.)

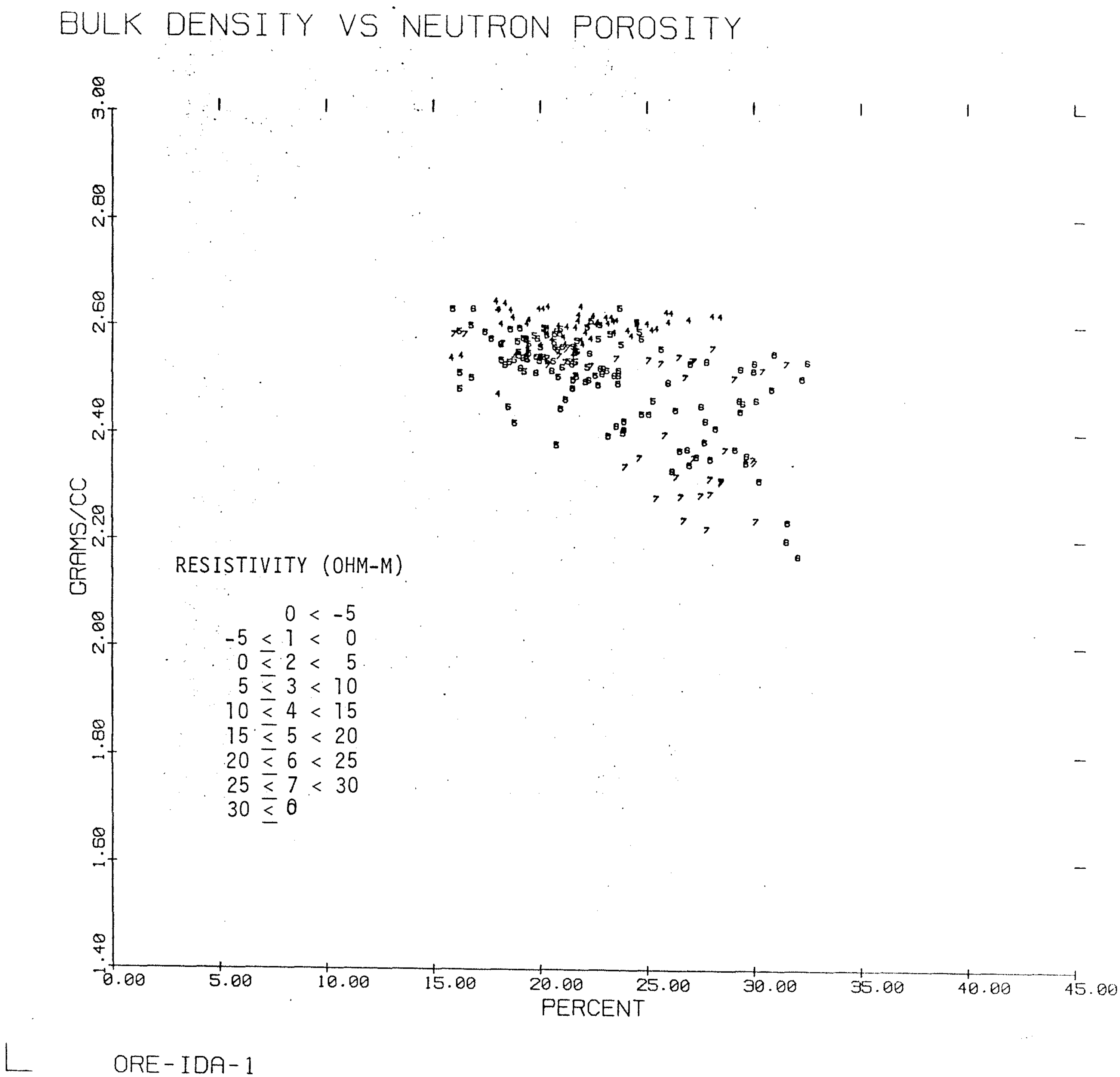

FIGURE 144. Z-Plot of Bulk Density vs. Neutron Porosity with Resistivity (6294 - 7008 ft.)

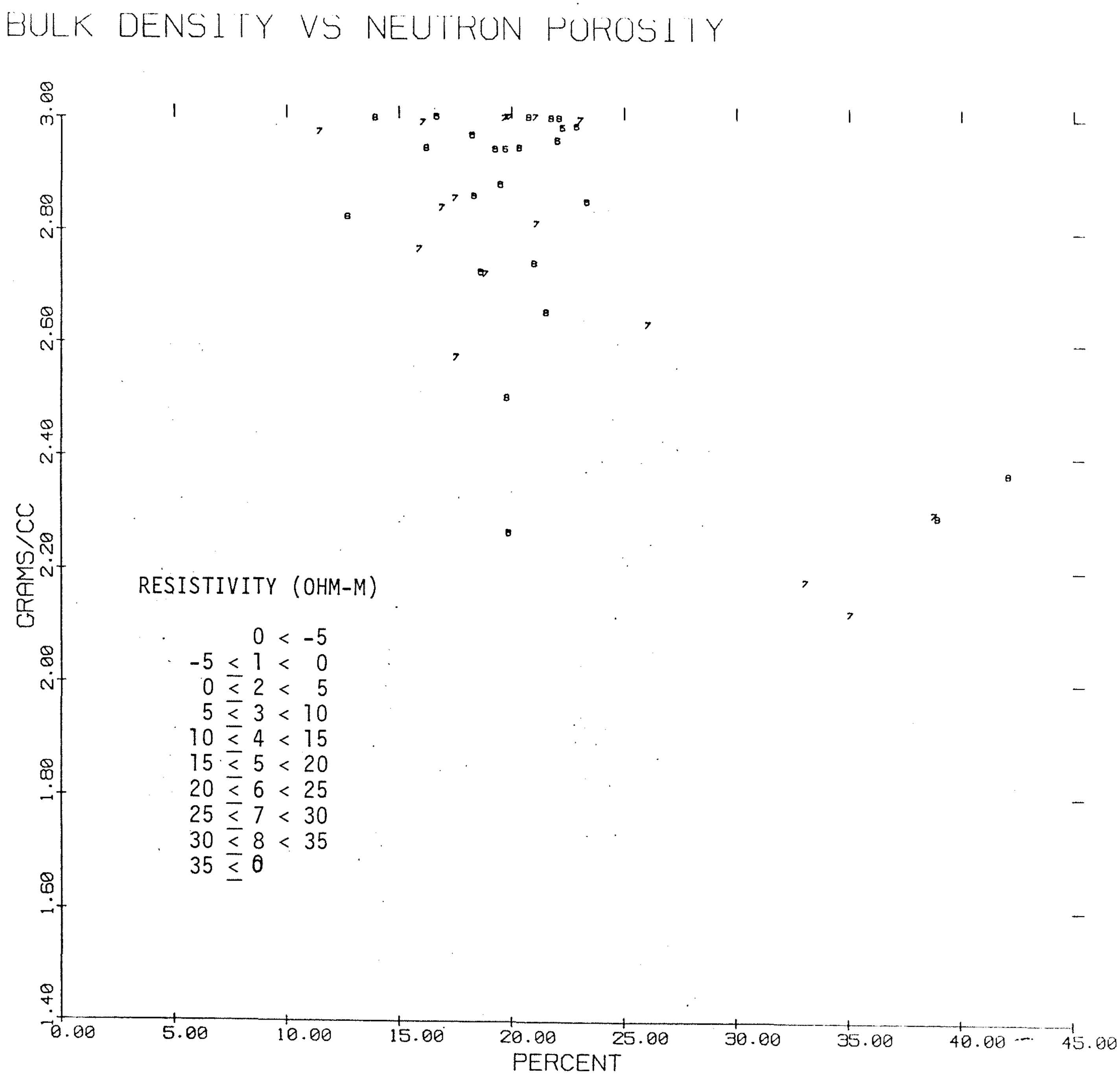

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FIGURE 145. Z-Plot of Bulk Density vs. Neutron Porosity with Resistivity (7015 - 7135 ft.)

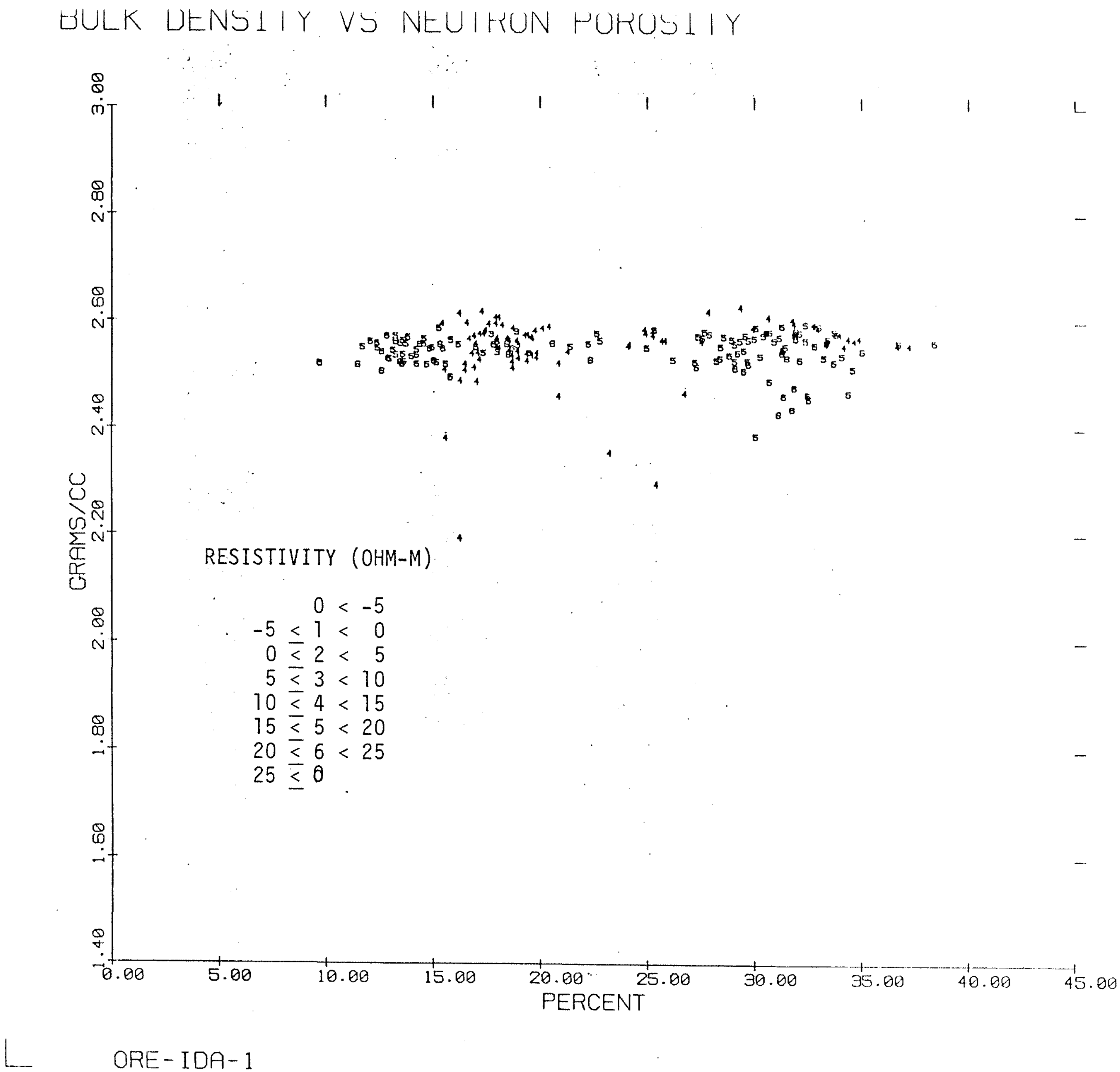

FIGURE 146. Z-Plot of Bulk Density vs. Neutron Porosity with Resistivity (7147 - 7798 ft.)

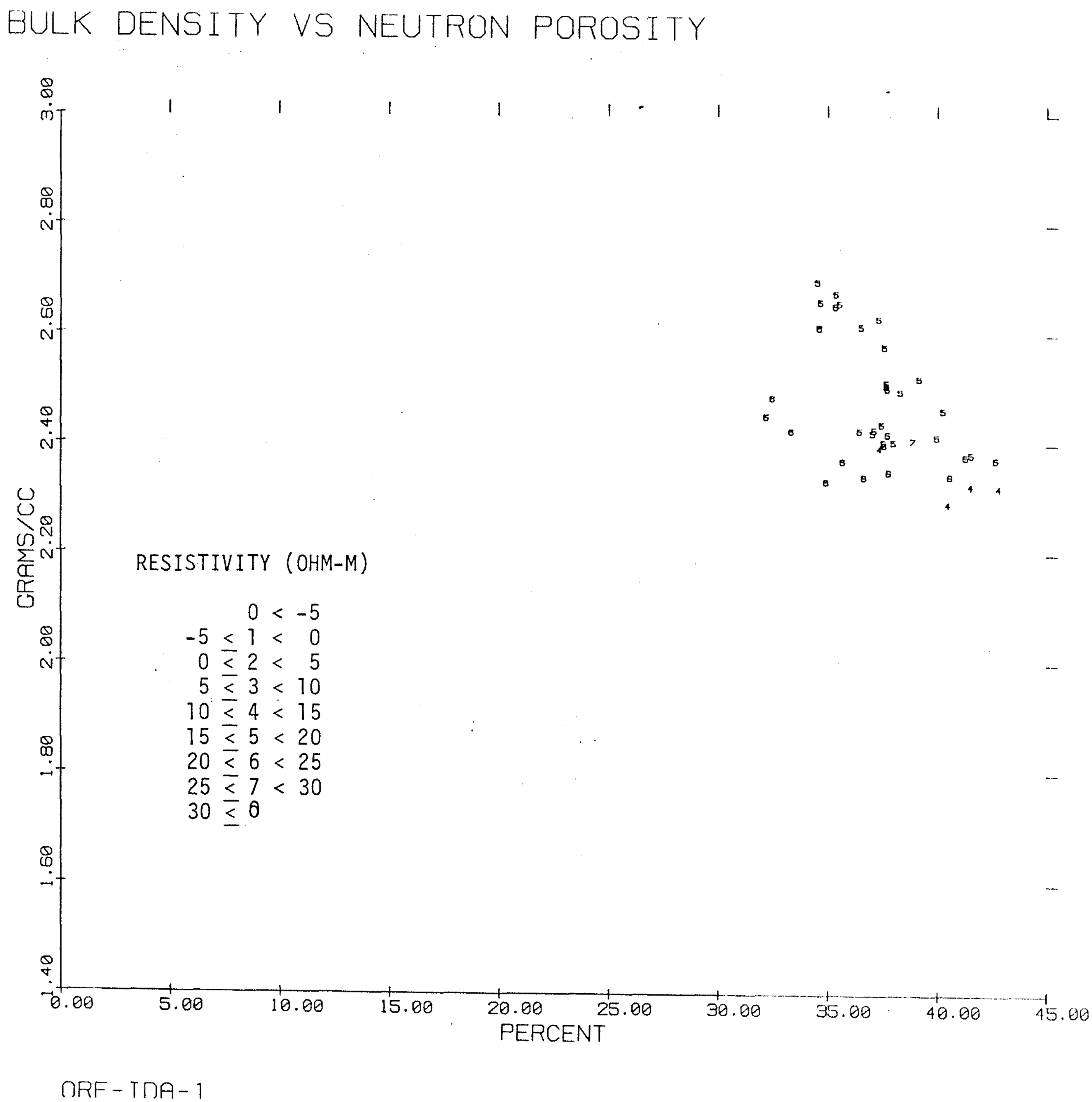

FIGURE 147. Z-Plot of Bulk Density vs. Neutron Porosity with Resistivity (7803 - 7926 ft.)

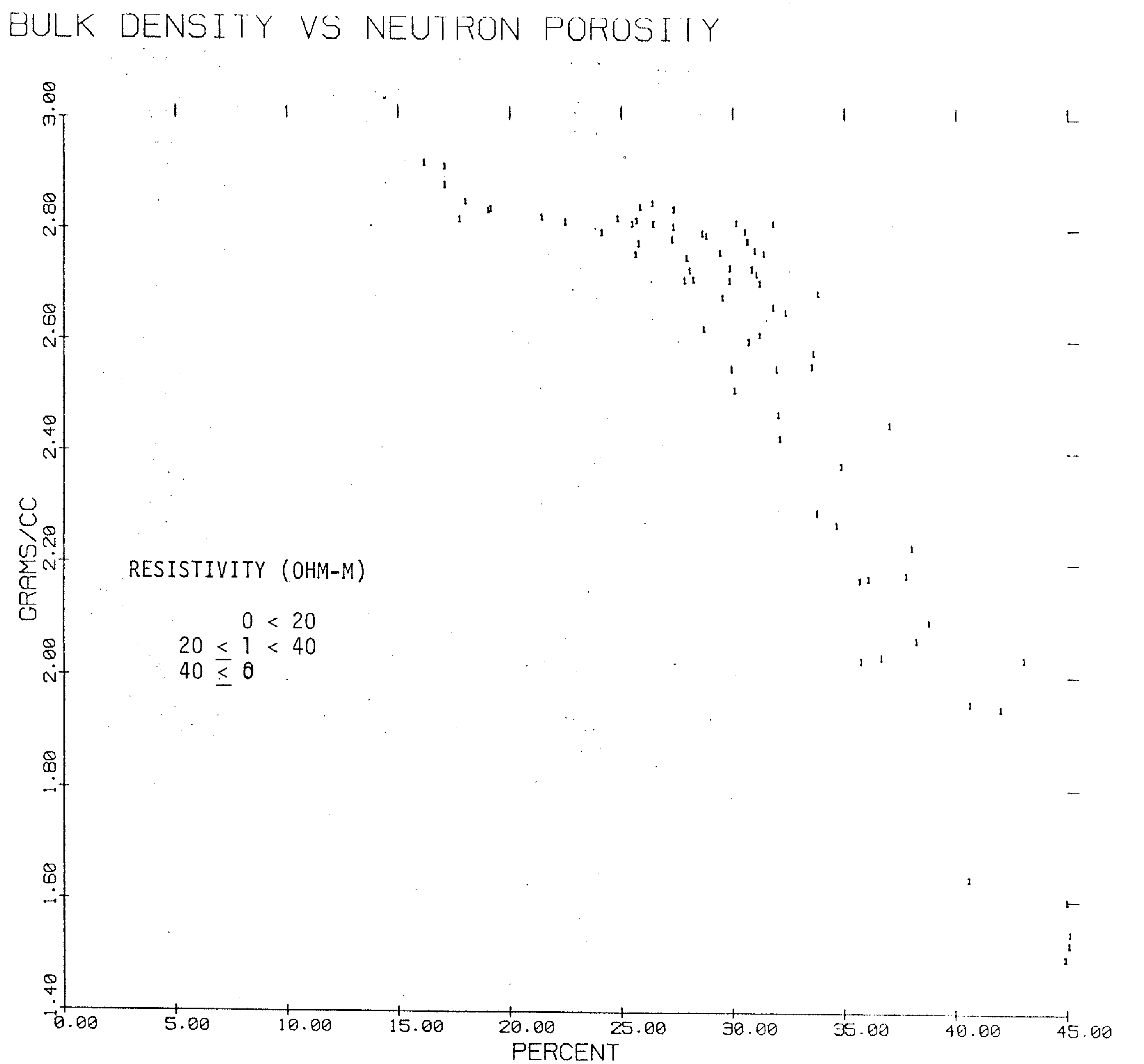

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FIGURE 148. Z-Plot of Bulk Density vs. Neutron Porosity with Resistivity (8181 - 8403 ft.)

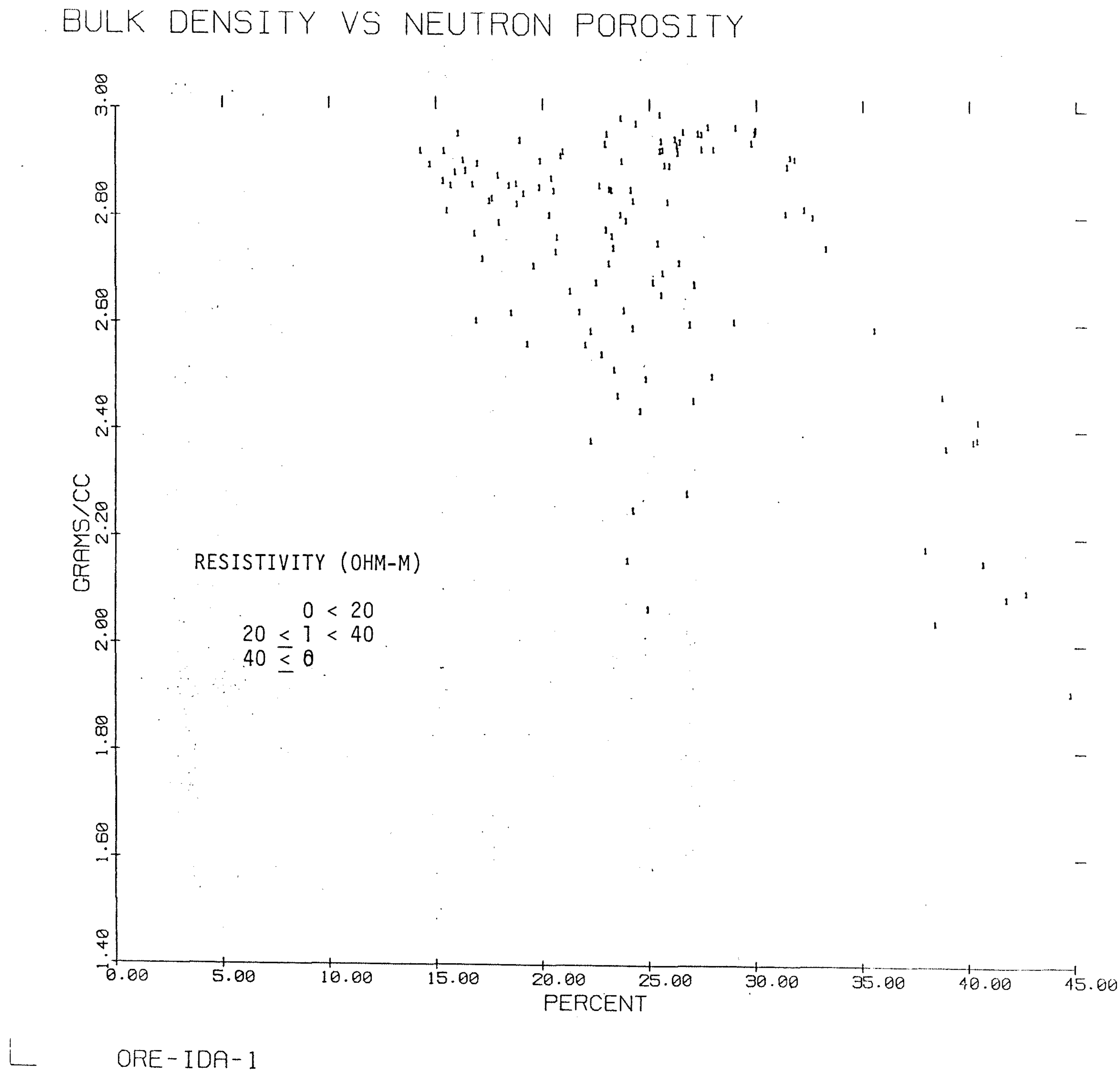


FIGURE 149. Z-Plot of Bulk Density vs. Neutron Porosity with Resistivity (8466 - 8826 ft.)

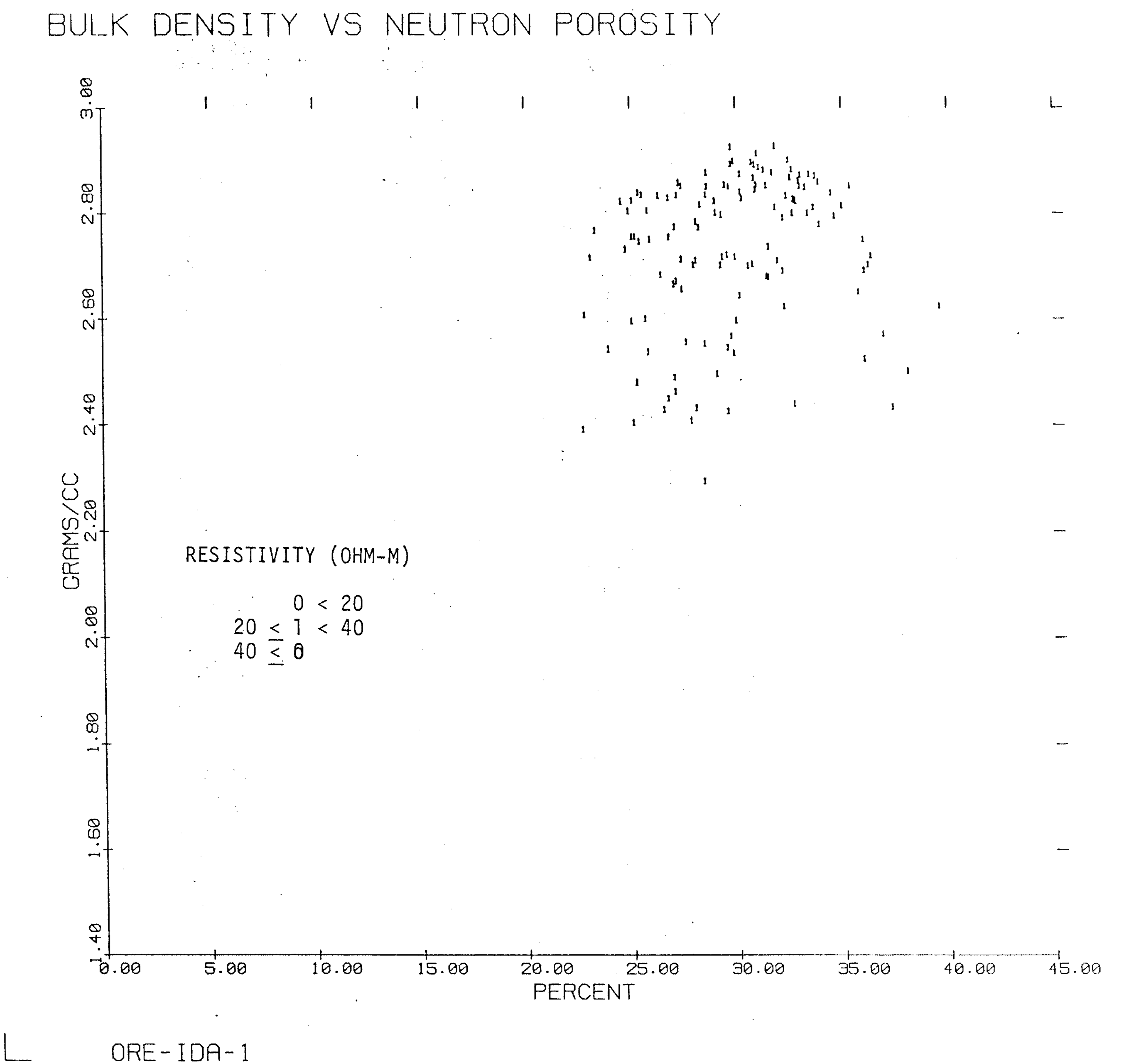


FIGURE 150. Z-Plot of Bulk Density vs. Neutron Porosity with Resistivity (8863 - 9238 ft.)

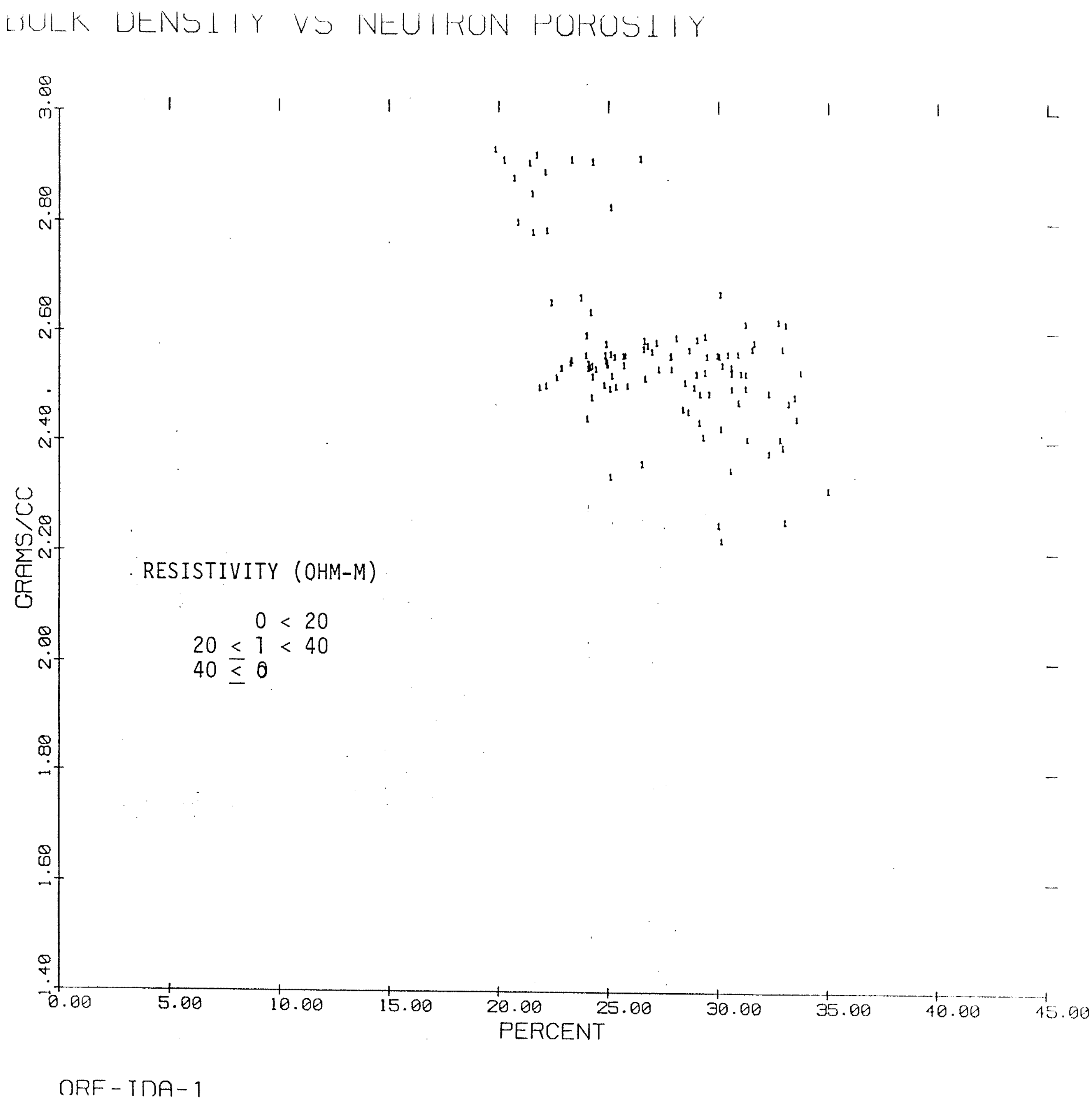


FIGURE 151. Z-Plot of Bulk Density vs. Neutron Porosity with Resistivity (9253 - 9577 ft.)

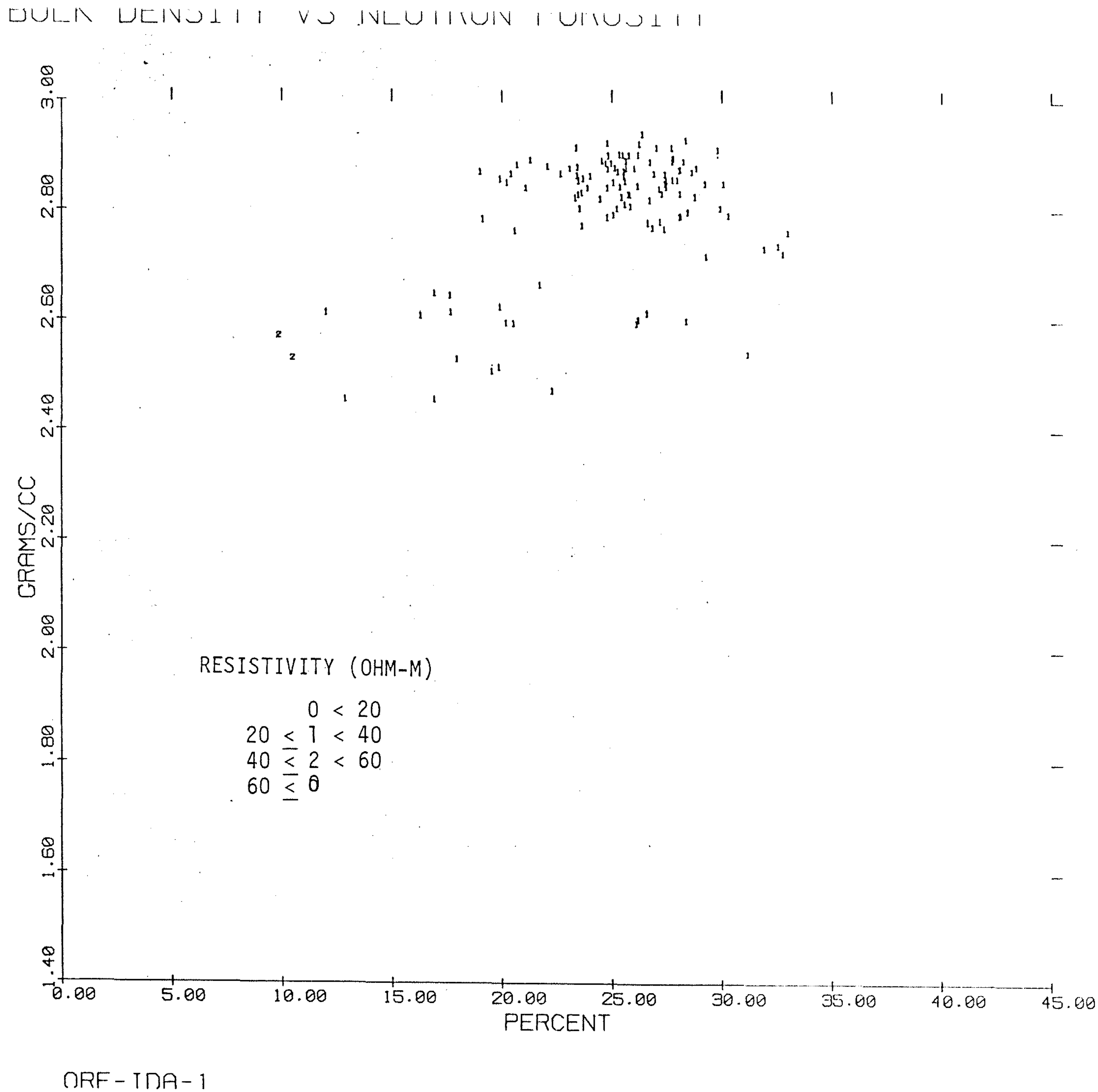


FIGURE 152. Z-Plot of Bulk Density vs. Neutron Porosity with Resistivity (9581 - 9938 ft.)

