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Informal Report

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Scintillation Probe Profiles 200 East Area Crib Monitoring Wells

M. K. Additon
K. R. Fecht
T. L. Jones
G. V. Last

February 1978

REFERENCE COPY

Prepared for the United States
Department of Energy
Under Contract EY-77-C-06-1030

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PRELIMINARY REPORT

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RHO-LD-28

SCINTILLATION PROBE PROFILES

200 EAST AREA

CRIB MONITORING WELLS

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K. R. Fecht
T. L. Jones
G. V. Last

RESEARCH AND ENGINEERING DIVISION

RESEARCH DEPARTMENT

February 1978

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ABSTRACT

Scintillation probe profiles from 154 monitoring wells located in 200 East Area have been compiled for input into the Long Term Management of Low Level Waste Project's data base. A thallium activated sodium iodide scintillation system and the scintillation equipment and instrumentation used to log these monitoring wells are described. In addition, waste management applications ofscintillation probe profiles are discussed including the determination of the distribution of gamma emitting radiocontaminants and the identification of stratigraphic units. Cross references for well number and associated crib facility designation are given in the appendices.

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SCINTILLATION PROBE PROFILES
200 EAST AREA
CRIB MONITORING WELLS

INTRODUCTION AND BACKGROUND

The United States Department of Energy Hanford Site has served as a nuclear facility for over 30 years. During this period liquid radioactive waste from chemical separation operations in the 200 Areas has been discharged to the ground by means of subsurface structures, termed *crib facilities*. One hundred and ninety-five *crib facilities* including cribs, trenches, french drains, and reverse wells(1) have been used for the disposal of about 2.8×10^{10} liters of waste liquids, containing an estimated 3.3×10^{6} curies of radioactive material(2).

Monitoring wells, constructed around the various *crib facilities*, have been periodically logged using a scintillation probe system since 1954. Well logging operations have consisted of probing specific wells with a scintillator to measure radiation intensity of gamma emitting radionuclides in subsurface sediments. Scintillation probe profiles from well logging operations have been used for assessing the spacial distribution of gamma emitting radionuclides in the vadose zone. In addition, scintillation probe profiles are useful in identifying and correlating various stratigraphic units and sedimentary structures because radiation intensity varies with textural and mineralogical changes in the sediment column.

This document is a partial compilation of scintillation probe profiles collected between 1954 and 1976. Included in this report are scintillation probe profiles from 154 *crib facility* monitoring wells located within 200 East Area. These data are an integral part of the Long Term Management of Low Level Waste Project. Scintillation probe profiles are listed by well number according to the Hanford well numbering system(3). Cross references for well number and associated *crib facility* designation are given in Appendix A and *crib facility* designation and associated monitoring well number are given in Appendix B.

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PREVIOUS SCINTILLATION PROBE STUDIES

Scintillation probe studies were conducted in 1964, 1969, and 1977 to evaluate the distribution, redistribution and decay of radionuclides discharged to the ground from the *crib facilities* (4,5,6). These studies were based on scintillation probe profiles developed from crib monitoring well logging operations between 1954 and 1976. The 1964 study discusses the disposition of radionuclides beneath most of the *crib facilities* in use from 1945 to 1963, while the 1969 study discusses only those *crib facilities* where significant changes or the apparent lack of changes in the scintillation probe profiles were observed. The 1976 study consists of a detailed discussion of the disposition of radionuclides beneath those *crib facilities* associated with monitoring wells and gives scintillation probe profiles from selected years and a waste disposal history for each facility.

METHODOLOGY

The scintillation probe system is an in-well technique used to measure radiation intensity of gamma emitting radionuclides in subsurface sediments. Gamma radiation produces light scintillations in the thallium activated sodium iodide, NaI(Tl), phosphor as a result of photoelectric sorption, Compton scattering or pair production depending on the energy of the gamma photon. The counts per minute (or amperage) is proportional to the number of disintegrations of the radionuclide(s) and intensity (or voltage) is proportional to the energy of the radionuclide.

In the sonde, the photomultiplier tube converts light emitted by the NaI(Tl) phosphor to electrons at a photocathode. The electrons are directed onto multiple dynodes where they are multiplied. The increased electron flow is collected on an anode and pulses are converted to electrical voltage by a preamplifier. At the surface, the output is amplified by a linear amplifier and fed into a log/linear count rate meter which typically drives a potentiometric strip chart recorder. The recorder chart drive is coupled to a cable measuring sheave, and count rate is recorded against depth of the sonde in the well.

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EQUIPMENT AND INSTRUMENTATION

Four different scintillation probe systems have been used at Hanford for measuring the intensity of gamma radiation as a function of depth (well logging) over the past twenty-four years. Most of the data were collected by a Hanford-developed logging system, shown in Figure 1, that was in use from 1963 to 1974[7]. This logging system was a third-generation system and consisted of a detector sonde, armored wire lines, hoisting equipment, and recording and control instrument[8]. The sonde was a 33-centimeter long by 7-centimeter diameter stainless steel canister which contained a transistorized preamplifier and a 5.1 x 5.1-centimeter, thallium activated sodium iodide, NaI(Tl), crystal coupled to a photomultiplier tube. The system had a lower detection limit of about three picocuries (ruthenium-106-rhodium-106) per milliliter in water and about 3×10^{-4} millirem (radium-226) per hour in air. Maximum meter count rate in air (1×10^{6} counts per minute) was reached in a field of about 150 mr/hr. Maximum meter count rate in water occurred at a ^{106}Ru - ^{106}Rh concentration of about 5,000 pCi/ml.

Modifications were made in the scintillation probe system in 1966. A miniaturized amplifier-discriminator and a high voltage power supply were designed and mounted in the probe. This resulted in a lower noise level and a lower background. Overall sensitivity was not materially affected. The rest of the equipment remained unchanged.

This equipment was replaced with a Gearhart-Owen Industries, (G.O.I.), Model 3200 logging system in 1974[9]. The data obtained in 1976 and incorporated in this report were collected by the Model 3200 system. The system is similar to the earlier developed equipment, but incorporates advances made in electronic and mechanical instrumentation over the past 15 years. As with the earlier equipment, the G.O.I. system consists of a detector (sonde), armored wire lines, hoisting equipment, and recording and control instrumentation. Improved detection circuitry of the new logging system increases the lower-limit sensitivity by approximately a factor of three over the former system.

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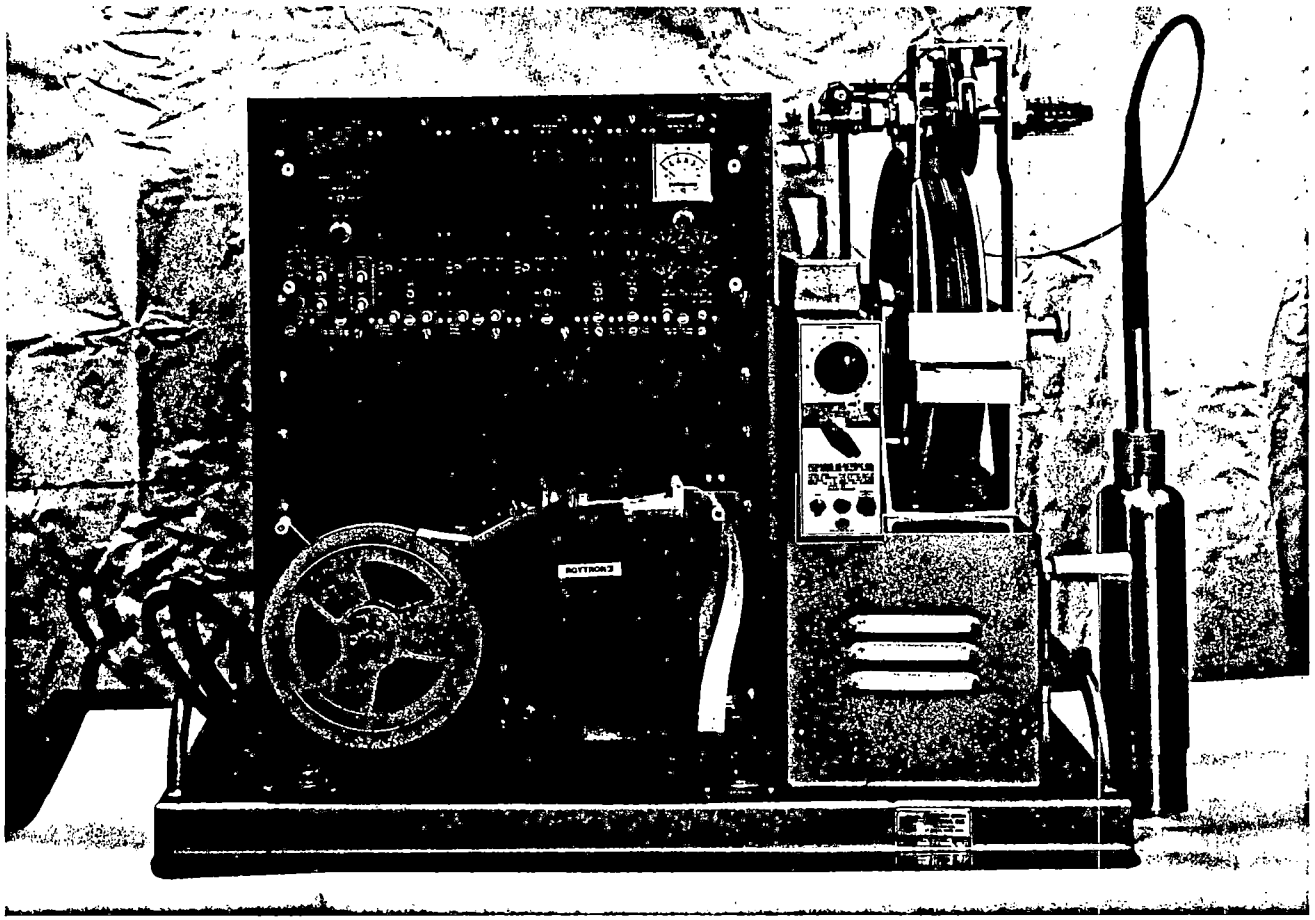

Figure 1: Scintillation Probe and Well Logging System

An analog recorder chart was used with the logging systems to record gamma radiation intensity (count rate) versus well depth. Required scale changes during logging make direct observation and interpretation of the chart somewhat difficult. Therefore, as was done in this report, the recorder chart data may be digitized, processed by computer, and plotted in logarithmic format (count rate plotted against well depth) for easier examination. The data were also normalized to adjust the background level of the pre-1976 logs to the 1976 values to allow easier, direct comparison of the various logs. The data were normalized by applying correction factors during computer processing.

APPLICATIONS OF SCINTILLATION PROBE PROFILES

Scintillation probe profiles graphically represent the radiation intensity of gamma emitting radionuclides in the sediments adjacent to monitoring wells. The profiles are generally used to 1) determine the vertical distribution of radionuclides in the sediment column, 2) detect changes in radiation intensity related to natural decay and/or radionuclide migration, 3) delineate the zone of gamma contamination using scintillation probe profiles taken from a network of wells adjacent to a *crib facility*, and 4) aid in the identification of stratigraphic units based on textural and mineralogical variations in the sediment column.

Vertical Distribution

The scintillation probe profiles are predominantly used to determine qualitatively the distribution of gamma emitting radionuclides beneath *crib facilities*. The initial scintillation probe profiles from monitoring wells adjacent to a *crib facility* are used to determine the vertical extent of gamma contaminants in the subsurface sediments. These profiles also establish the base line data necessary for subsequent comparisons of profiles from further scintillation probe logging operations. Figure 2 illustrates the vertical extent of gamma comtamination in the sediments beneath the 216-T-6 cribs adjacent to Well 299-W11-56.

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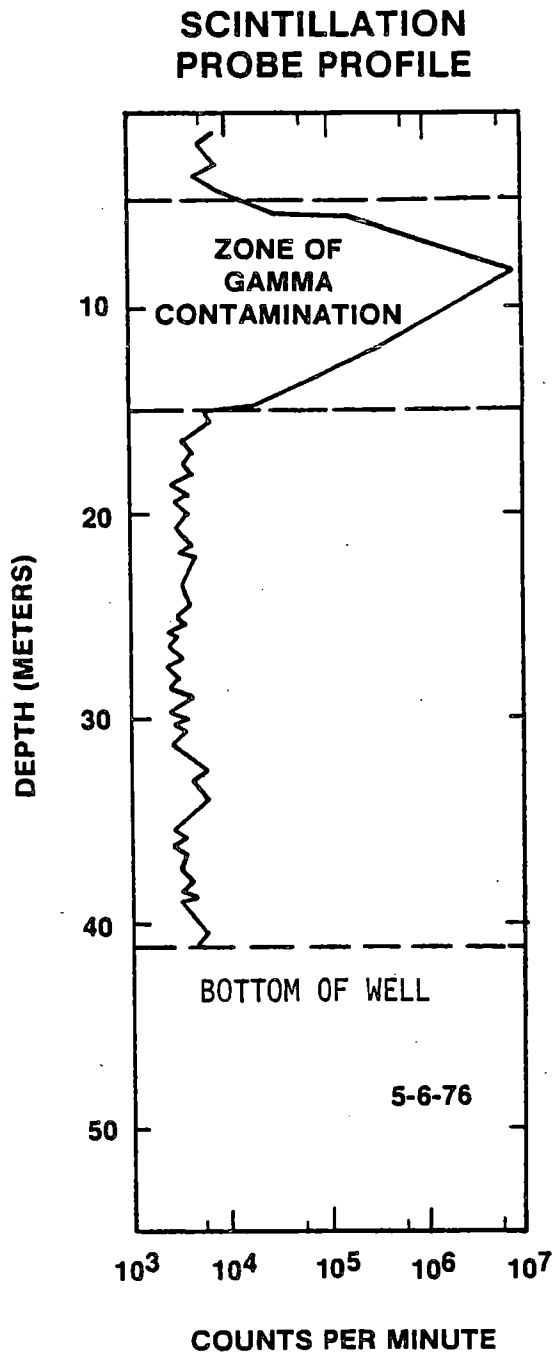

Figure 2: Vertical Extent Of Gamma Contamination In Well 299-W11-56, Adjacent To The 216-T-6(1) Crib.

9 2 1 2 4 8 6 0 5 9 9

Changes In Radiation Intensity

Changes in radiation intensity in the zone of gamma contamination can be noted in most scintillation probe profiles where multiple probings have been conducted over a period of time. These changes are generally attributed to 1) the natural decay of gamma emmitting radionuclides present in the sediments, 2) continued discharges of waste liquids to a crib, 3) redistribution of radionuclides in the sediments beneath deactivated *crib facilities* or 4) a combination of natural decay and continued discharges or redistribution. In order to determine if the changes in radiation intensity are due to natural decay or migration involves the assessment of base line data, inventory data, waste type and disposal practice, sediment type, and observed changes in profiles from adjacent wells. Detailed discussions, including examples, concerning the determination of changes in radiation intensity can be found in previous scintillation probe studes.[4,5,6]

Zone of Gamma Contamination

The scintillation probe profile from Well 299-W11-56, Figure 2, was used in conjunction with profiles from 14 other wells in the vicinity of 216-T-6 cribs to delineate the zone of gamma contamination beneath the facility (Figure 3). Both plan and section view are given for the composite lateral and vertical extent of the zone of gamma contamination in 1976.

Identification of Stratigraphic Units

Abrupt changes in radiation intensity with depth in the scintillation probe profiles are often associated with changes in the textural and mineralogical variations in the sediments underlying the 200 Areas. Radiocontaminant concentrations tend to increase in fine-grained sediments due to the presence of clays and hydromicas which have high sorptive properties. Conversely, in coarse-grained sediments, the radiation intensity tends to decrease due to the abundance of quartz and feldspar minerals which have low sorption properties. The abrupt changes through the sediment column can be used to develop stratigraphic cross sections for areas of limited geologic information.

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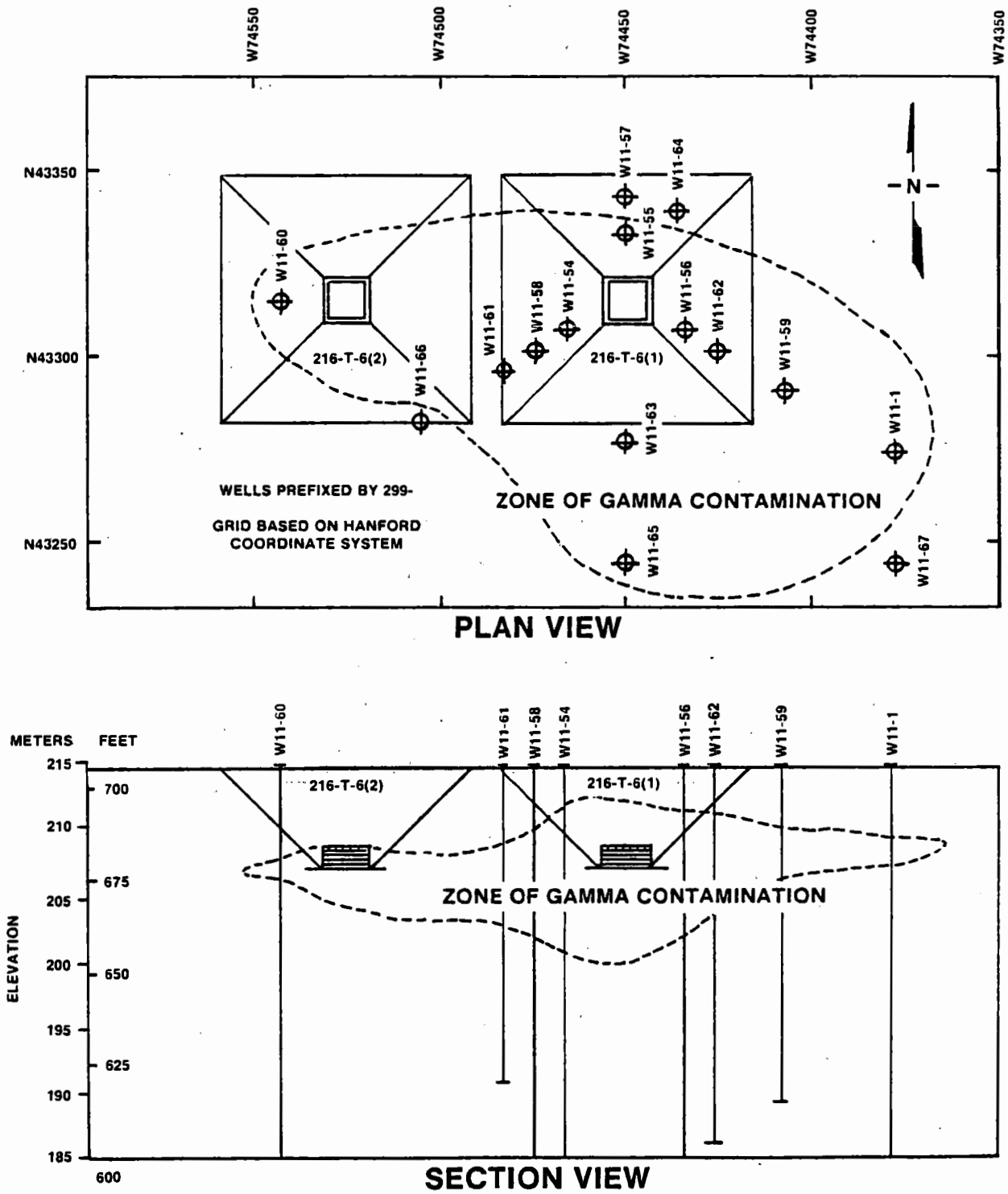

Figure 3: Composite Lateral and Vertical Extent Of Gamma Contamination Beneath The 216-T-6 Crib Facility In 1976.