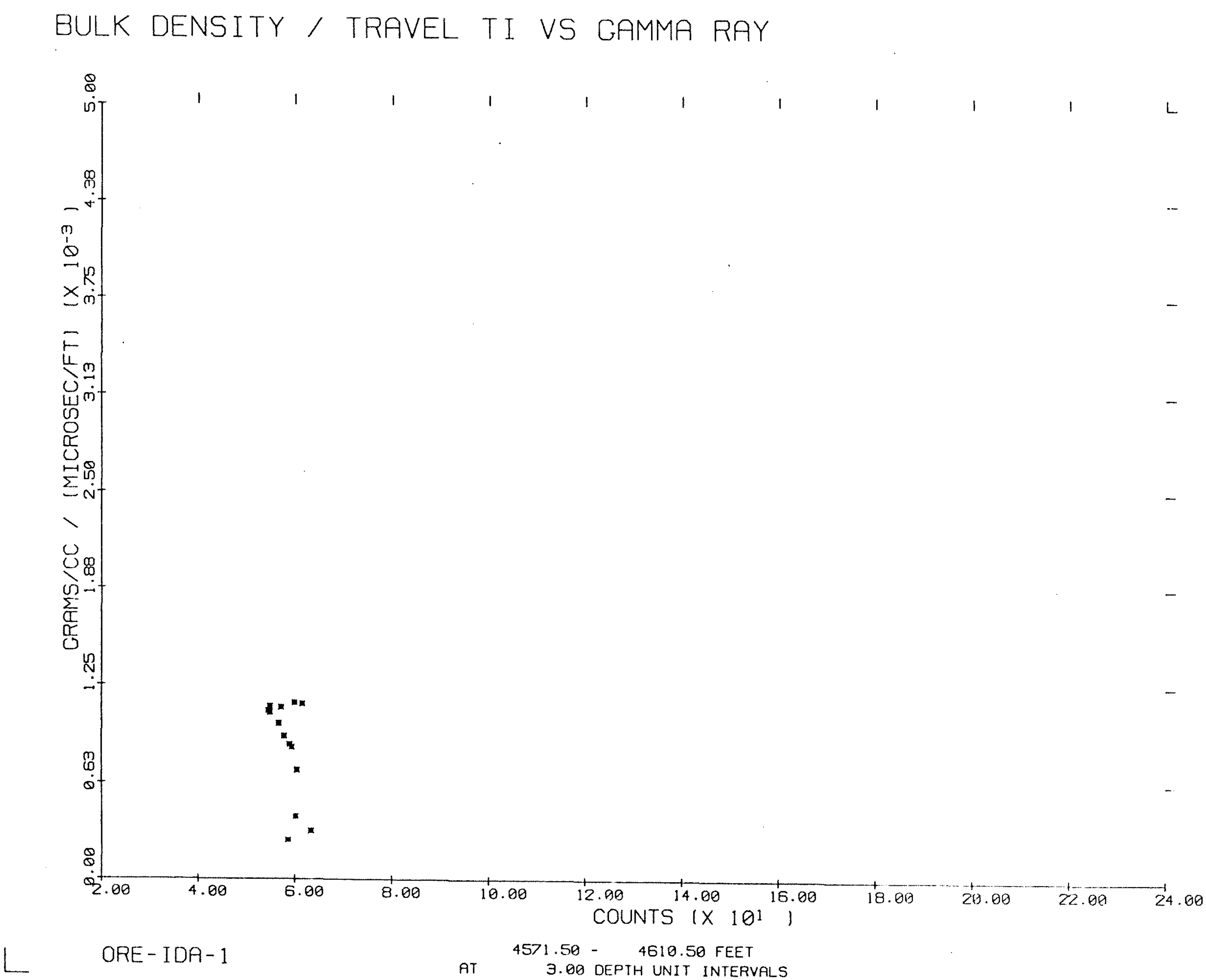


FIGURE 153. Crossplot of Mechanical Strength Index vs. Gamma Ray (4571 - 4610 ft.)

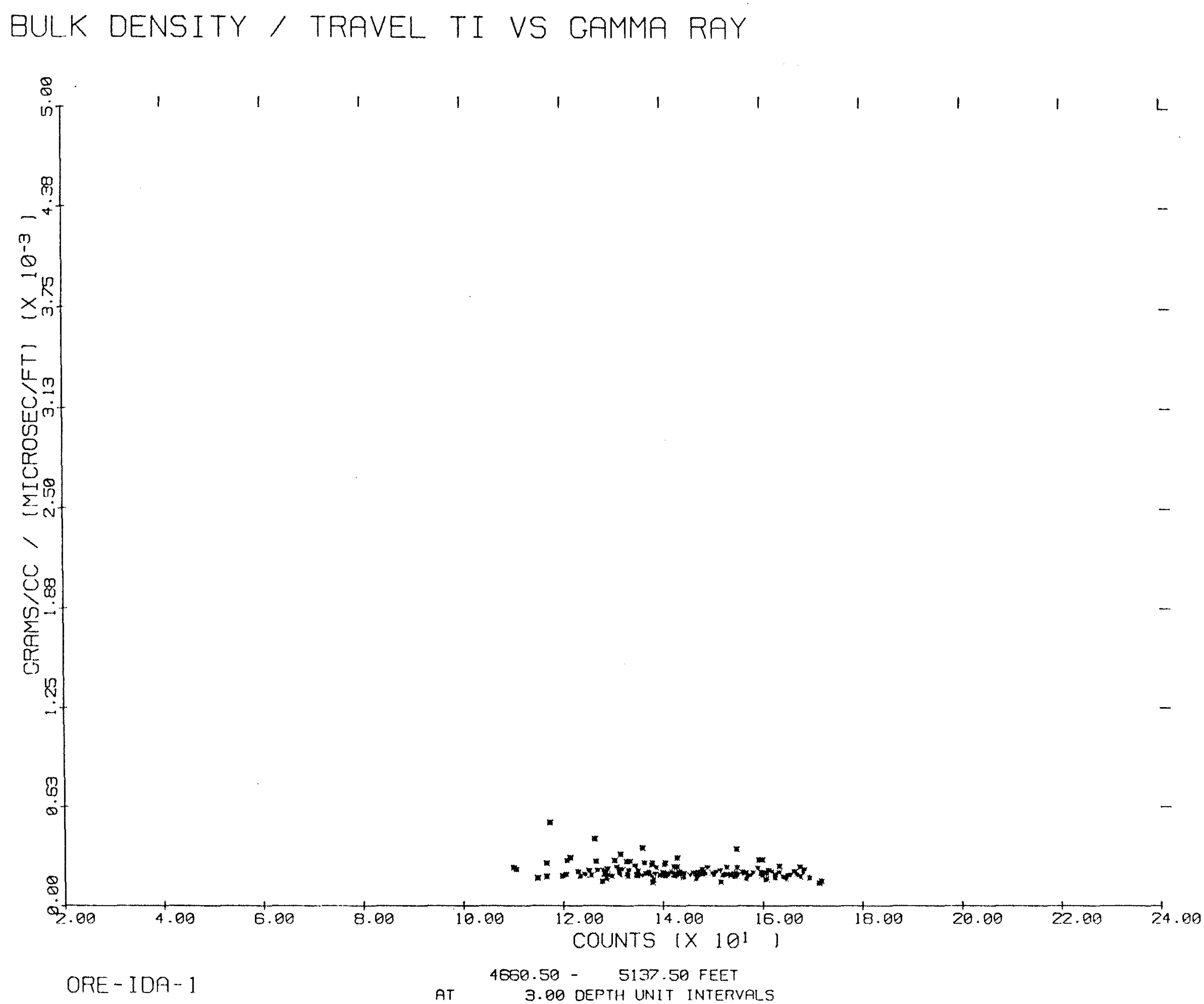
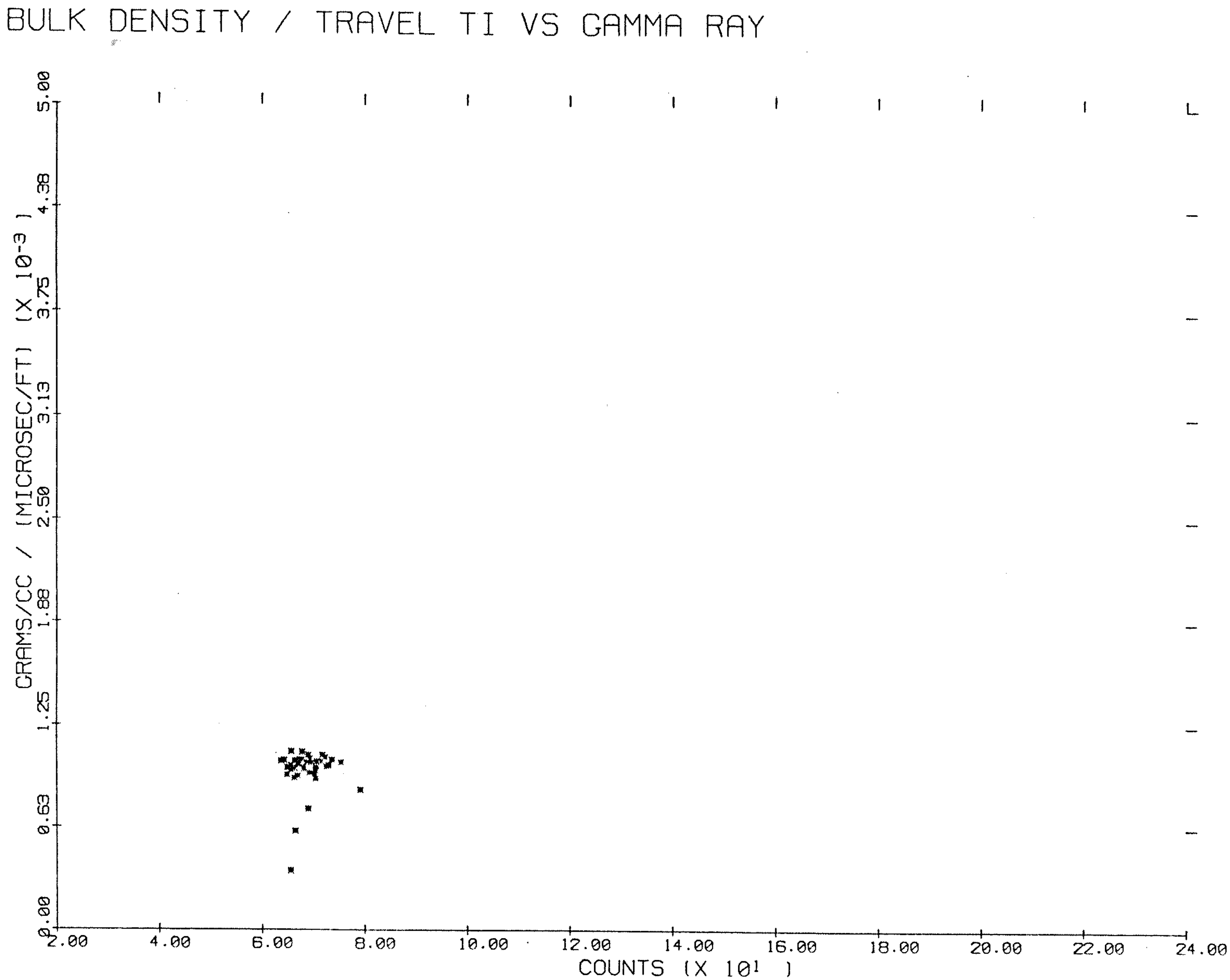


FIGURE 154. Crossplot of Mechanical Strength Index vs. Gamma Ray (4660 - 5137 ft.)



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5152.50 - 5287.50 FEET
AT 3.00 DEPTH UNIT INTERVALS

FIGURE 155. Crossplot of Mechanical Strength Index vs. Gamma Ray (5152 - 5287 ft.)

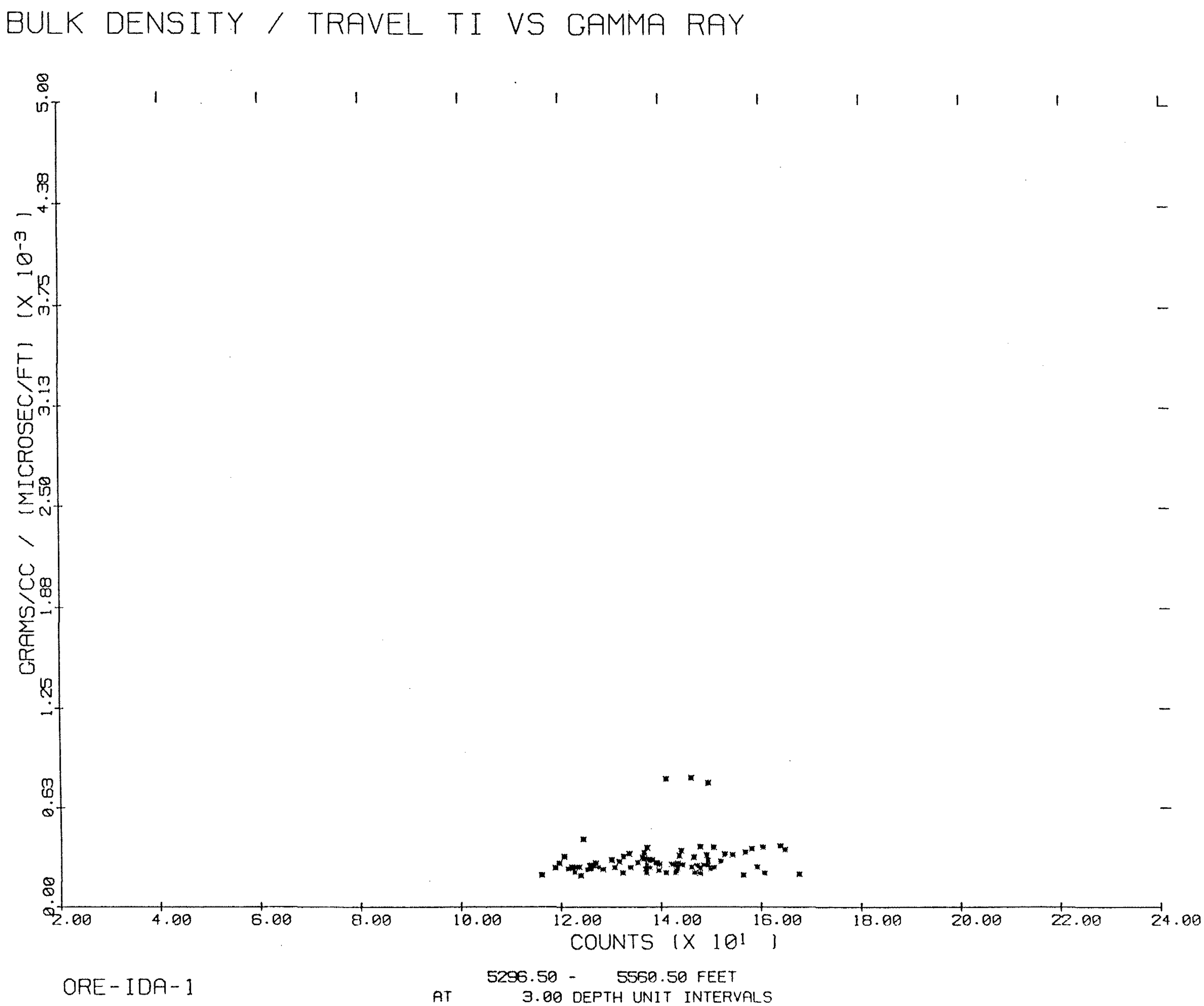


FIGURE 156. Crossplot of Mechanical Strength Index vs. Gamma Ray (5296 - 5560 ft.)

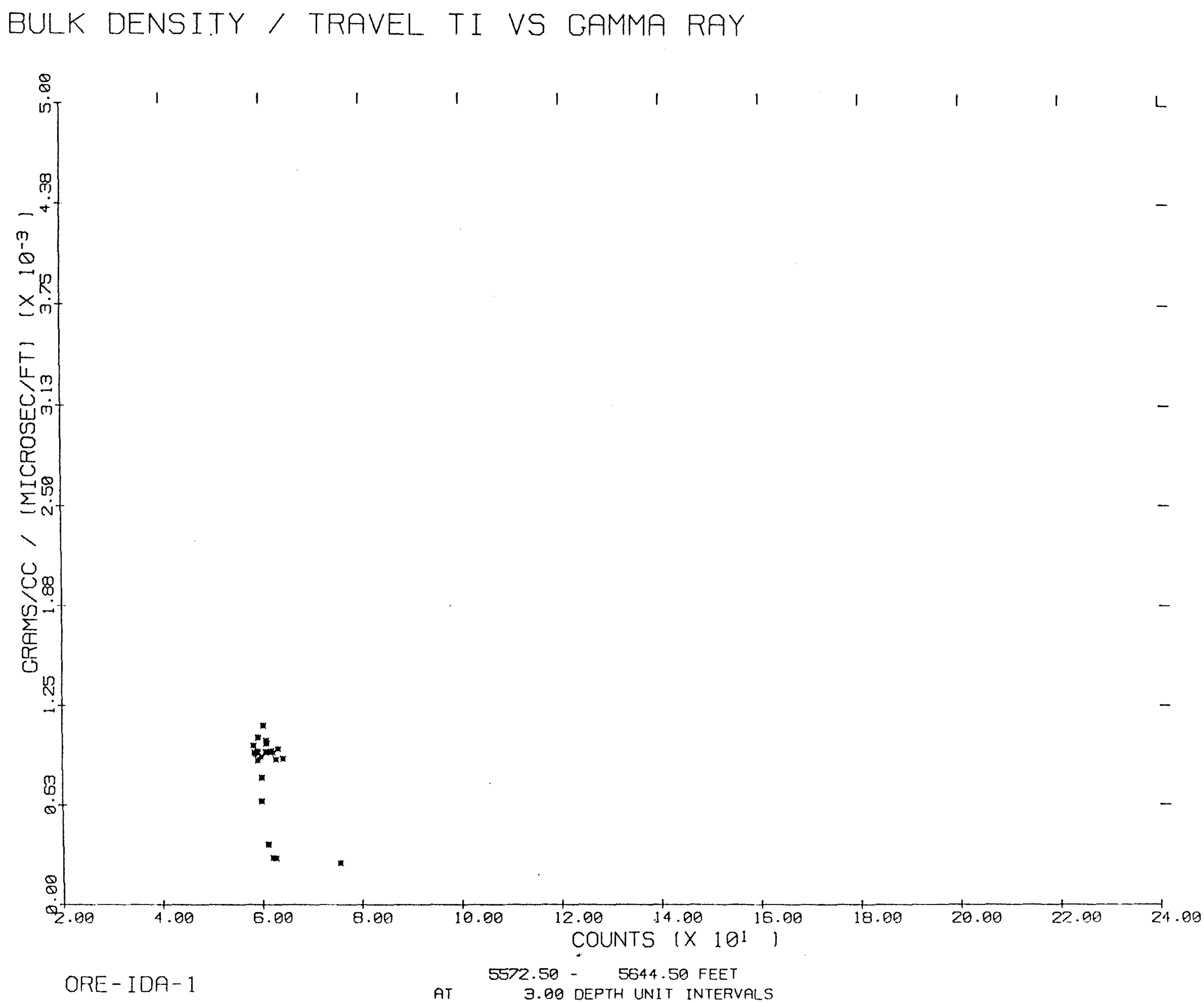


FIGURE 157. Crossplot of Mechanical Strength Index vs. Gamma Ray (5572 - 5644 ft.)

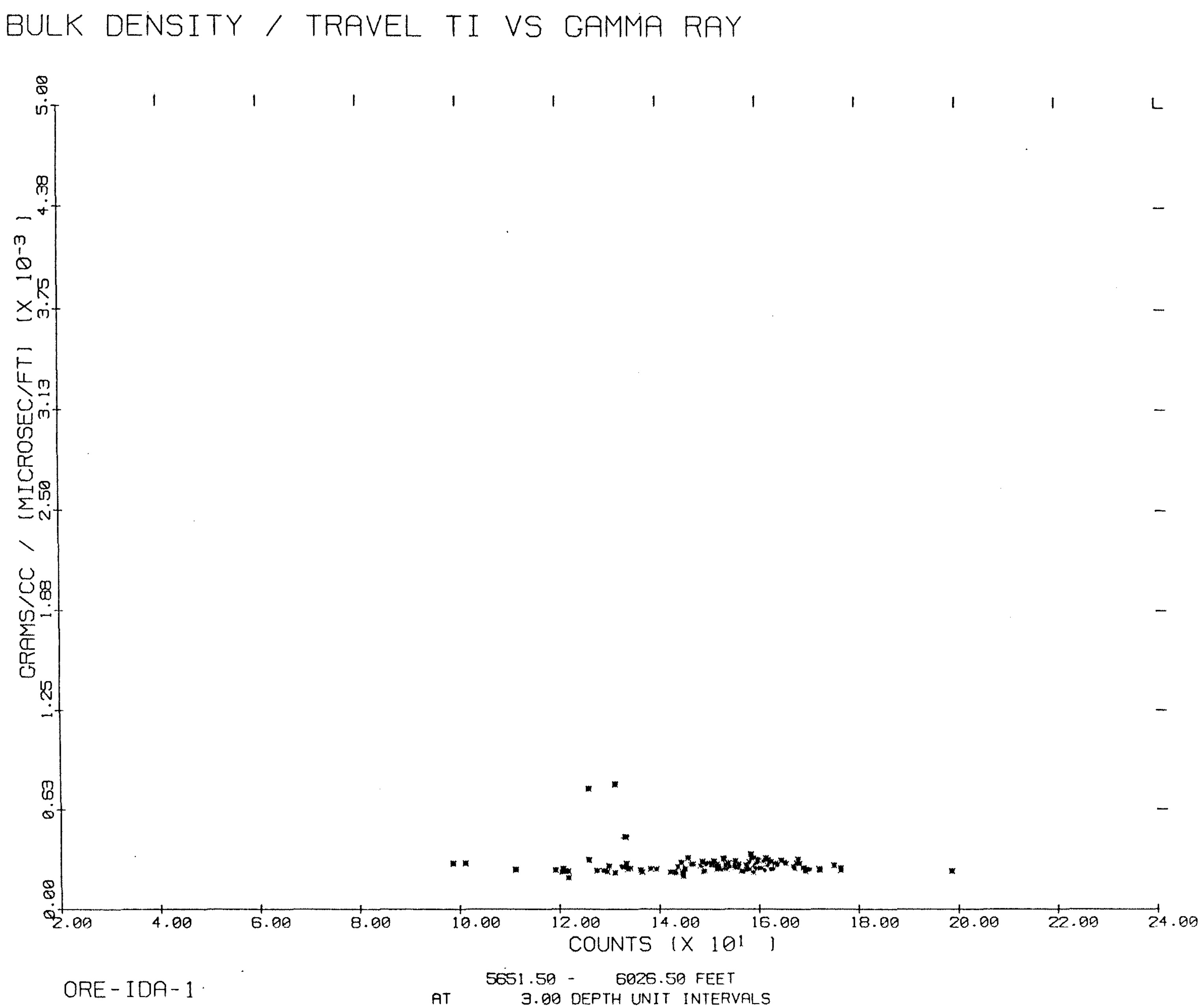


FIGURE 158. Crossplot of Mechanical Strength Index vs. Gamma Ray (5651 - 6026 ft.)

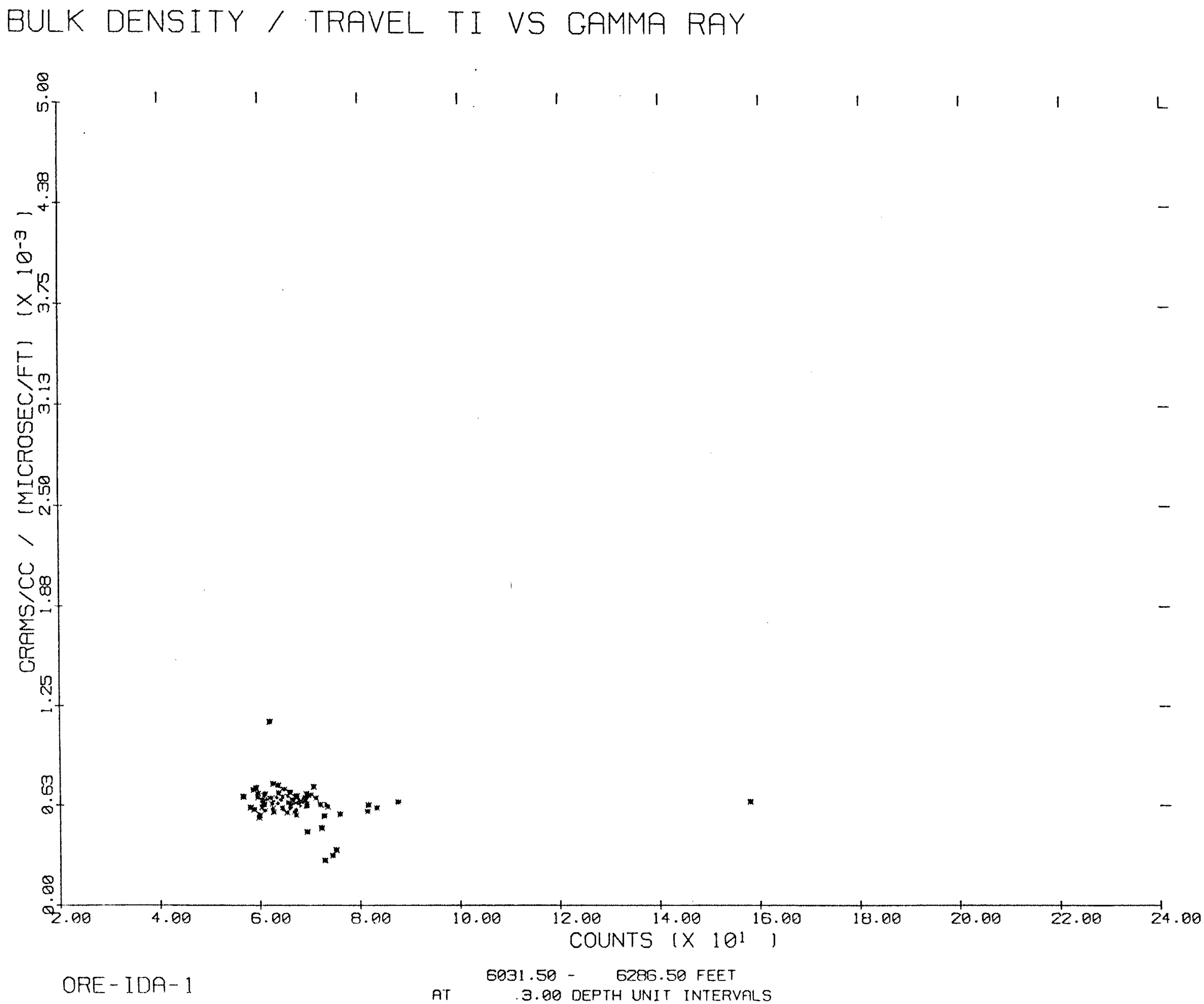


FIGURE 159. Crossplot of Mechanical Strength Index vs. Gamma Ray (6031 - 6286 ft.)

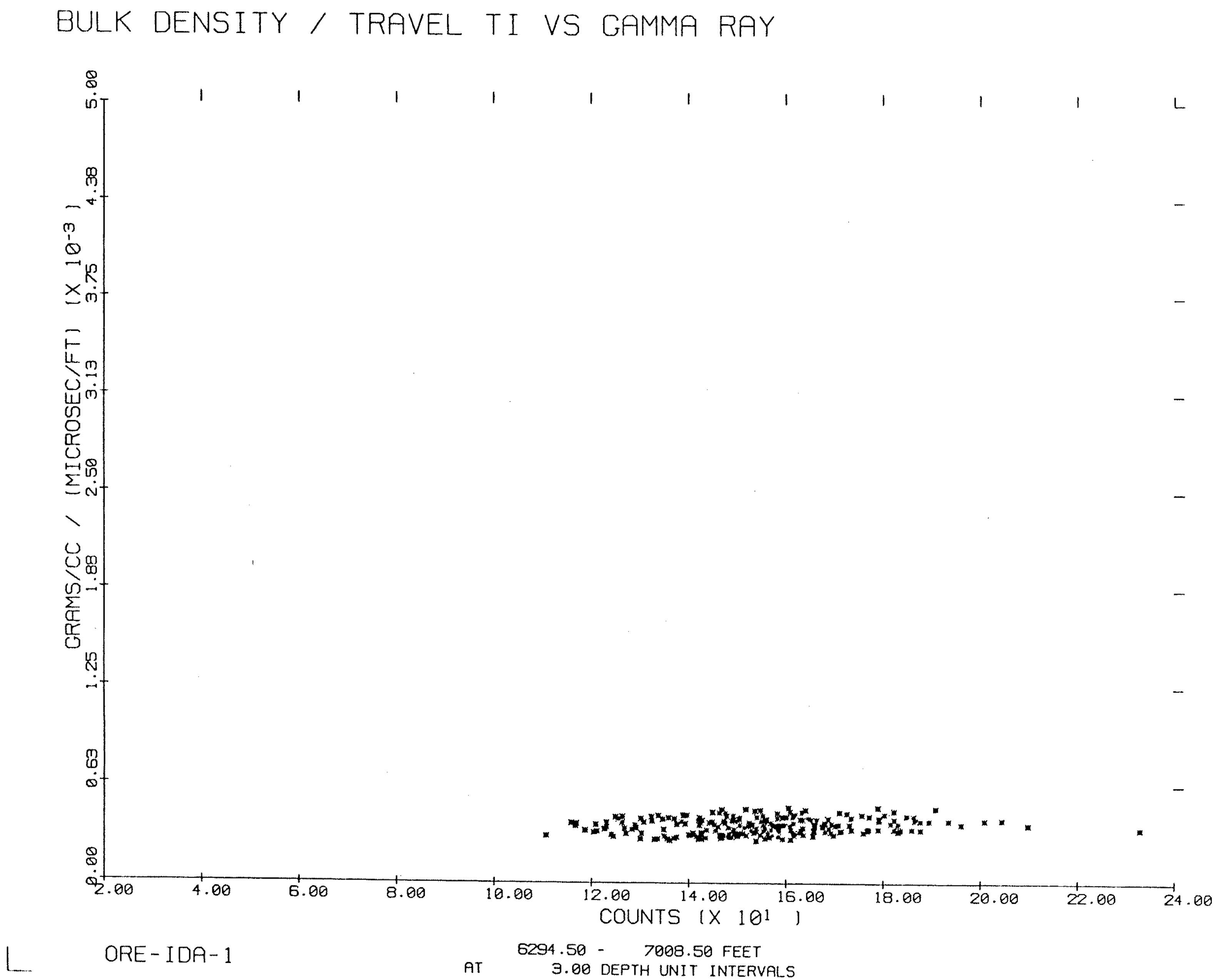


FIGURE 160. Crossplot of Mechanical Strength Index vs. Gamma Ray (6294 - 7008 ft.)

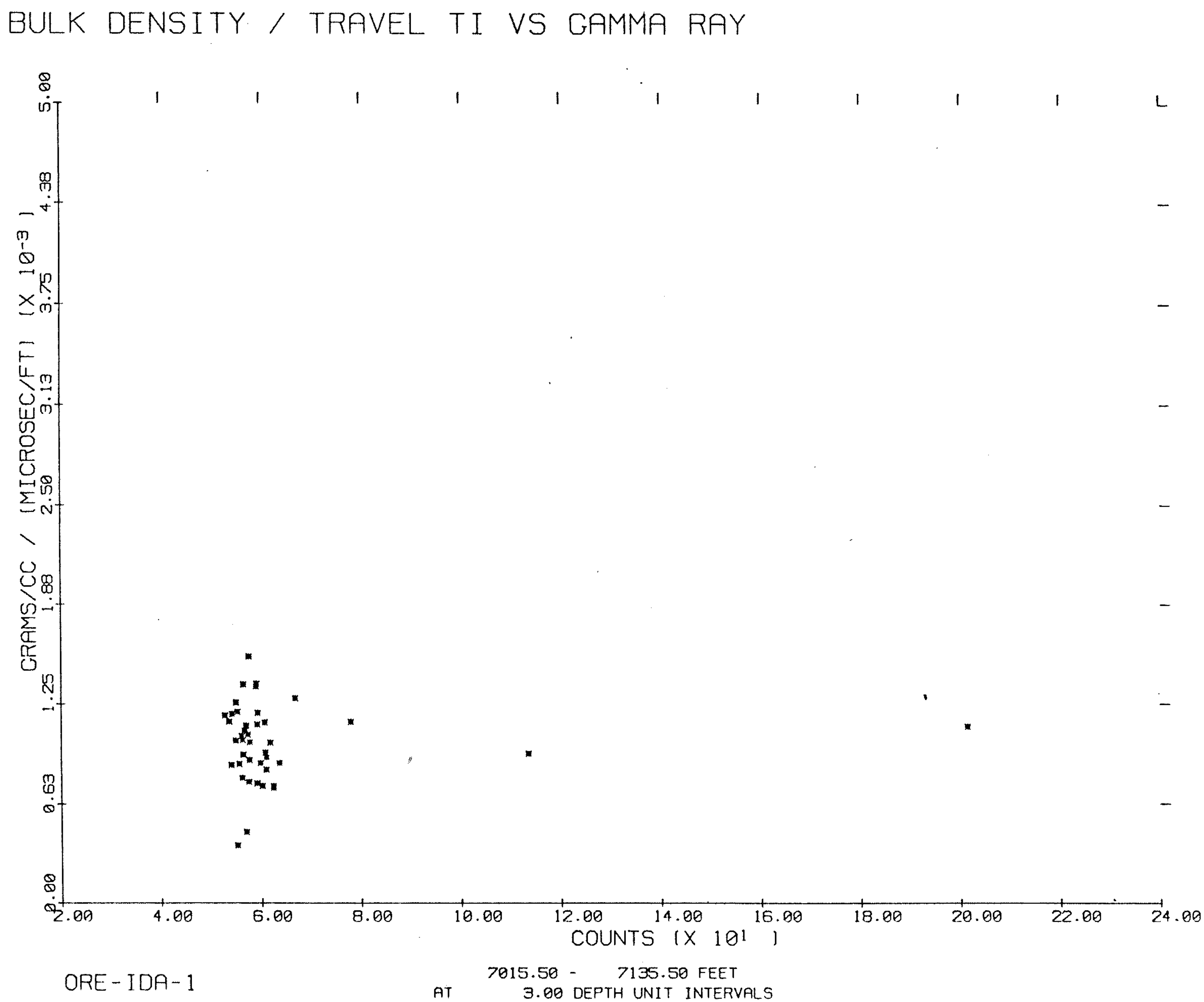


FIGURE 161. Crossplot of Mechanical Strength Index vs. Gamma Ray (7015 - 7135 ft.)

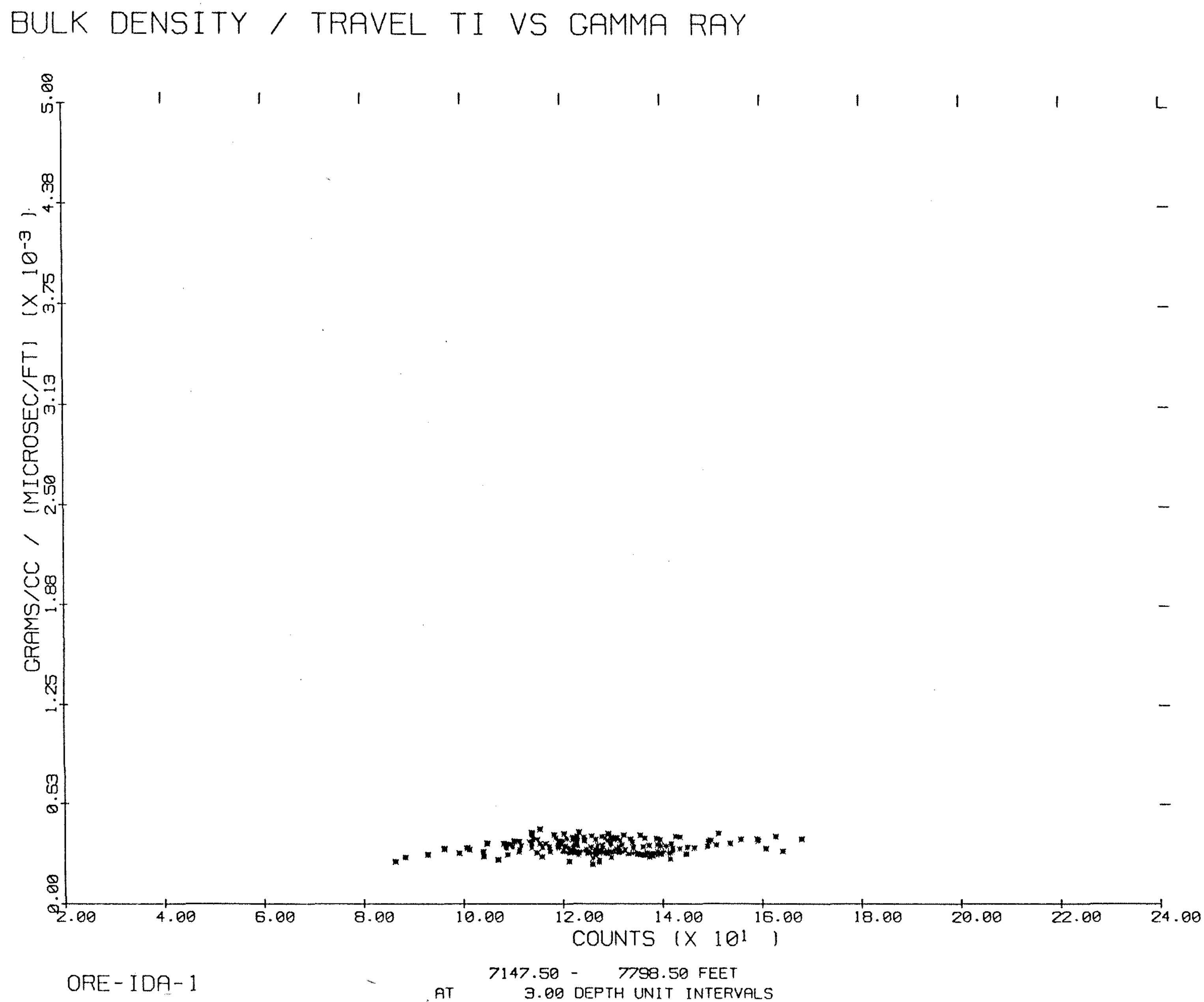


FIGURE 162. Crossplot of Mechanical Strength Index vs. Gamma Ray (7147 - 7798 ft.)

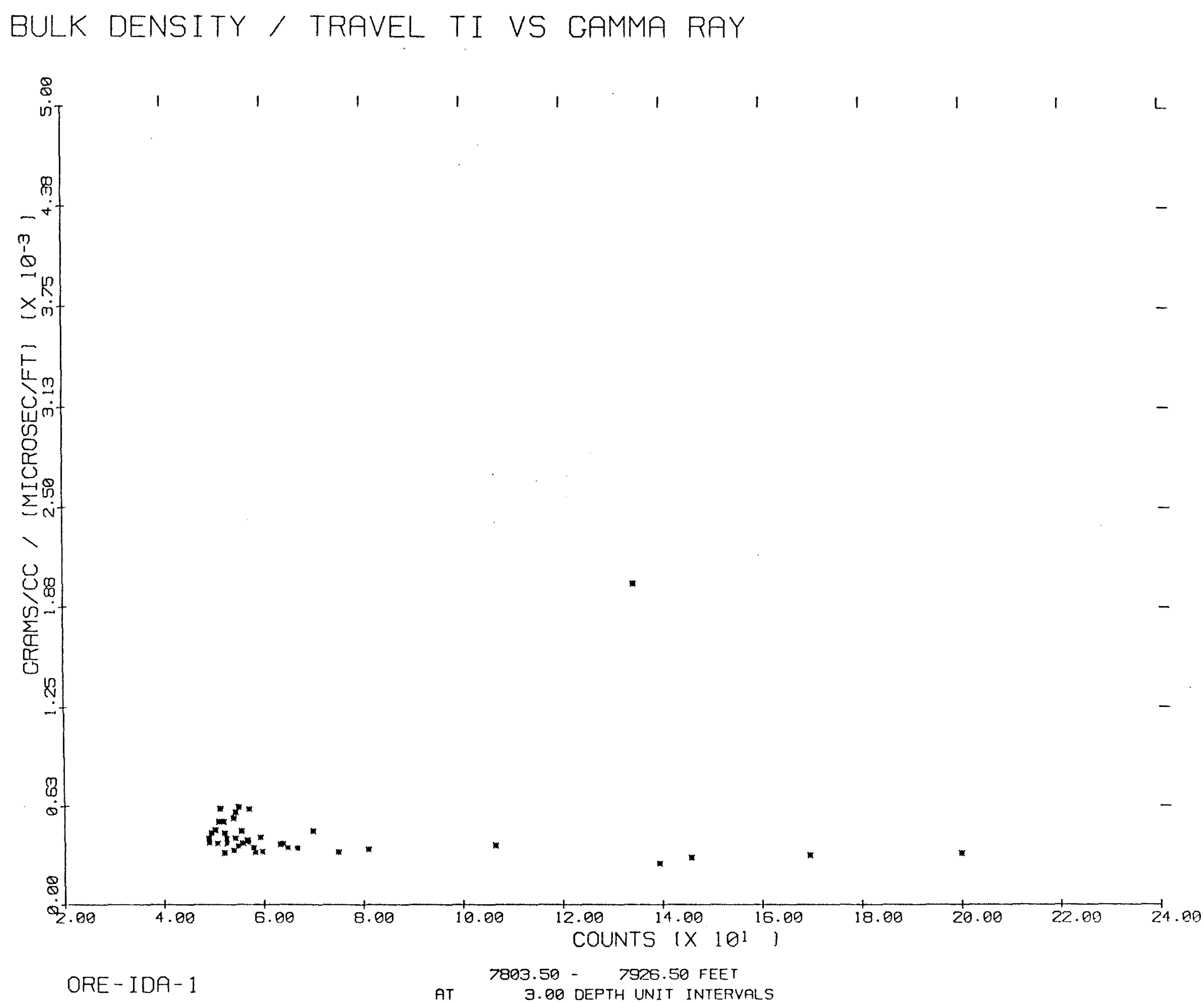


FIGURE 163. Crossplot of Mechanical Strength Index vs. Gamma Ray (7803 - 7926 ft.)

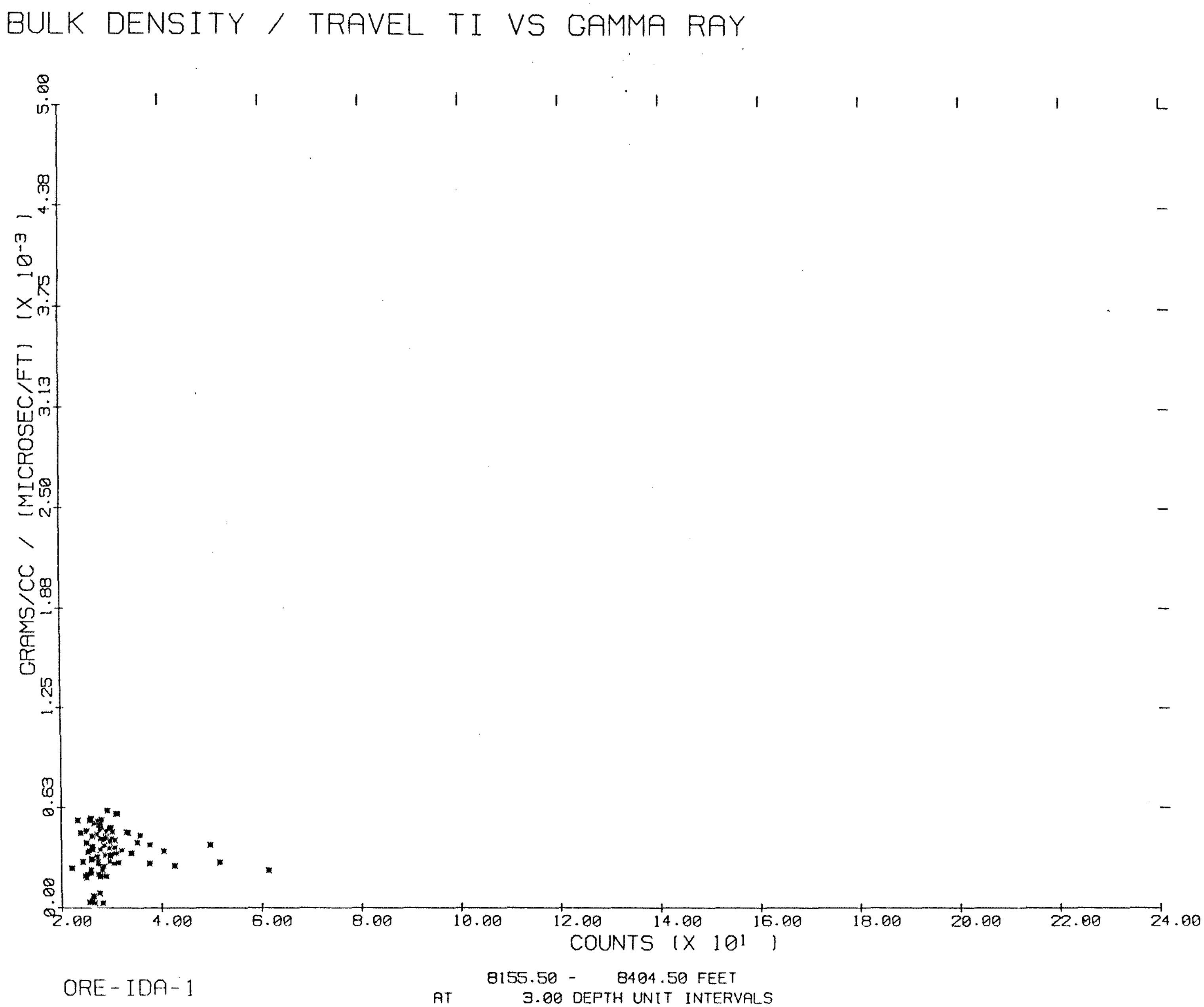


FIGURE 164. Crossplot of Mechanical Strength Index vs. Gamma Ray (8155 - 8404 ft.)

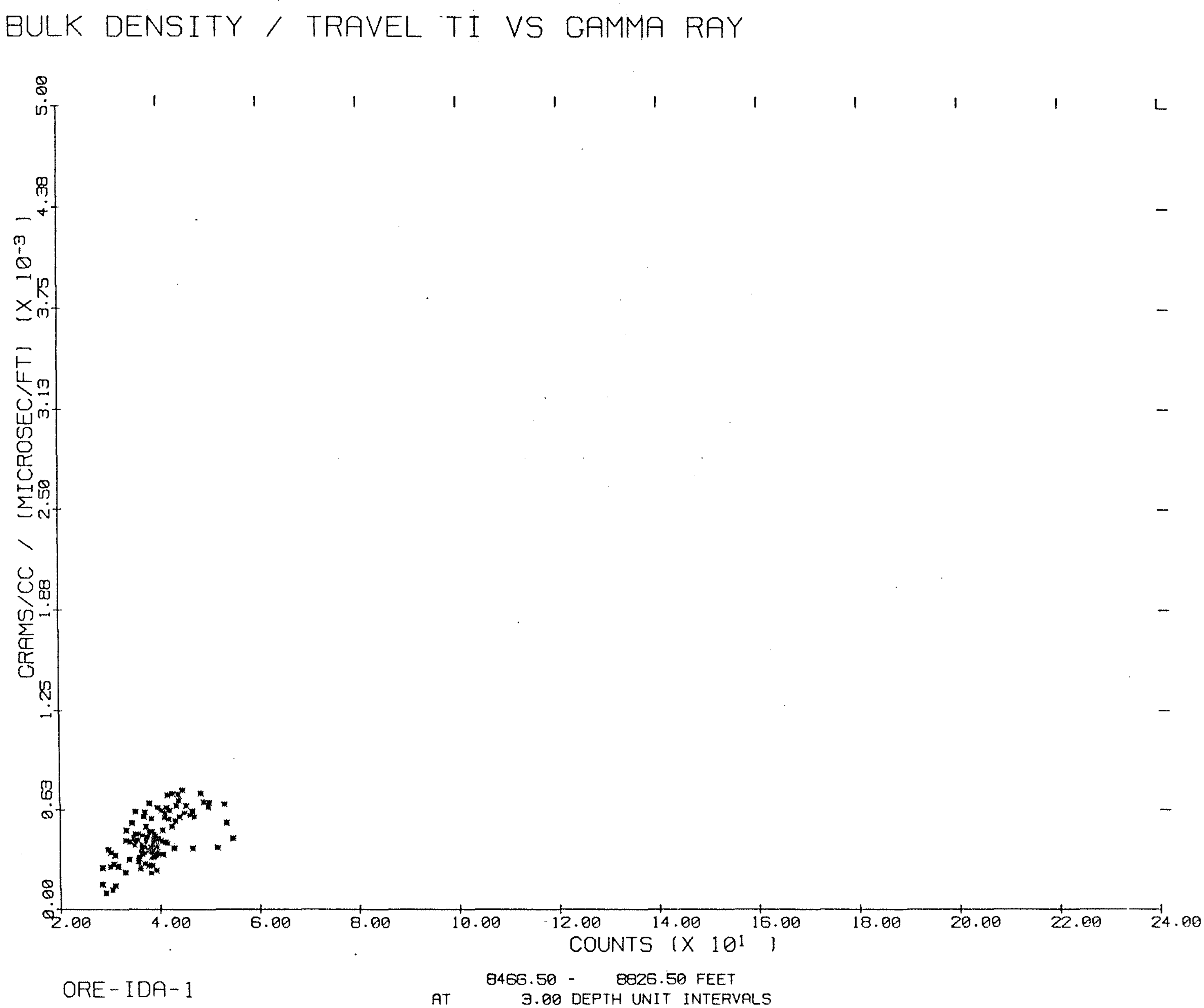


FIGURE 165. Crossplot of Mechanical Strength Index vs. Gamma Ray (8466 - 8826 ft.)

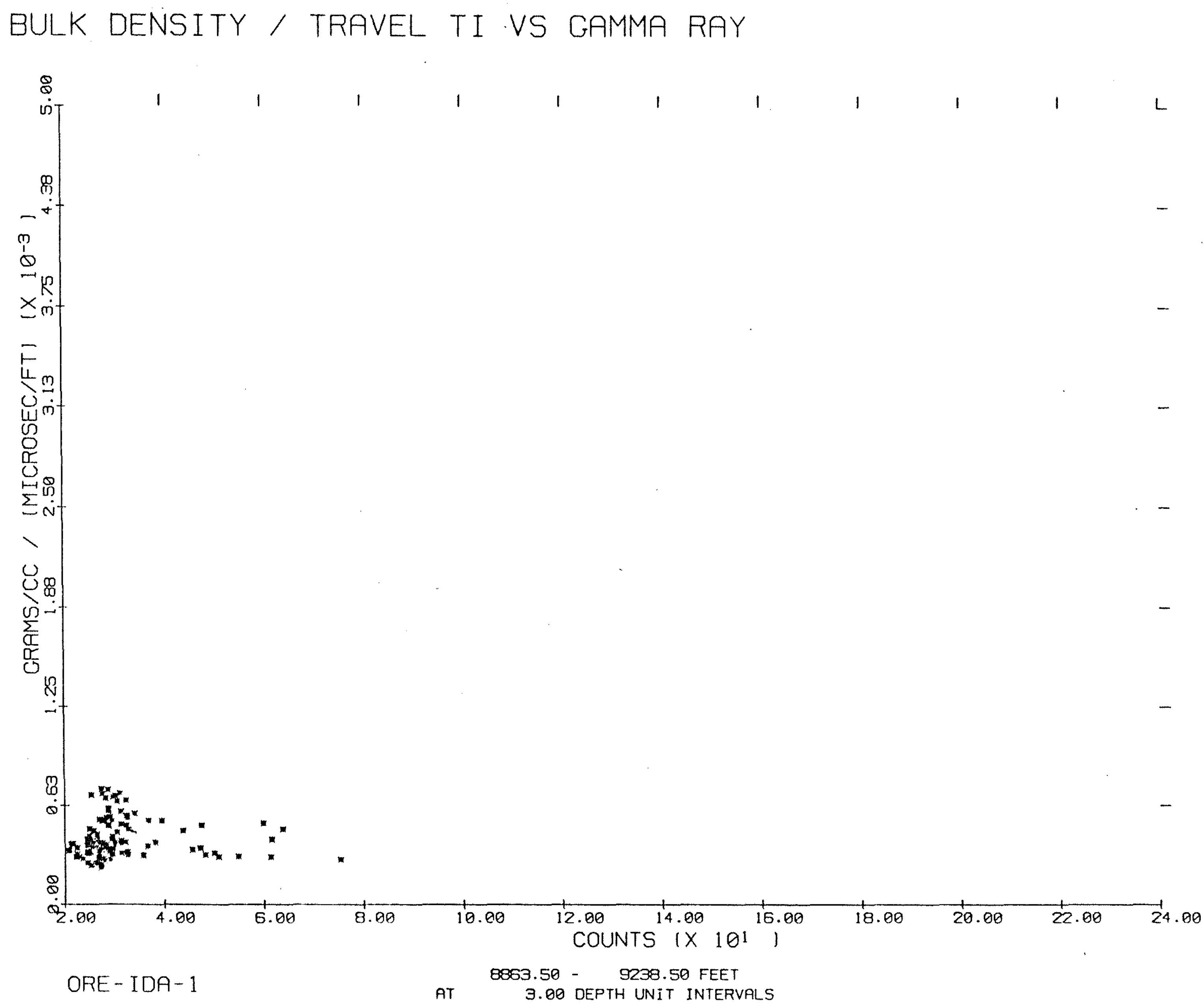


FIGURE 166. Crossplot of Mechanical Strength Index vs. Gamma Ray (8863 - 9238 ft.)

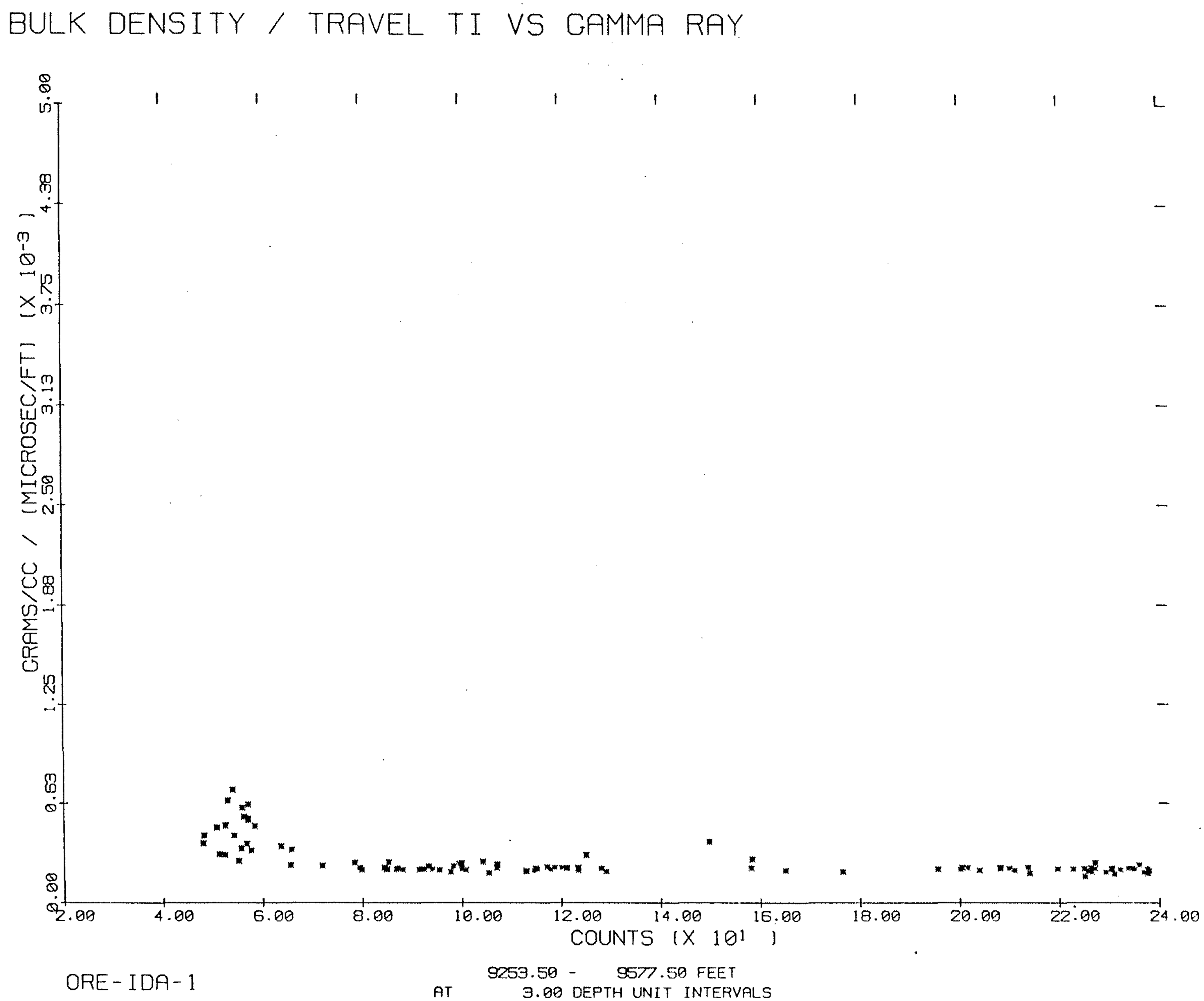


FIGURE 167. Crossplot of Mechanical Strength Index vs. Gamma Ray (9253 - 9577 ft.)

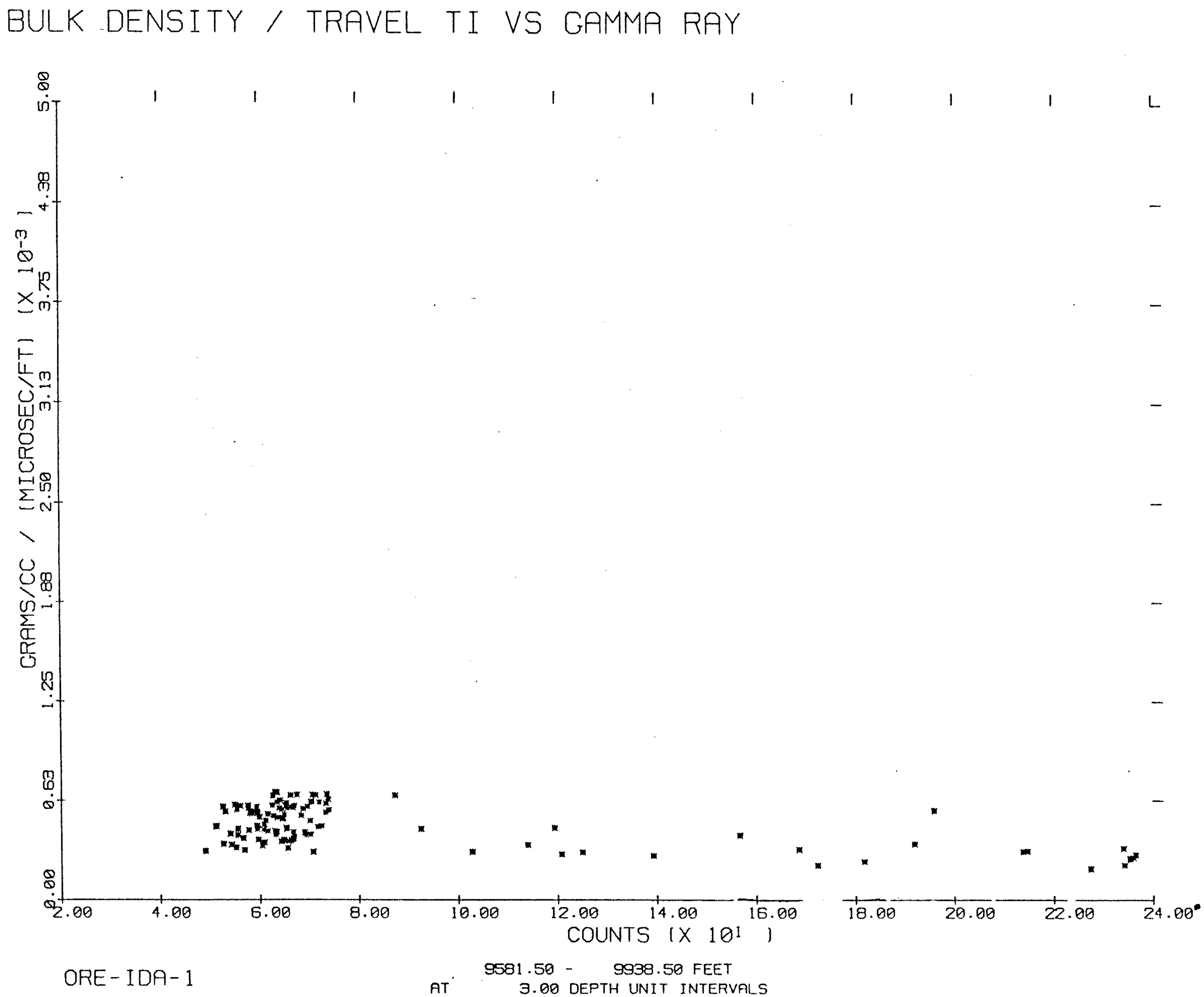


FIGURE 168. Crossplot of Mechanical Strength Index vs. Gamma Ray (9581 - 9938 ft.)

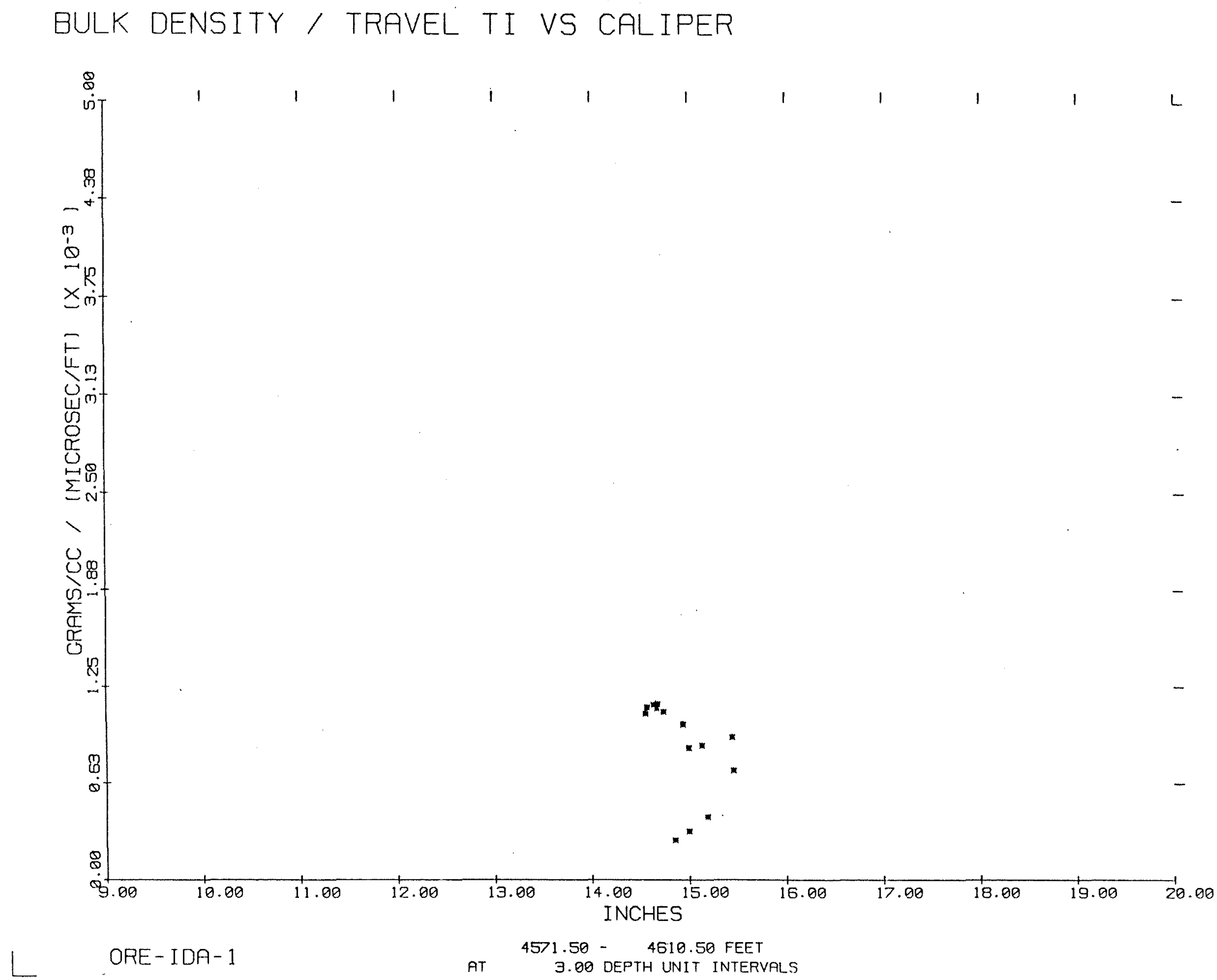


FIGURE 169. Crossplot of Mechanical Strength Index vs. Caliper Reading (4571 - 4610 ft.)

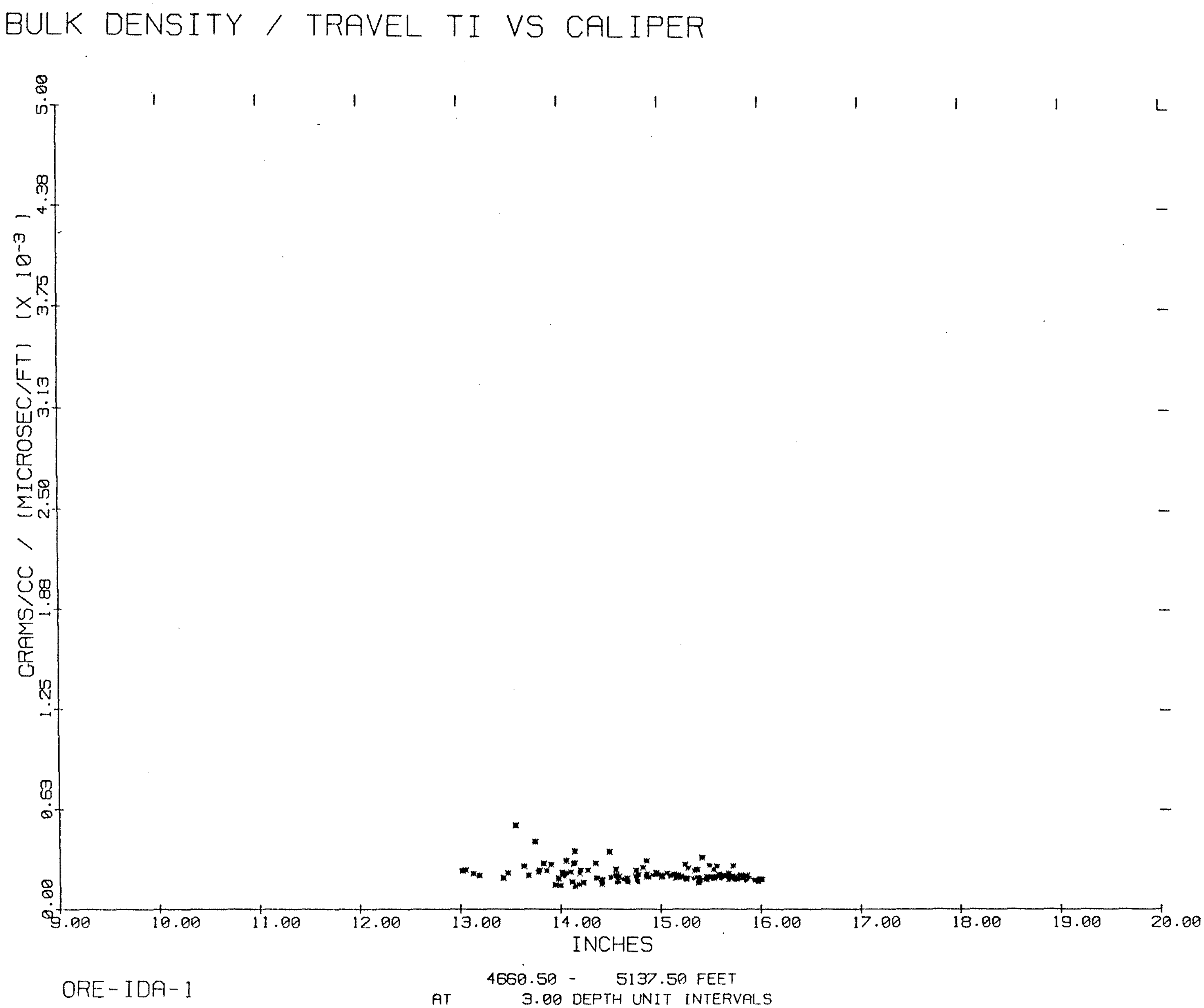


FIGURE 170. Crossplot of Mechanical Strength Index vs. Caliper Reading (4660 - 5137 ft.)

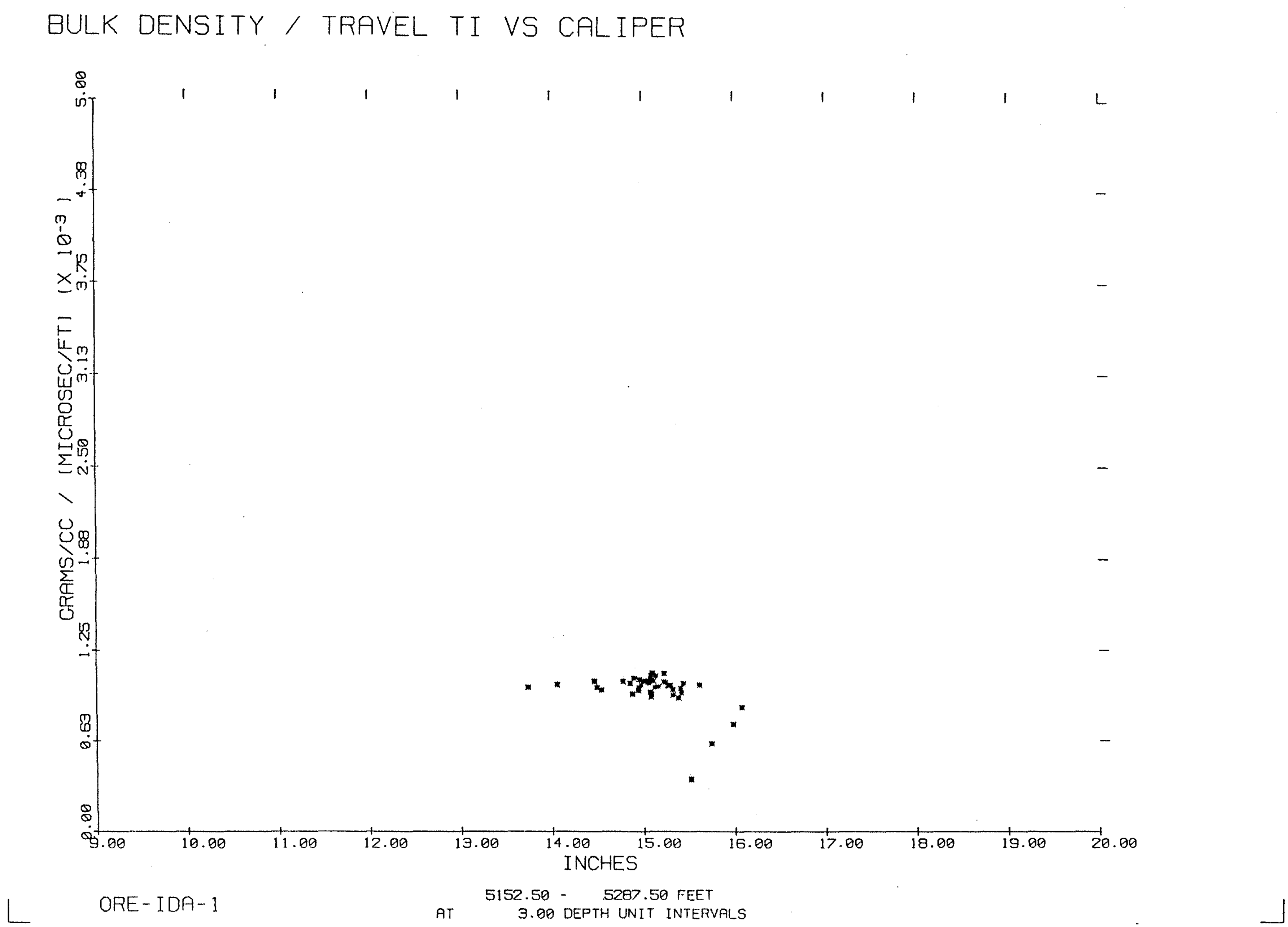


FIGURE 171. Crossplot of Mechanical Strength Index vs. Caliper Reading (5152 - 5287 ft.)