9 2 1 2 4 6 6 0 6 0 1

For example, scintillation probe profiles and the driller's log from Well 299-W10-72 are presented in Figure 4. The coarser-grained sediments, gravelly sand and coarse sand, contain sand fractions predominantly composed of quartz and feldspars which have low sorptive properties and consequently, relatively lower radiation intensities in the profiles. The fine-grained sediments consisting of clay, silt, and fine sand contain a greater abundance of clays and micas which have higher sorptive properties resulting in relatively higher radiation intensities in the profiles.

Subsurface silt horizons in areas uncontaminated by radioactive waste disposal are detected by a scintillator due to the naturally occurring radioisotopes concentrated in the fine-grained sediments, generally silt and clay. The most commonly detected radioisotopes are potassium-40, comprising about 0.012% of the potassium in the earth's crust[10], and to a lesser extent, radium-226, thorium-228 and thorium-232. Figure 5 depicts increased radiation intensity from the naturally occurring radioisotopes in an eolian silt unit at the 32-50 meter depth in Well 299-W23-9.

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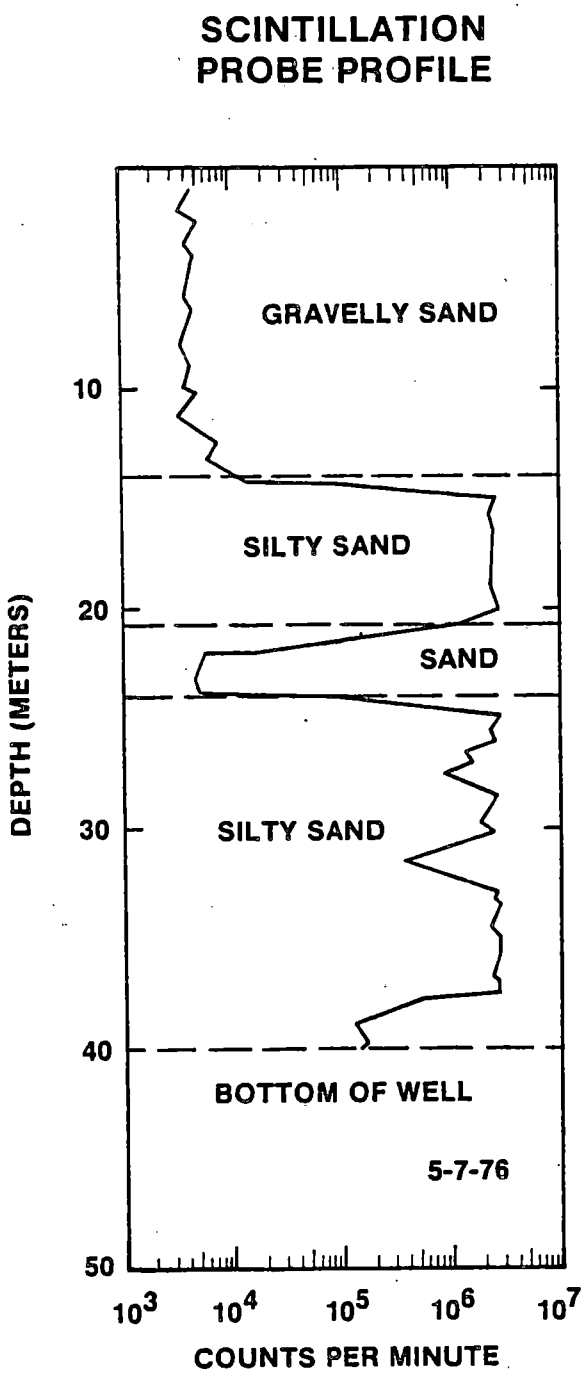

Figure 4: Radiation Intensity Variations Due To Stratigraphic Changes In The Sediment Profile For Well 299-W10-72.

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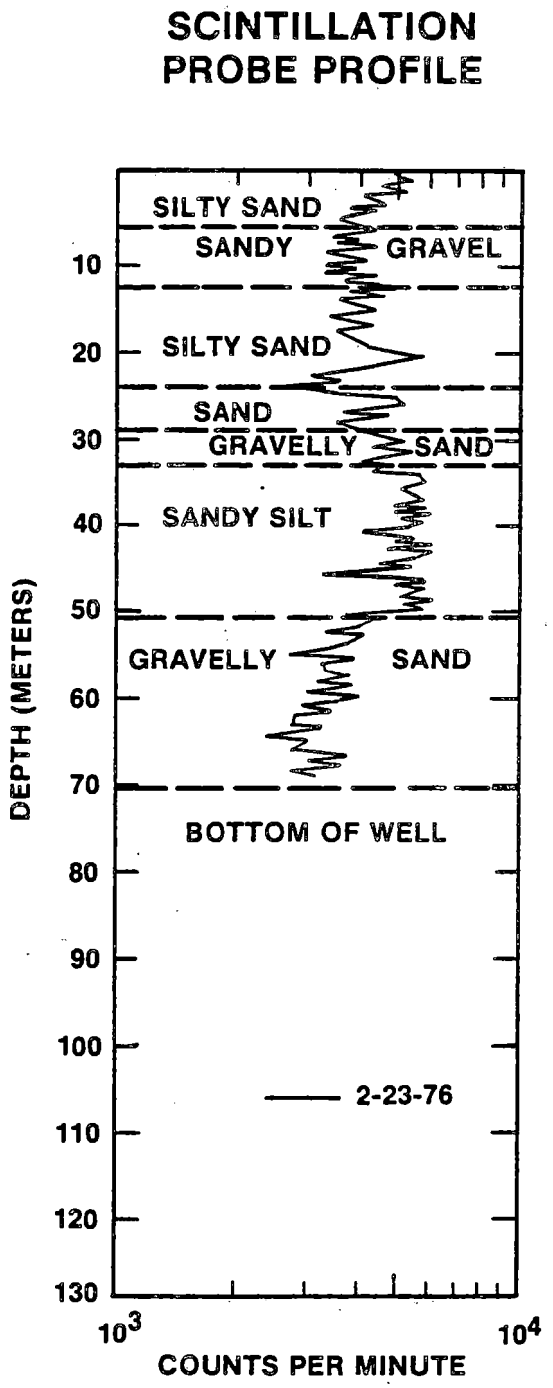

Figure 5: Increase in Radiation Intensity In Eolian Silt (Sandy Silt) Horizon Due To the Presence Of Naturally Occurring Radioisotopes.

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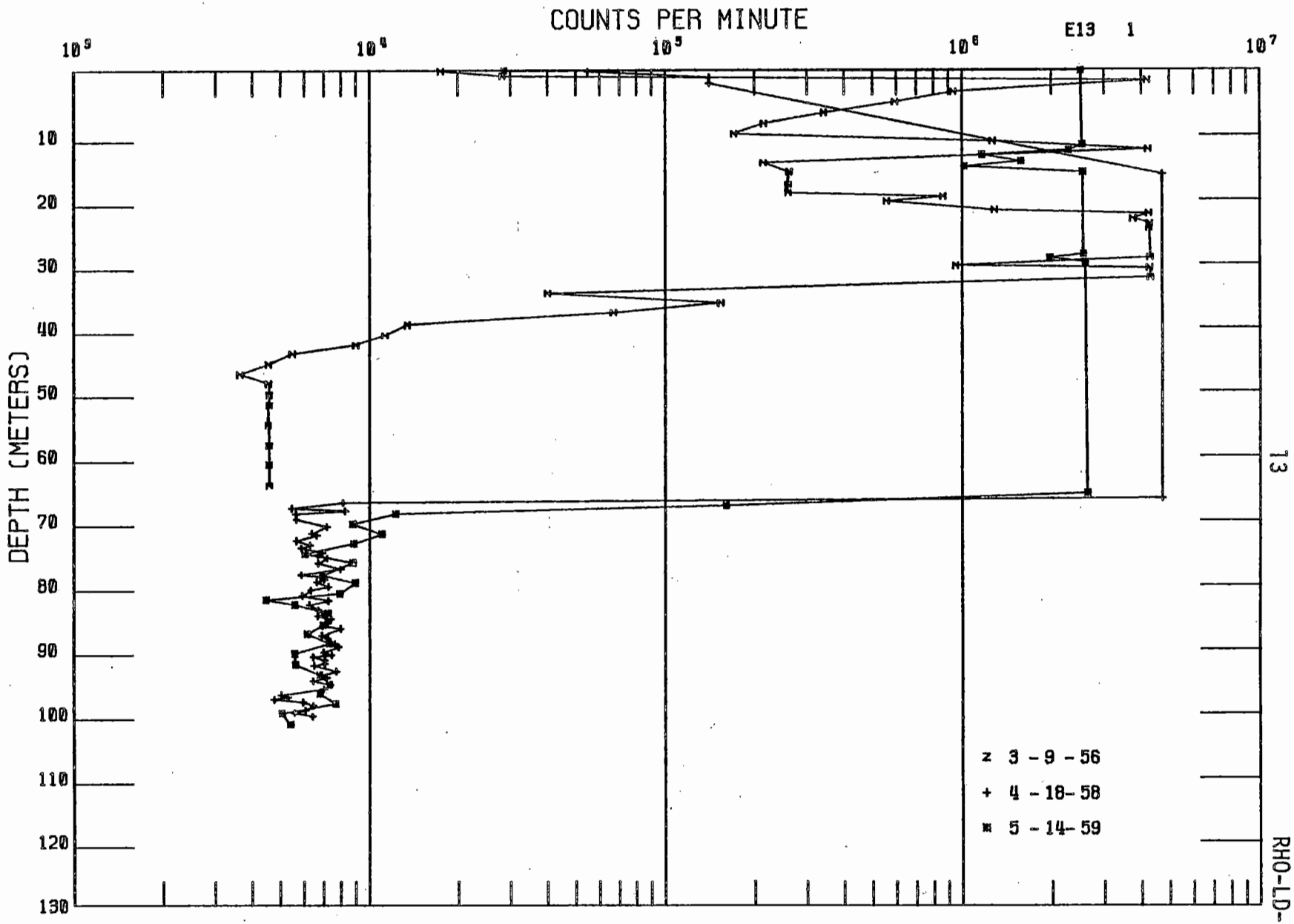
3 2 1 2 4 6 6 0 6 0 5

SCINTILLATION PROBE PROFILES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E13 1
10^3
10^4
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10^6
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DEPTH (METERS)
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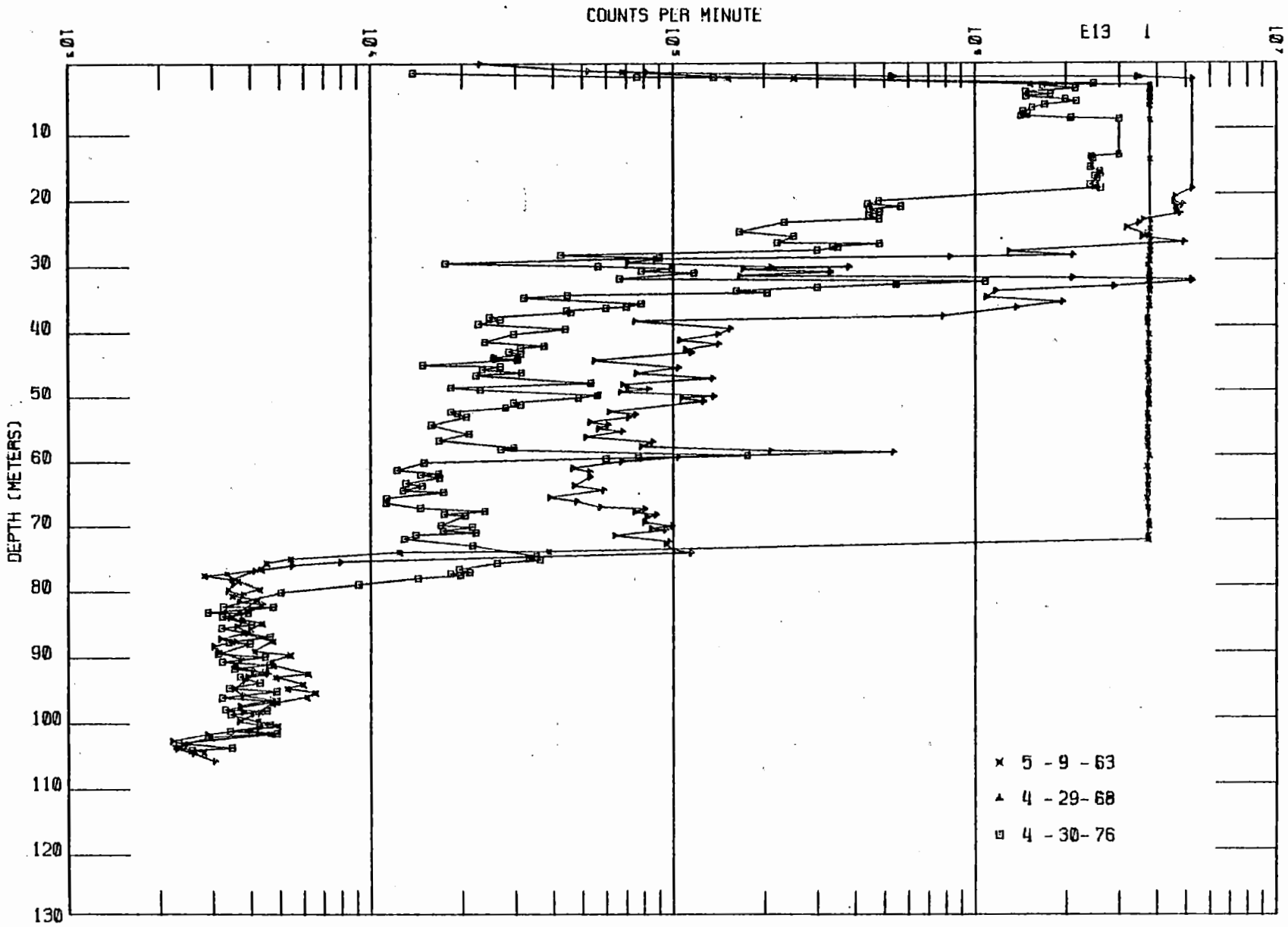
z 3 - 9 - 56
+ 4 - 18- 58
* 5 - 14- 59


COUNTS PER MINUTE
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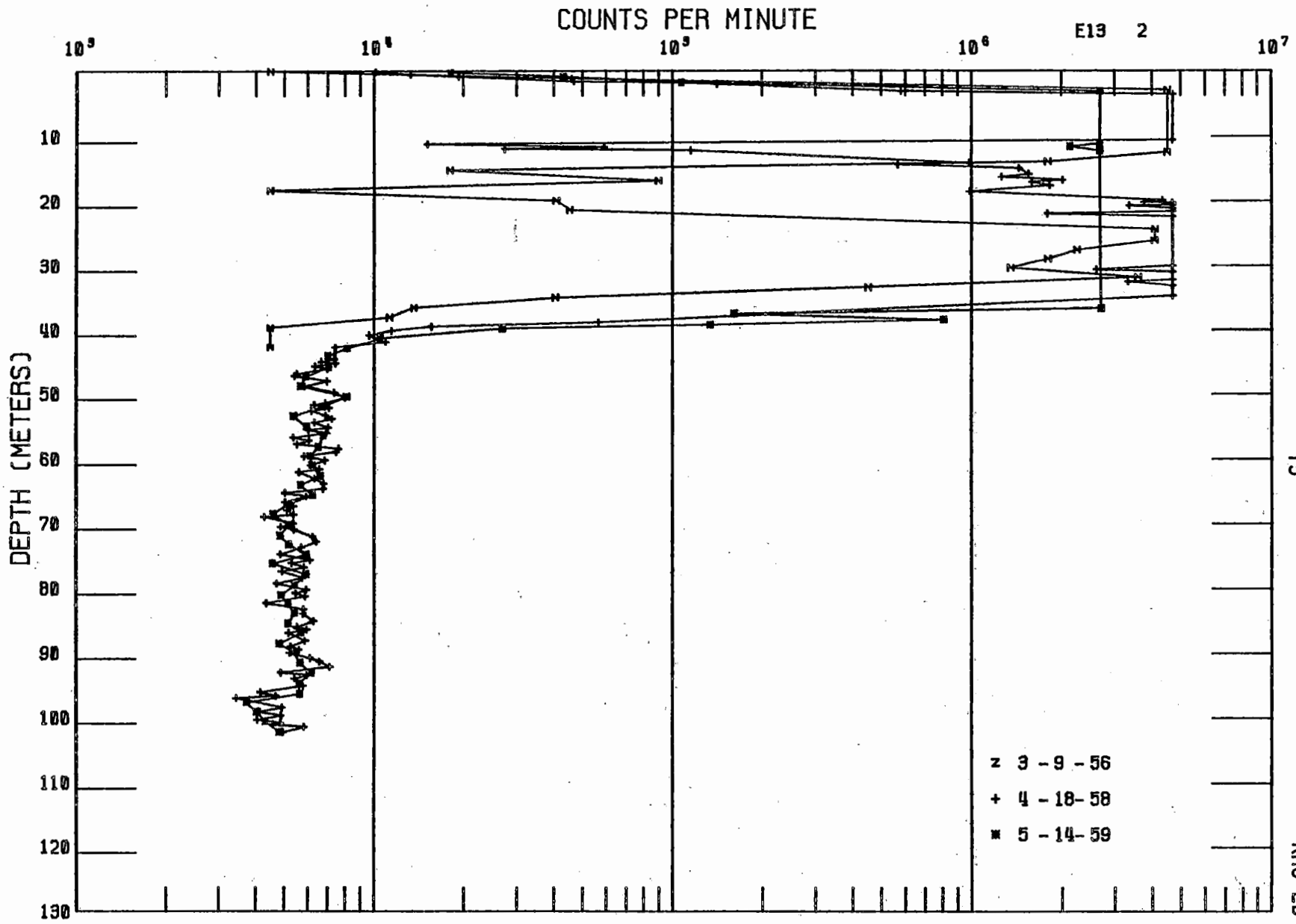
□ 4 - 30- 76


COUNTS PER MINUTE
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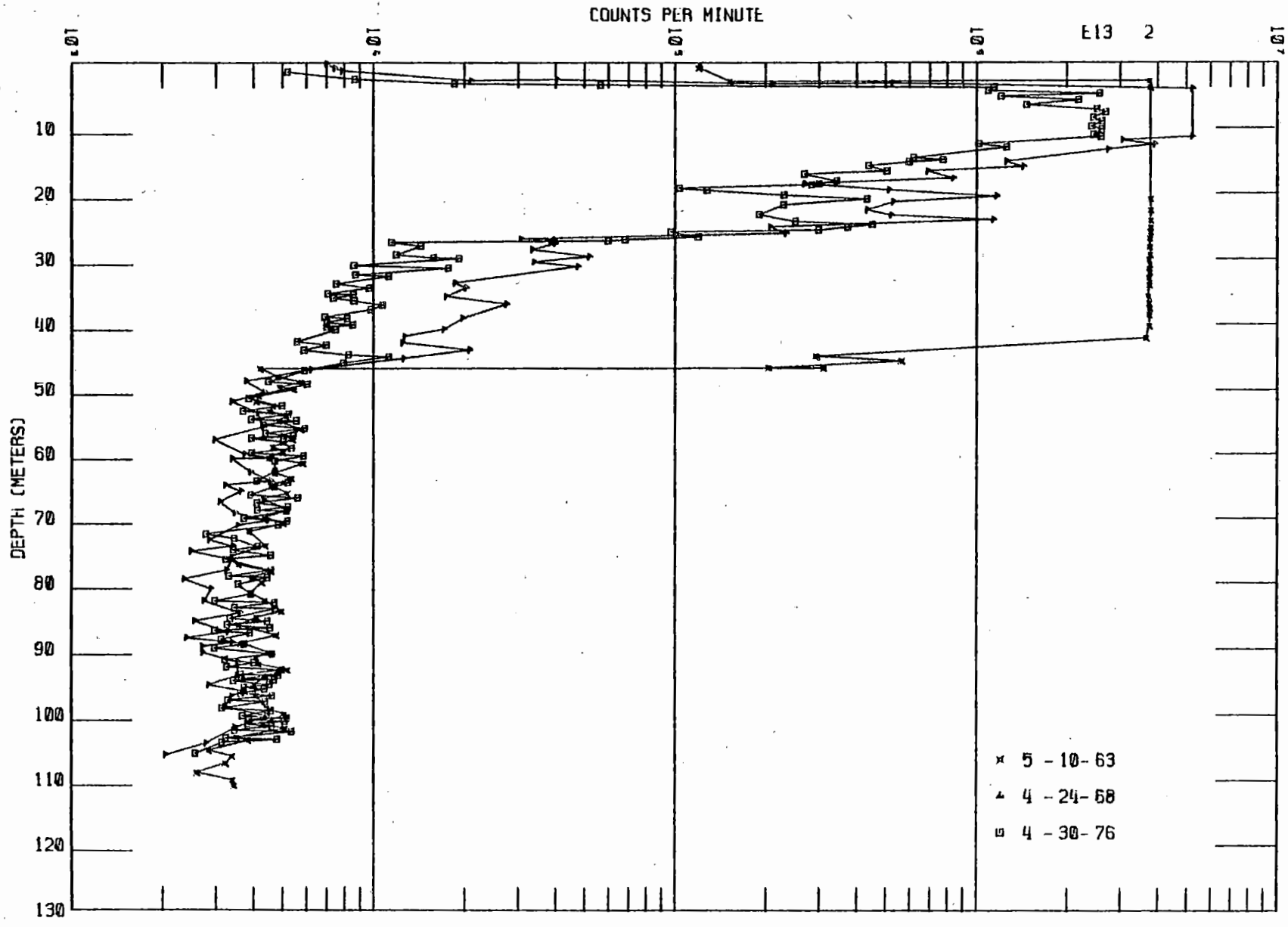
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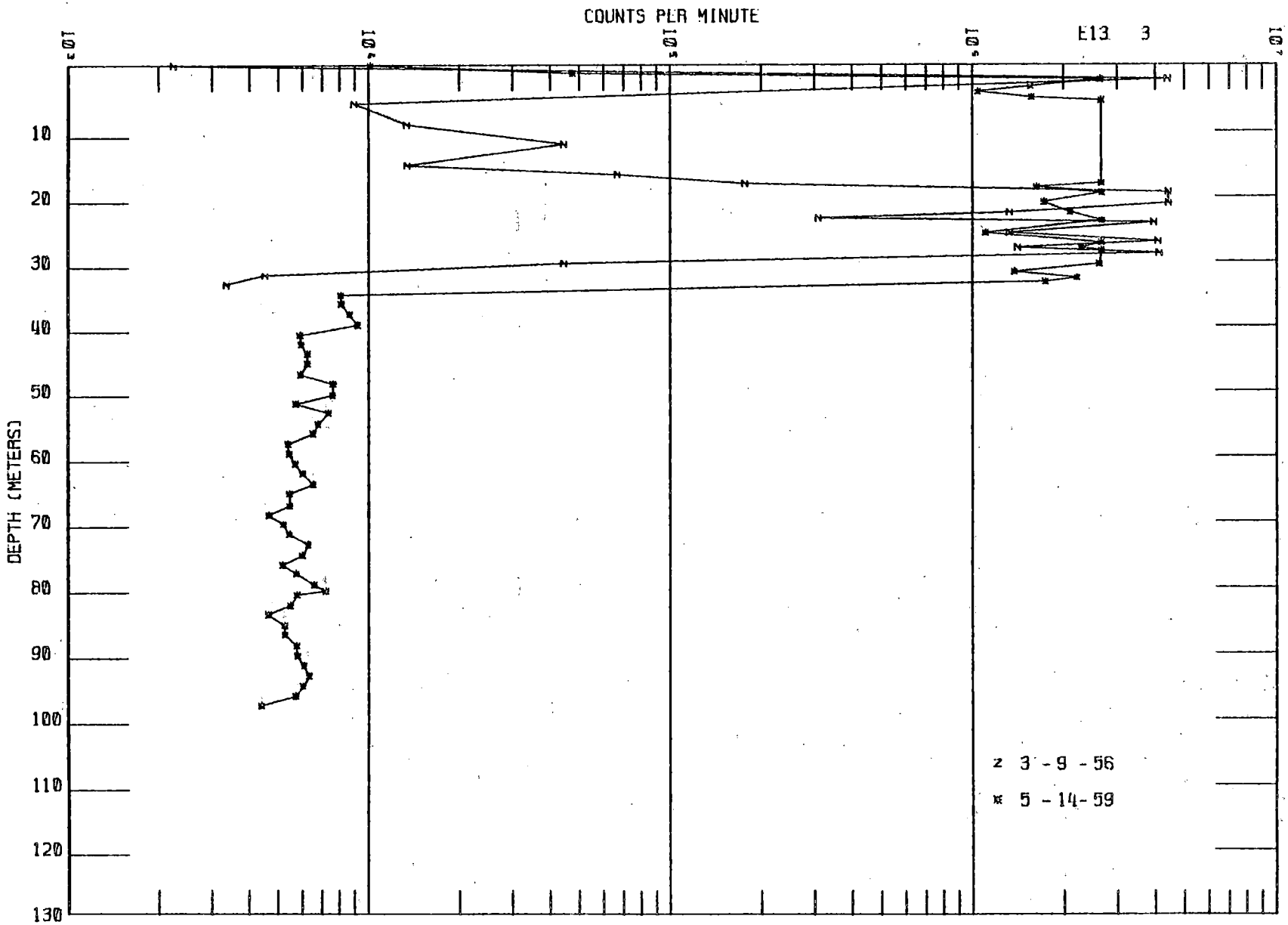
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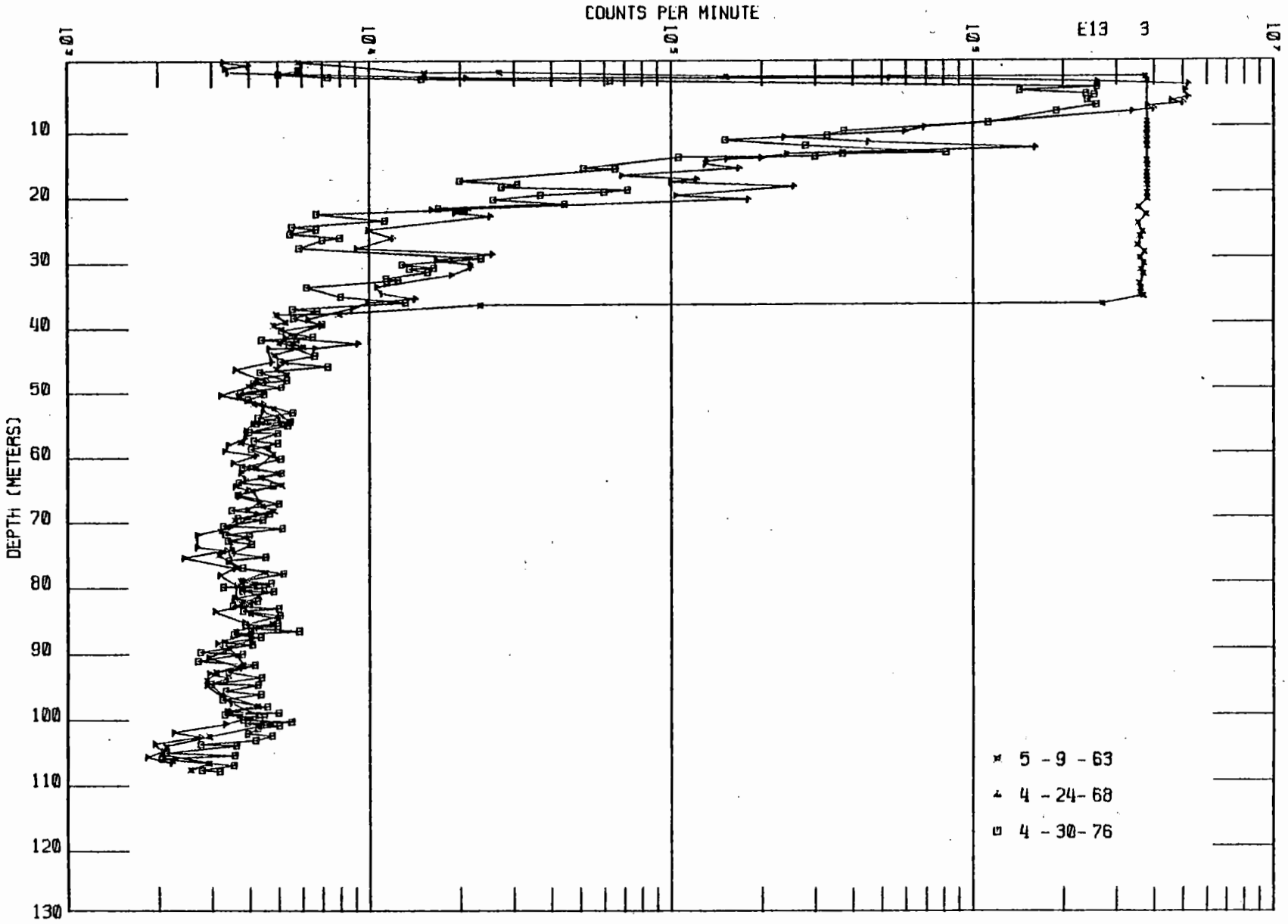
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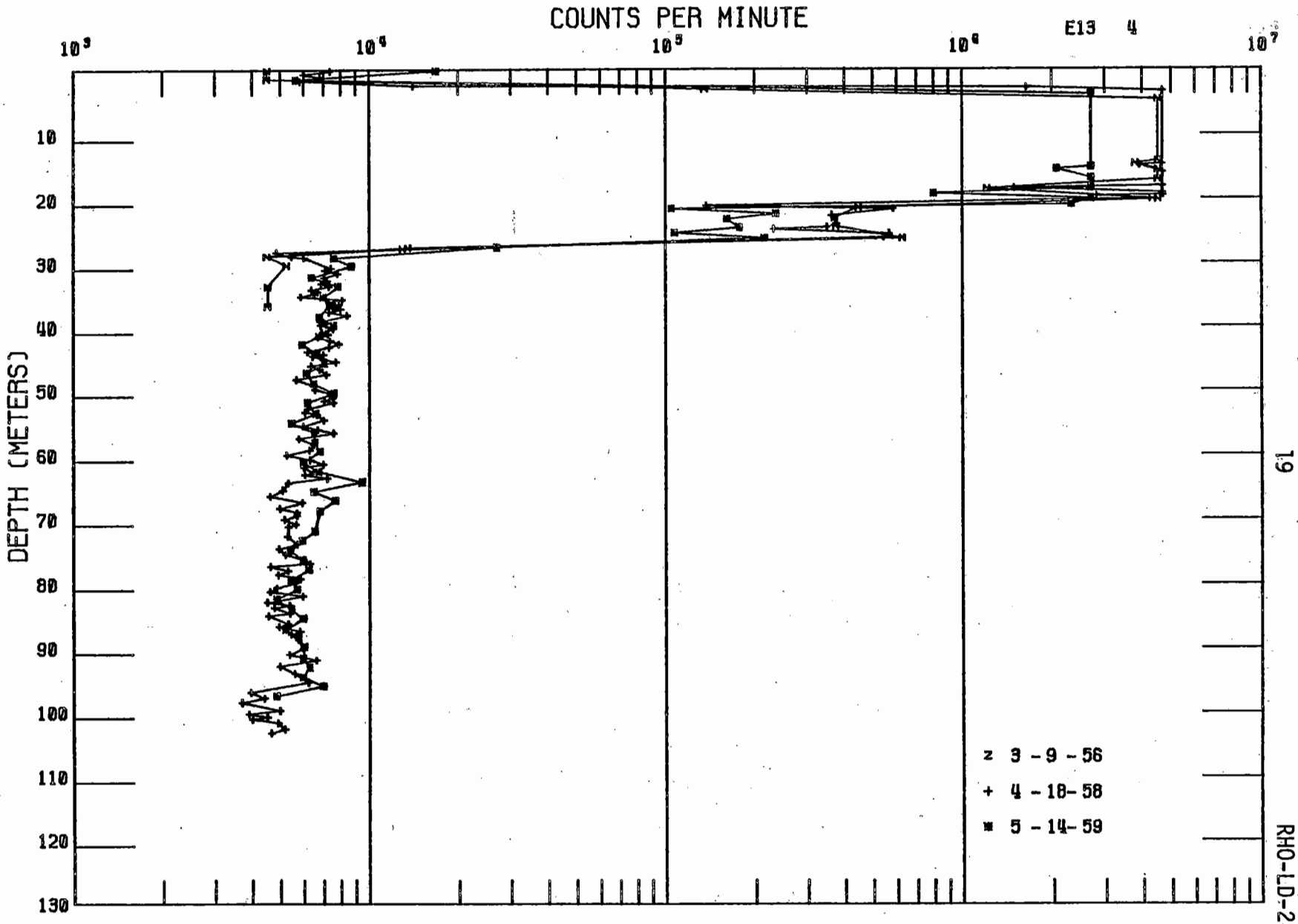
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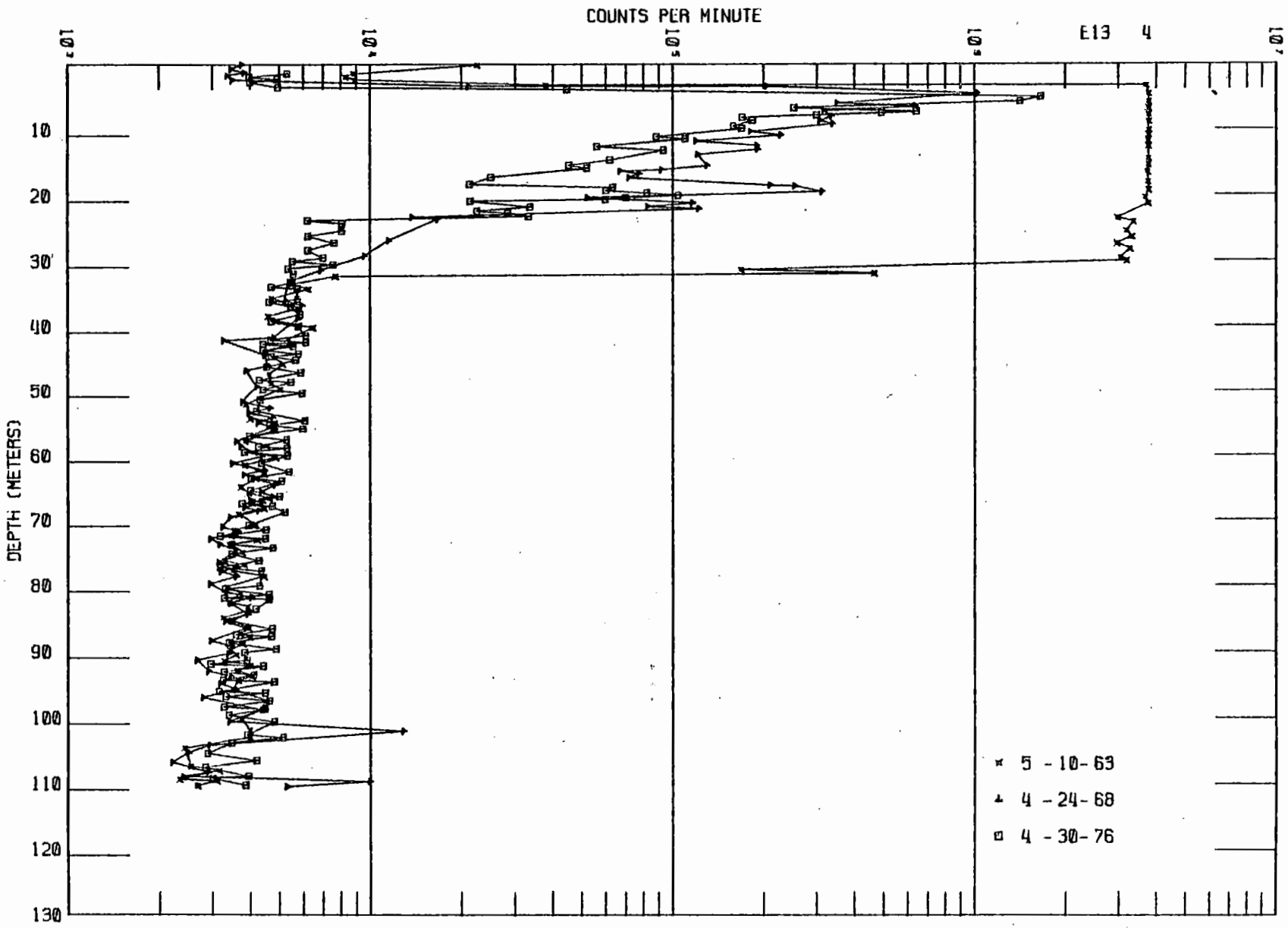