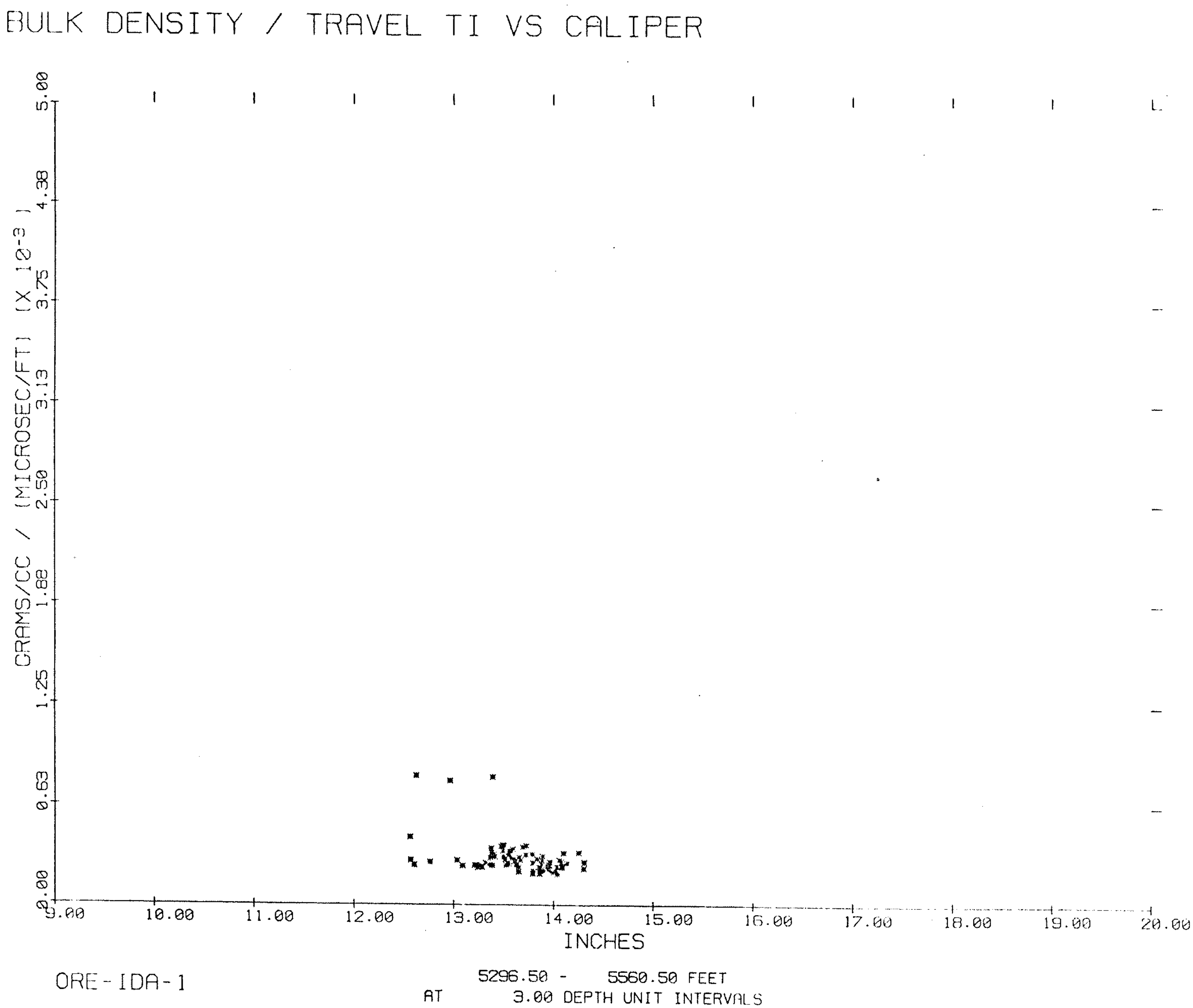


FIGURE 172. Crossplot of Mechanical Strength Index vs. Caliper Reading (5296 - 5560 ft.)

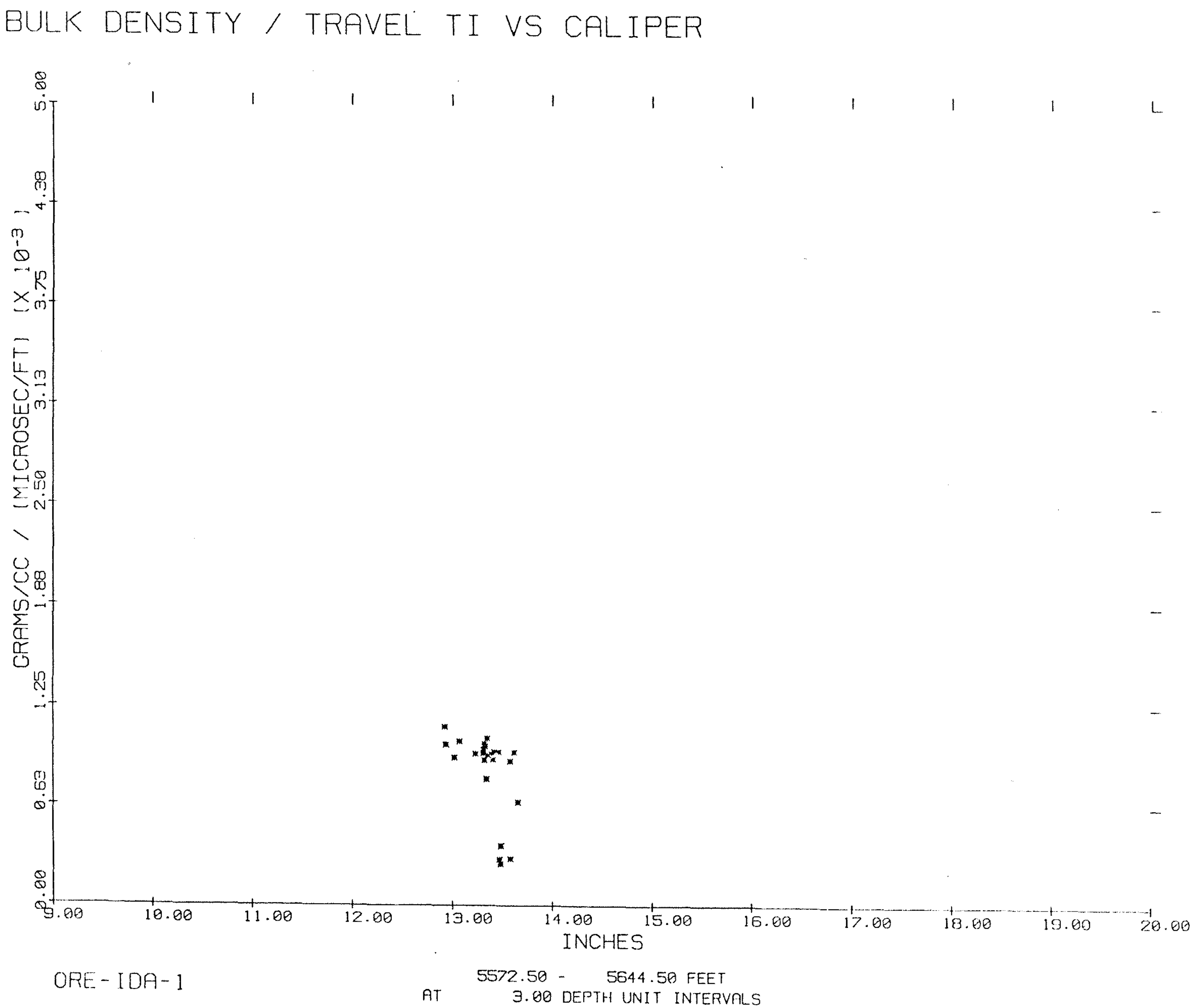


FIGURE 173. Crossplot of Mechanical Strength Index vs. Caliper Reading (5572 - 5644 ft.)

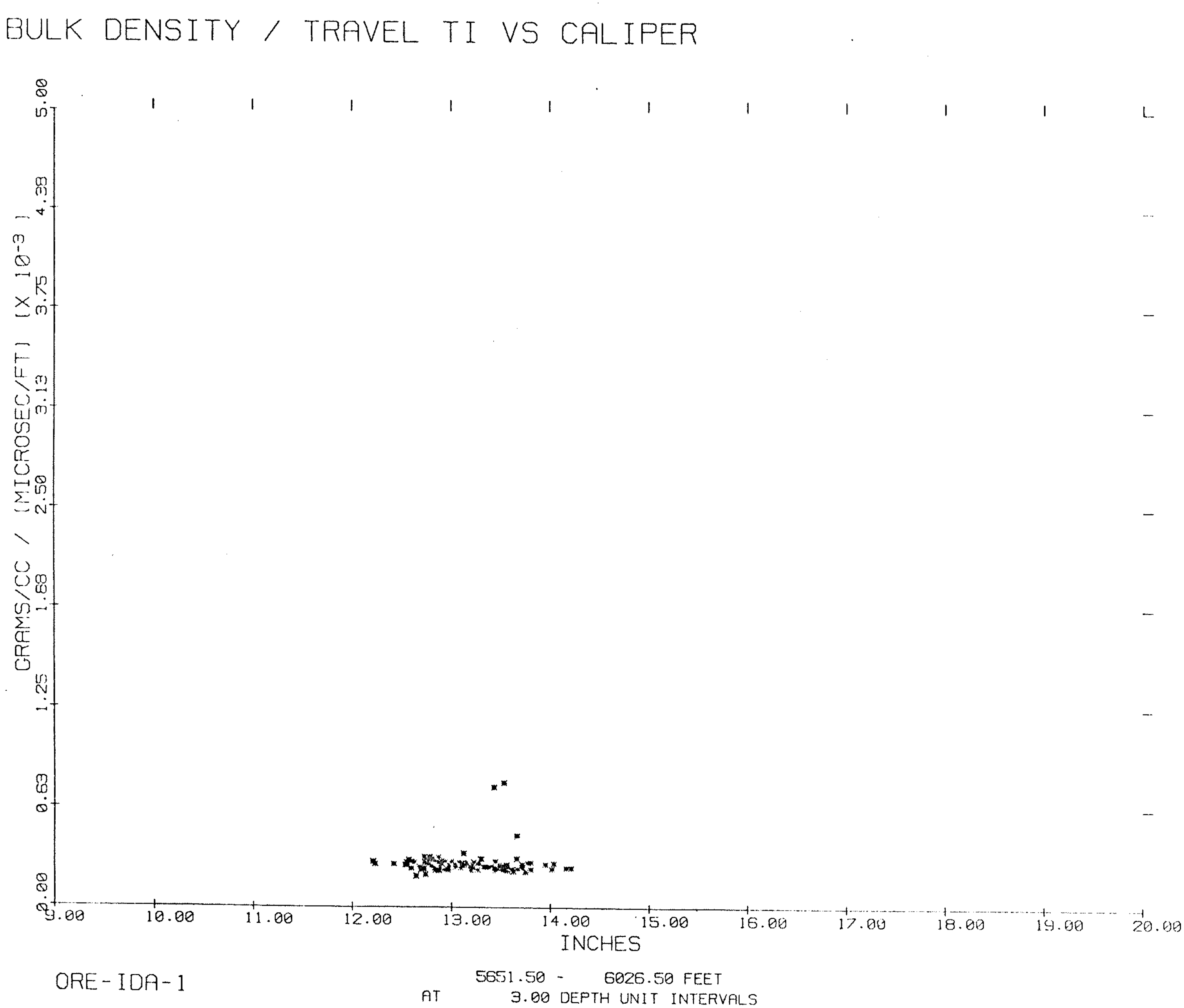
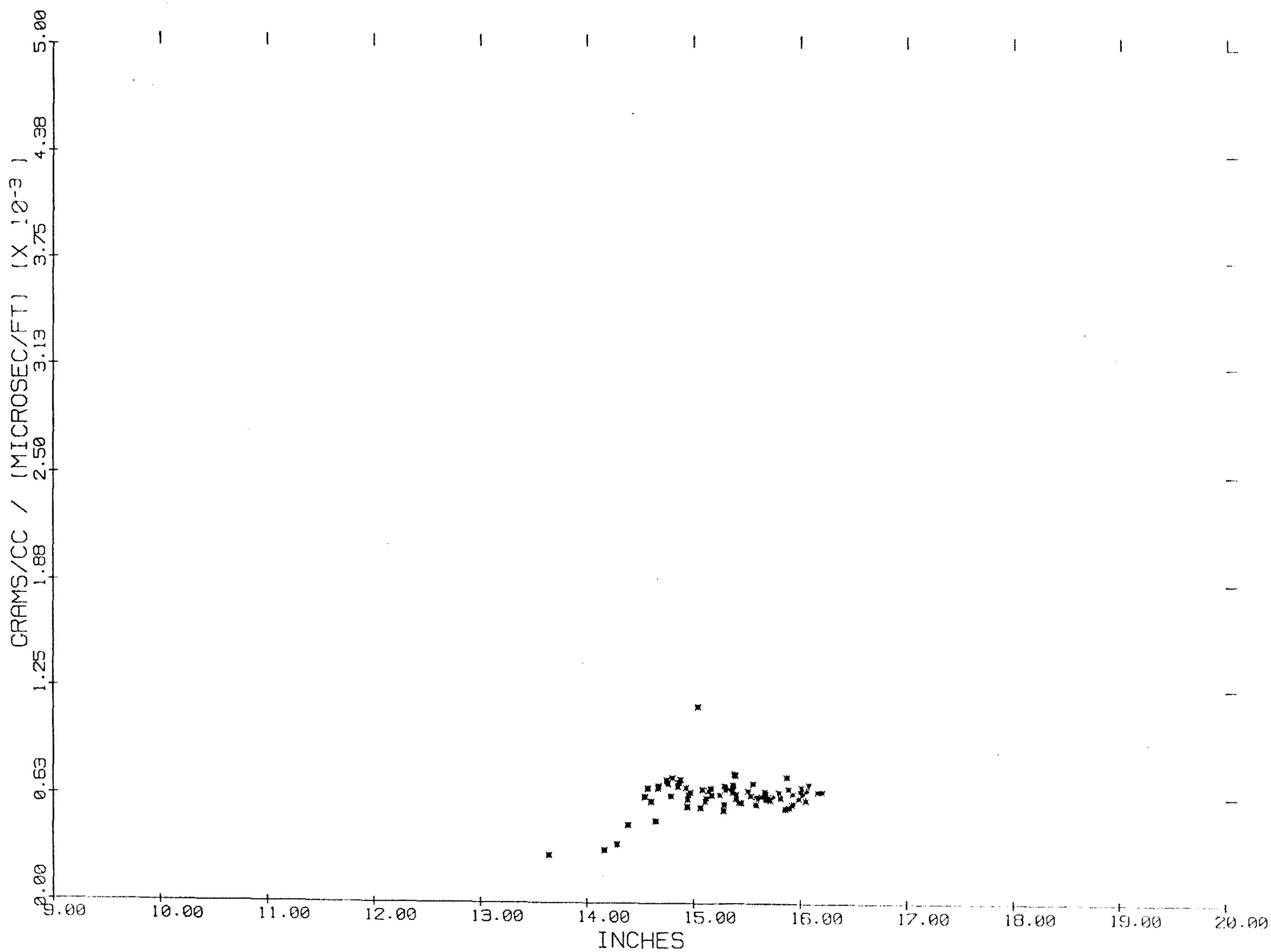


FIGURE 174. Crossplot of Mechanical Strength Index vs. Caliper Reading (5651 - 6026 ft.)

BULK DENSITY / TRAVEL TI VS CALIPER



ORE-IDA-1

6031.50 - 6286.50 FEET
AT 3.00 DEPTH UNIT INTERVALS

FIGURE 175. Crossplot of Mechanical Strength Index vs. Caliper Reading (6031 - 6286 ft.)

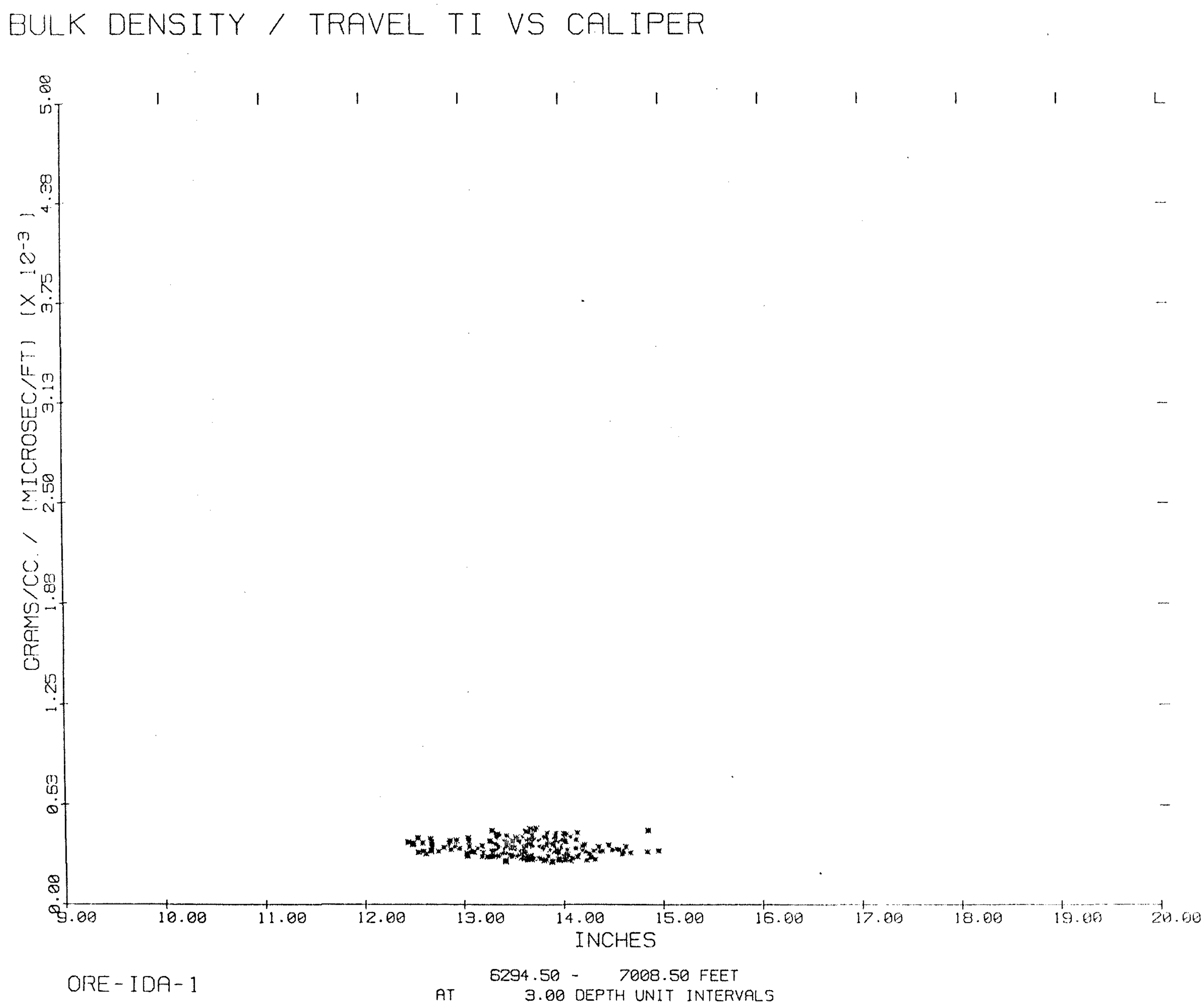


FIGURE 176. Crossplot of Mechanical Strength Index vs. Caliper Reading (6294 - 7008 ft.)

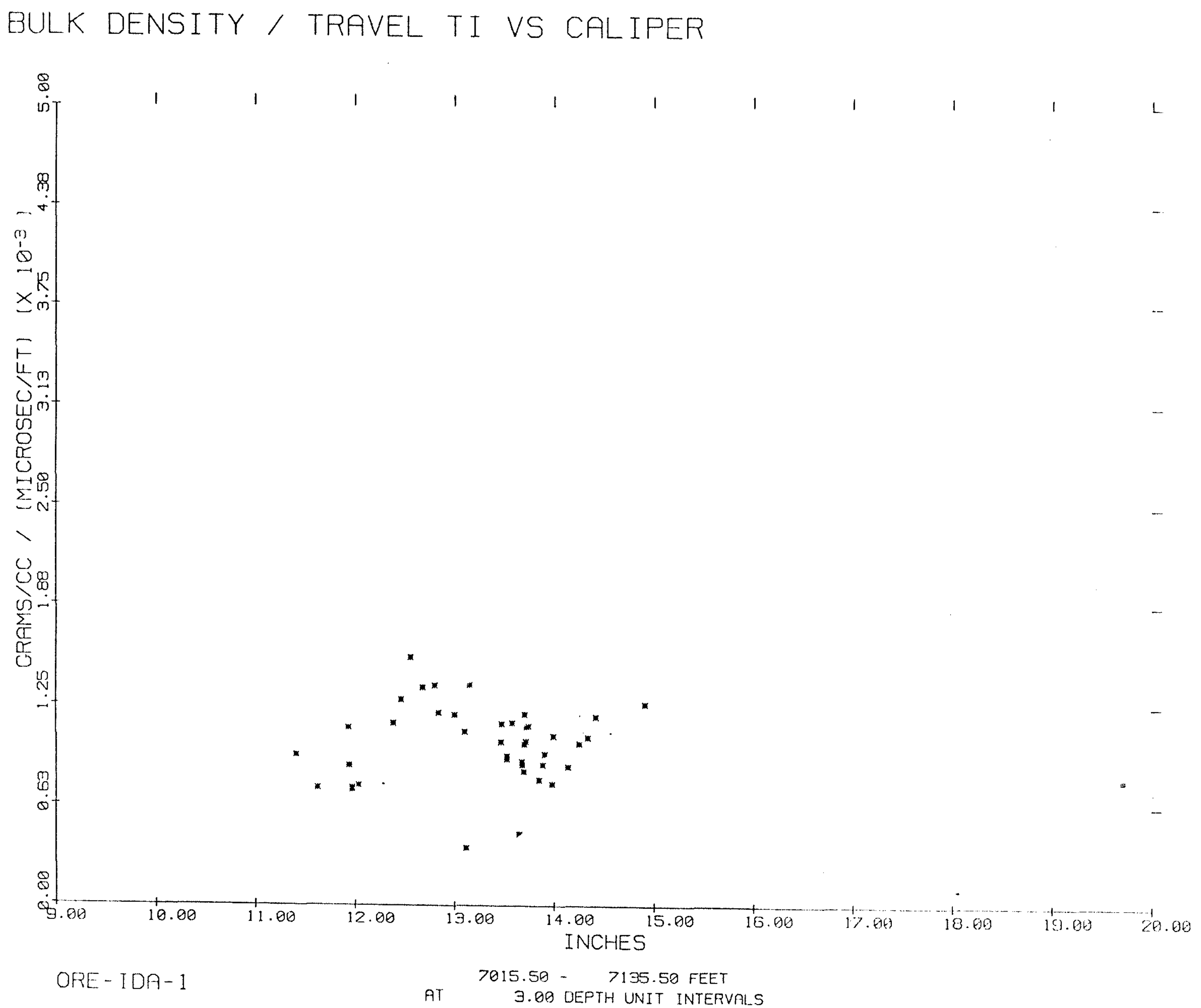


FIGURE 177. Crossplot of Mechanical Strength Index vs. Caliper Reading (7015 - 7135 ft.)

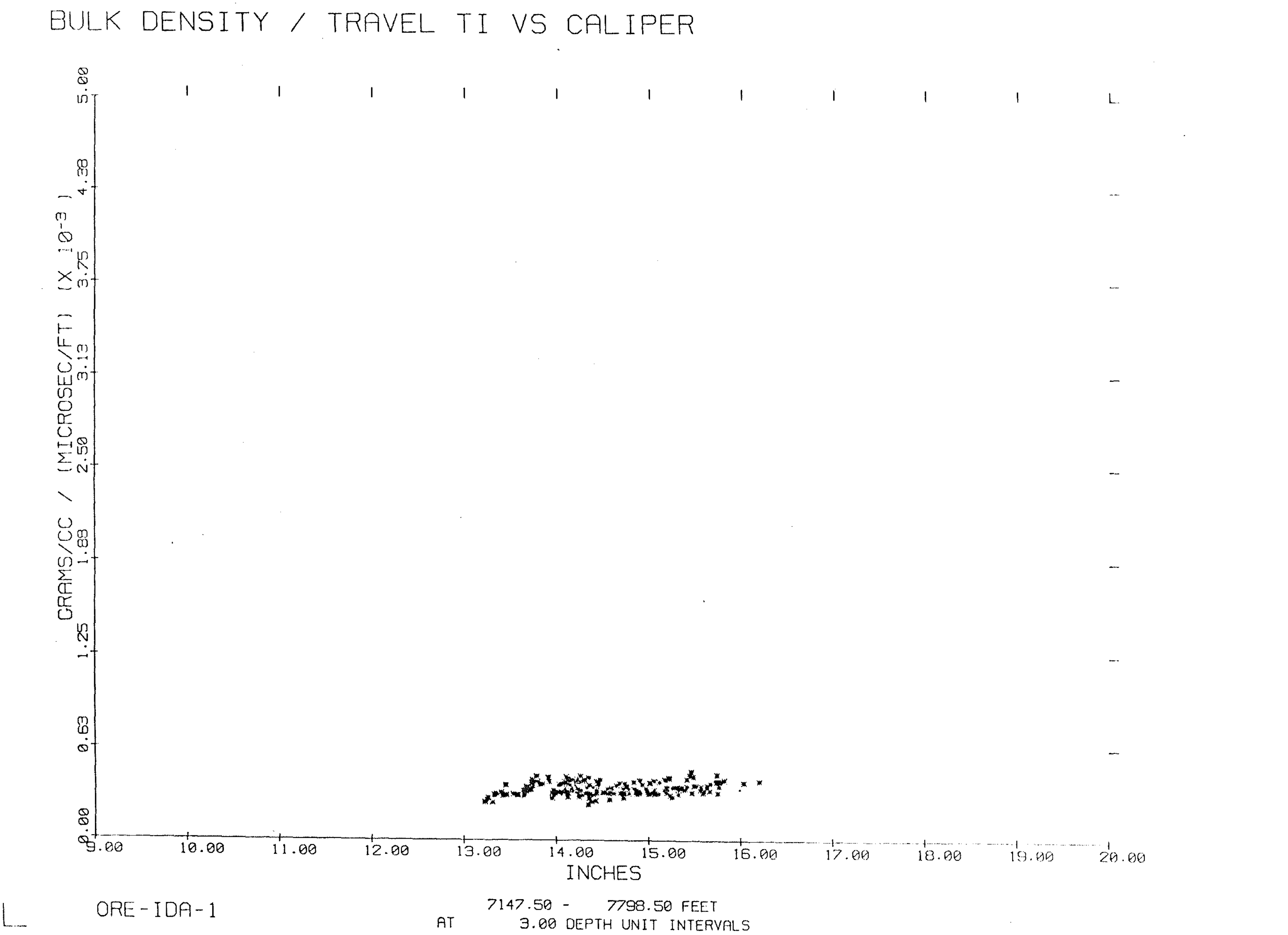


FIGURE 178. Crossplot of Mechanical Strength Index vs. Caliper Reading (7147 - 7798 ft.)

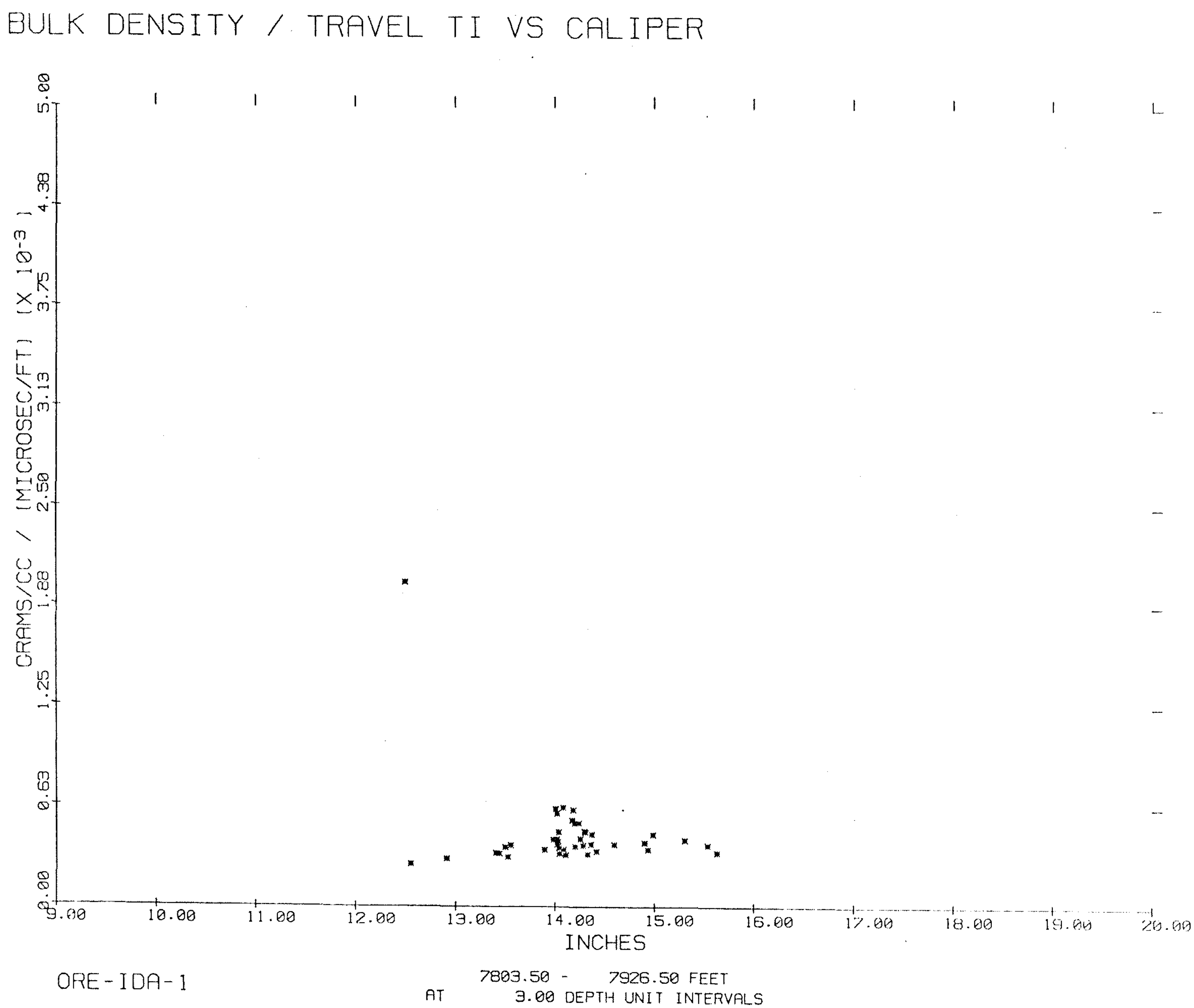


FIGURE 179. Crossplot of Mechanical Strength Index vs. Caliper Reading (7803 - 7926 ft.)

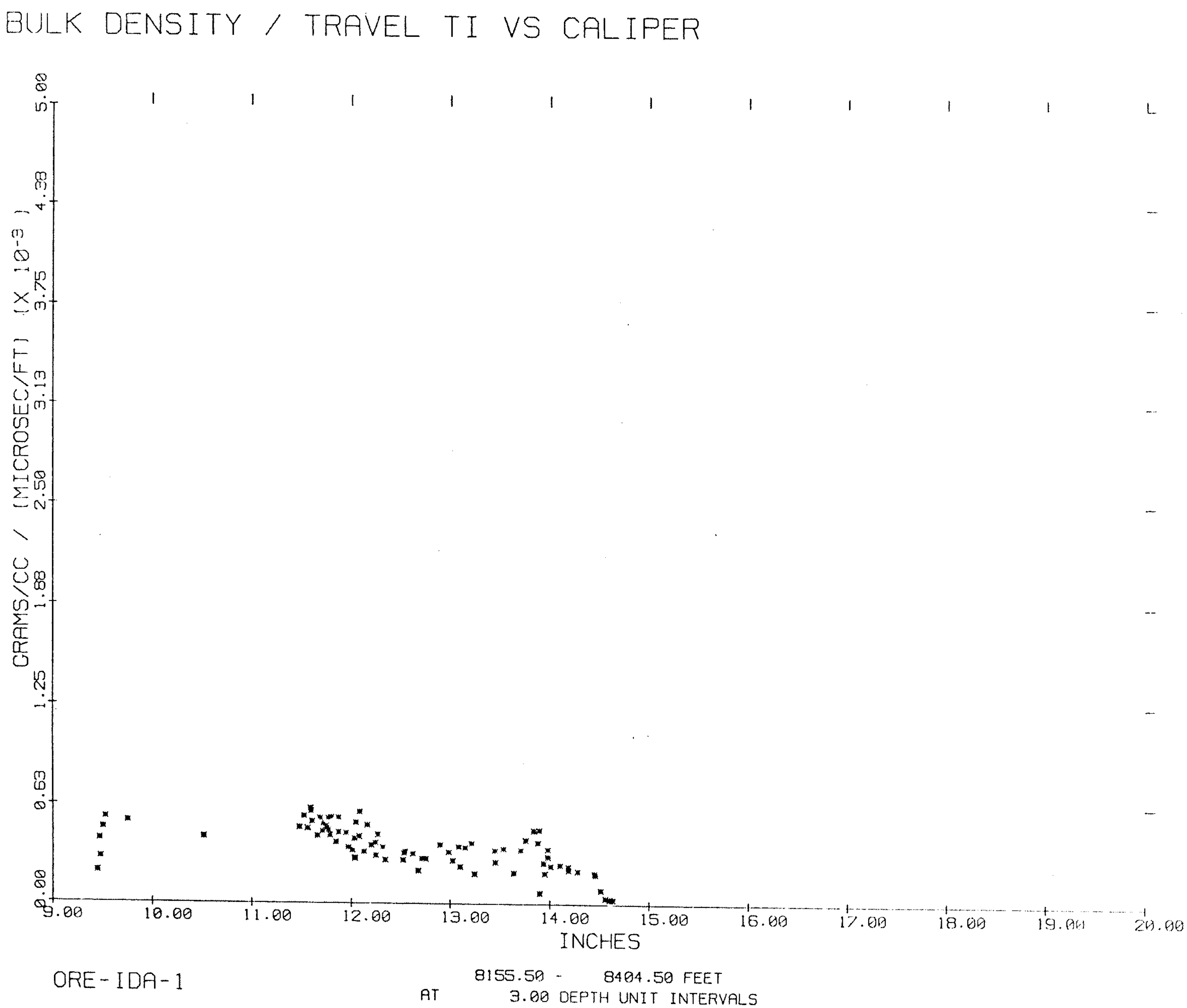


FIGURE 180. Crossplot of Mechanical Strength Index vs. Caliper Reading (8155 - 8404 ft.)