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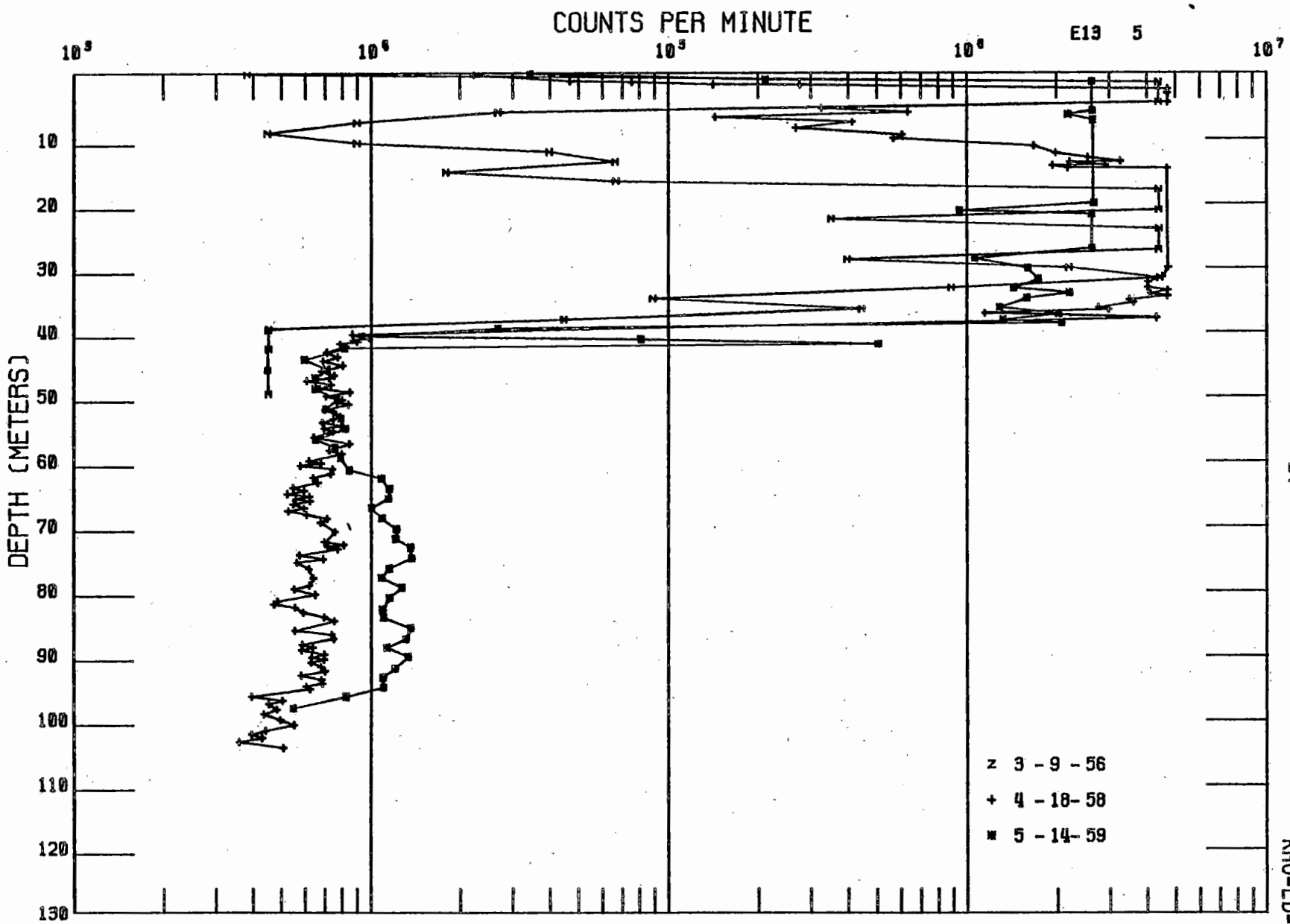
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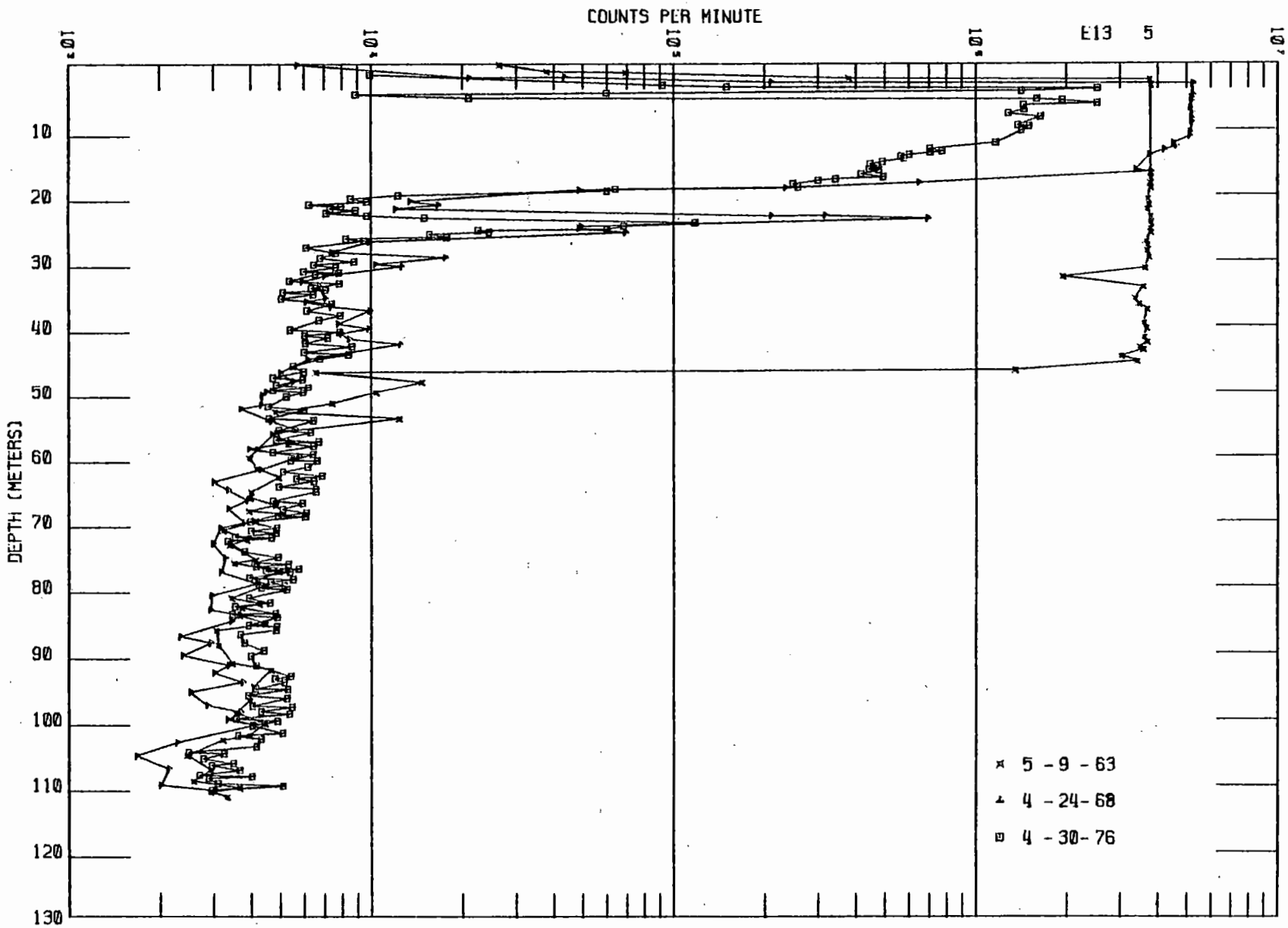
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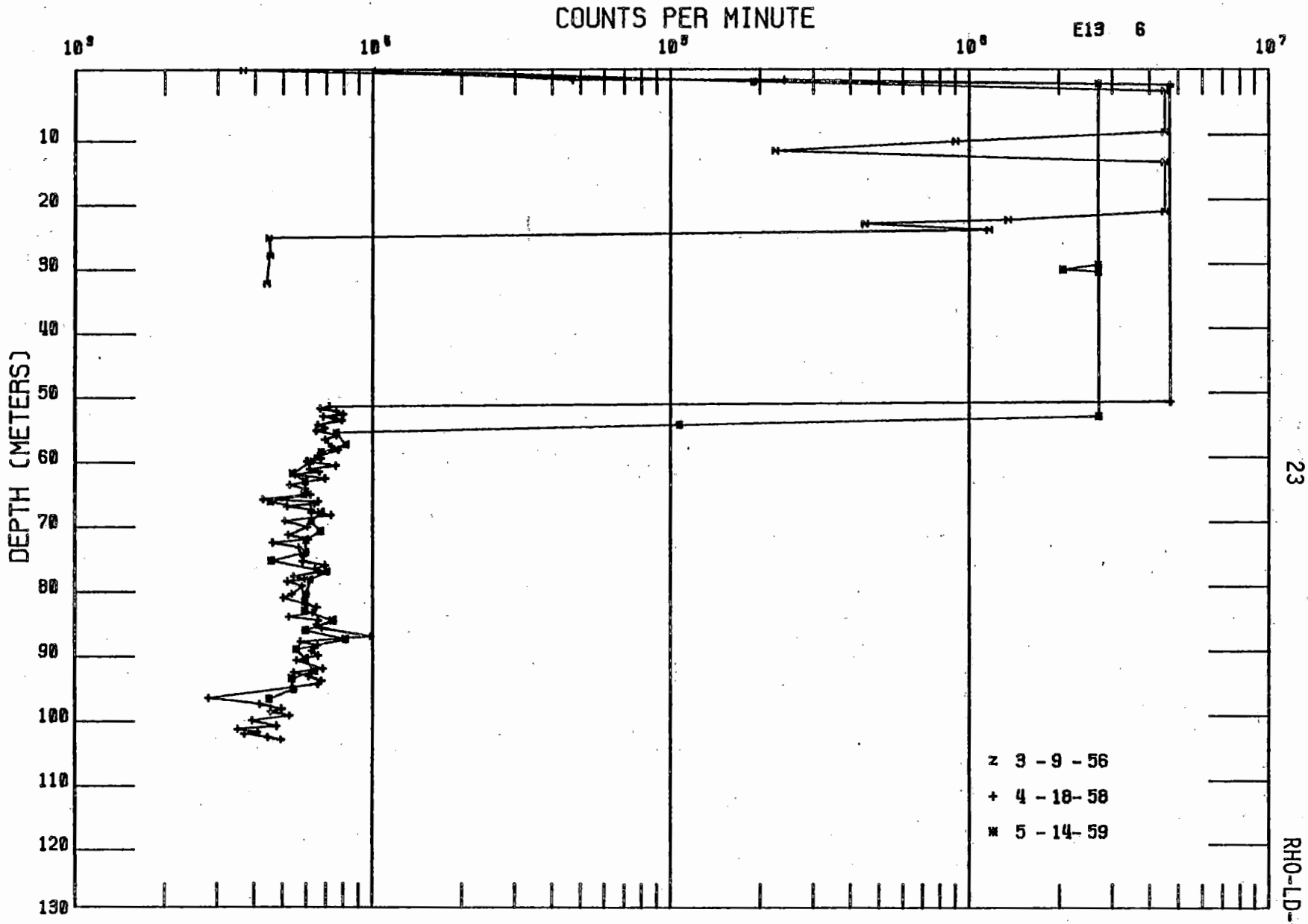
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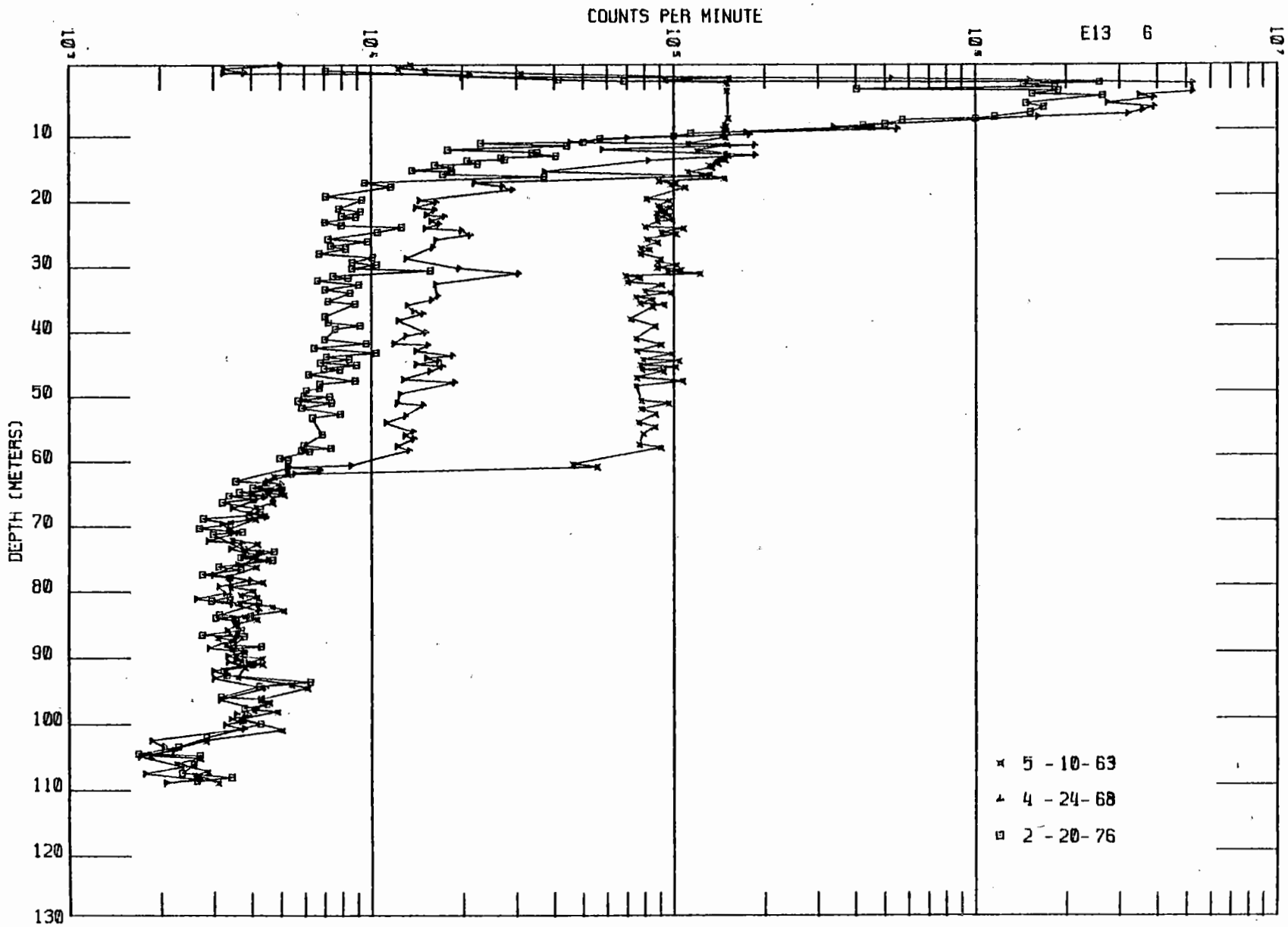
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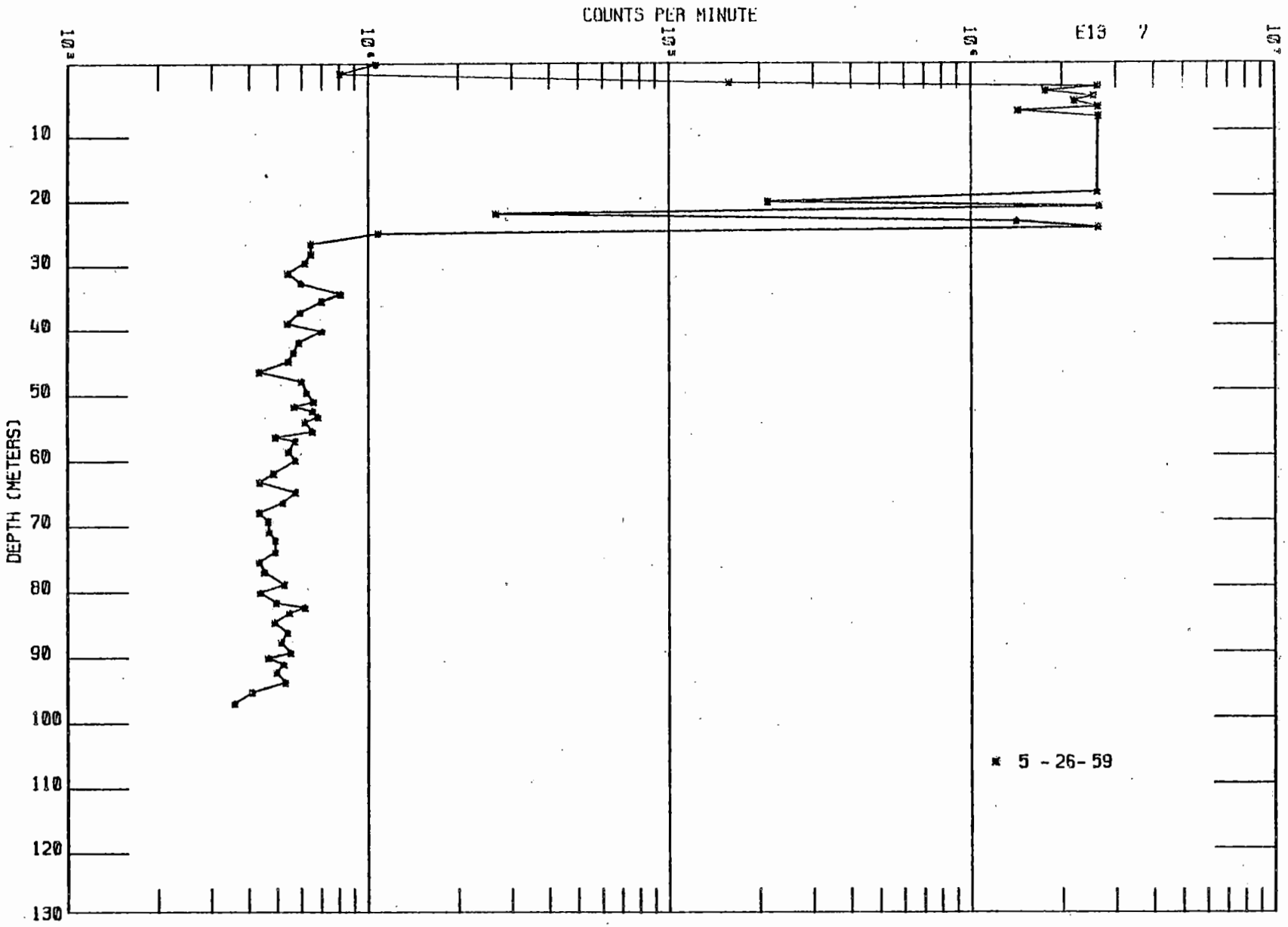
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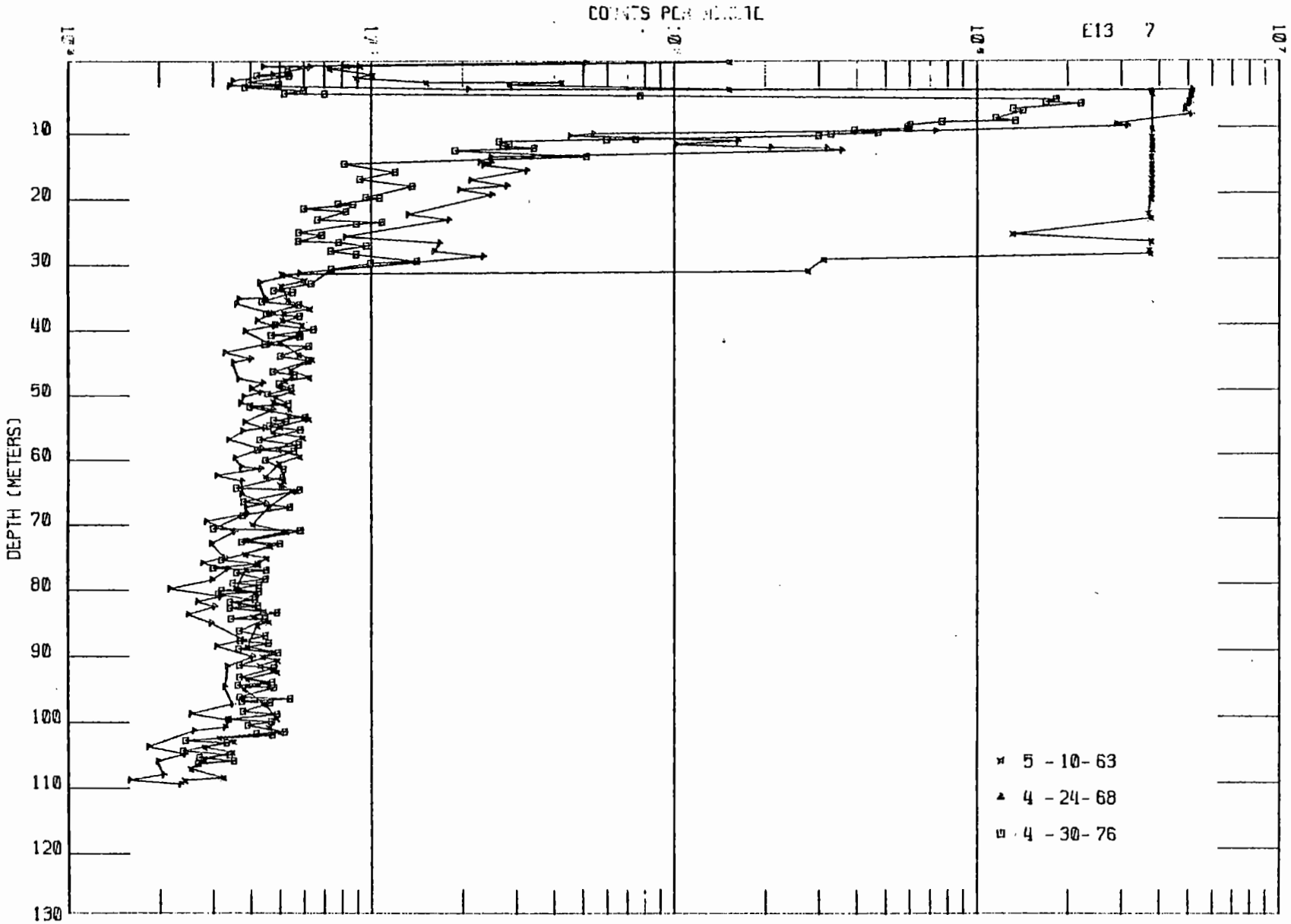