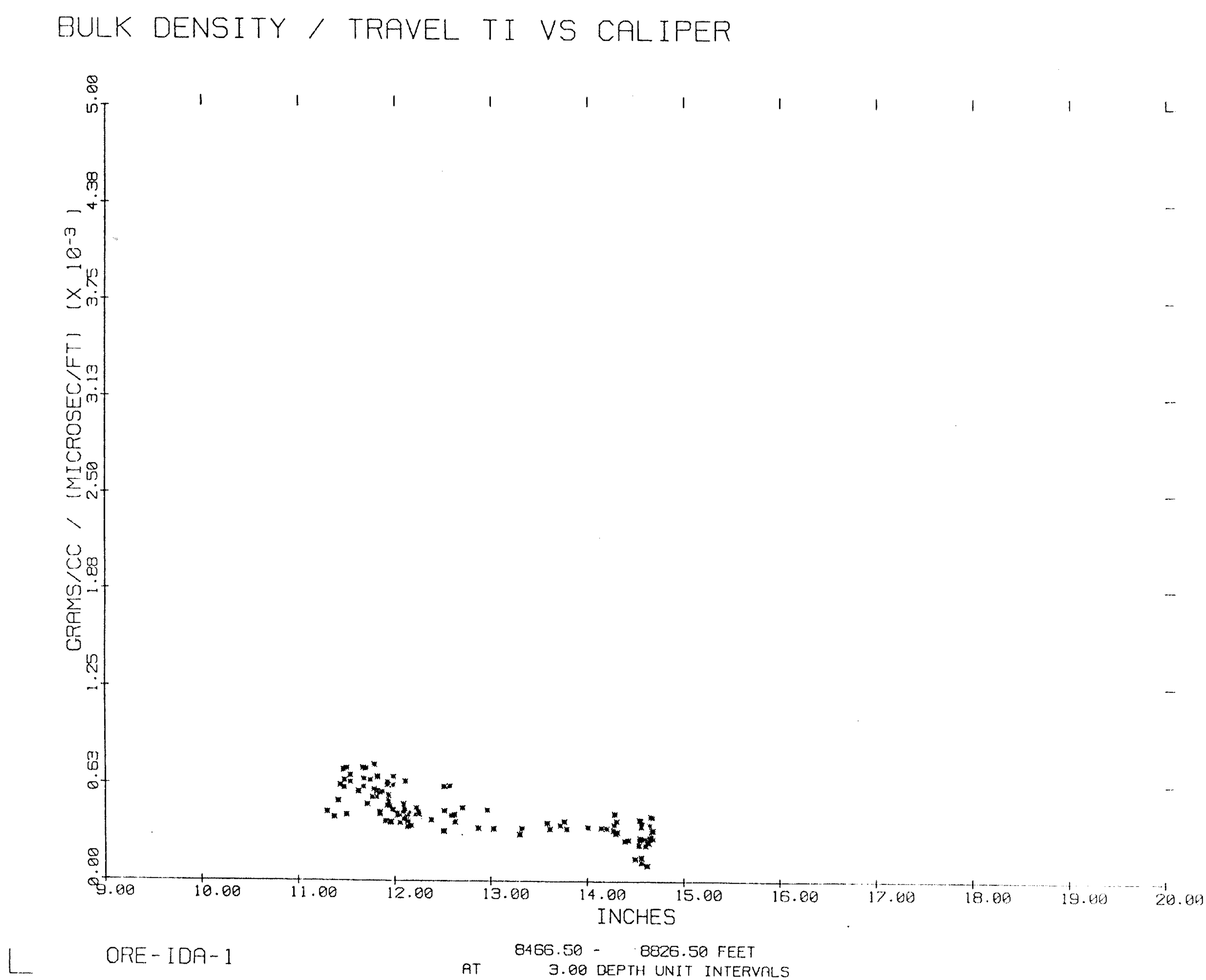


FIGURE 181. Crossplot of Mechanical Strength Index vs. Caliper Reading (8466 - 8826 ft.)

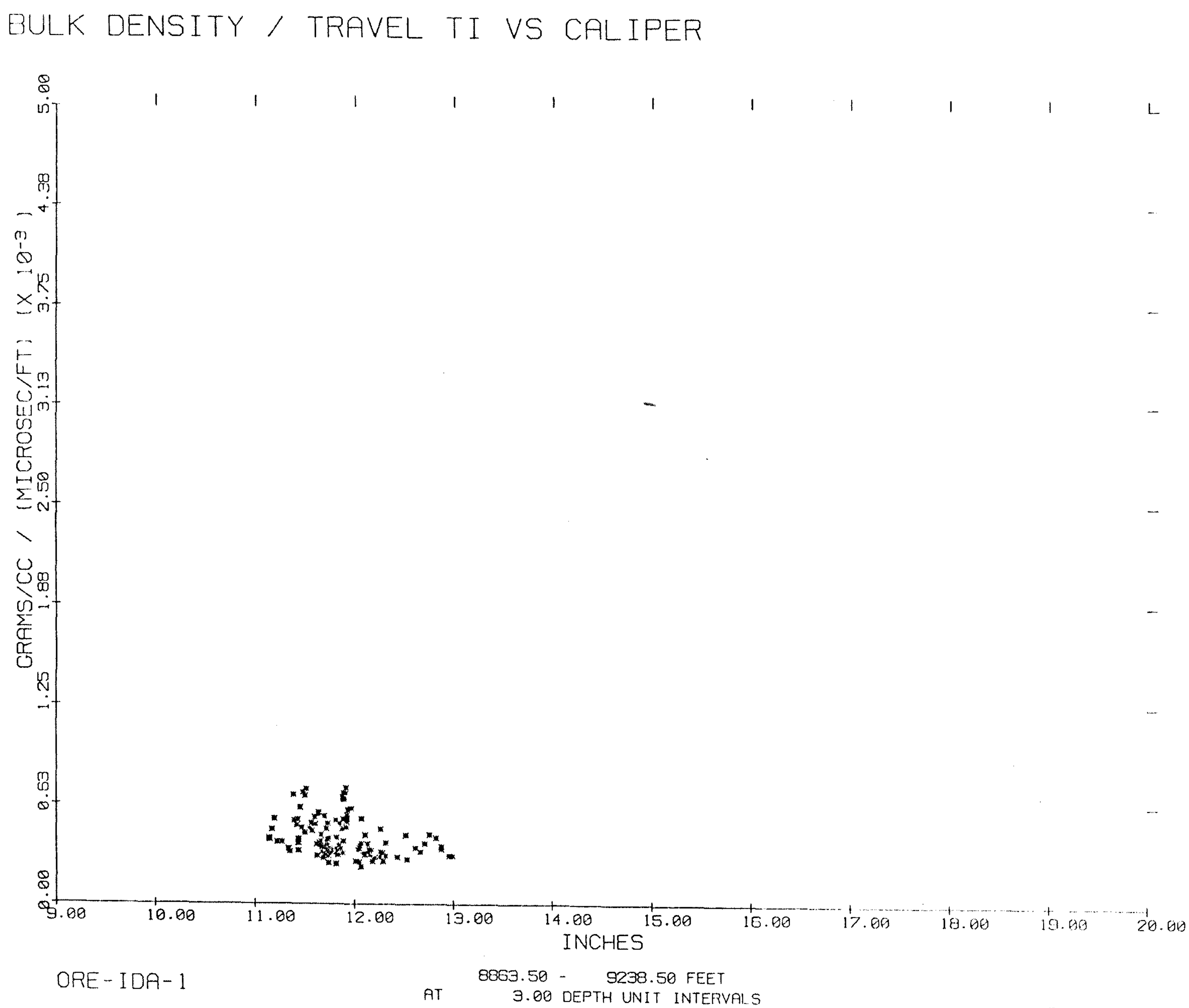


FIGURE 182. Crossplot of Mechanical Strength Index vs. Caliper Reading (8863 - 9238 ft.)

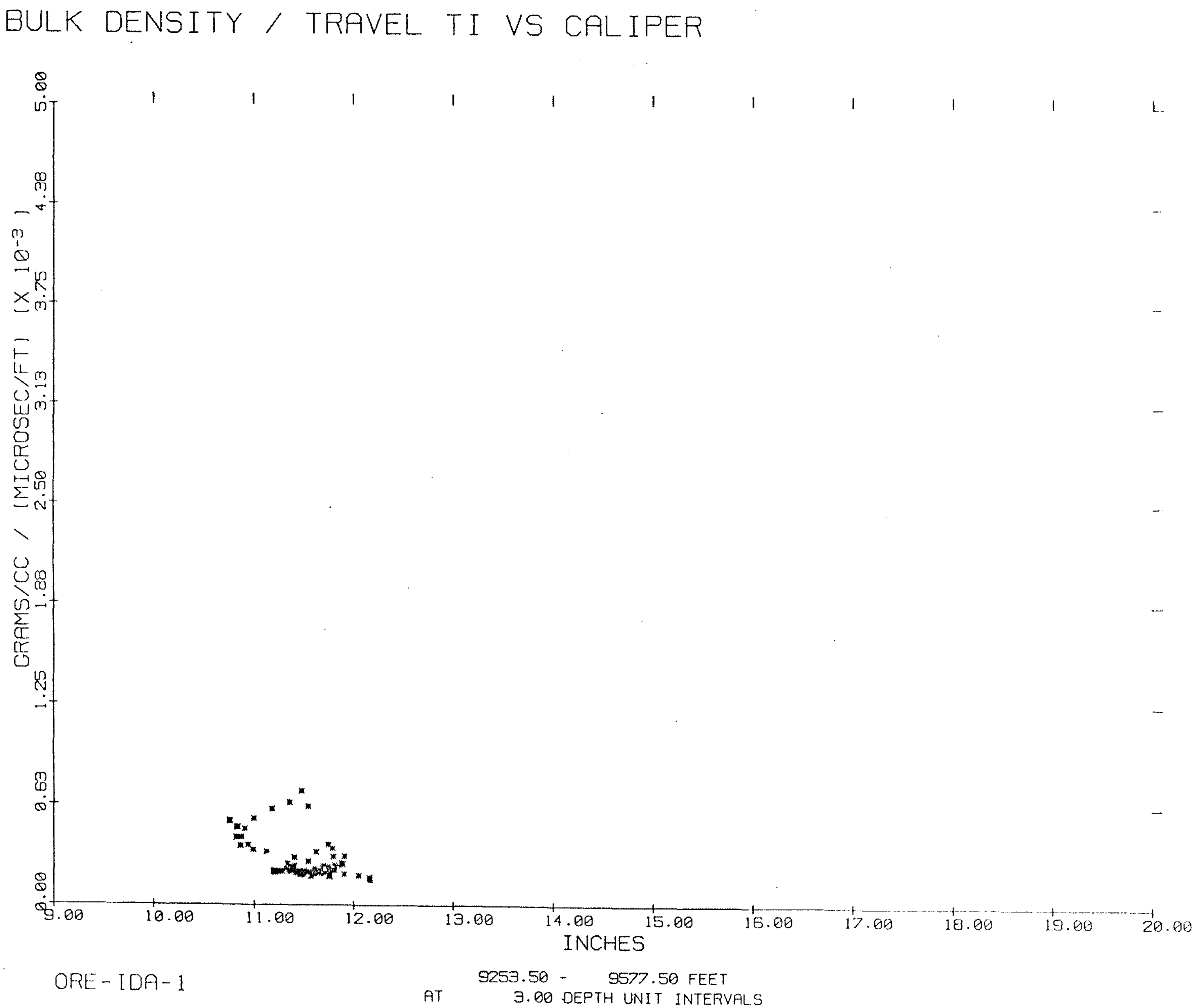


FIGURE 183. Crossplot of Mechanical Strength Index vs. Caliper Reading (9253 - 9577 ft.)

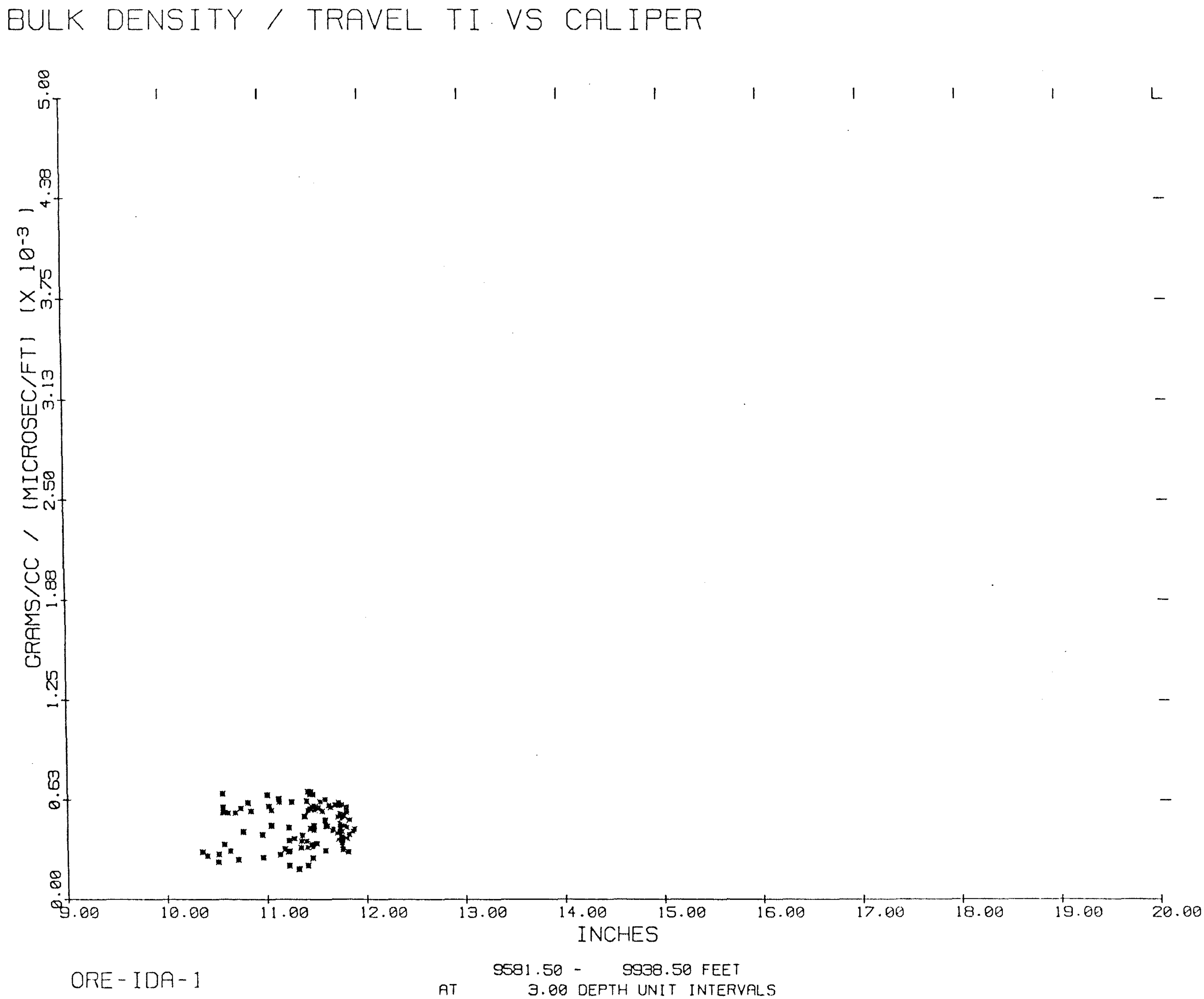


FIGURE 184. Crossplot of Mechanical Strength Index vs. Caliper Reading (9581 - 9938 ft.)

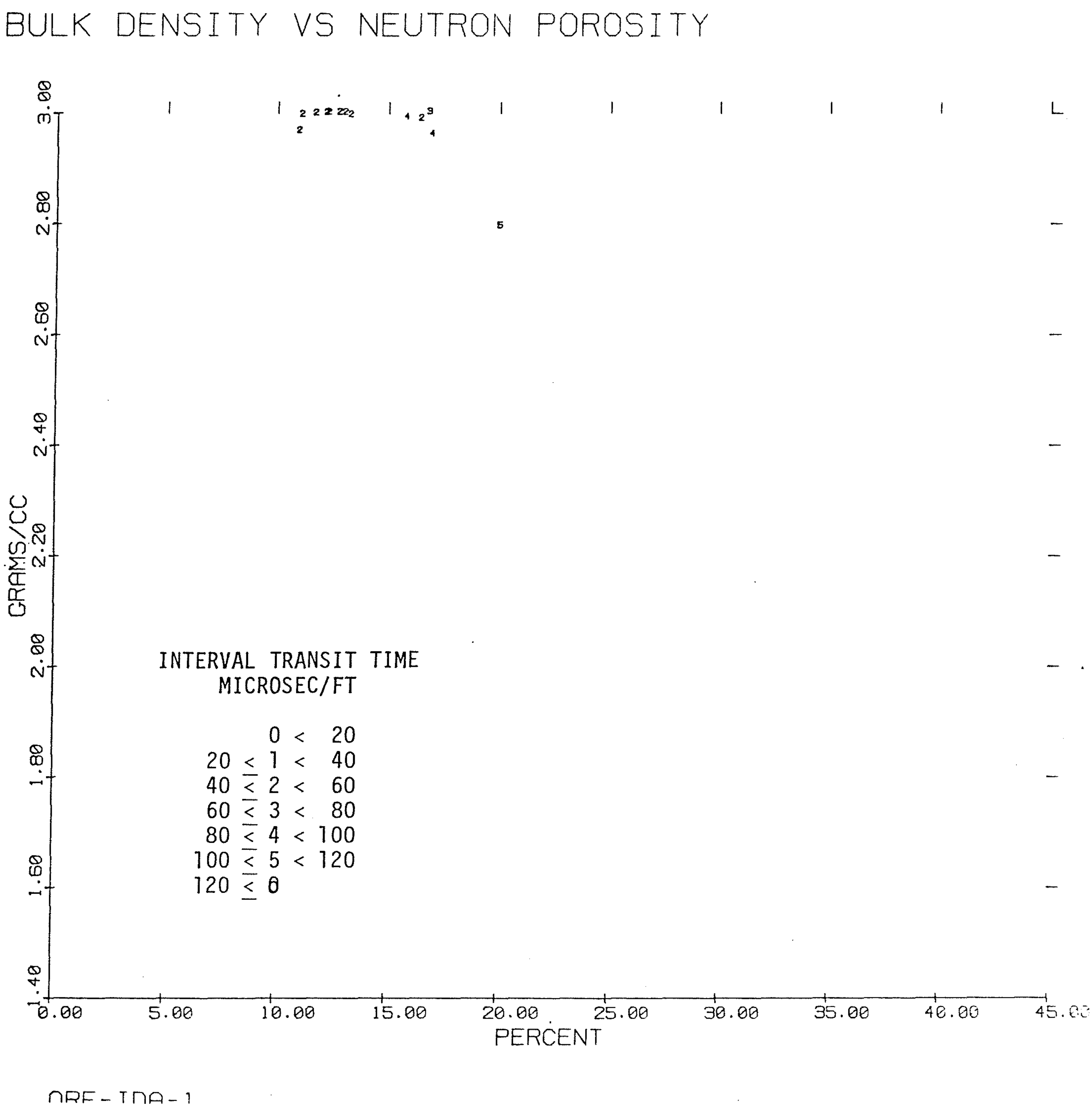


FIGURE 185. Z-Plot of Bulk Density vs. Neutron Porosity with Interval Transit Time (4571 - 4610 ft.)

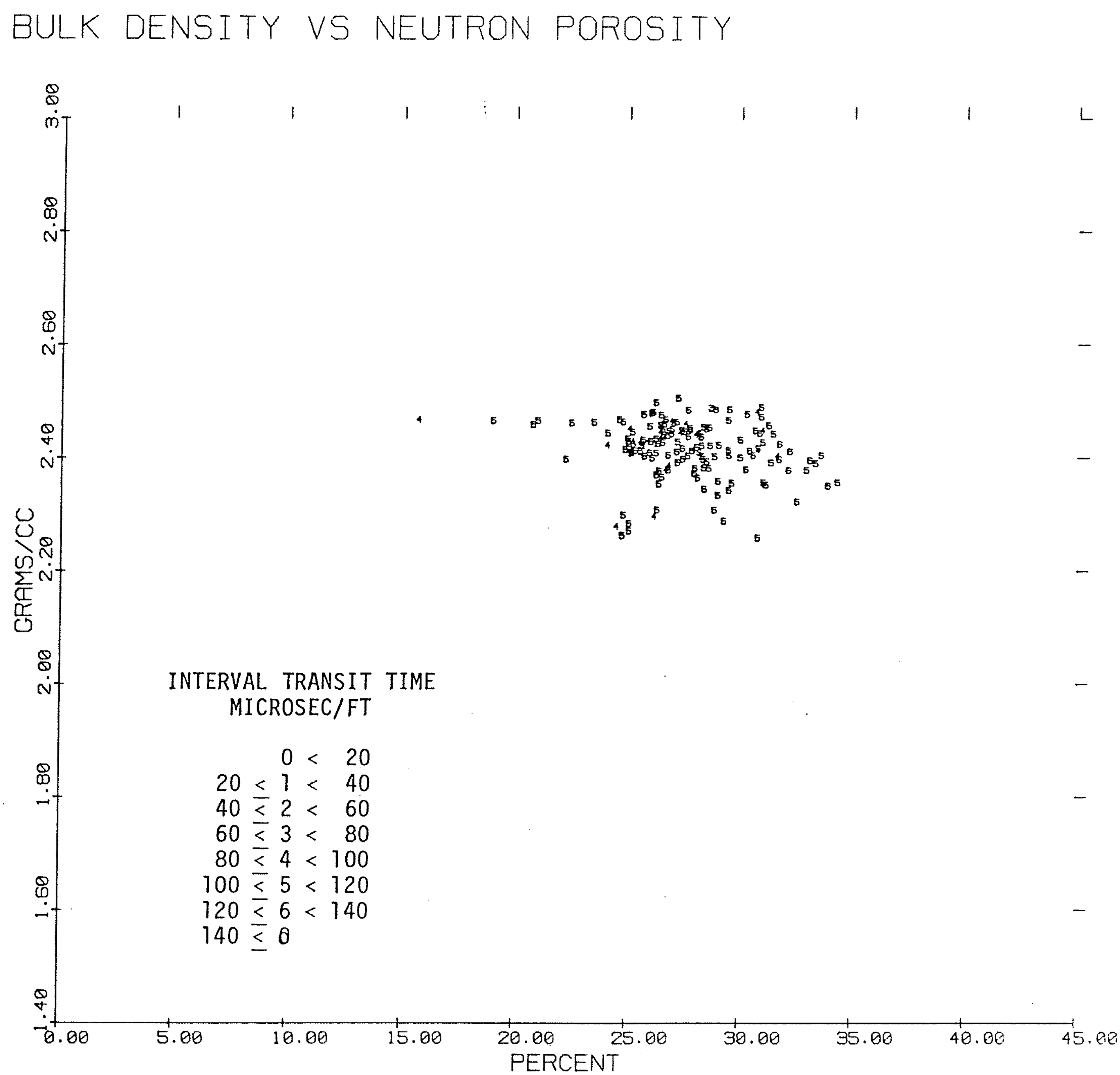


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FIGURE 186. Z-Plot of Bulk Density vs. Neutron Porosity with Interval Transit Time (4660 - 5137 ft.)

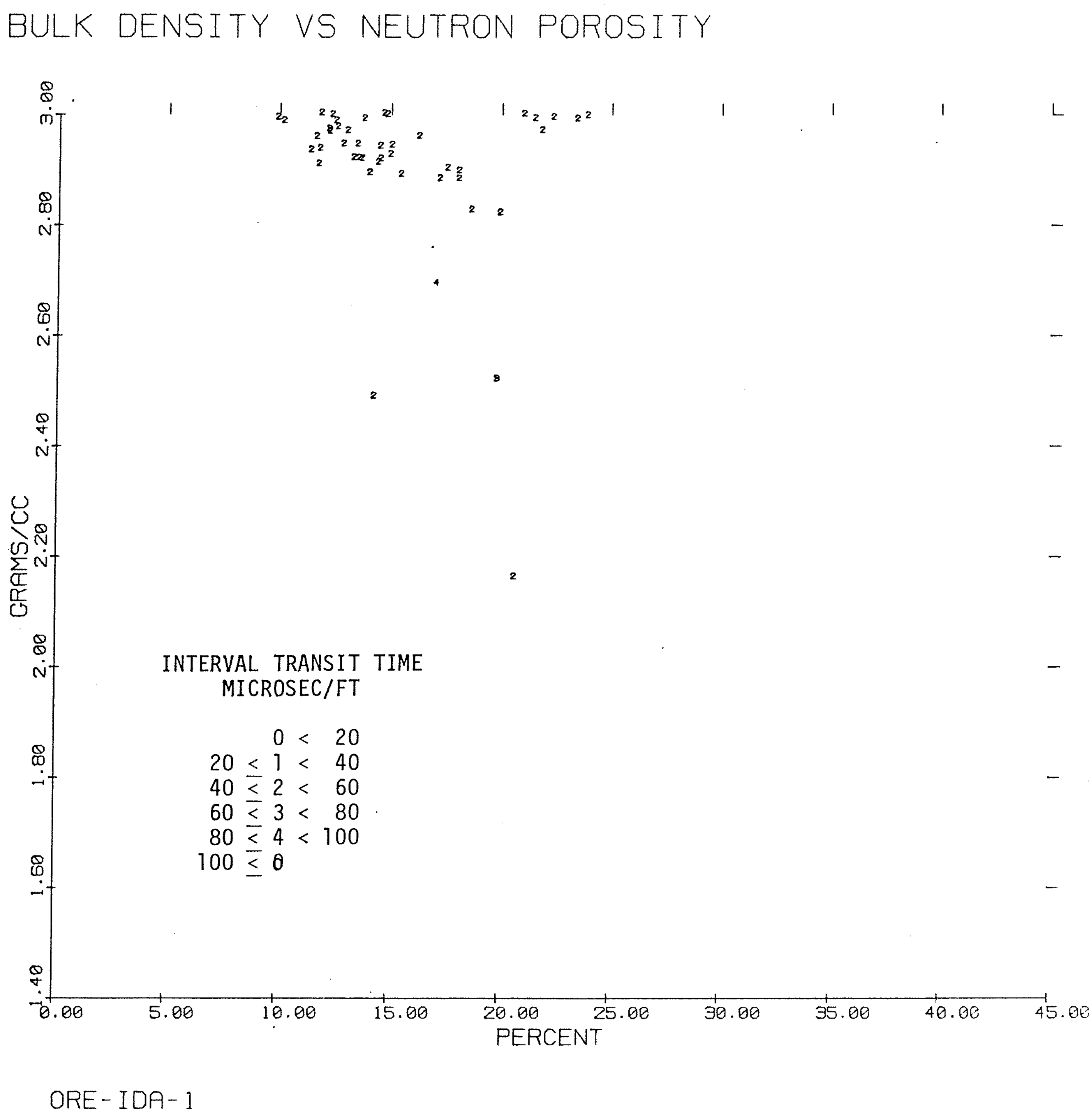

FIGURE 187. Z-Plot of Bulk Density vs. Neutron Porosity with Interval Transit Time (5152 - 5287 ft.)

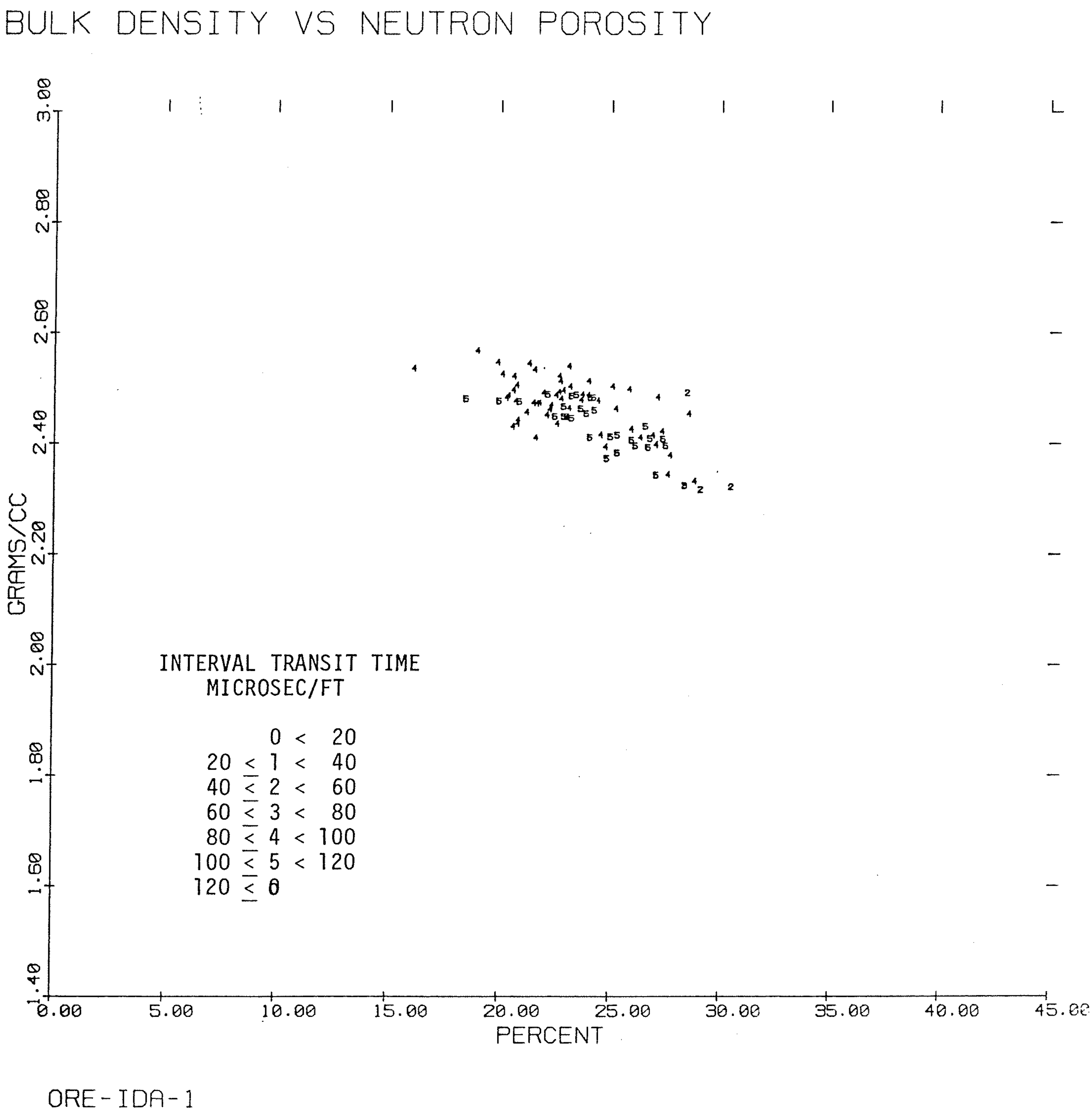

FIGURE 188. Z-Plot of Bulk Density vs. Neutron Porosity with Interval Transit Time (5296 - 5560 ft.)

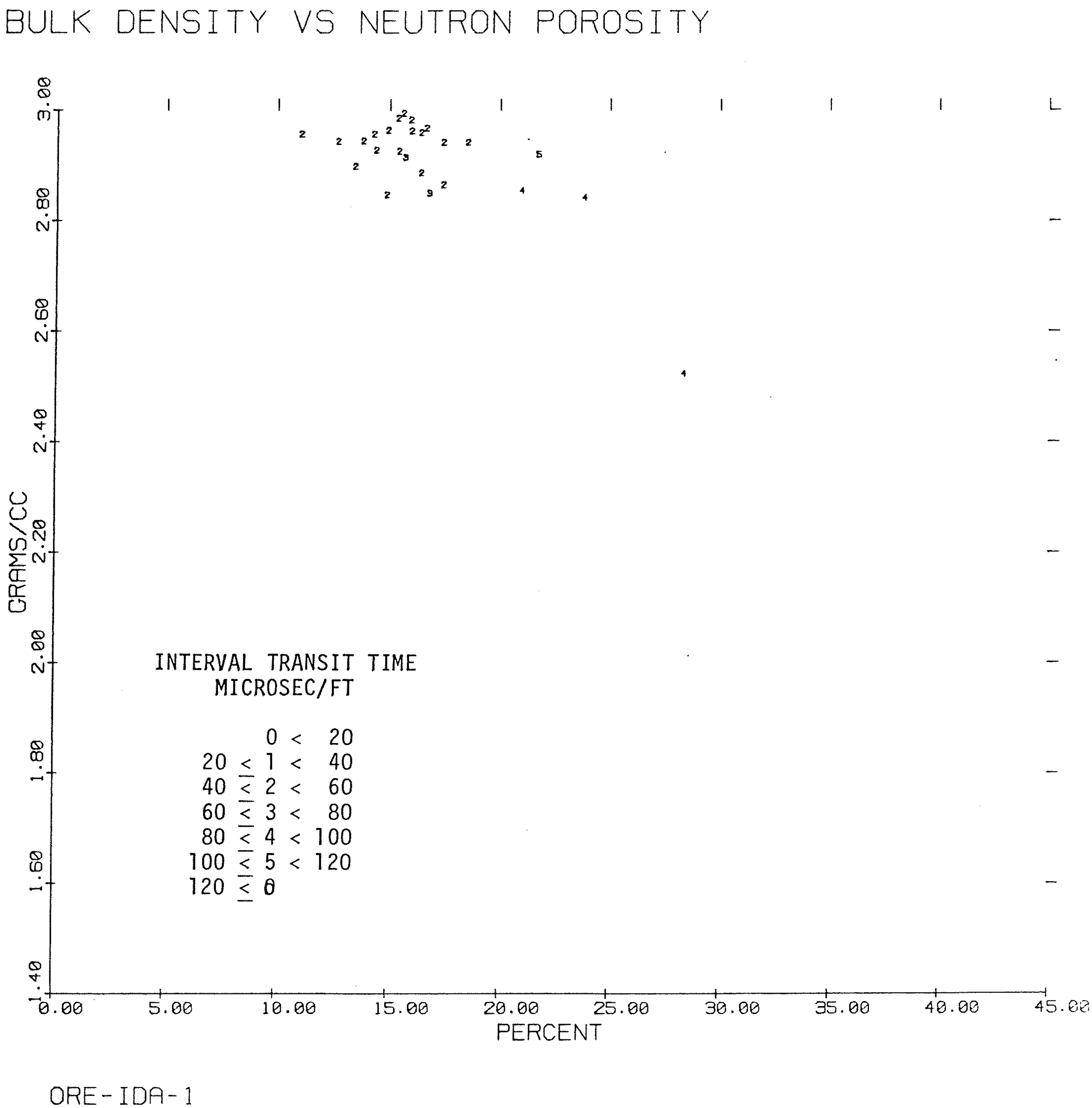

FIGURE 189. Z-Plot of Bulk Density vs. Neutron Porosity with Interval Transit Time (5572 - 5644 ft.)