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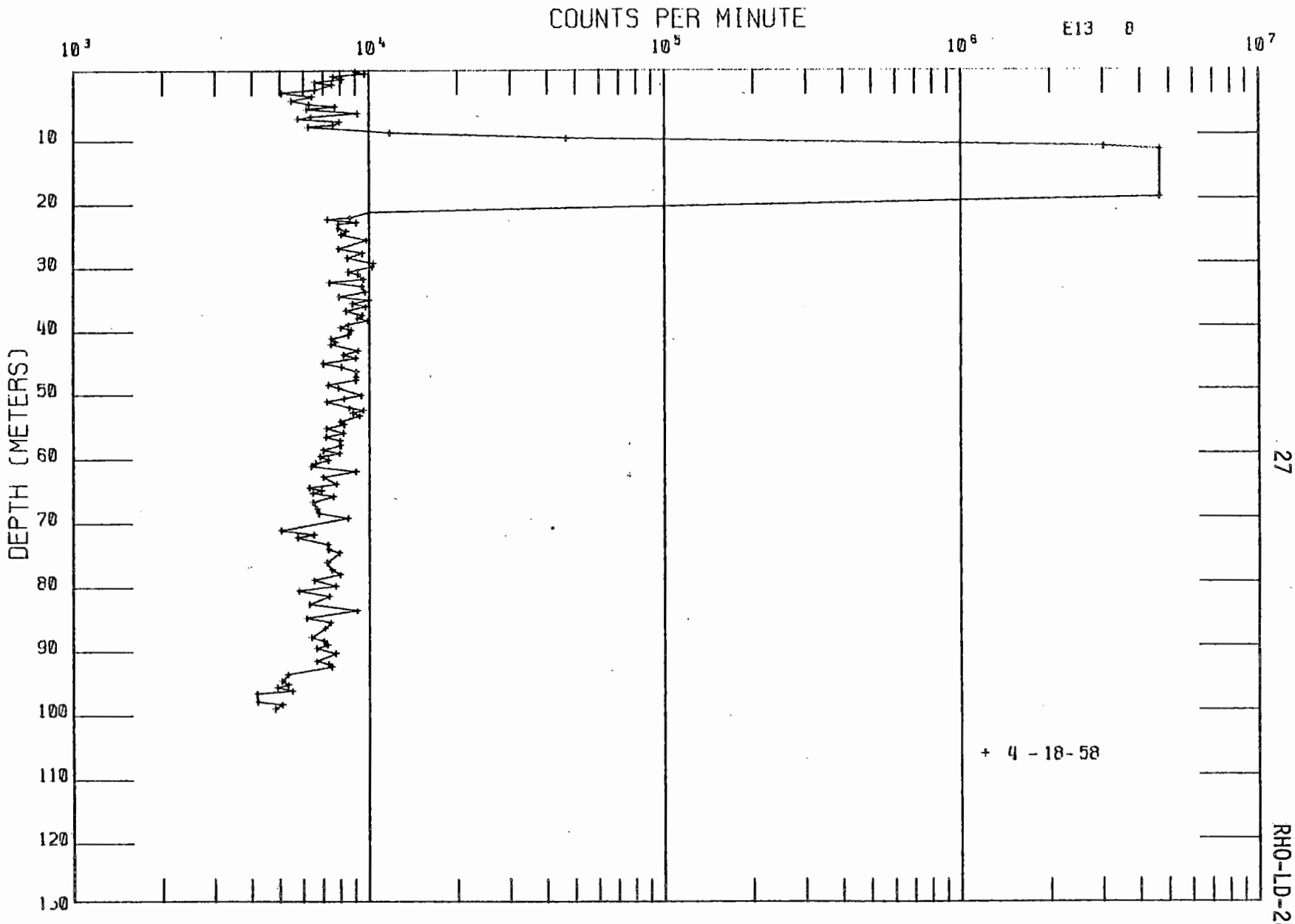
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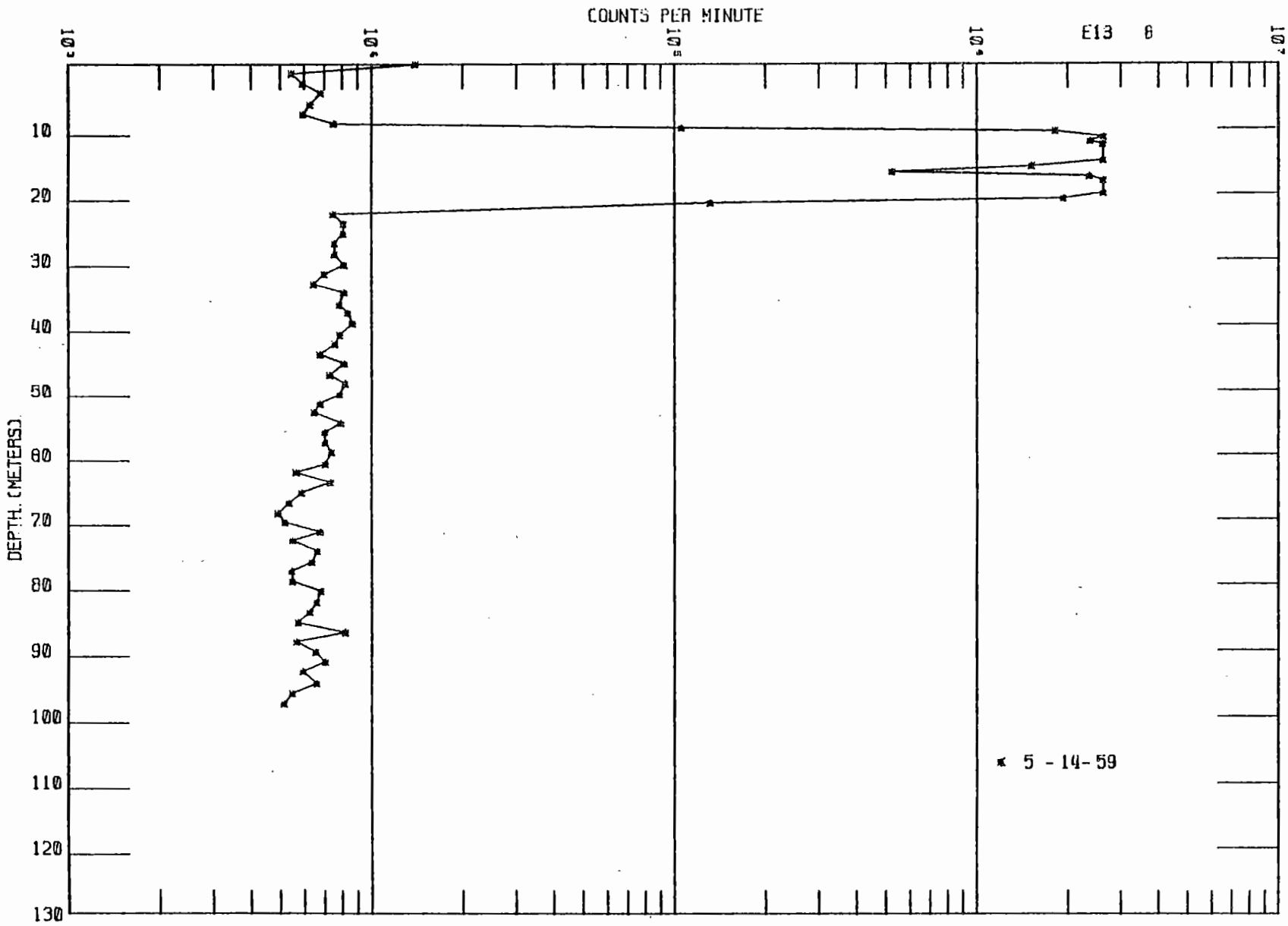
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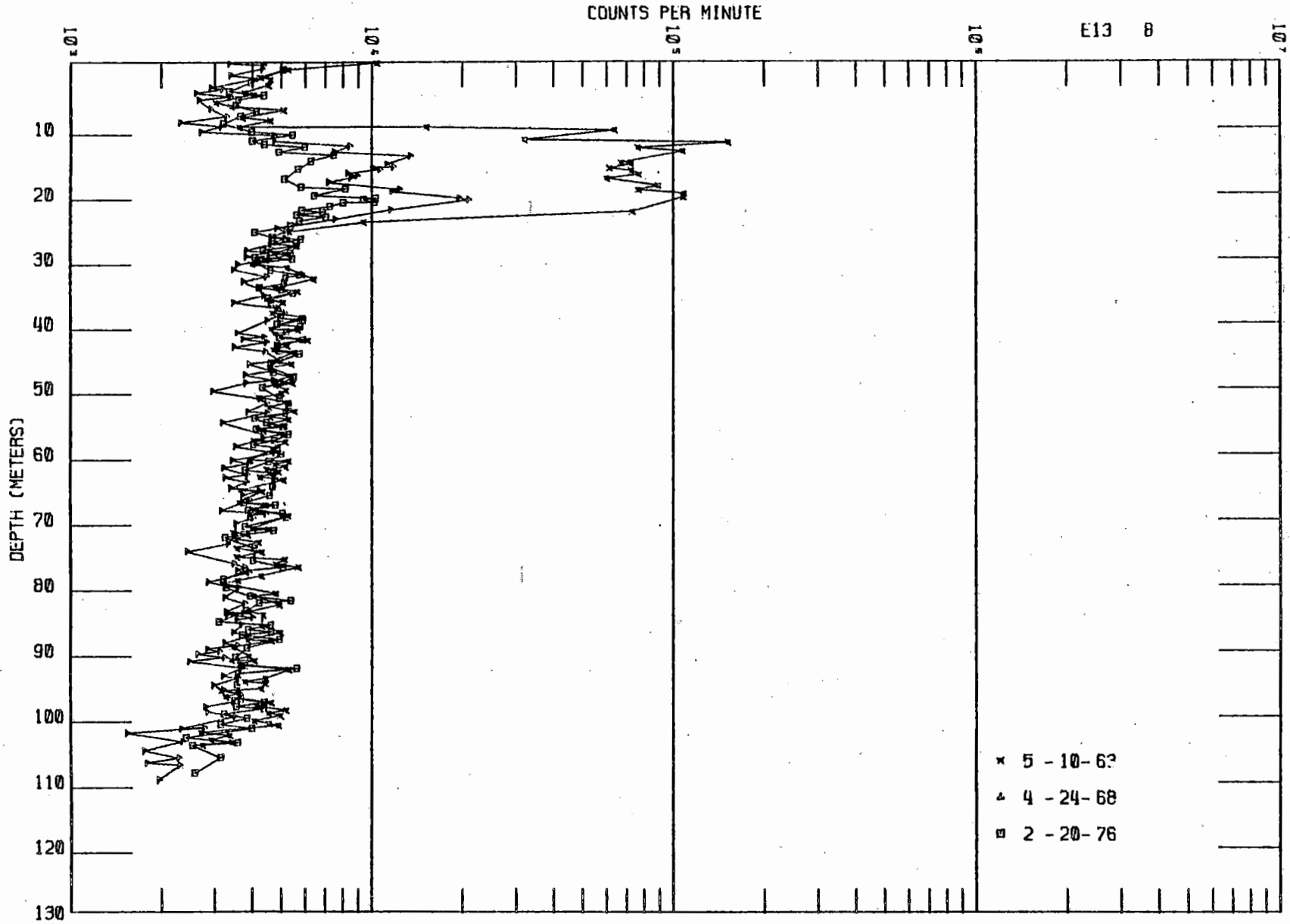
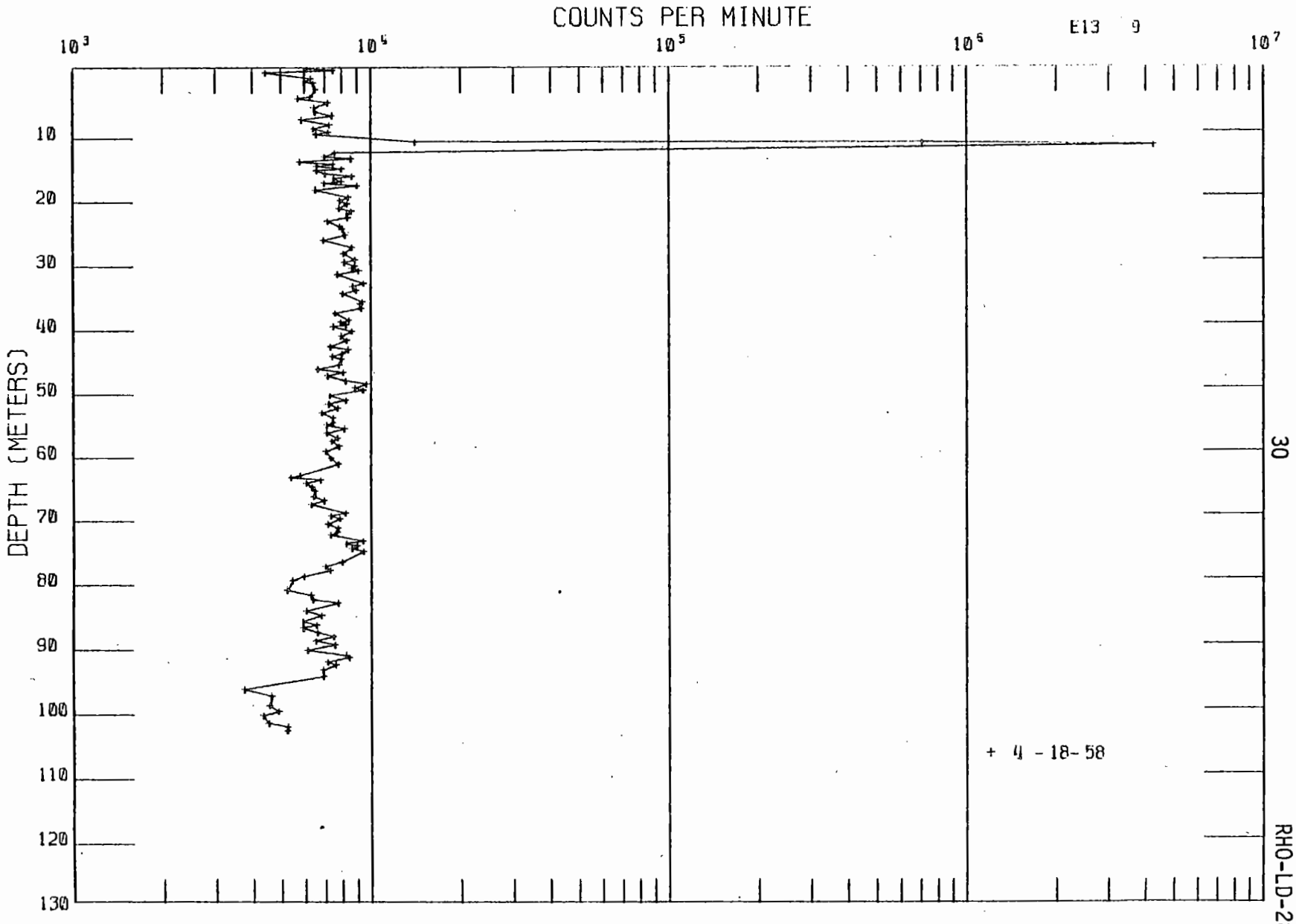
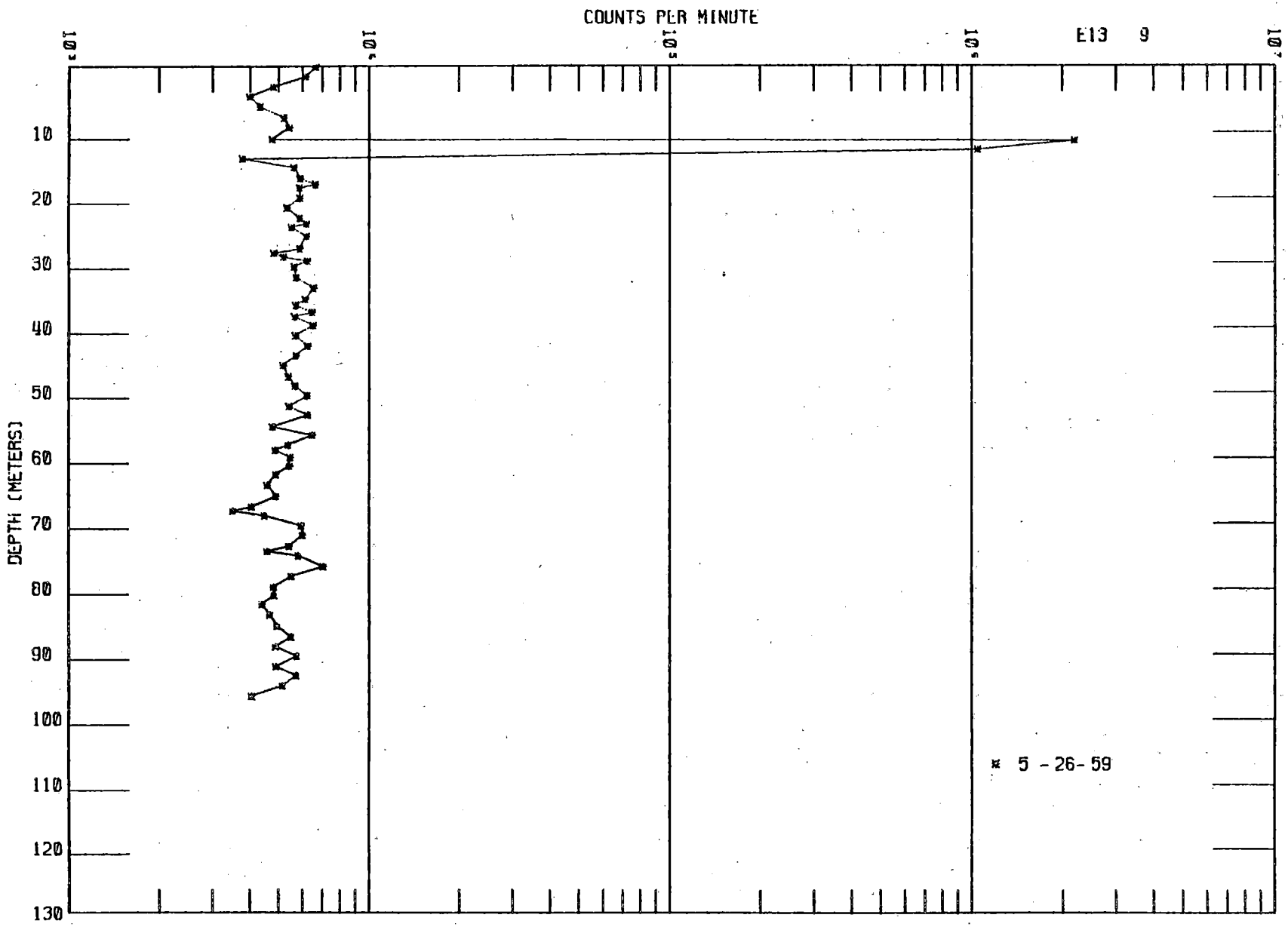
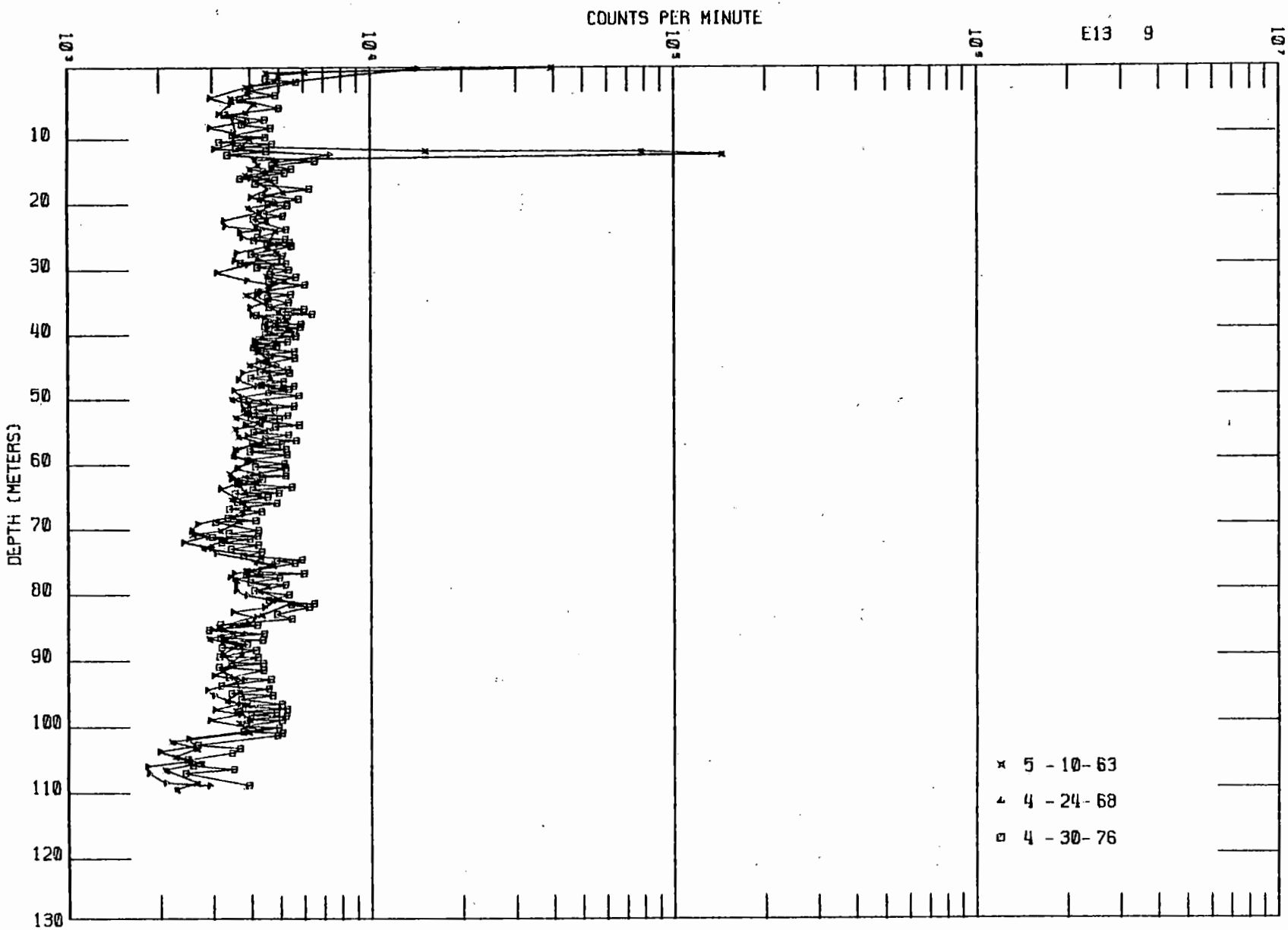
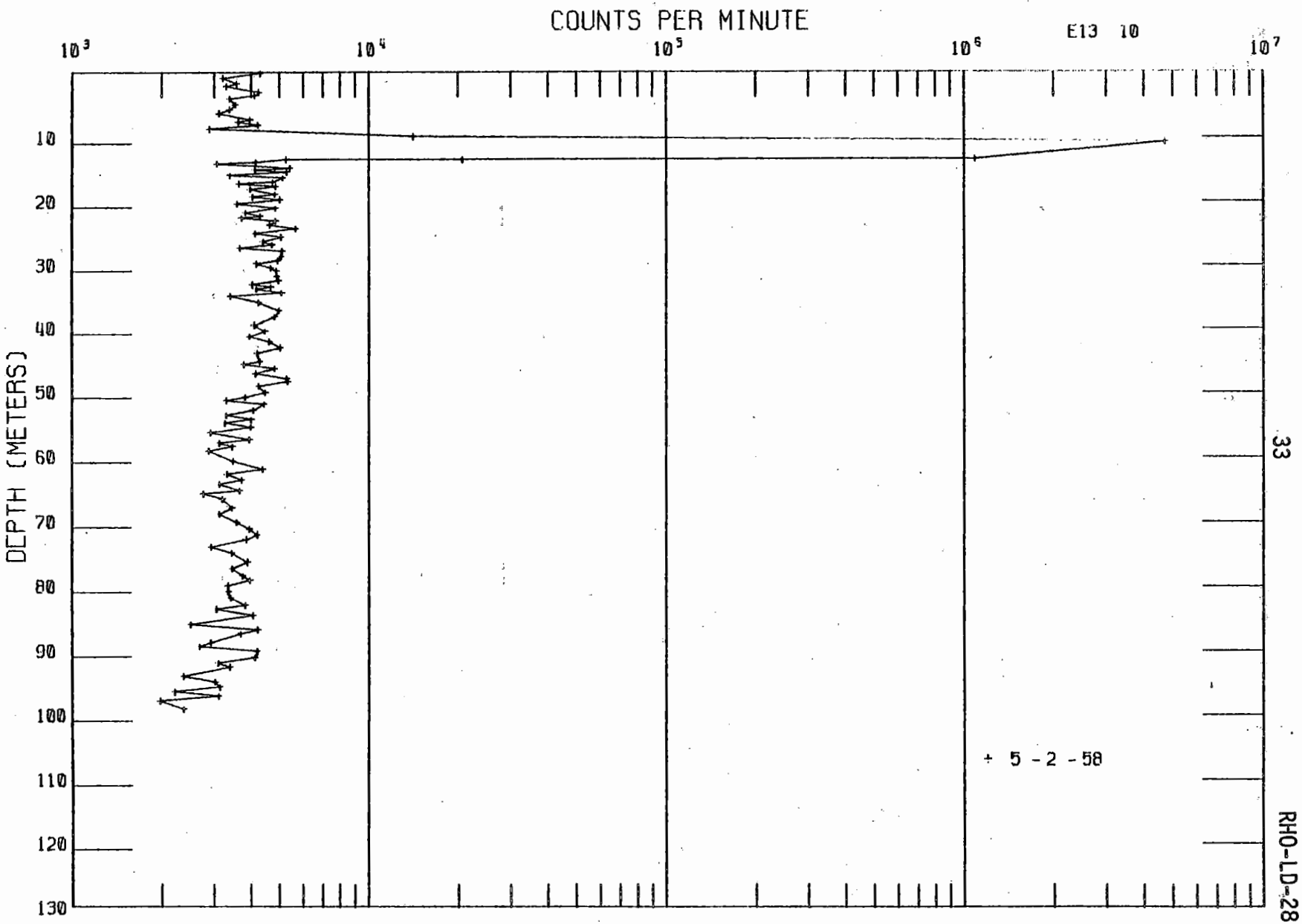
130
× 5 - 14- 59


COUNTS PER MINUTE
E13 8
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 10- 63
▲ 4 - 24- 68
□ 2 - 20- 76


COUNTS PER MINUTE
E13 9
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
+ 4 - 18- 58


COUNTS PER MINUTE
10^3
10^4
10^5
10^6
E13 9
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
* 5 - 26- 59


COUNTS PER MINUTE
E13 9
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 10- 63
4 - 24- 68
4 - 30- 76


COUNTS PER MINUTE
10^3
10^4
10^5
10^6
E13 10
10^7
DEPTH (METERS)
10
20
30
40
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60
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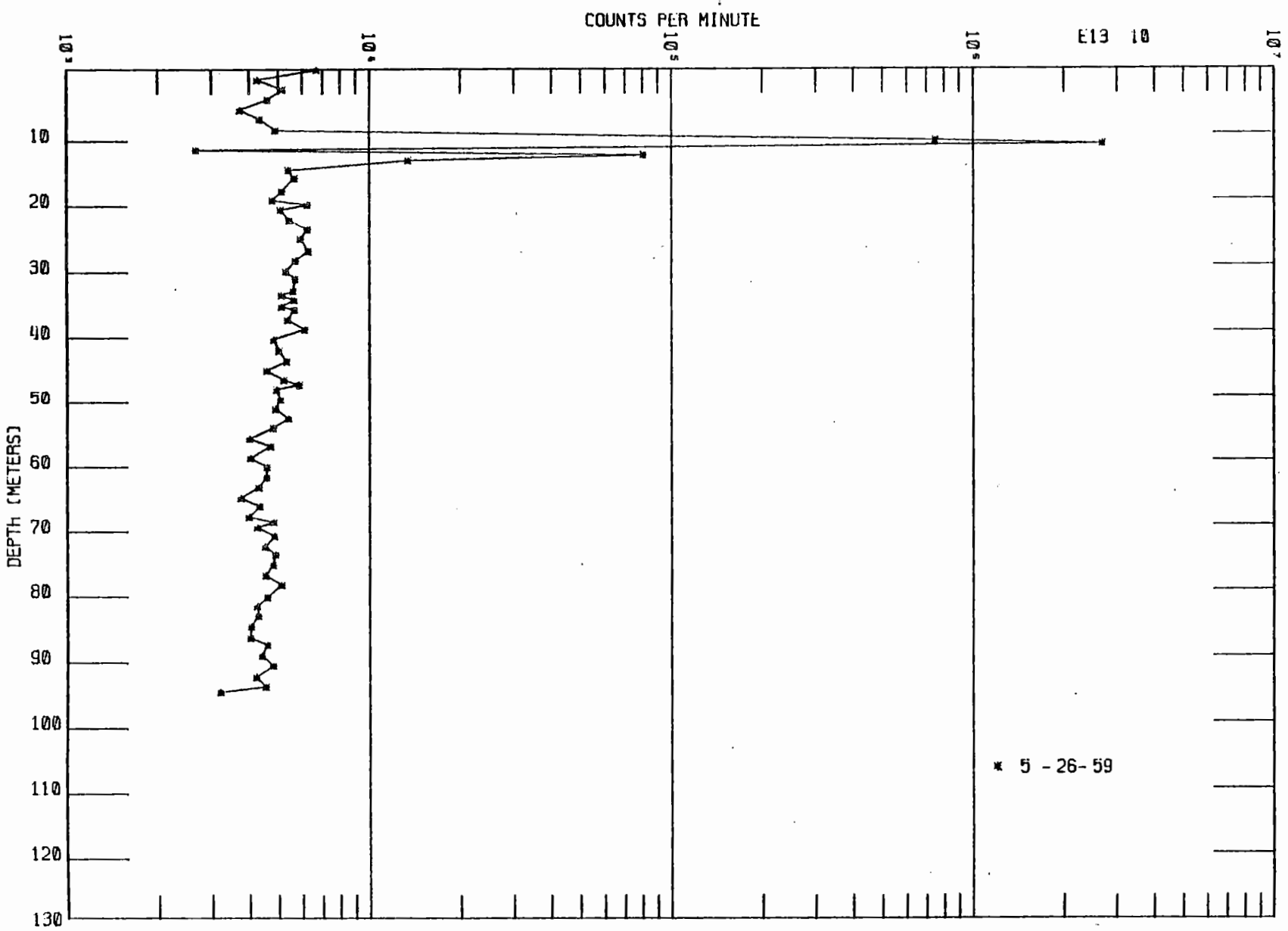
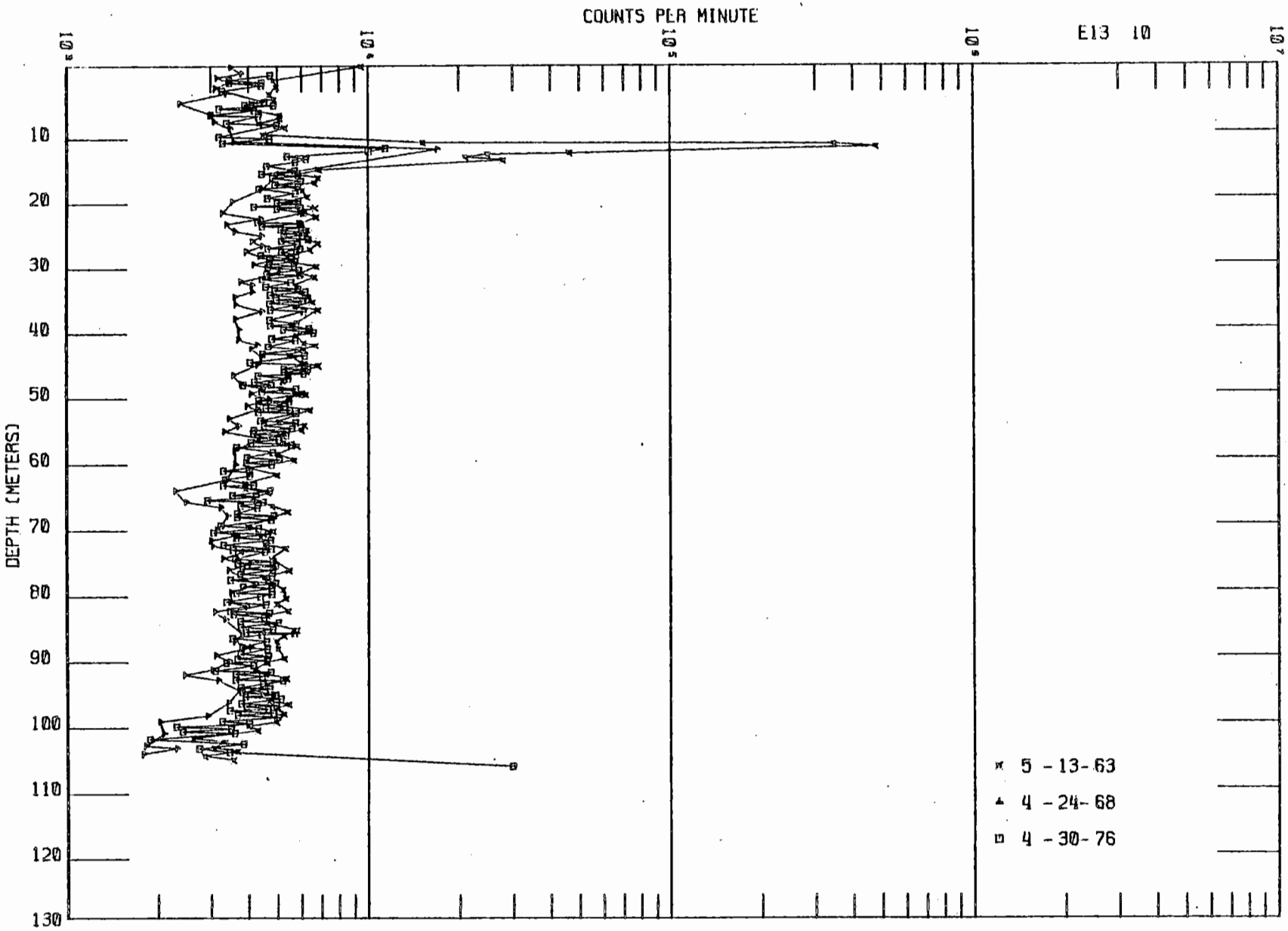
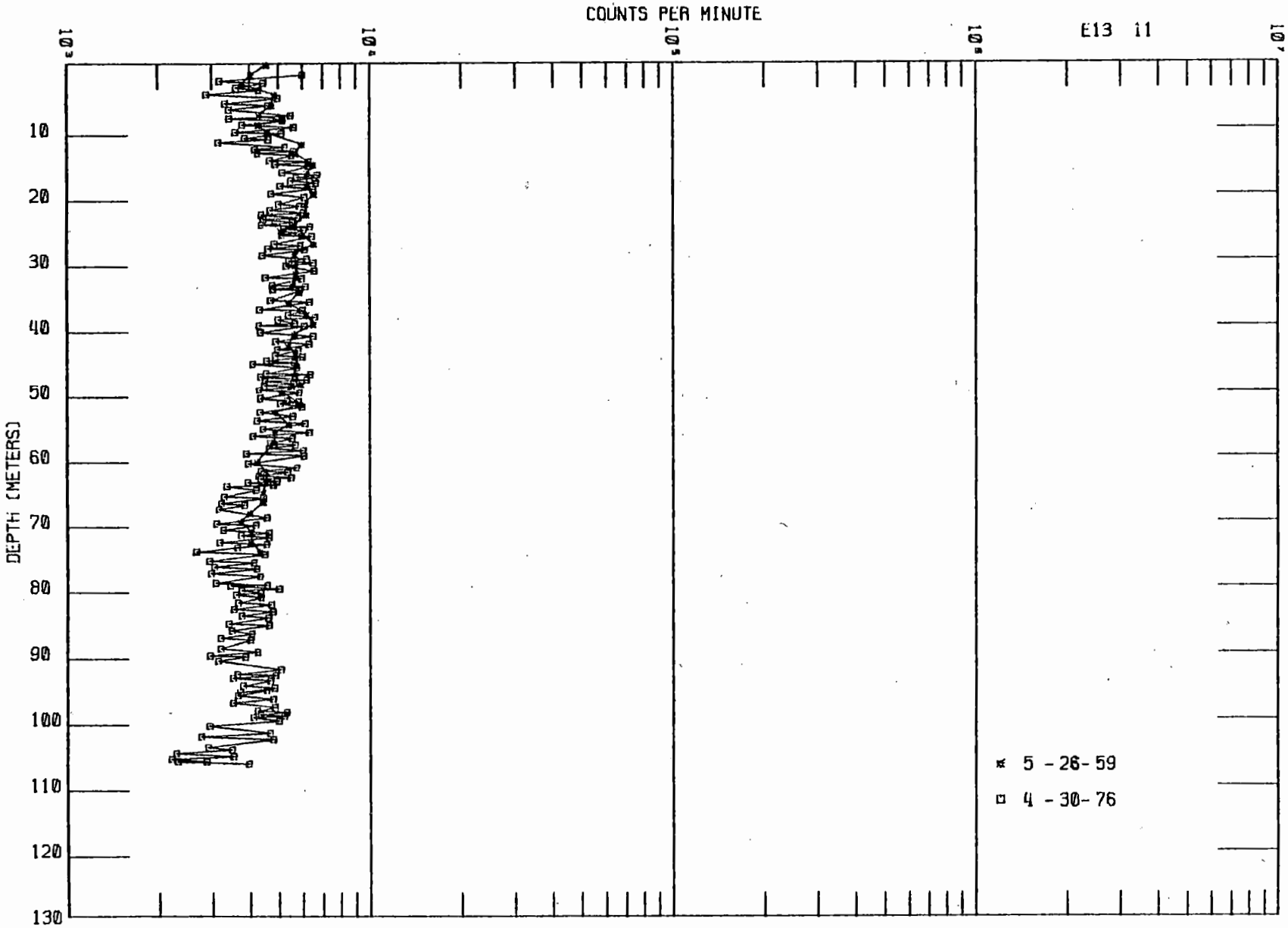
80
90
100
110
120
130
+ 5 - 2 - 58