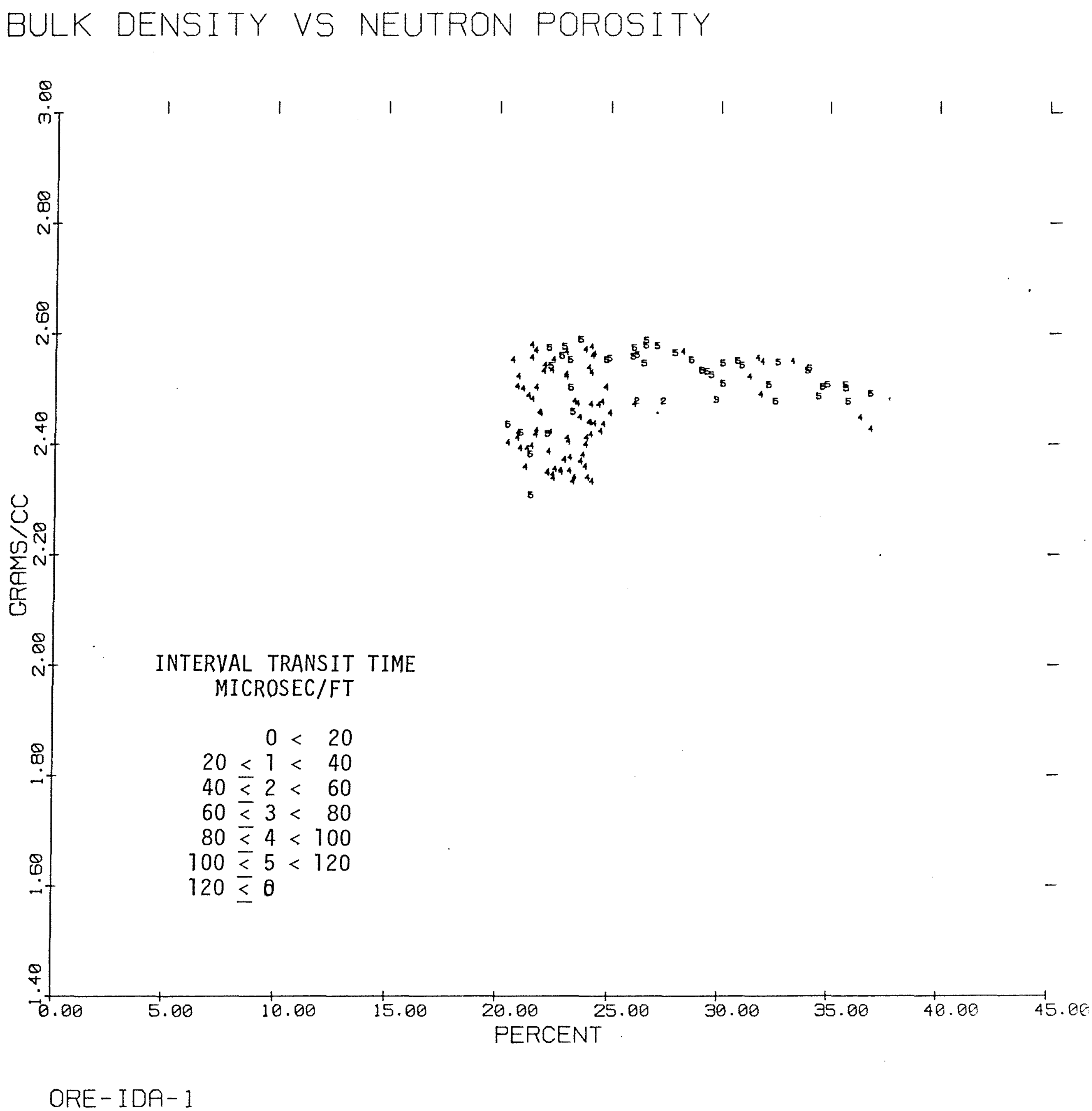

FIGURE 190. Z-Plot of Bulk Density vs. Neutron Porosity with Interval Transit Time (5651 - 6026 ft.)

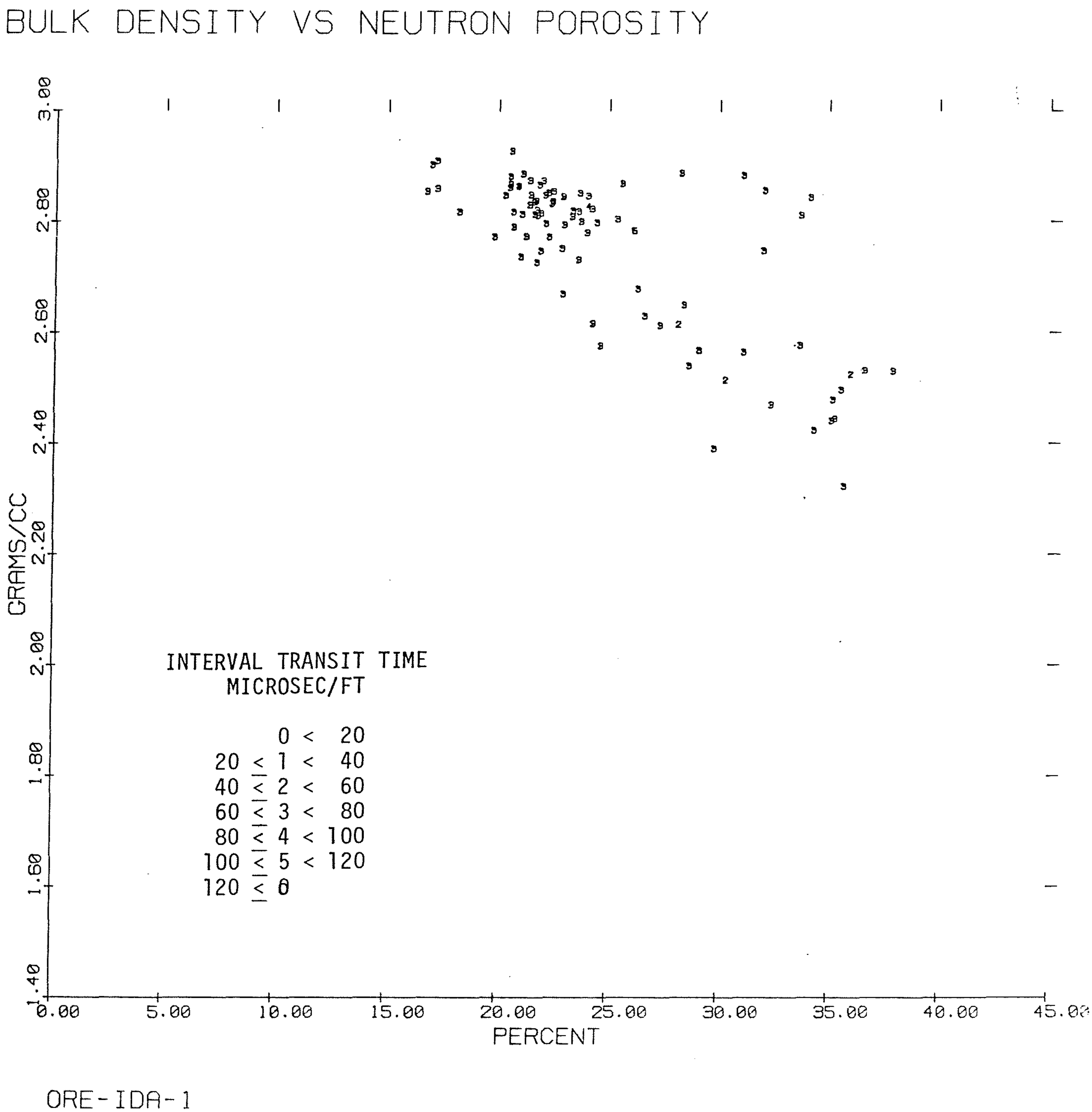

FIGURE 191. Z-Plot of Bulk Density vs. Neutron Porosity with Interval Transit Time (6031 - 6286 ft.)

BULK DENSITY VS NEUTRON POROSITY

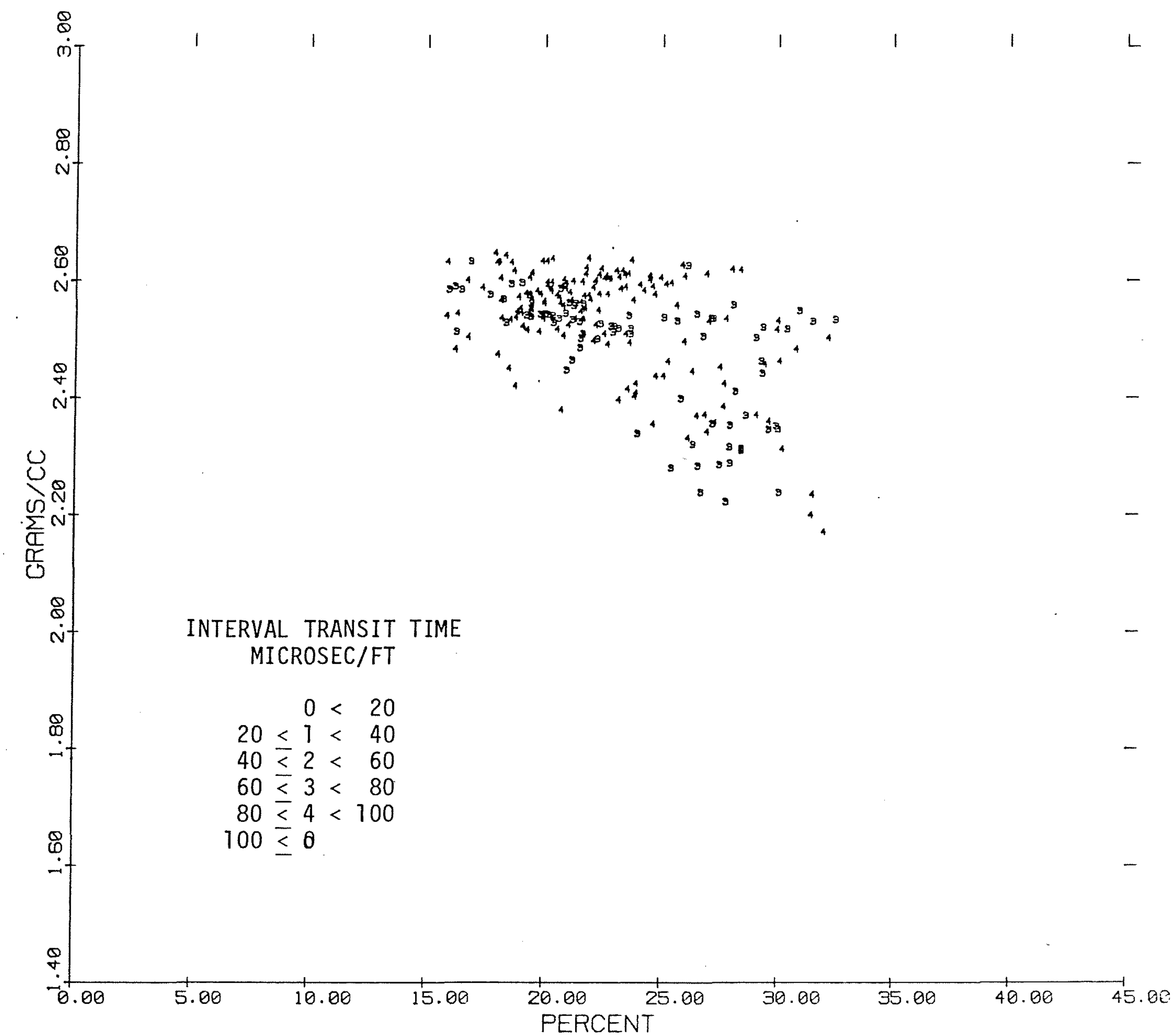

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FIGURE 192. Z-Plot of Bulk Density vs. Neutron Porosity with Interval Transit Time (6294 - 7008 ft.)

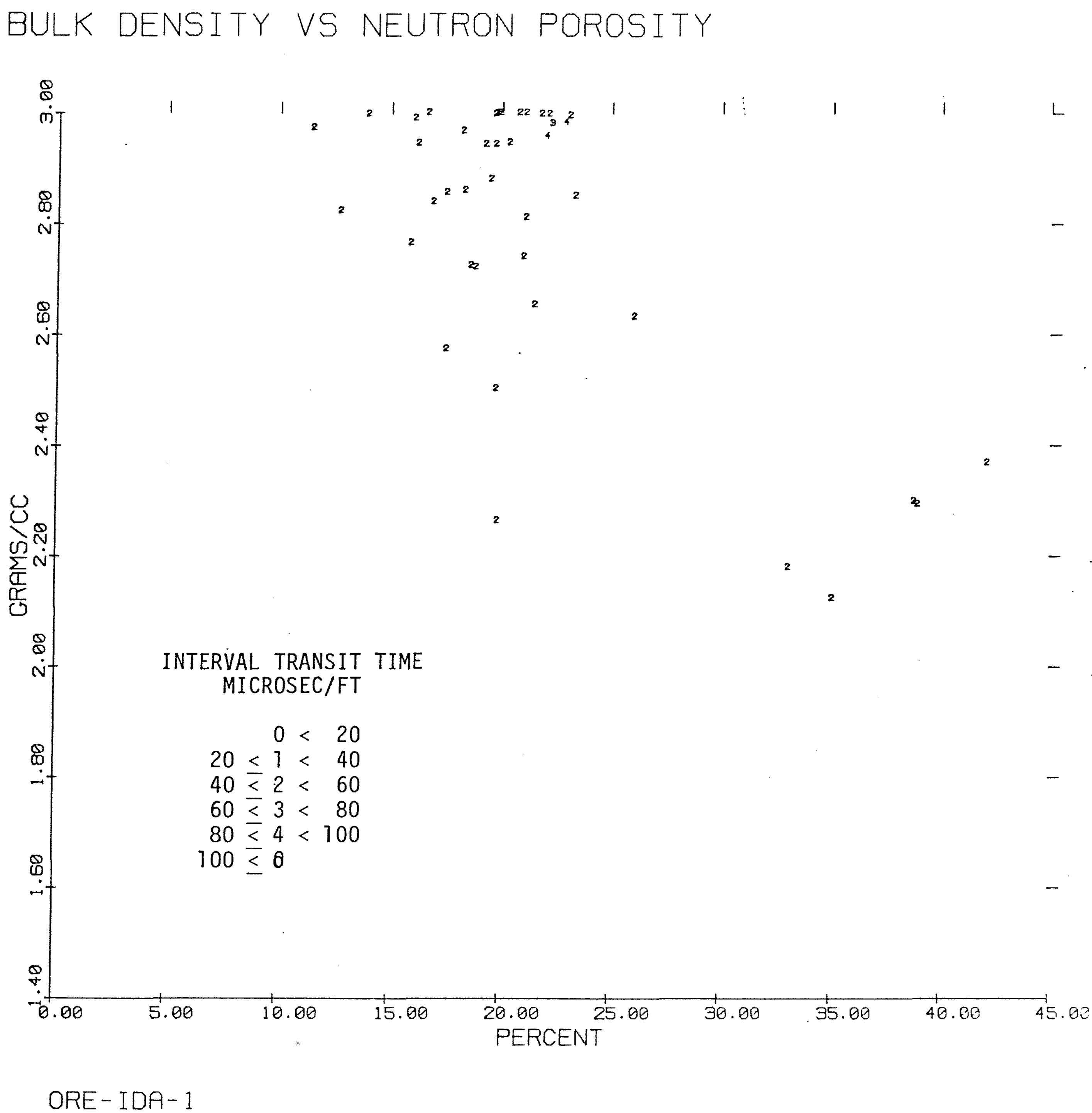

FIGURE 193. Z-Plot of Bulk Density vs. Neutron Porosity with Interval Transit Time (7015 - 7135 ft.)

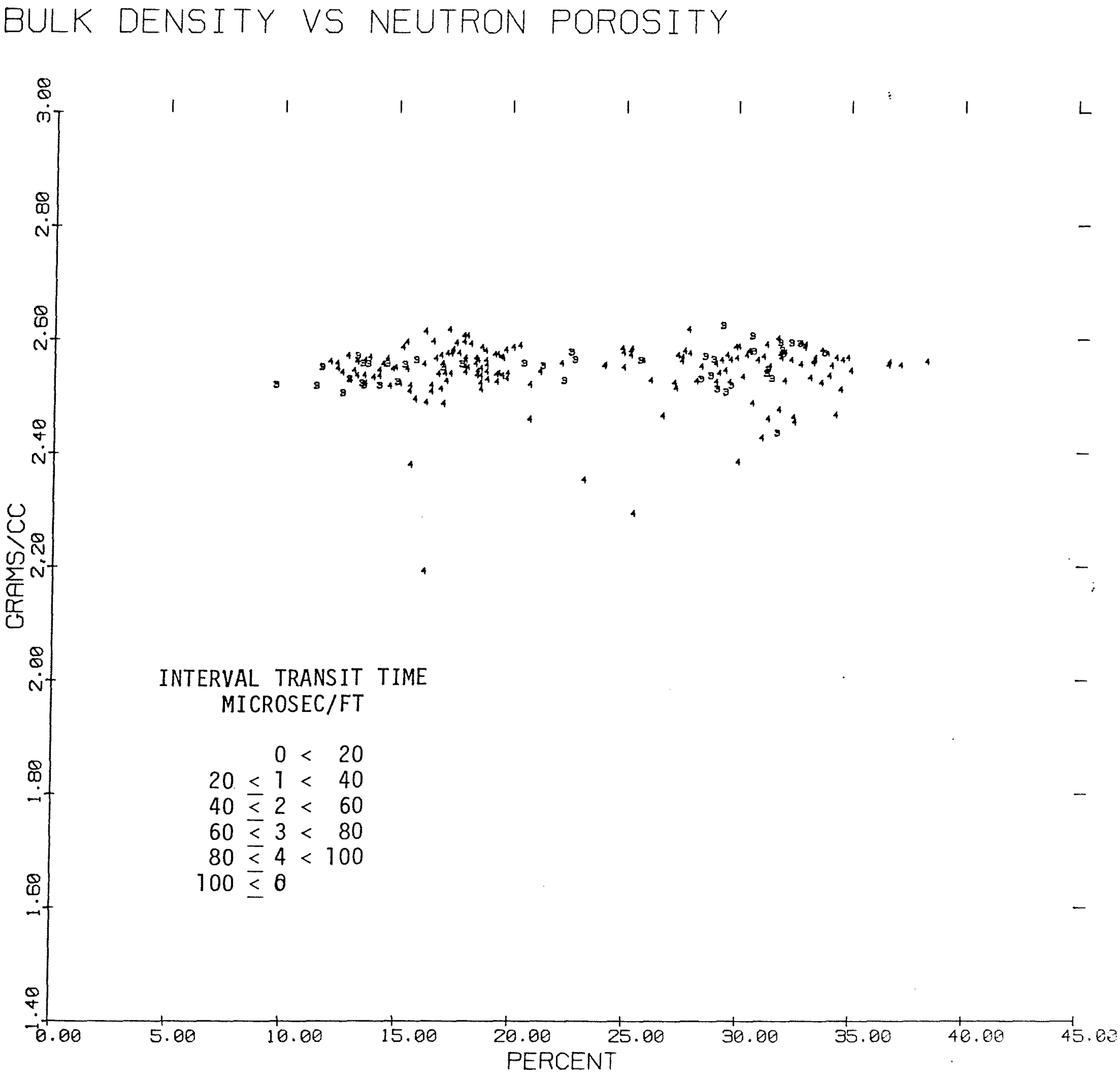

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FIGURE 194. Z-Plot of Bulk Density vs. Neutron Porosity with Interval Transit Time (7147 - 7798 ft.)

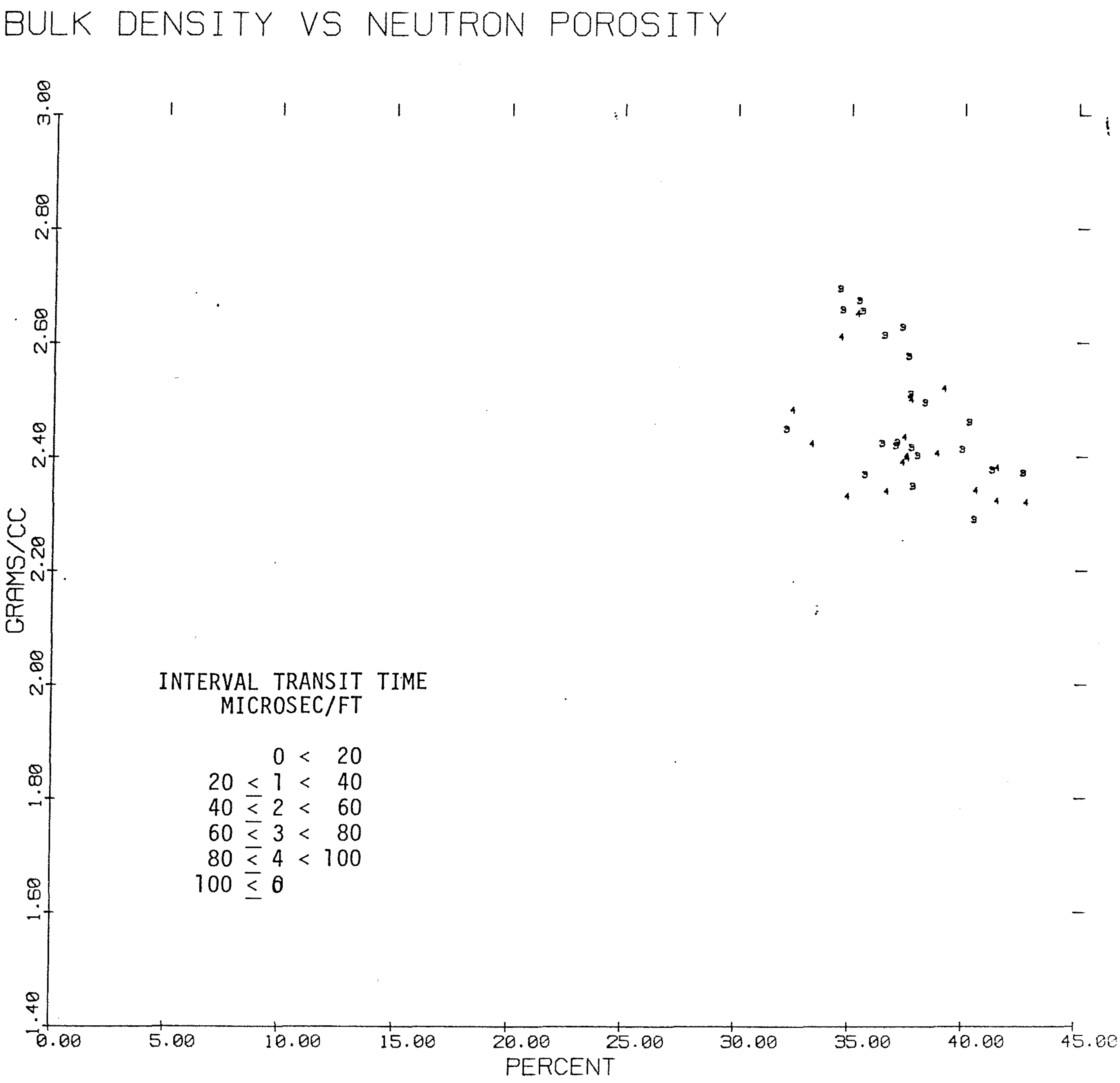

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FIGURE 195. Z-Plot of Bulk Density vs. Neutron Porosity with Interval Transit Time (7803 - 7926 ft.)

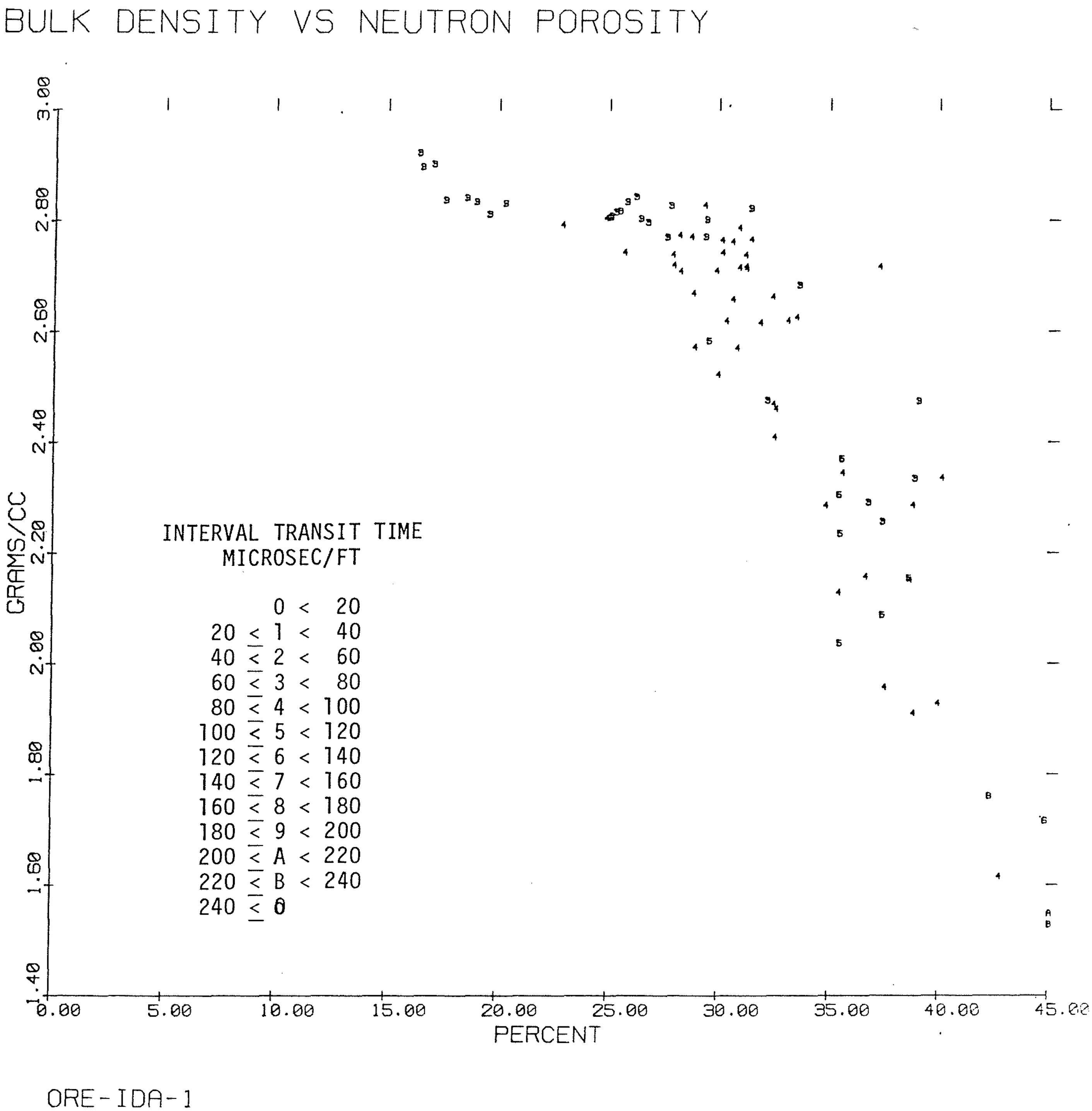

FIGURE 196. Z-Plot of Bulk Density vs. Neutron Porosity with Interval Transit Time (8155 - 8404 ft.)

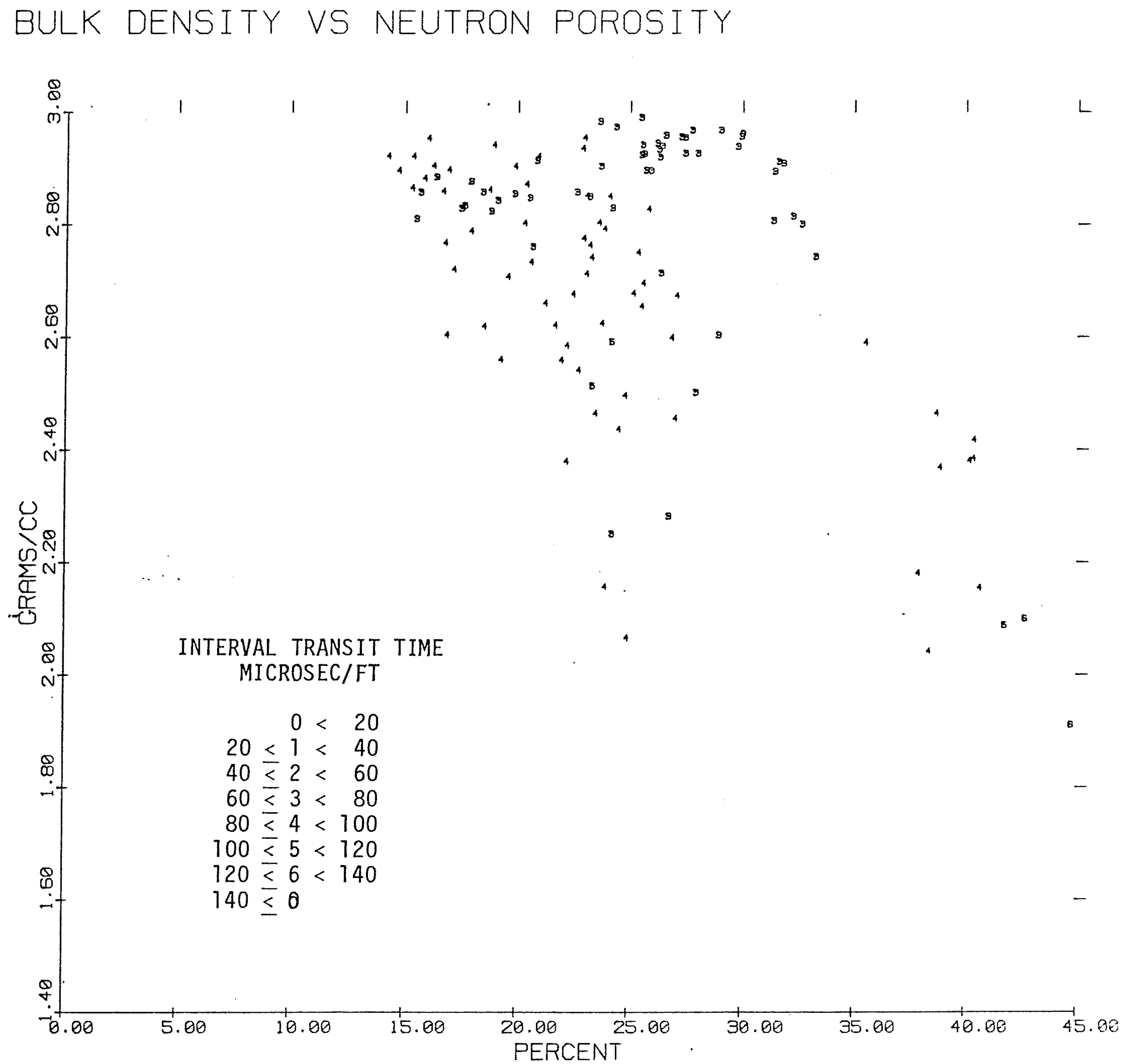

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FIGURE 197. Z-Plot of Bulk Density vs. Neutron Porosity with Interval Transit Time (8466 - 8826 ft.)

BULK DENSITY VS NEUTRON POROSITY

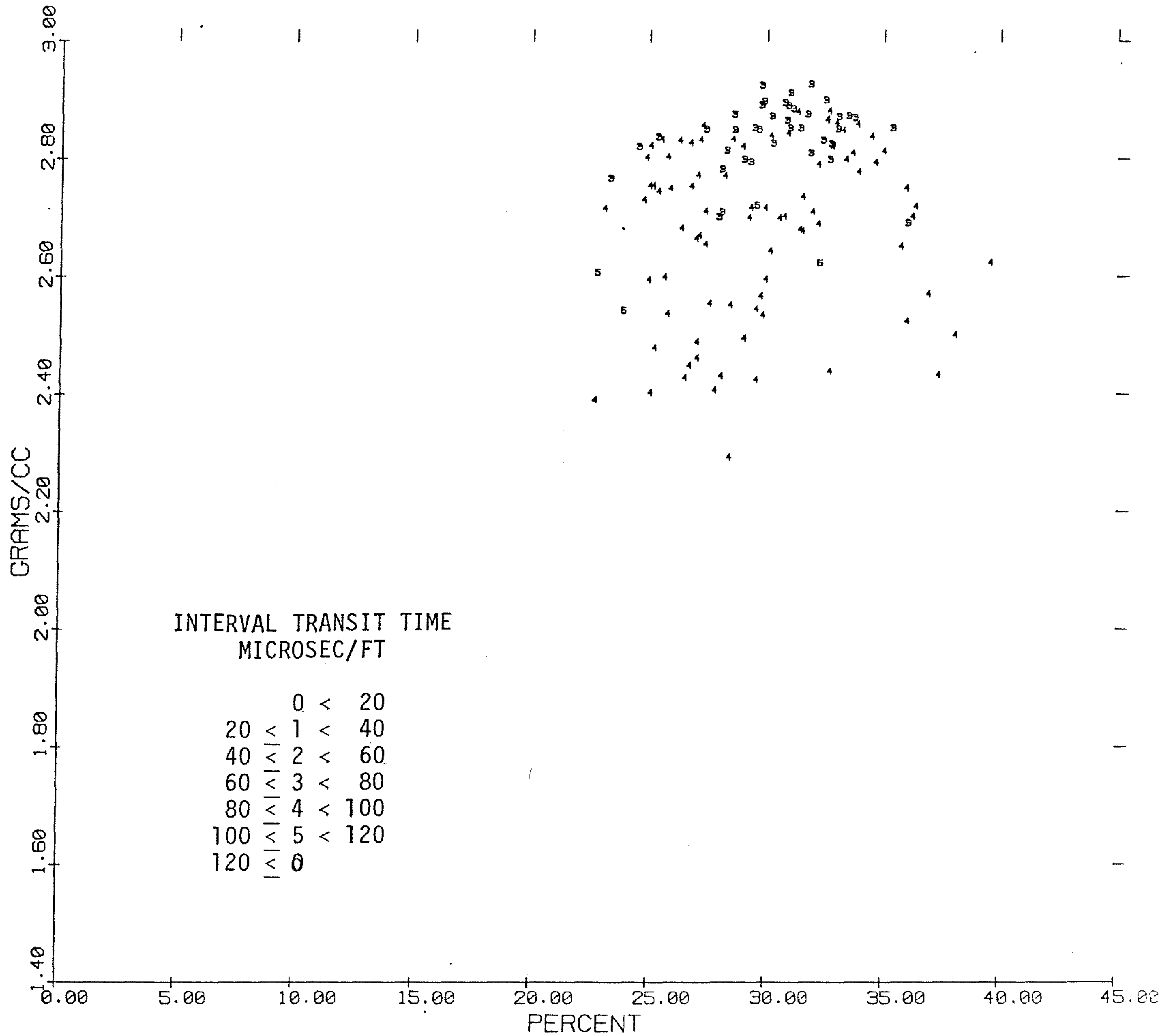

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FIGURE 198. Z-Plot of Bulk Density vs. Neutron Porosity with Interval Transit Time (8863 - 9238 ft.)