COUNTS PER MINUTE
E13 10
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
* 5 - 26- 59


COUNTS PER MINUTE
E13 10
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
5 - 13- 63
4 - 24- 68
4 - 30- 76


COUNTS PER MINUTE
E13 11
DEPTH (METERS)
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20
30
40
50
60
70
80
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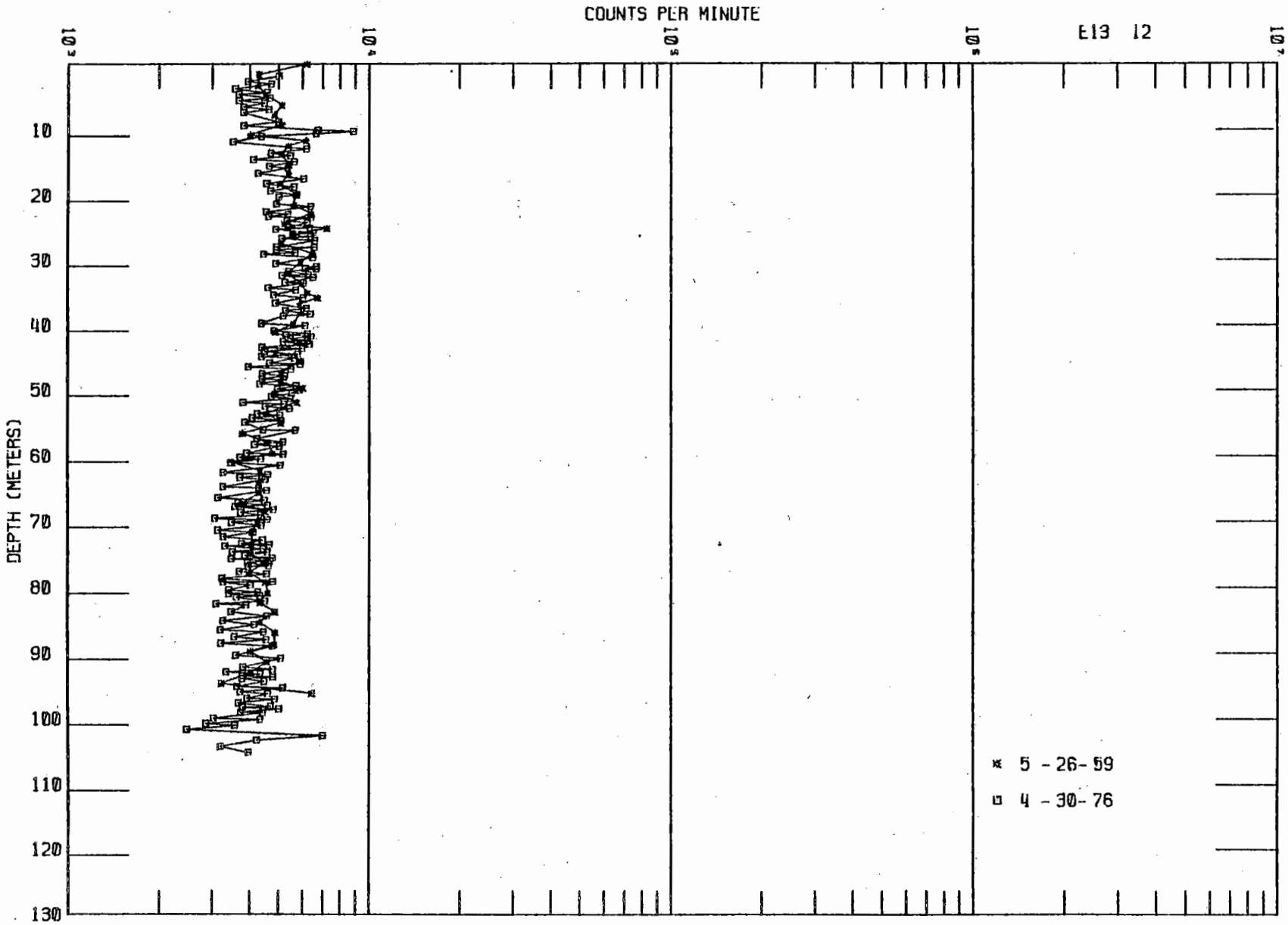
100
110
120
130
5 - 26- 59
4 - 30- 76


COUNTS PER MINUTE
E13 12
DEPTH (METERS)
10
20
30
40
50
60
70
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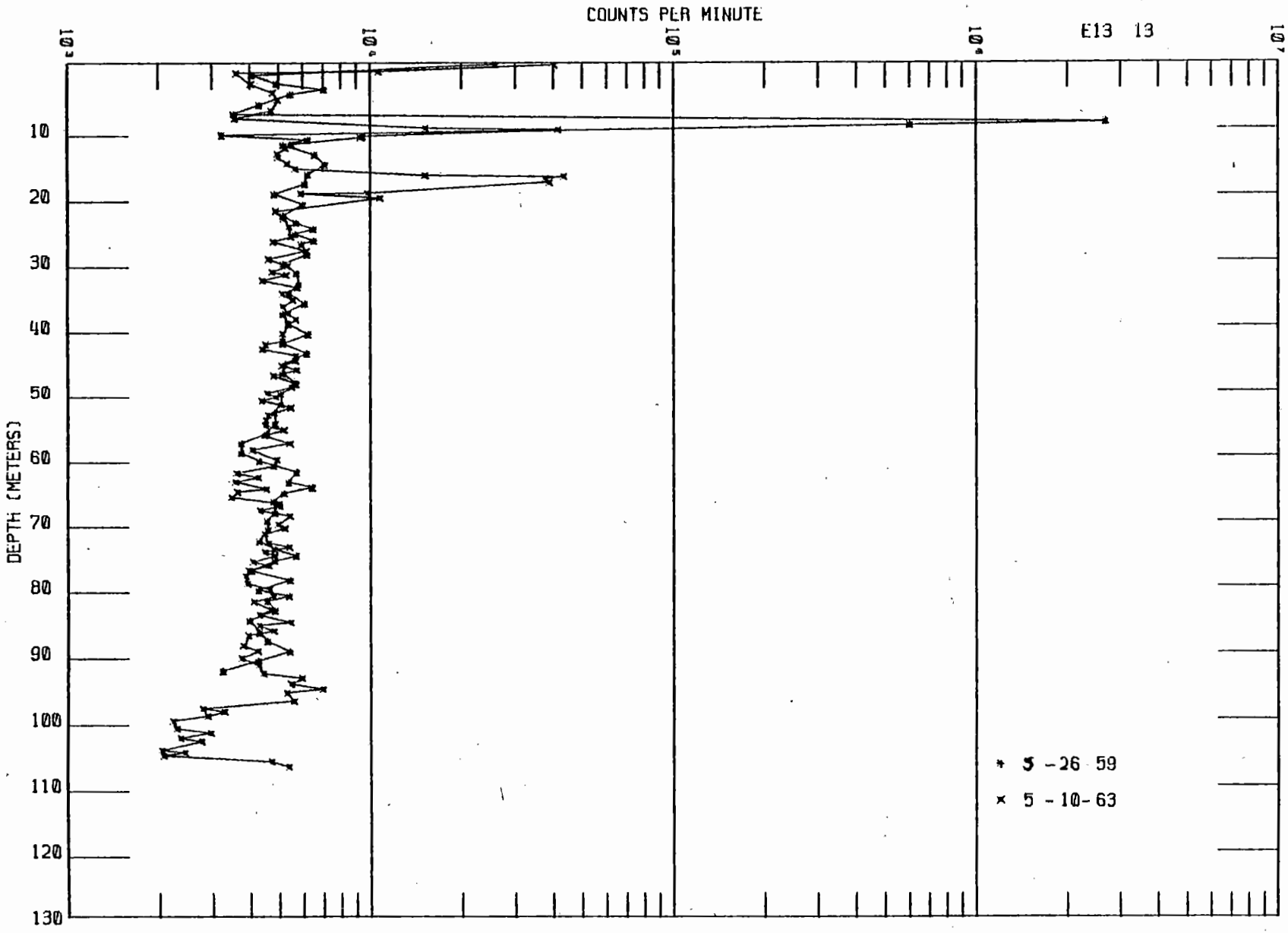
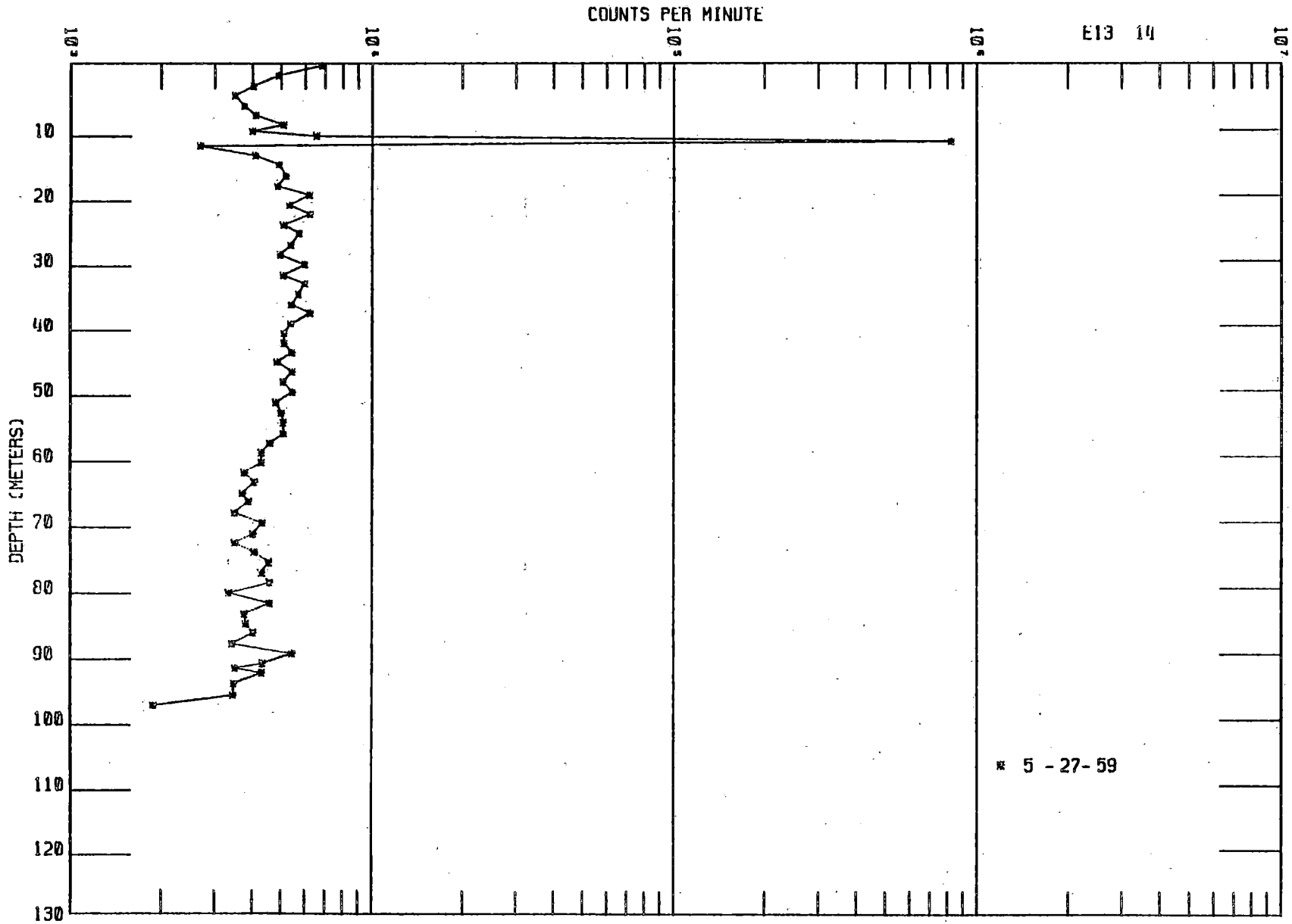
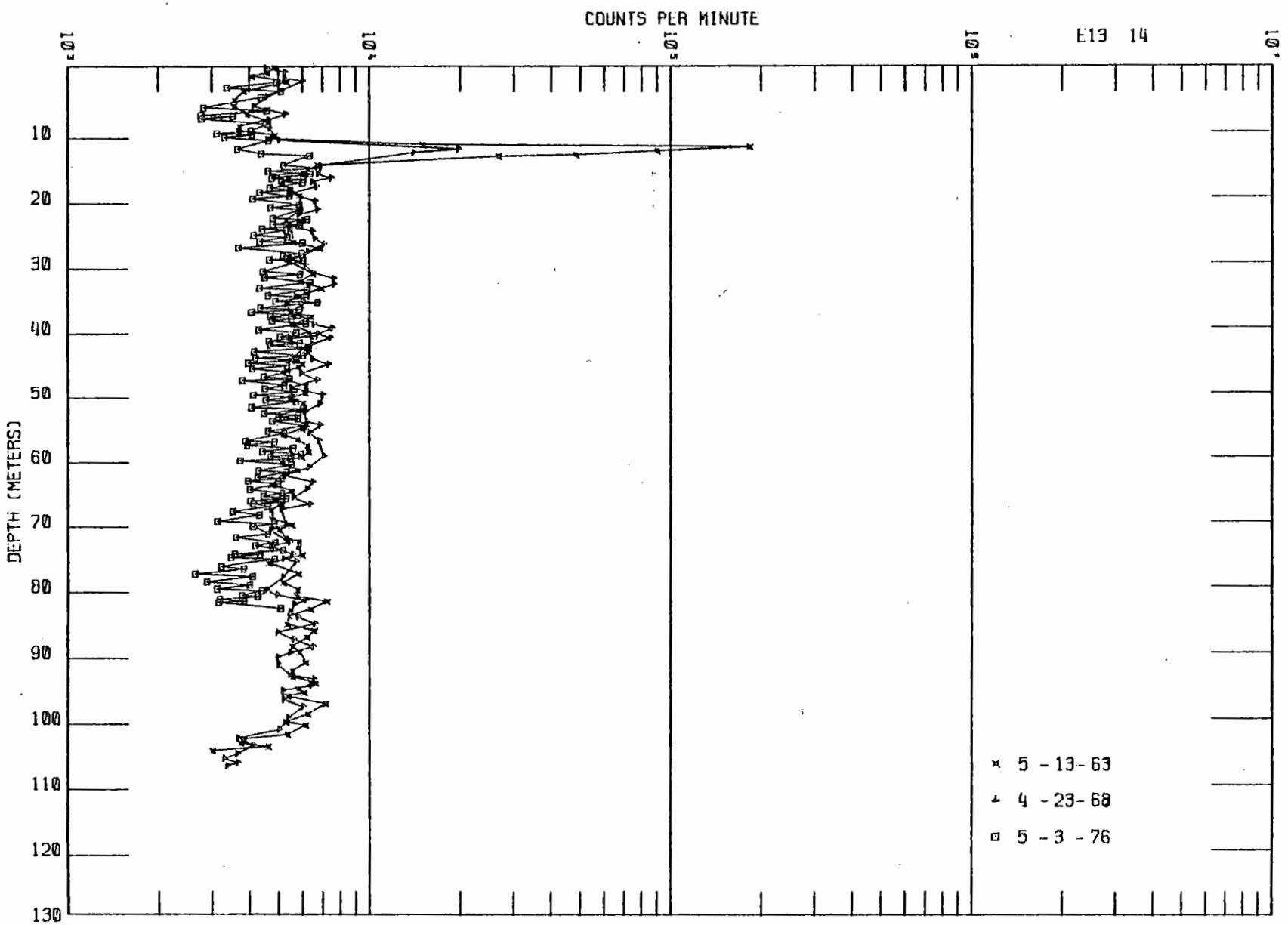
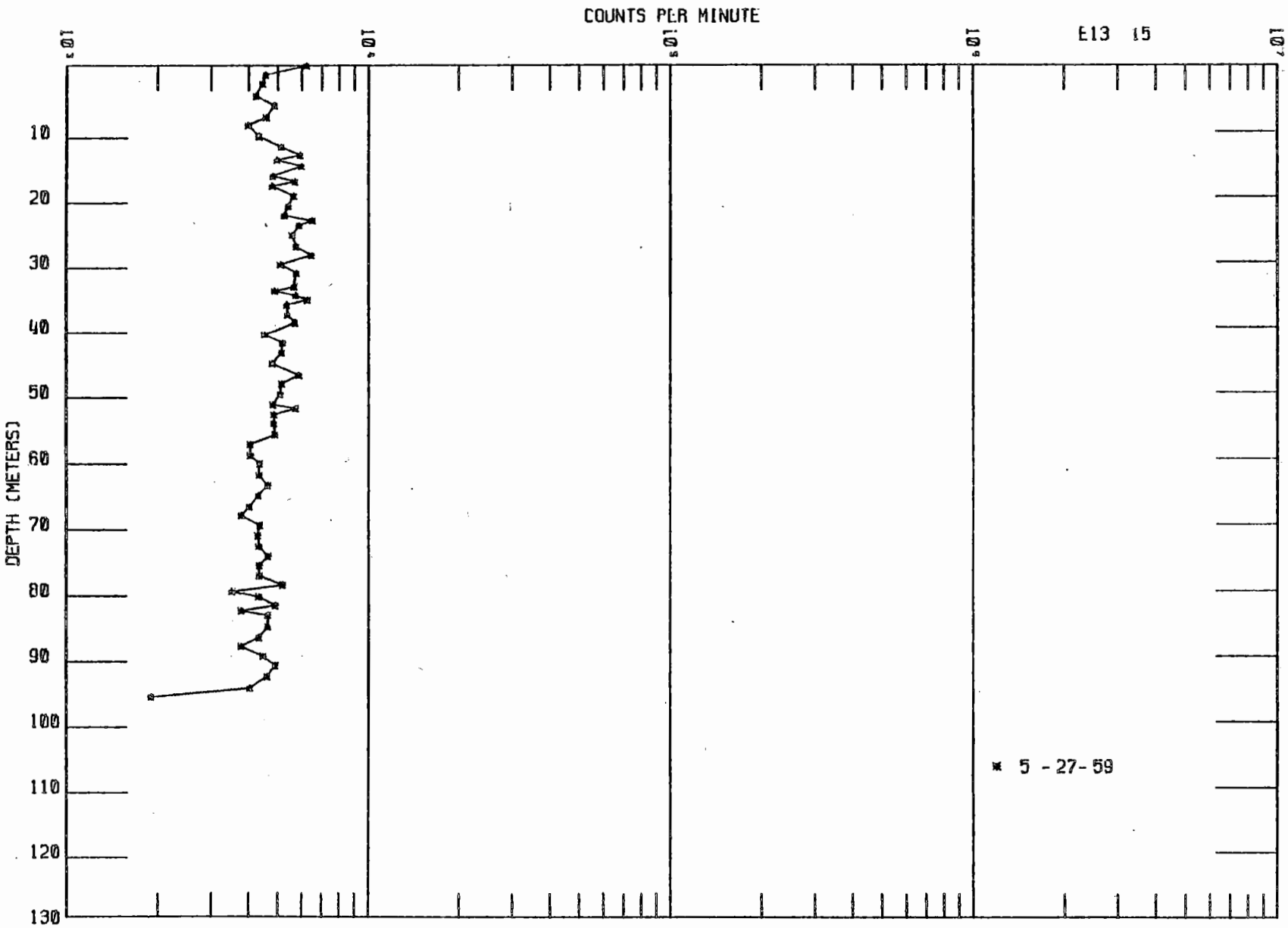
100
110
120
130
× 5 - 26- 59
□ 4 - 30- 76