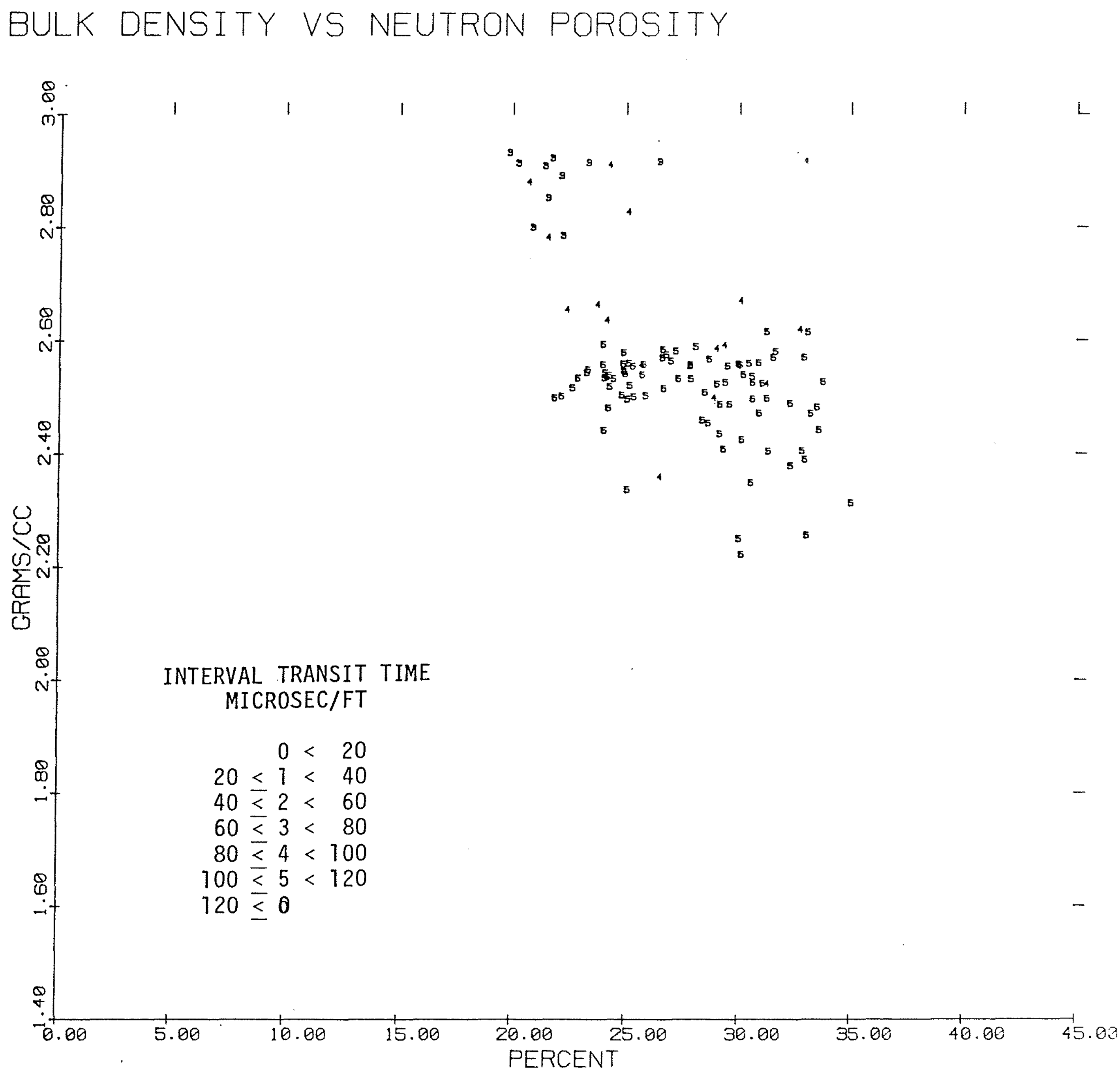

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FIGURE 199. Z-Plot of Bulk Density vs. Neutron Porosity with Interval Transit Time (9253 - 9577 ft.)

BULK DENSITY VS NEUTRON POROSITY

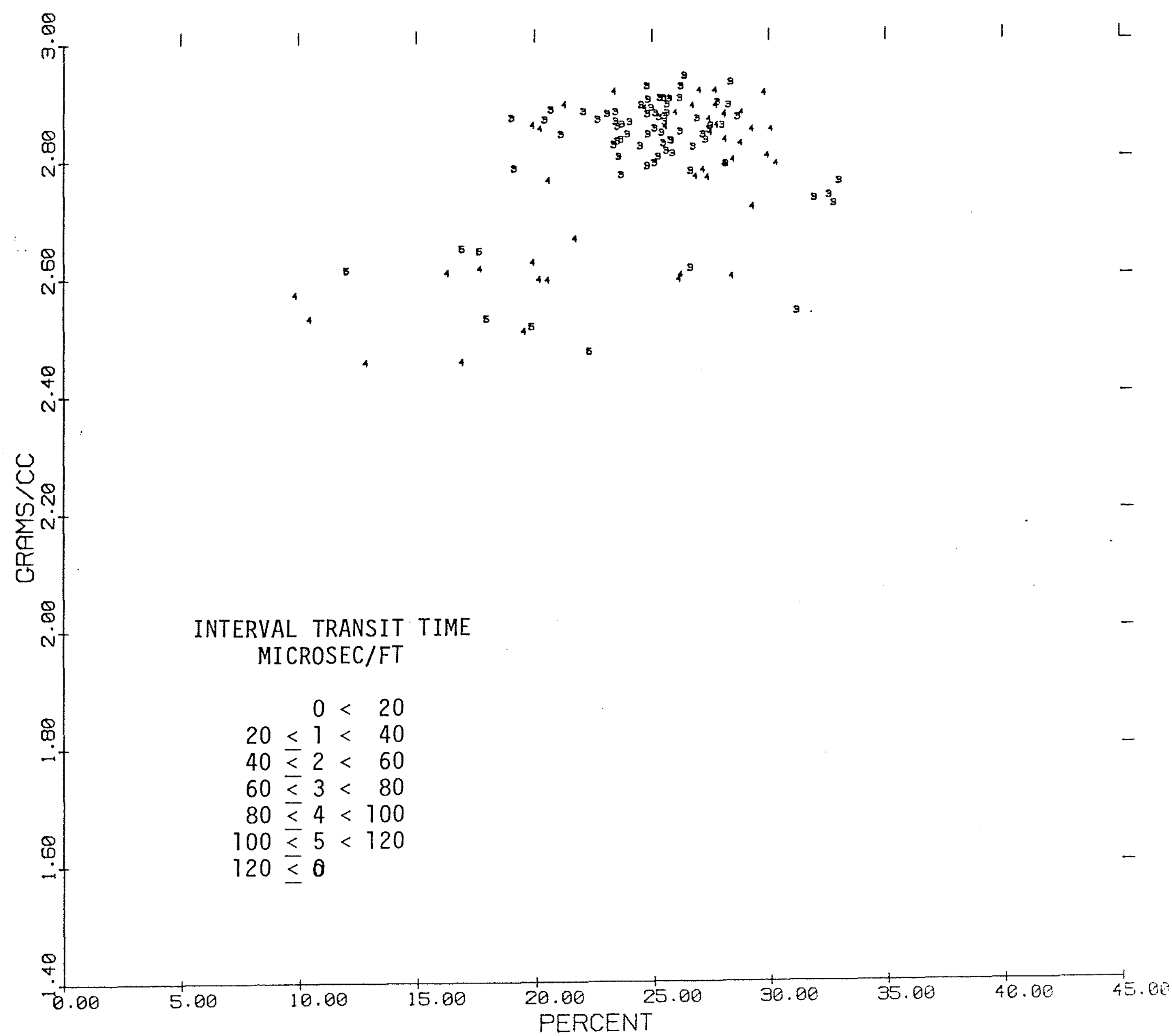

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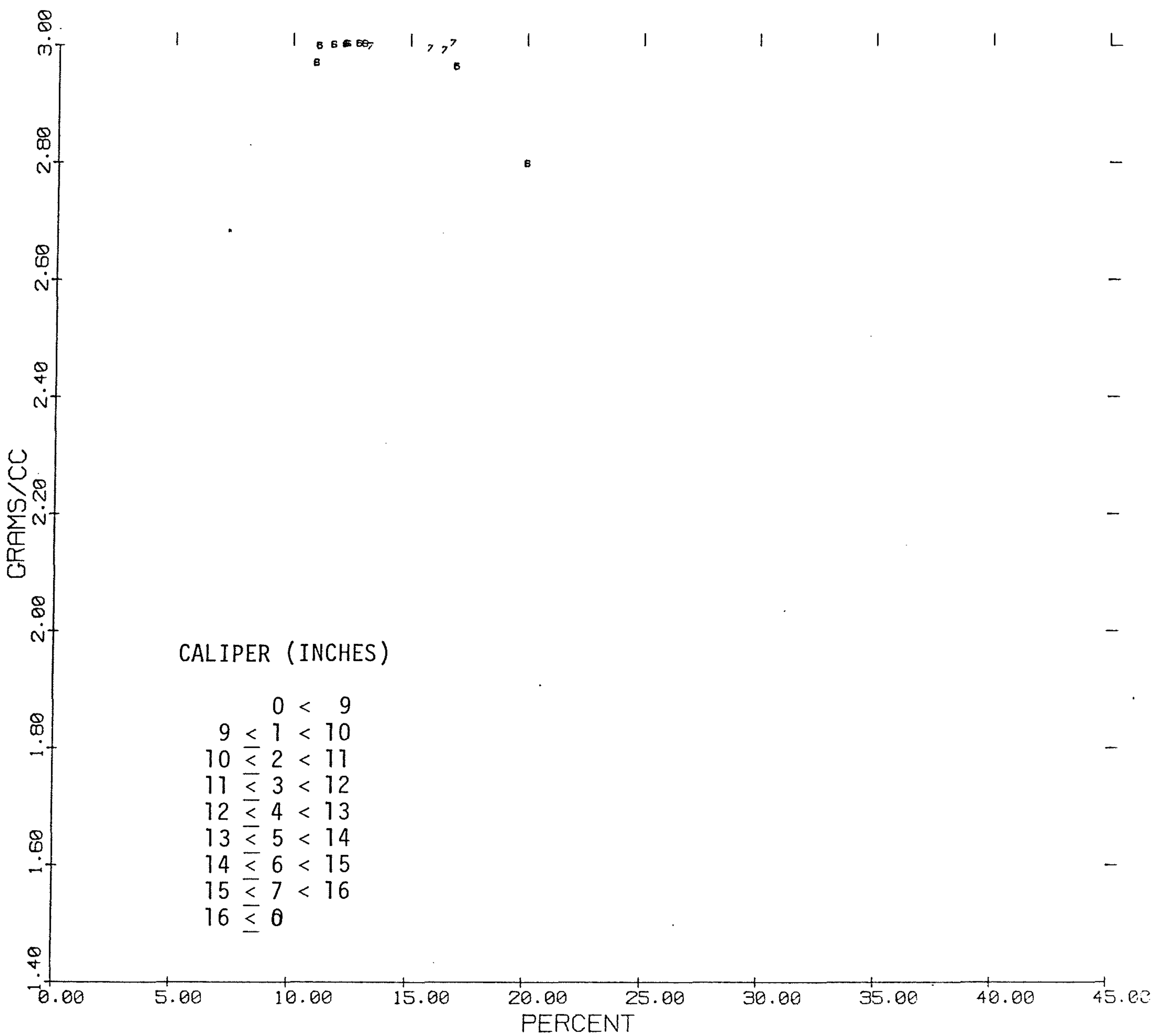
FIGURE 200. Z-Plot of Bulk Density vs. Neutron Porosity with Interval Transit Time (9581 - 9938 ft.)

BULK DENSITY VS NEUTRON POROSITY



ORE-IDA-1

FIGURE 201. Z-Plot of Bulk Density vs. Neutron Porosity with Caliper Reading (4571 - 4610 ft.)

BULK DENSITY VS NEUTRON POROSITY

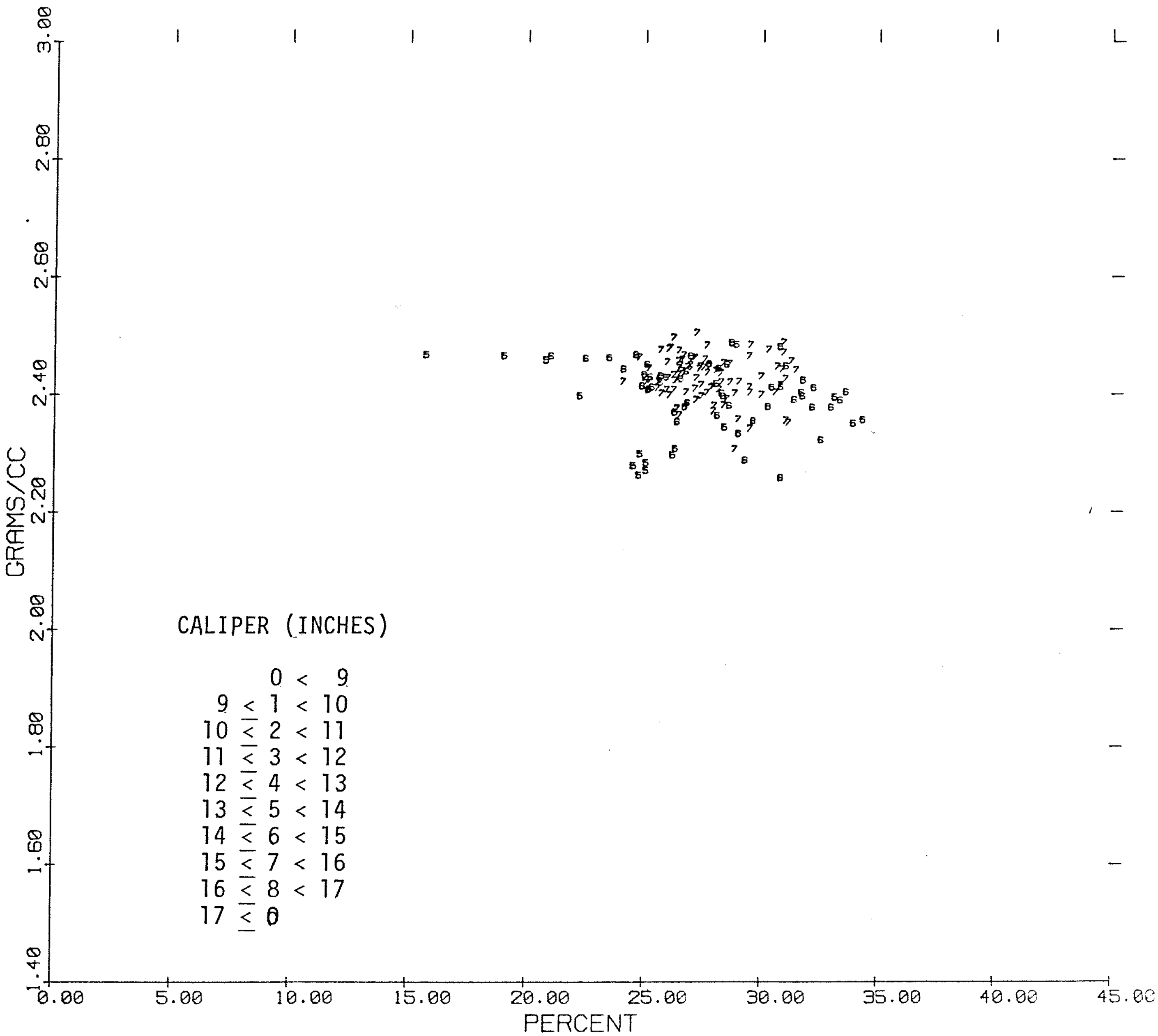


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FIGURE 202. Z-Plot of Bulk Density vs. Neutron Porosity with Caliper Reading (4660 - 5137 ft.)

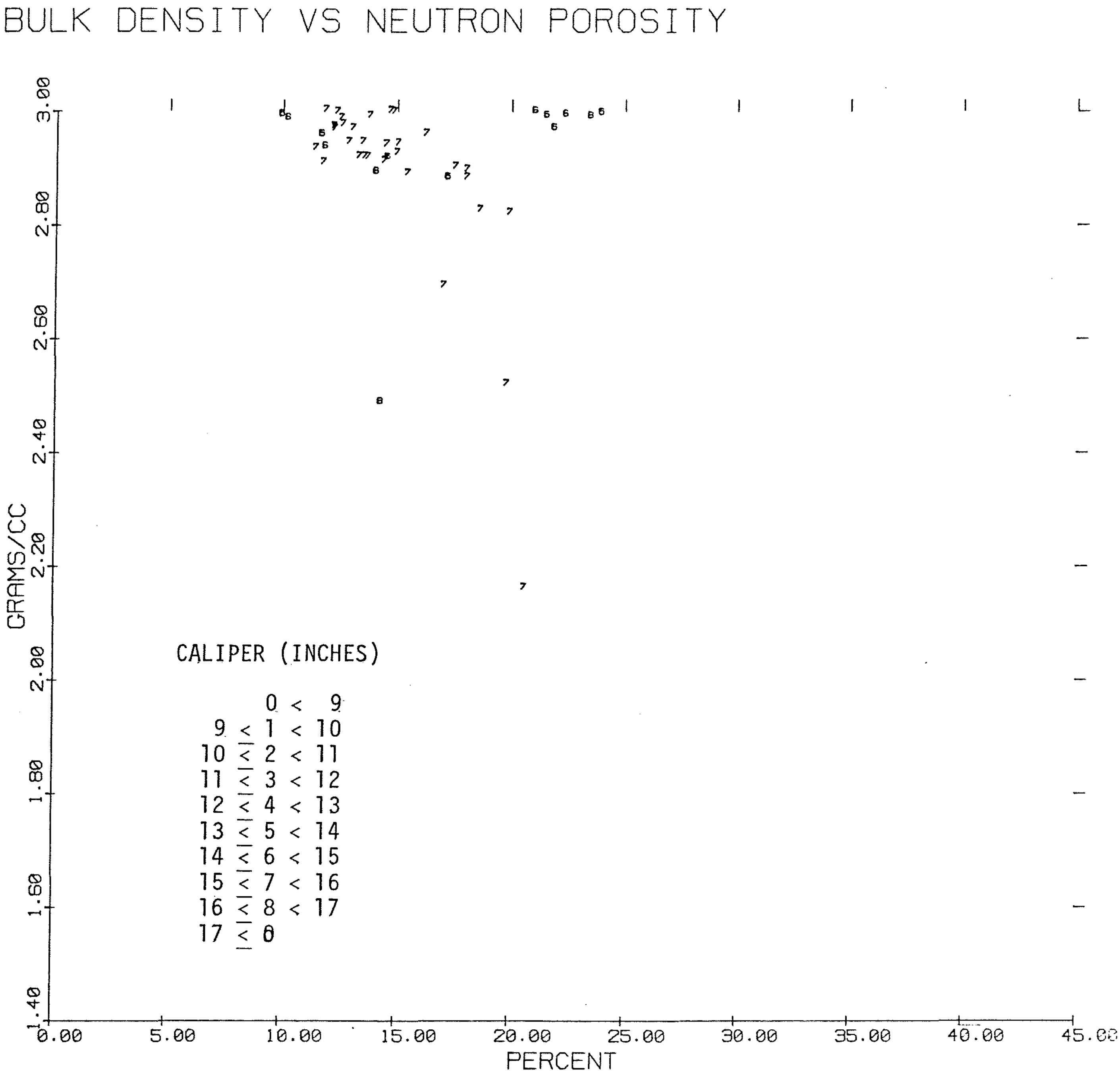

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FIGURE 203. Z-Plot of Bulk Density vs. Neutron Porosity with Caliper Reading (5152 - 5287 ft.)

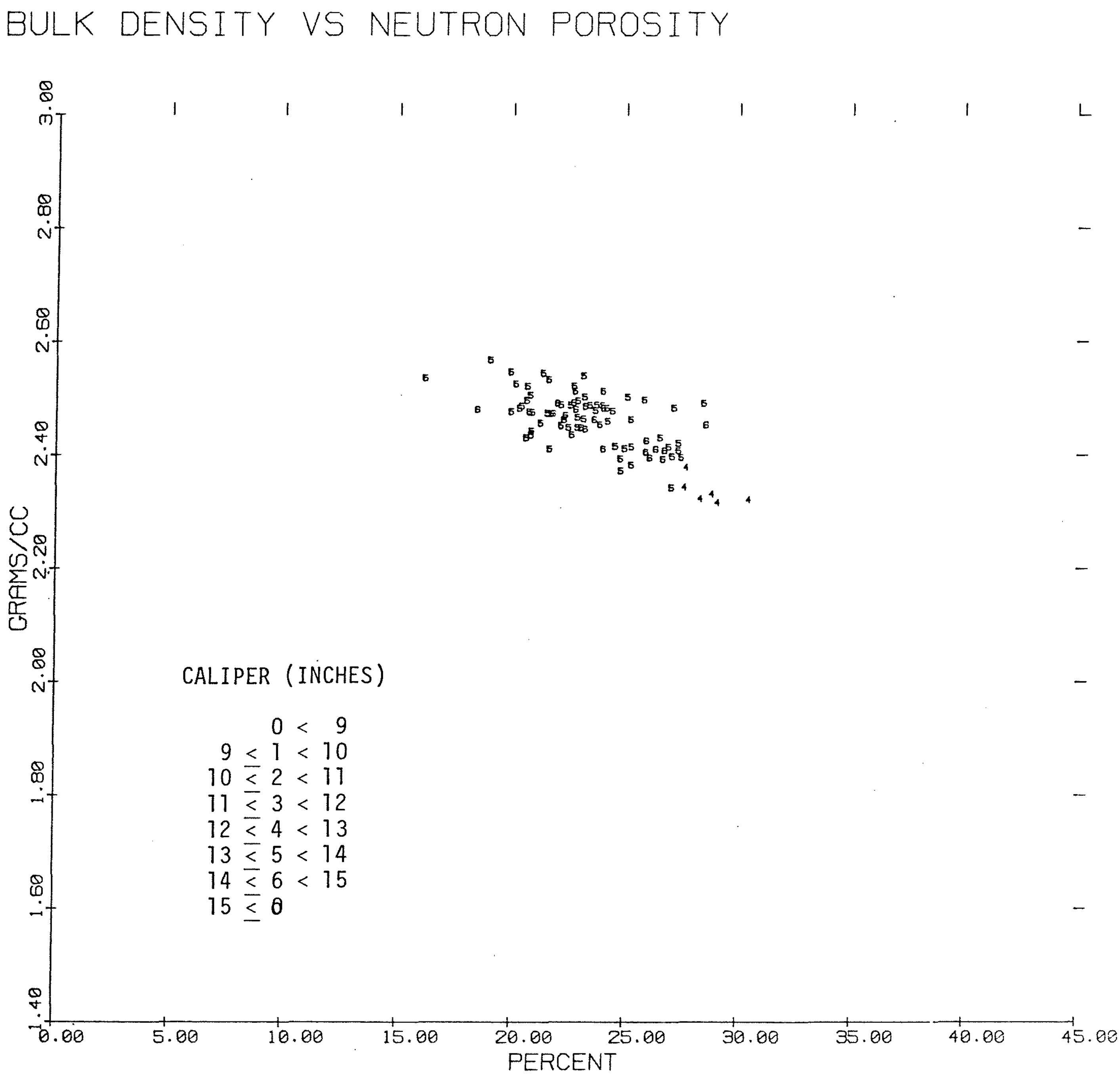

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FIGURE 204. Z-Plot of Bulk Density vs. Neutron Porosity with Caliper Reading (5296 - 5560 ft.)

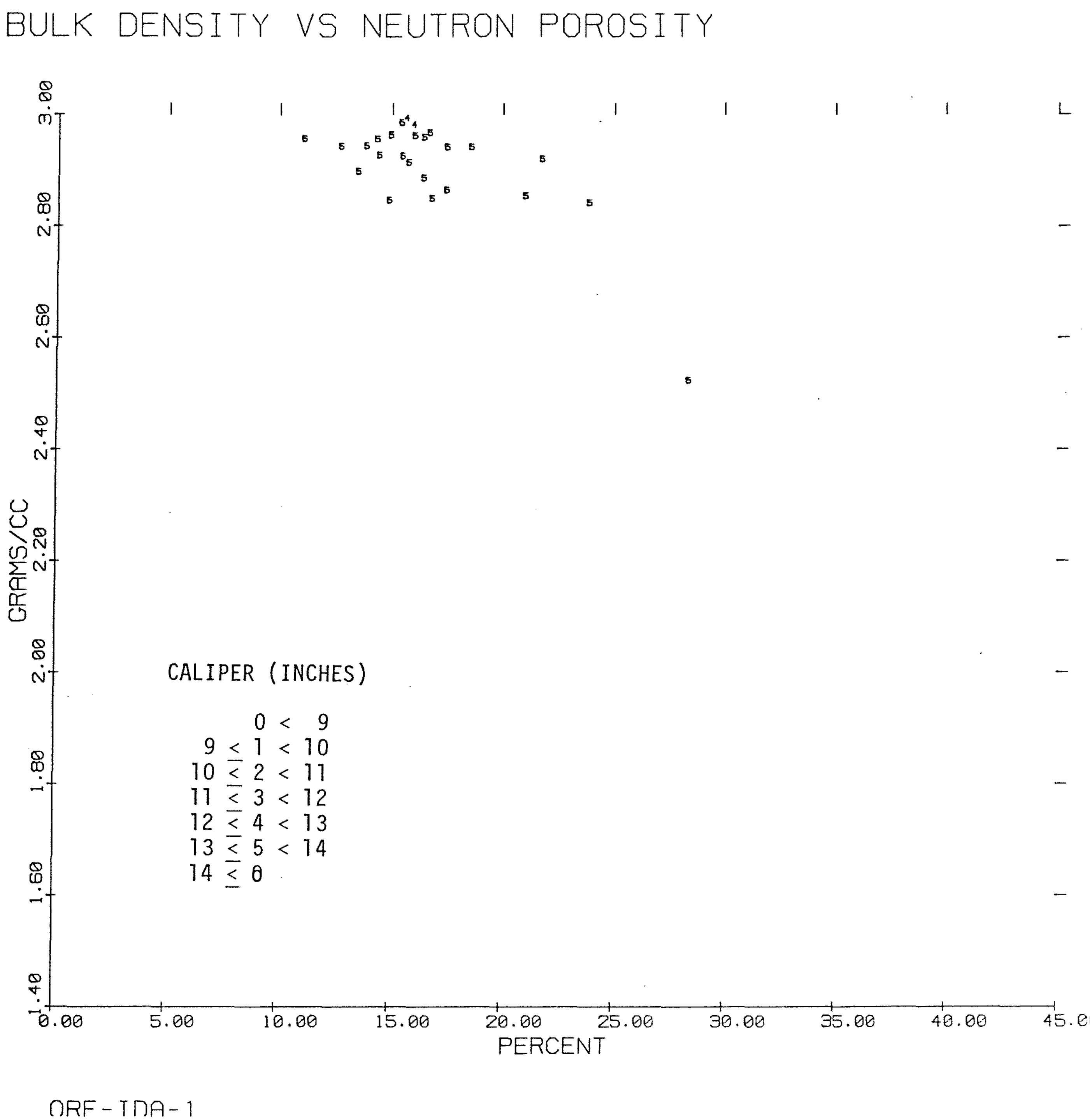

FIGURE 205. Z-Plot of Bulk Density vs. Neutron Porosity with Caliper Reading (5572 - 5644 ft.)

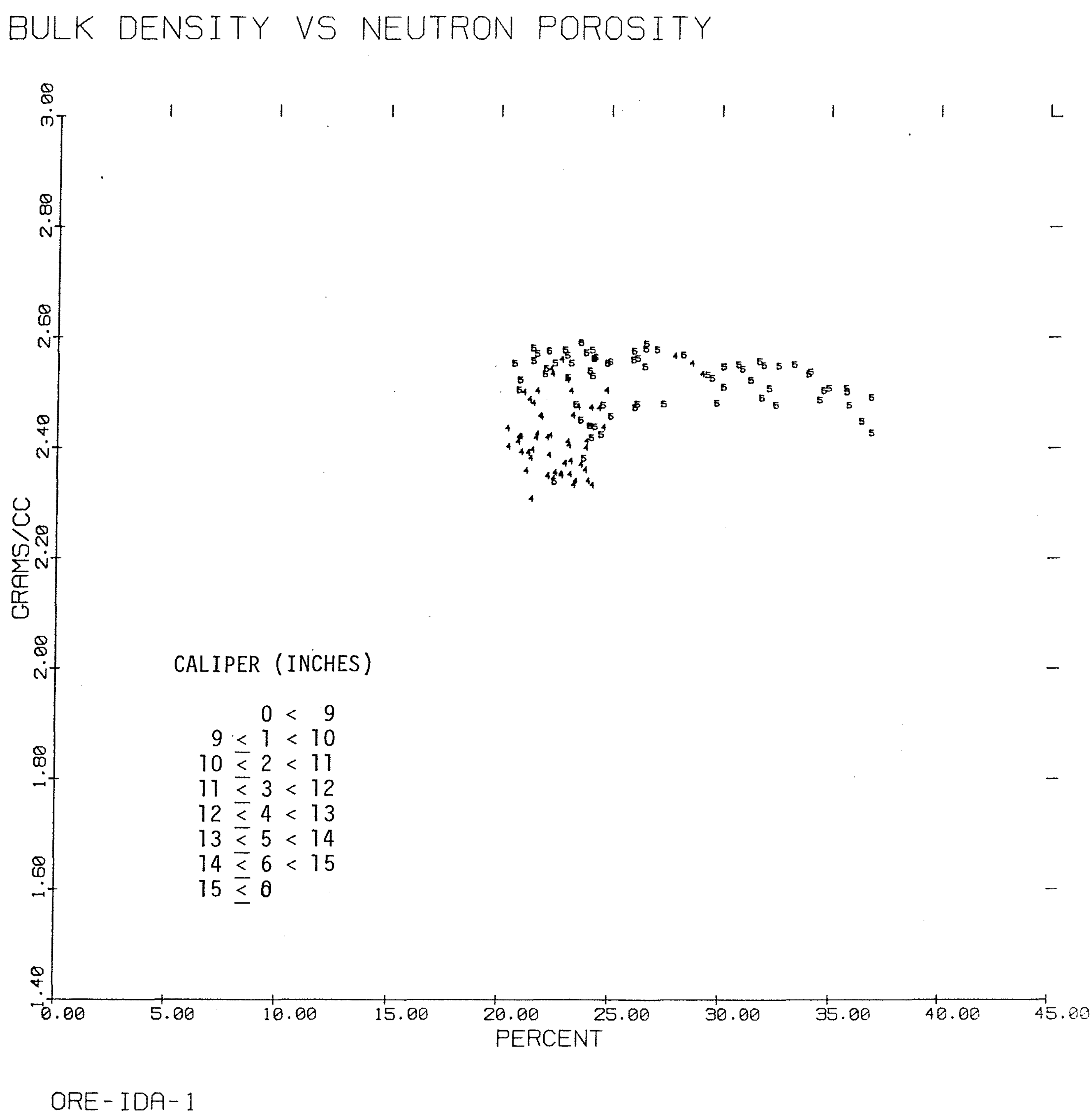

FIGURE 206. Z-Plot of Bulk Density vs. Neutron Porosity with Caliper Reading (5651 - 6026 ft.)

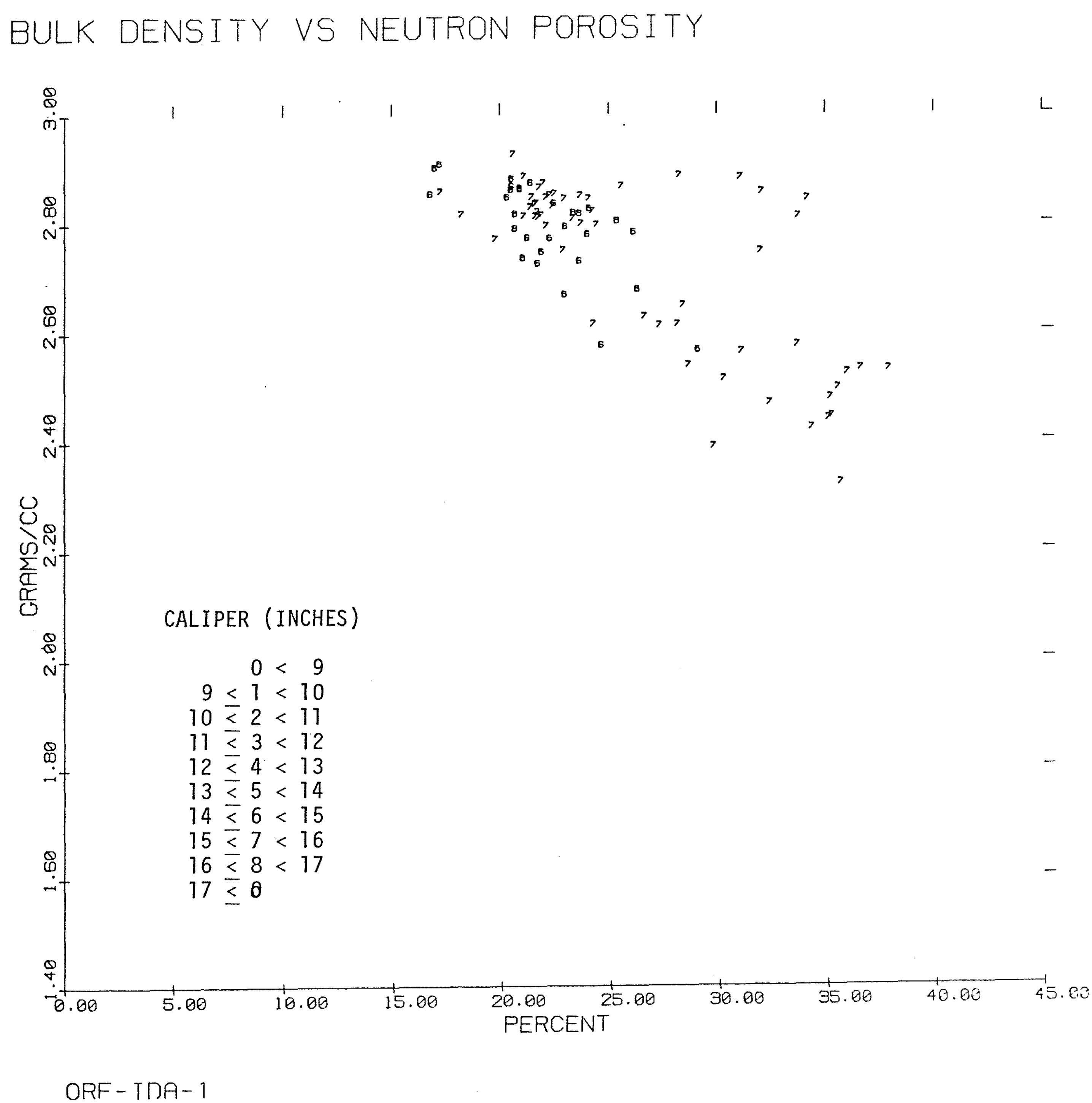

FIGURE 207. Z-Plot of Bulk Density vs. Neutron Porosity with Caliper Reading (6031 - 6286 ft.)

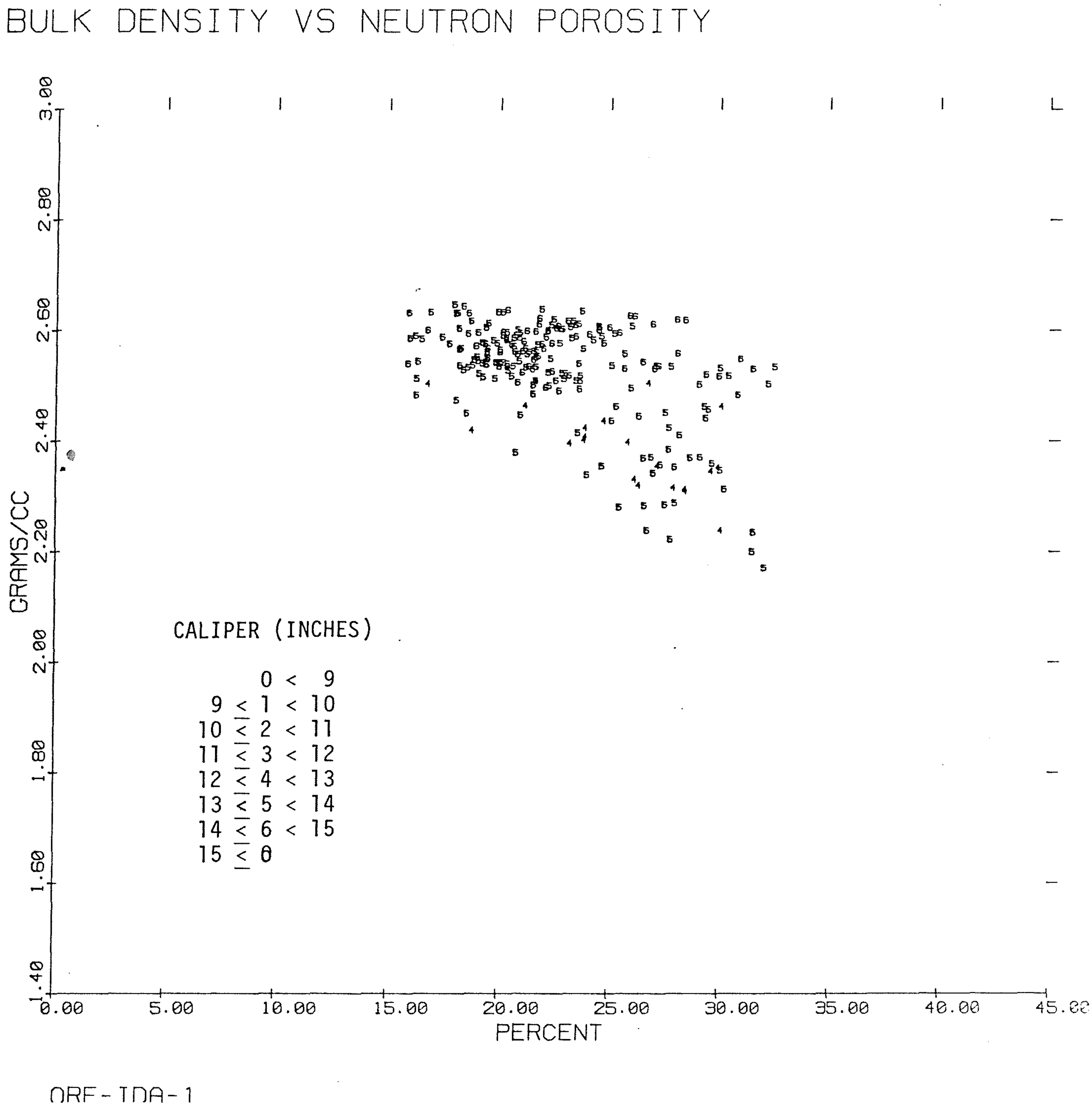

FIGURE 208. Z-Plot of Bulk Density vs. Neutron Porosity with Caliper Reading (6294 - 7008 ft.)

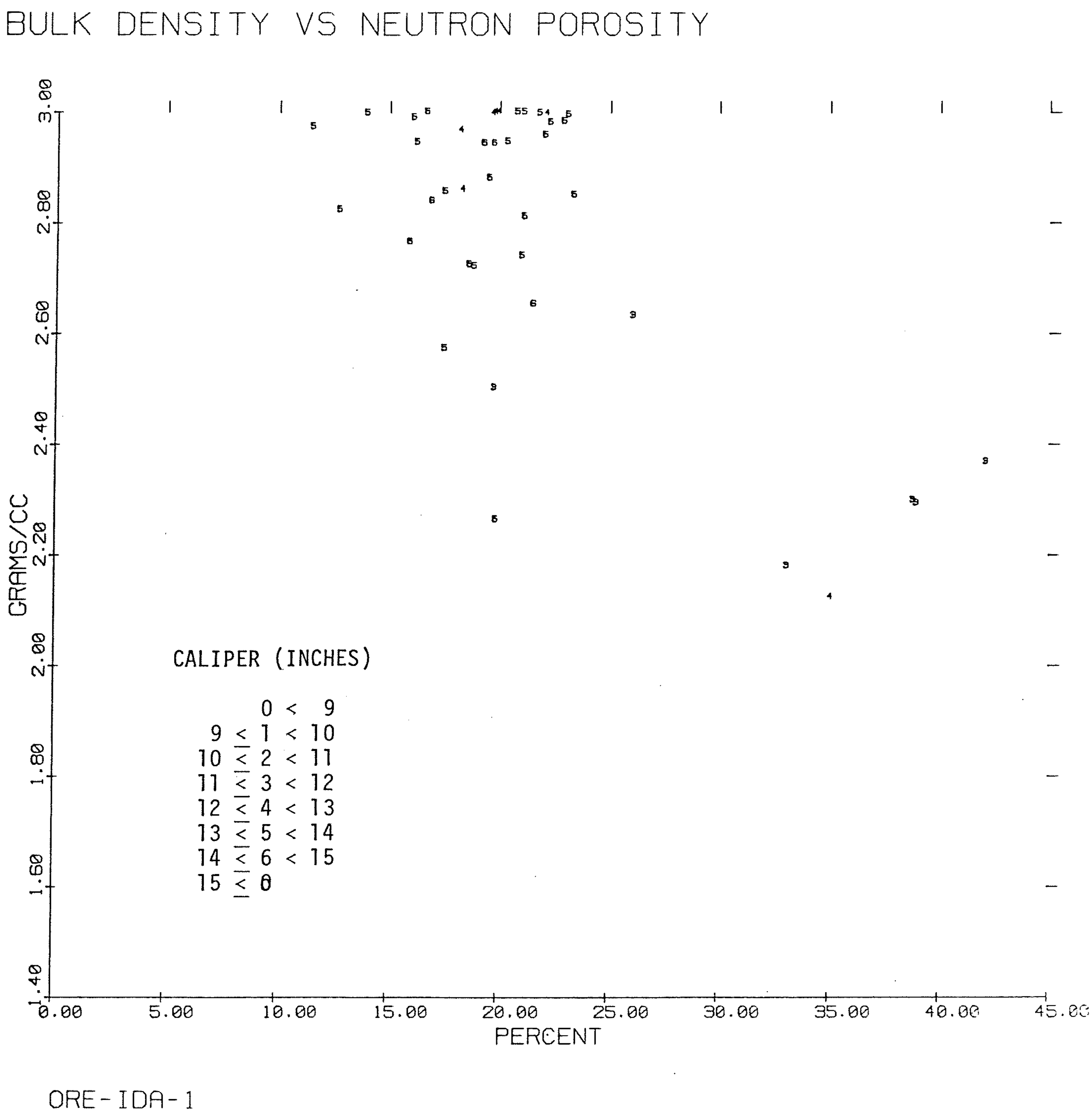

FIGURE 209. Z-Plot of Bulk Density vs. Neutron Porosity with Caliper Reading (7015 - 7135 ft.)

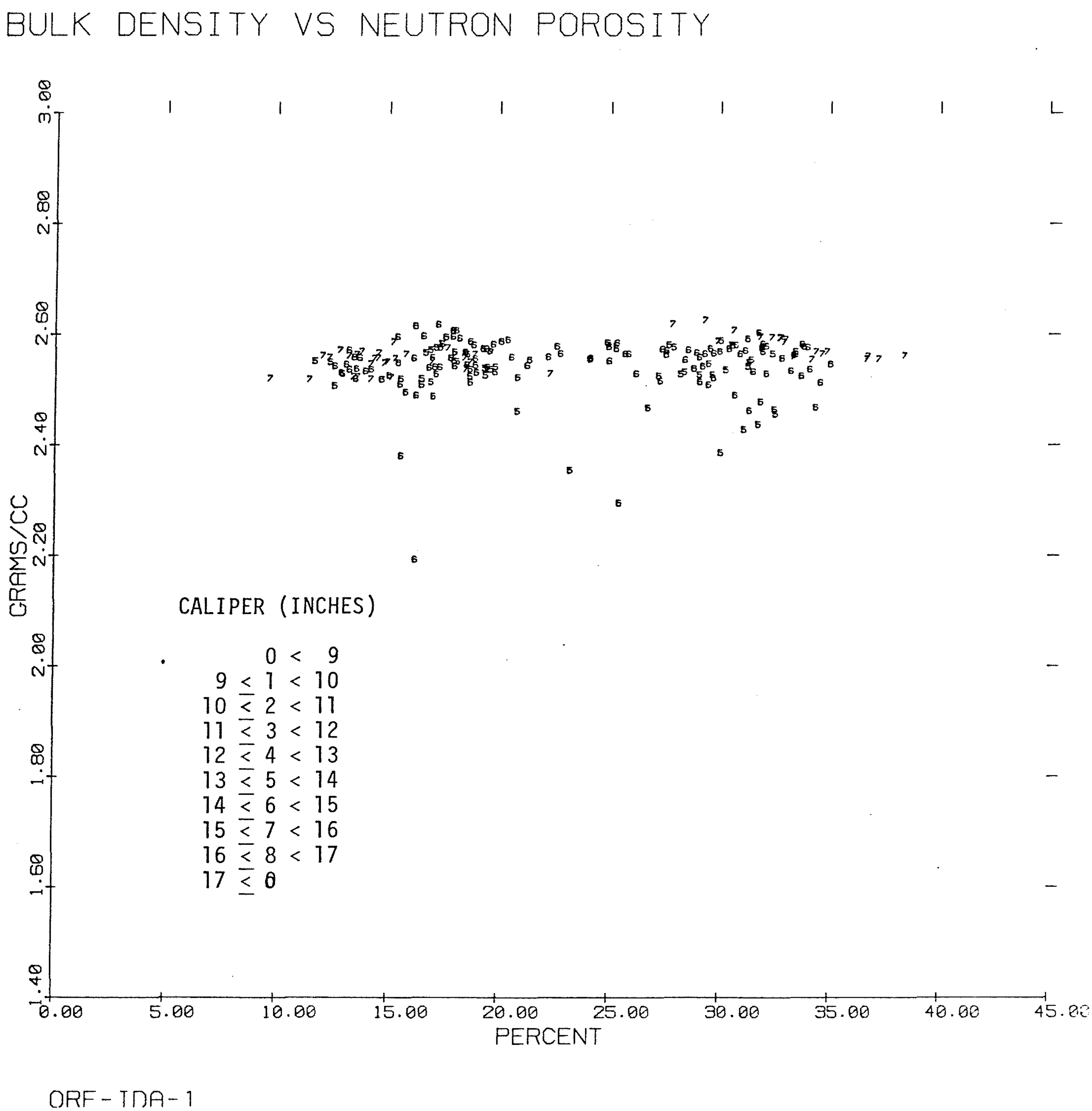

FIGURE 210. Z-Plot of Bulk Density vs. Neutron Porosity with Caliper Reading (7147 - 7798 ft.)

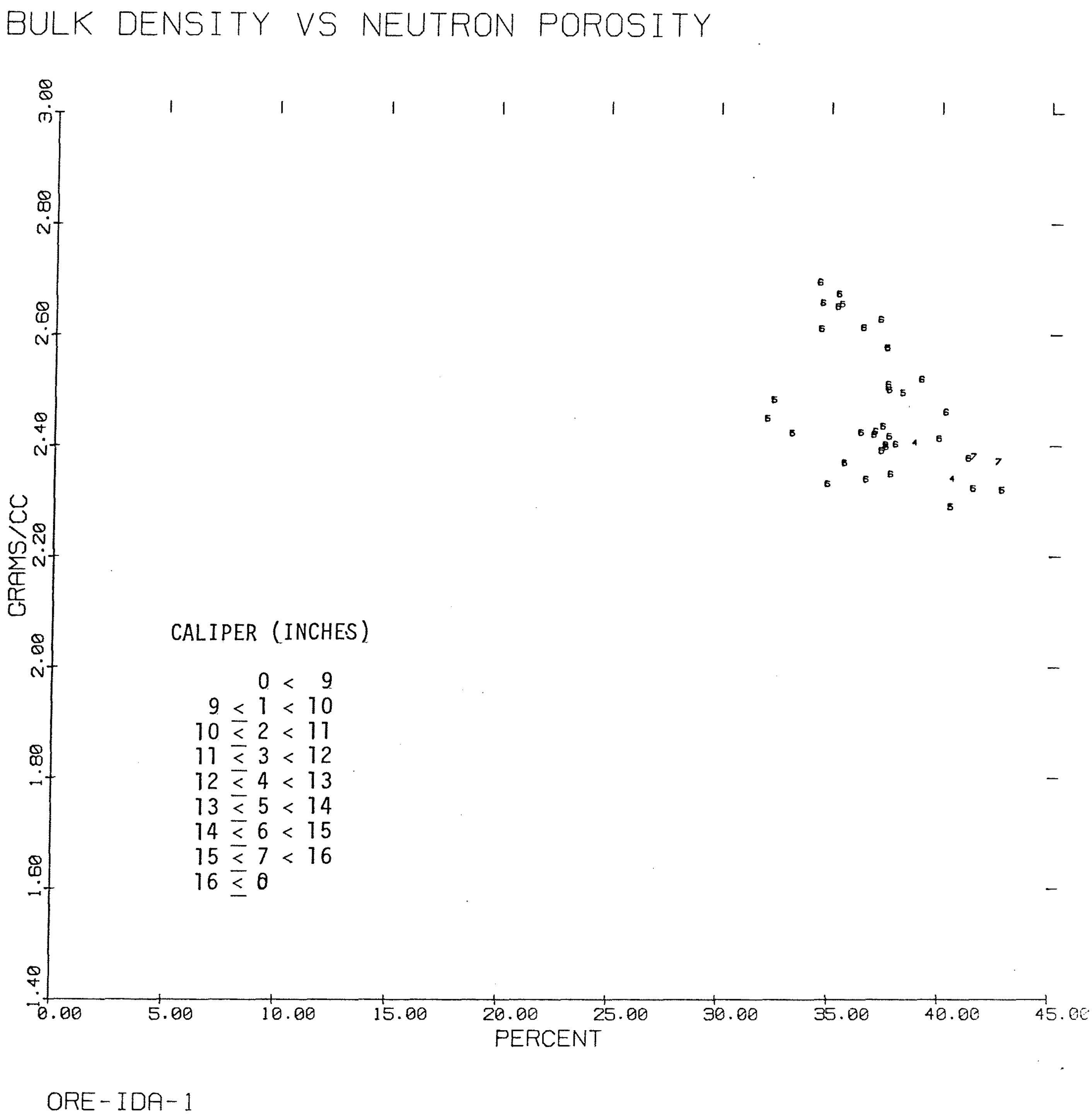

FIGURE 211. Z-Plot of Bulk Density vs. Neutron Porosity with Caliper Reading (7803 - 7926 ft.)

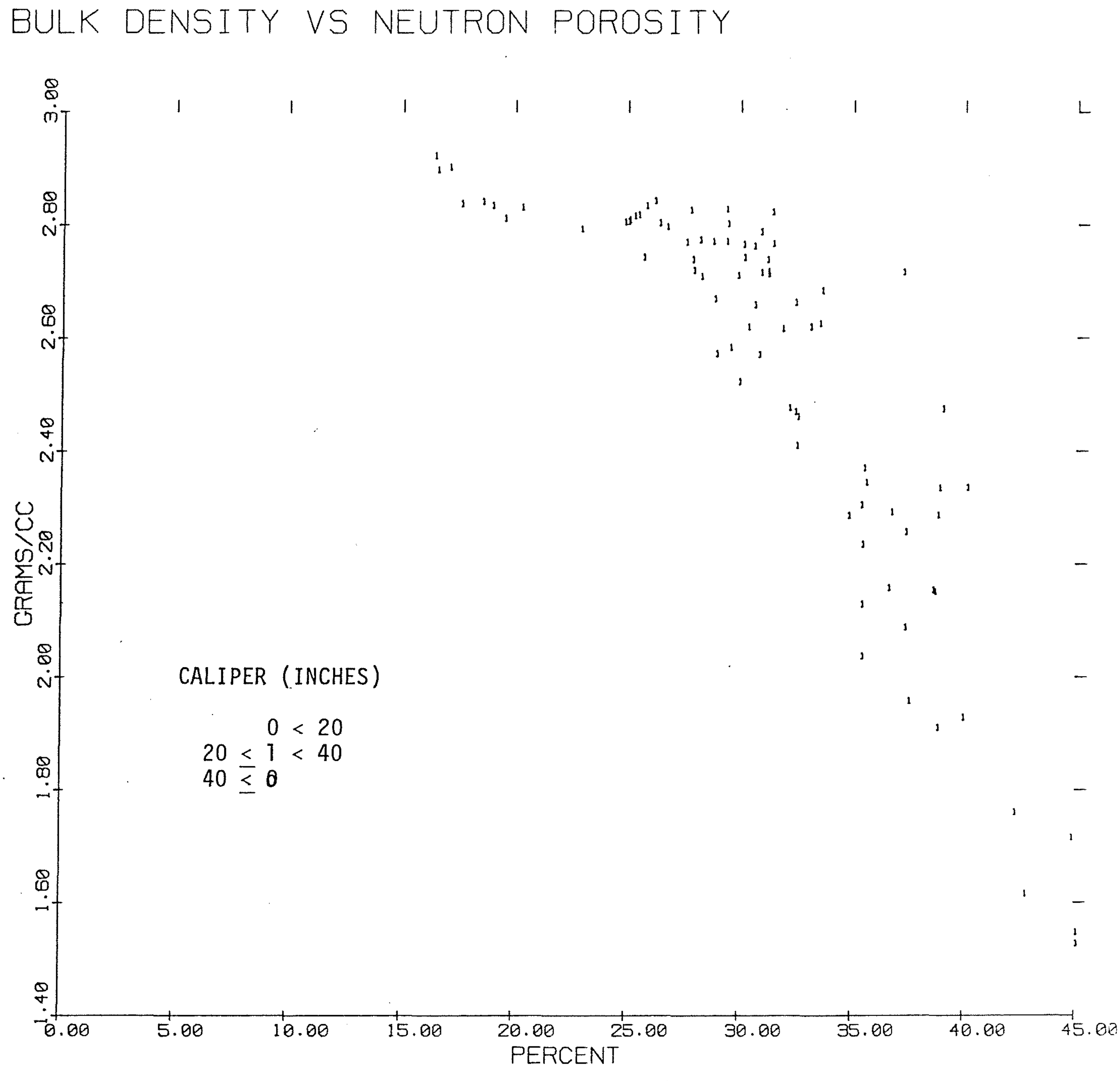

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FIGURE 212. Z-Plot of Bulk Density vs. Neutron Porosity with Caliper Reading (8155 - 8404 ft.)

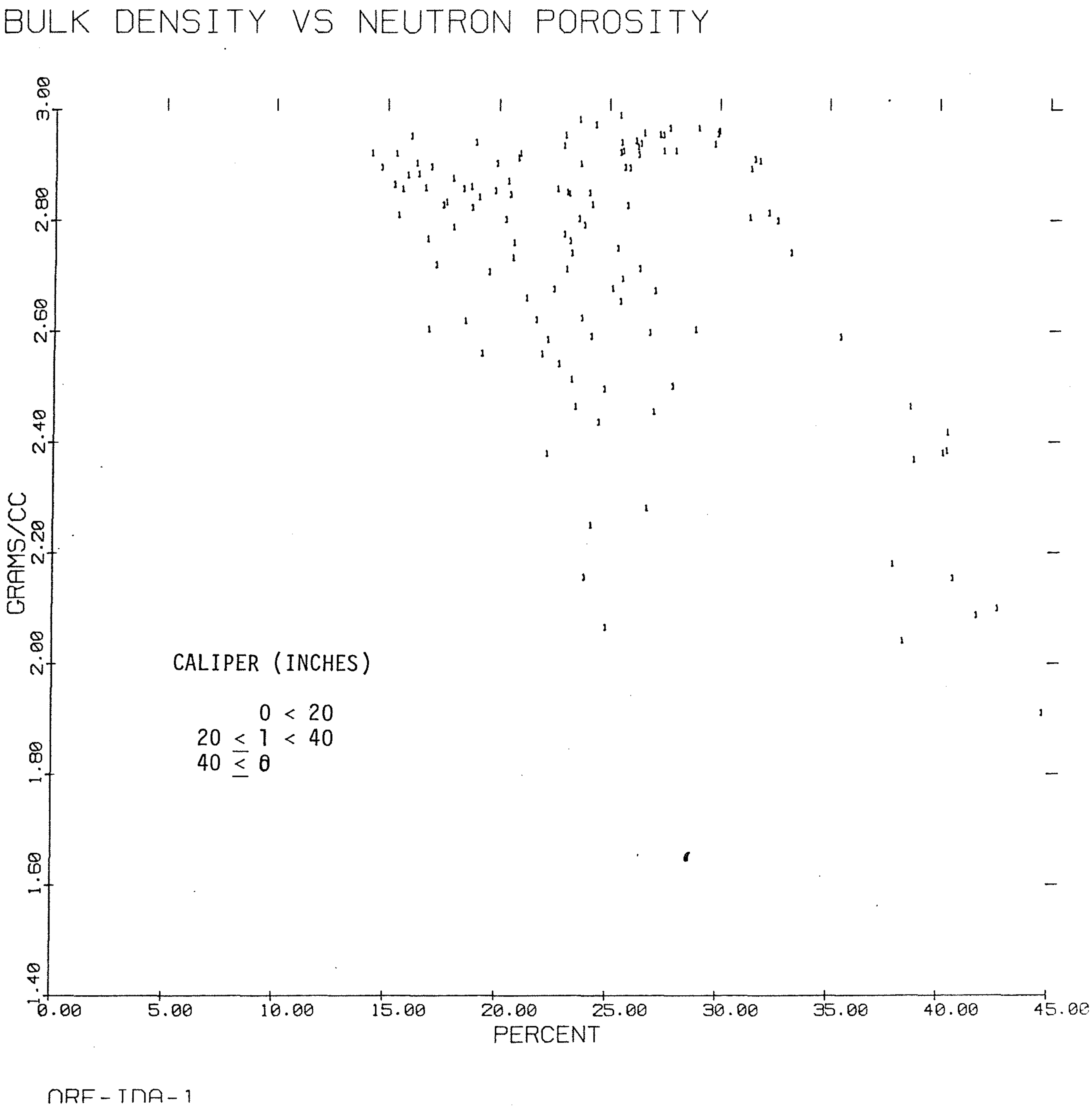

FIGURE 213. Z-Plot of Bulk Density vs. Neutron Porosity with Caliper Reading (8466 - 8826 ft.)

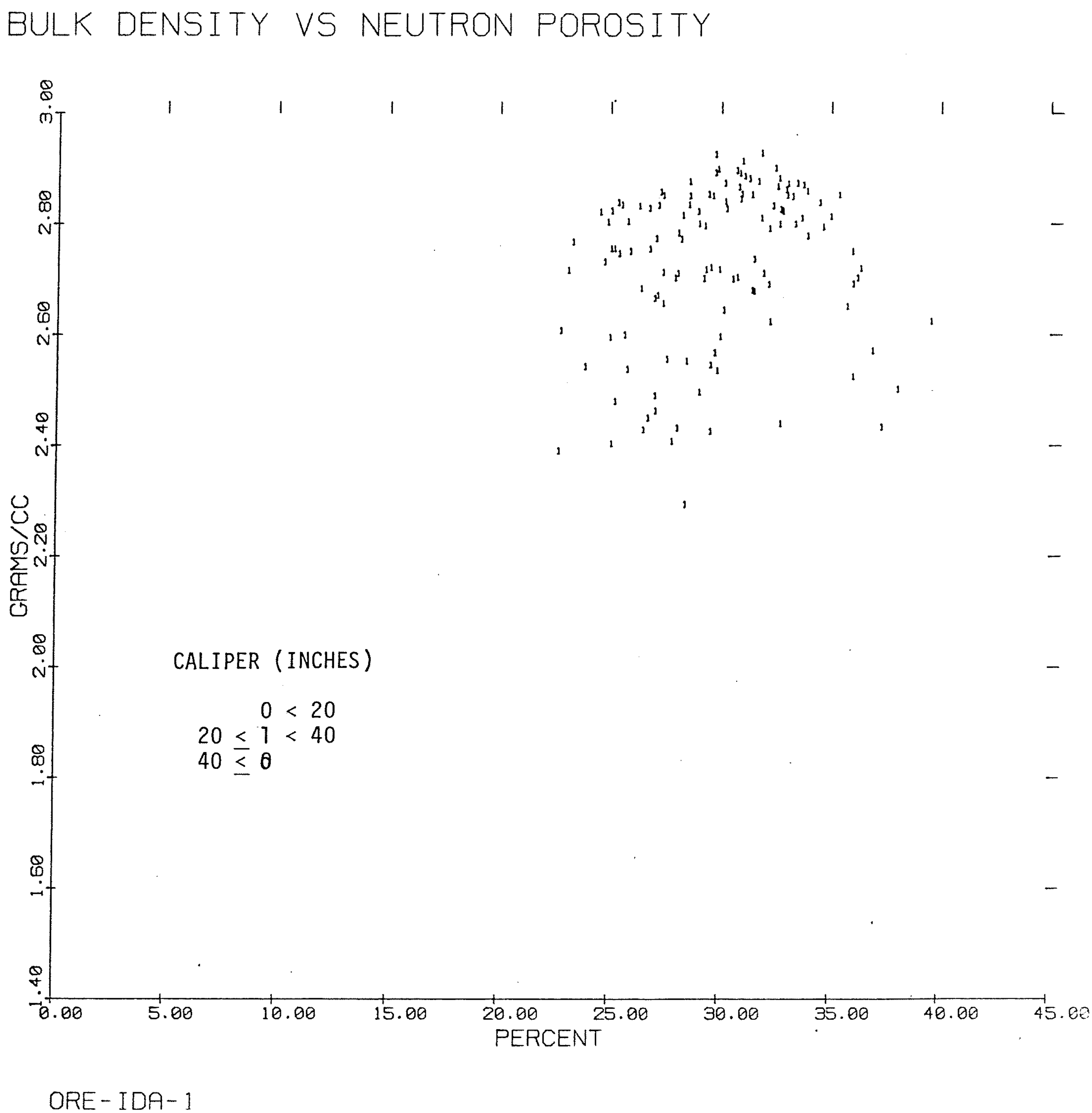

FIGURE 214. Z-Plot of Bulk Density vs. Neutron Porosity with Caliper Reading (8863 - 9238 ft.)

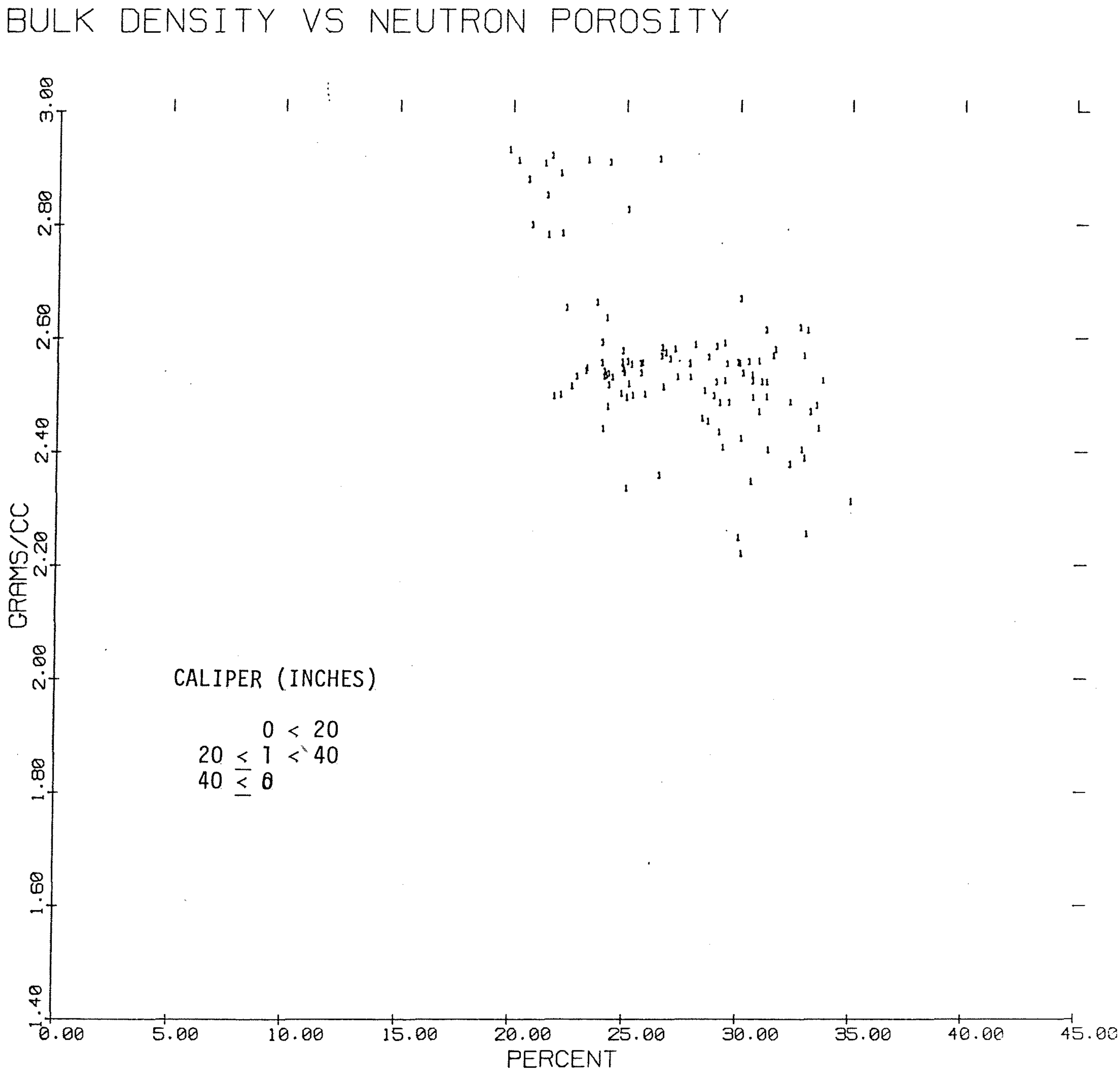

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FIGURE 215. Z-Plot of Bulk Density vs. Neutron Porosity with Caliper Reading (9253 - 9577 ft.)

BULK DENSITY VS NEUTRON POROSITY

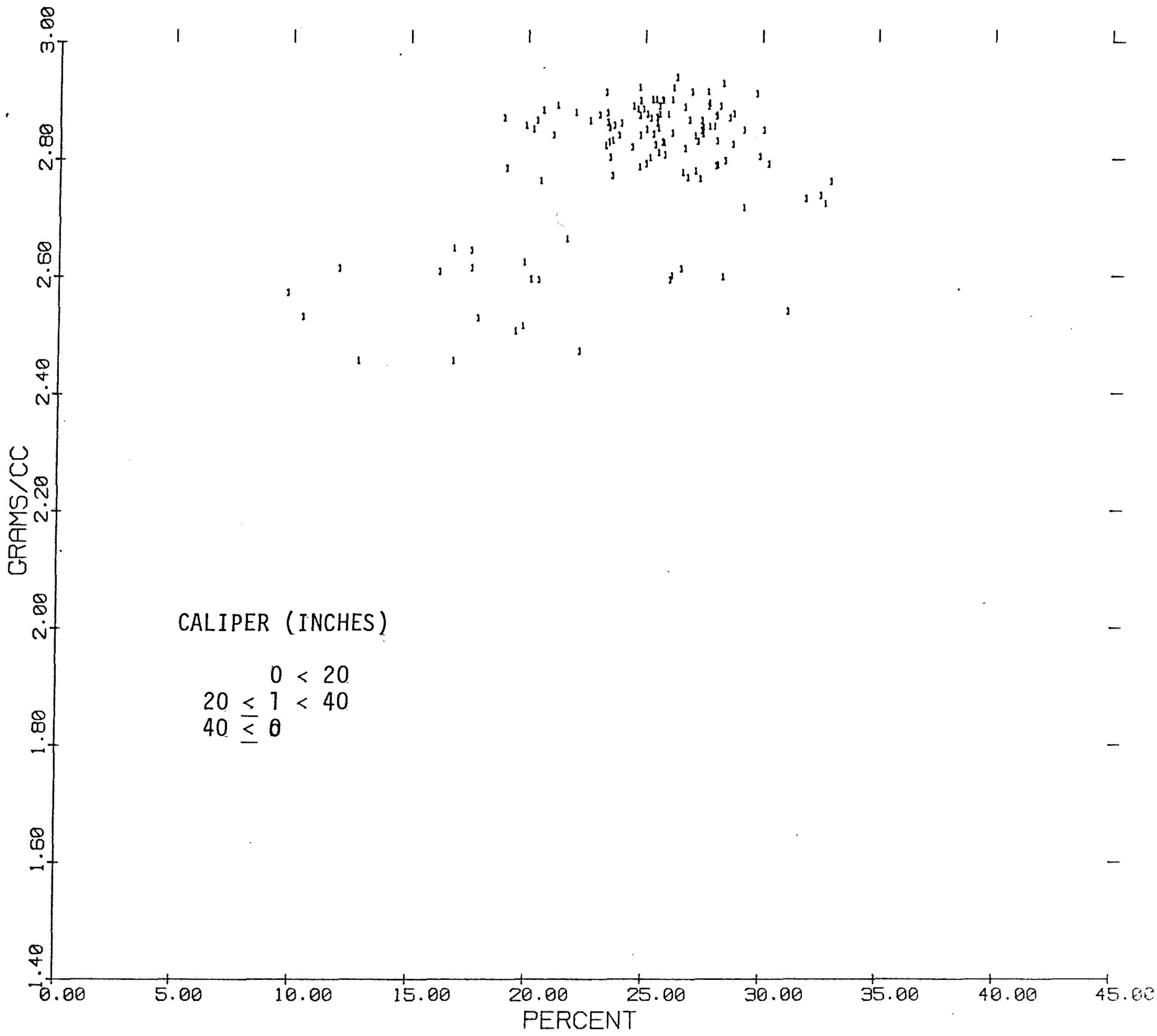

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FIGURE 216. Z-Plot of Bulk Density vs. Neutron Porosity with Caliper Reading (9581 - 9938 ft.)