COUNTS PER MINUTE
E13 13
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
* 5 -26 59
× 5 -10-63


COUNTS PER MINUTE
E13 14
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
* 5 - 27- 59


COUNTS PER MINUTE
E13 14
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 13- 63
+ 4 - 23- 68
□ 5 - 3 - 76


COUNTS PER MINUTE
E13 15
10³
10⁴
10⁵
10⁶
10⁷
DEPTH (METERS)
10
20
30
40
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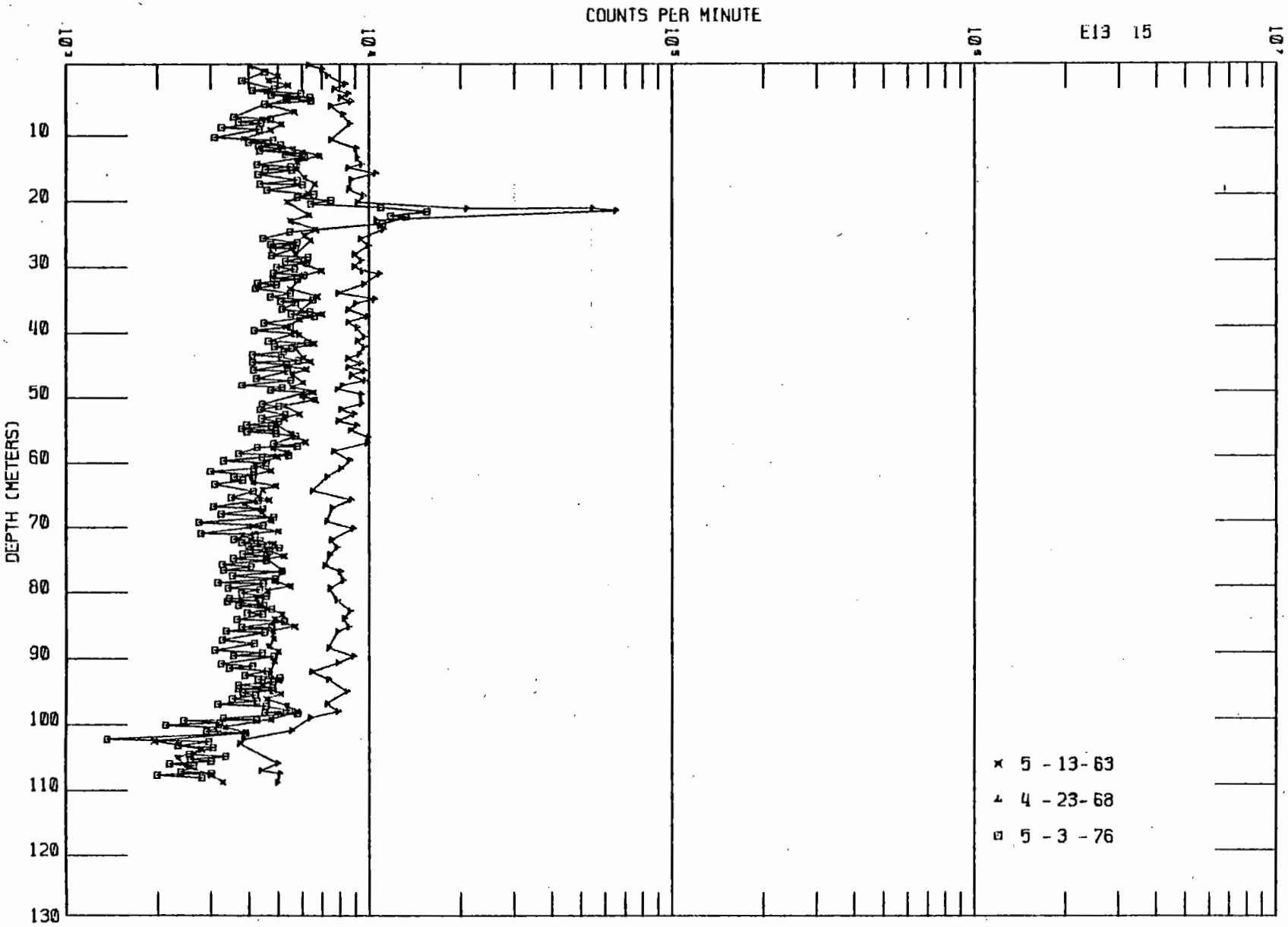
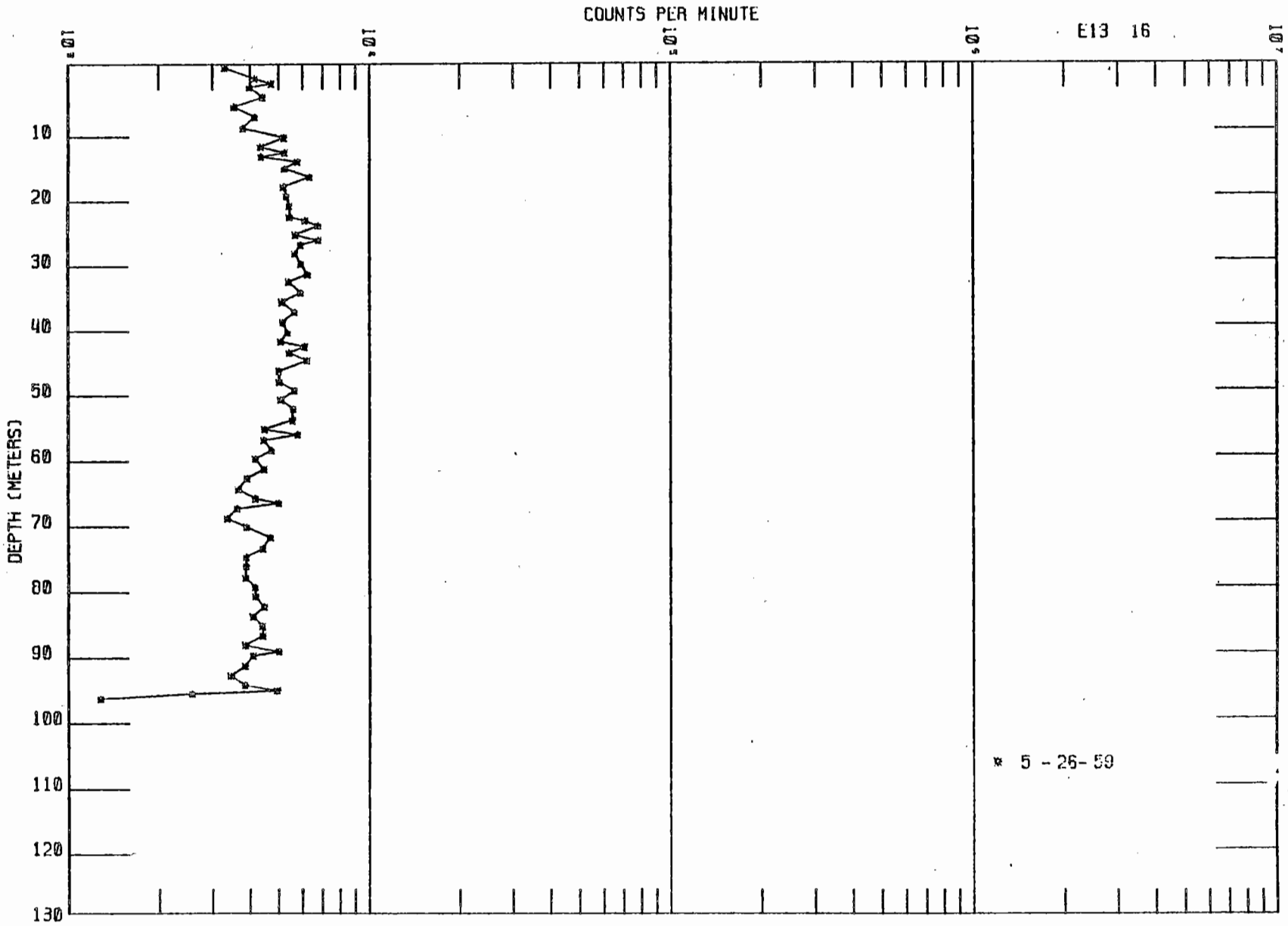
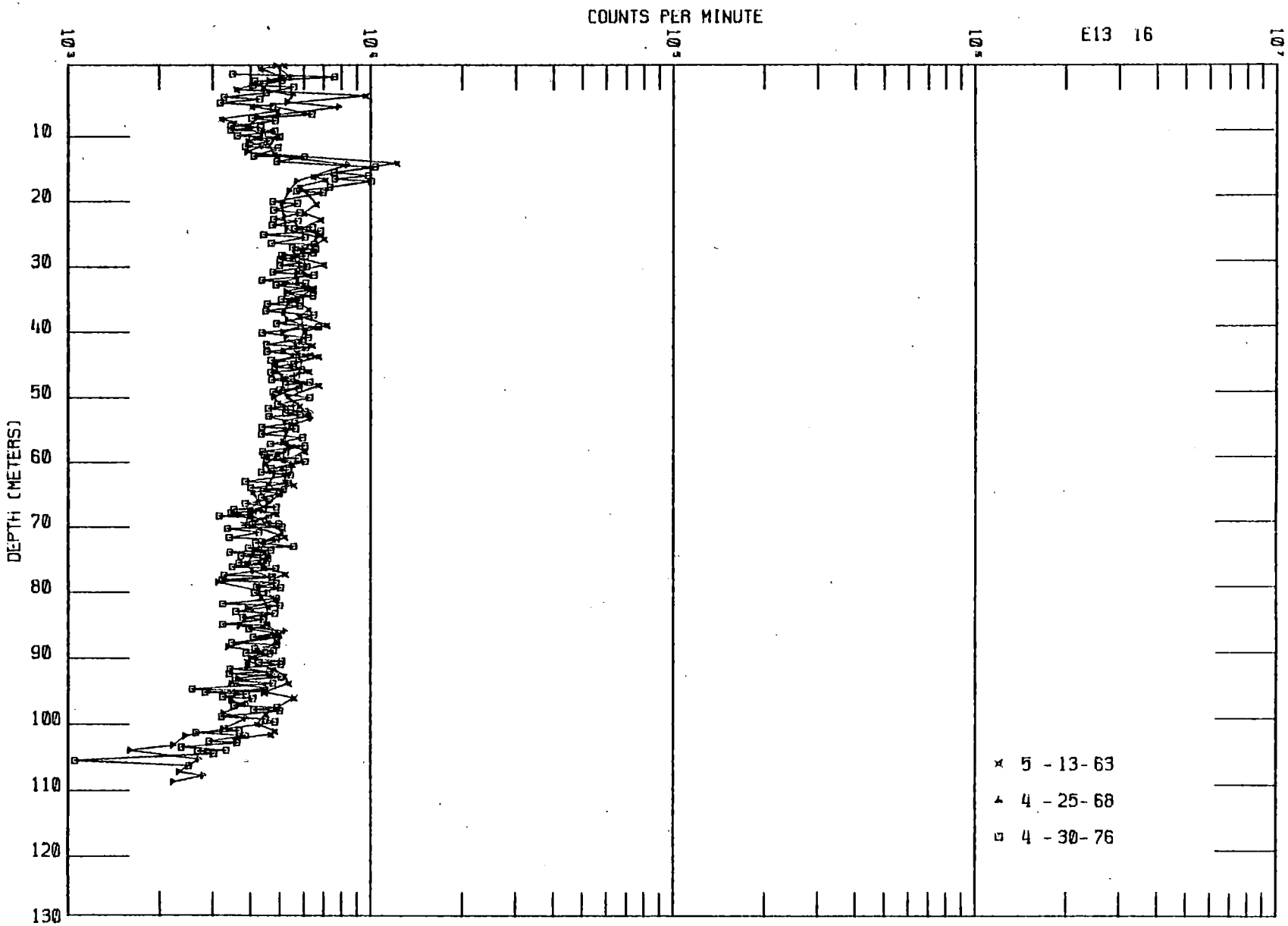
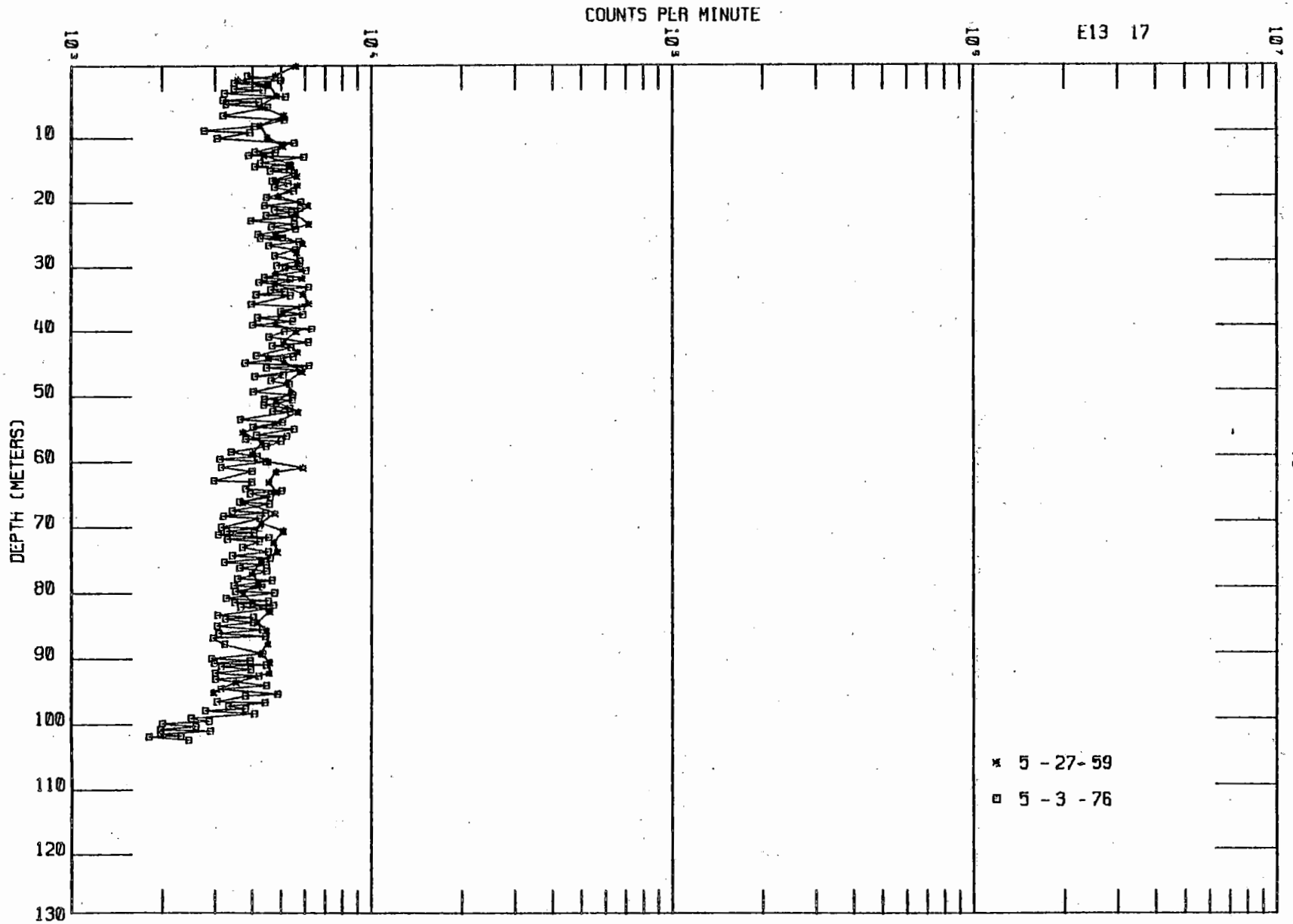
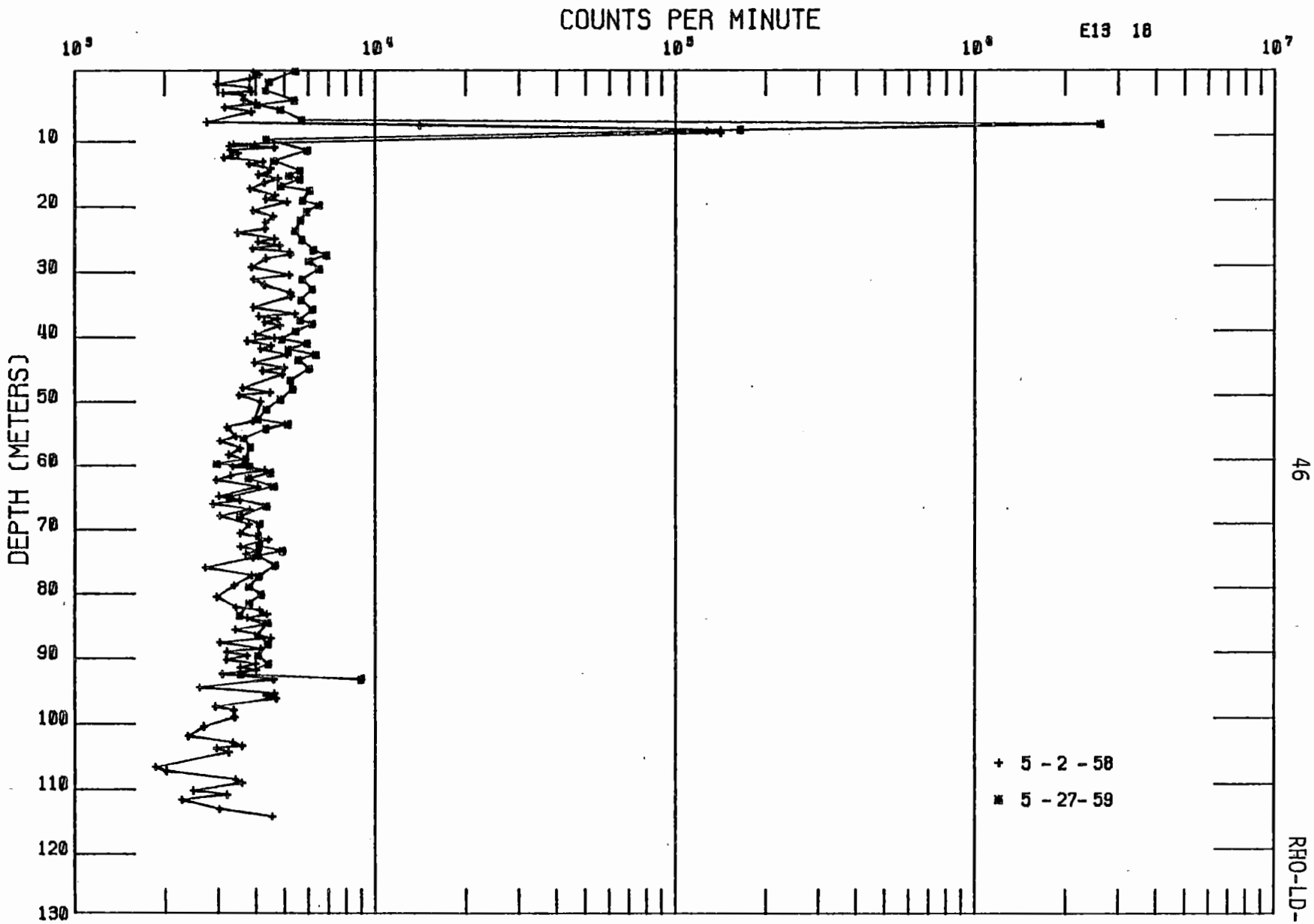
60
70
80
90
100
110
120
130
* 5 - 27- 59

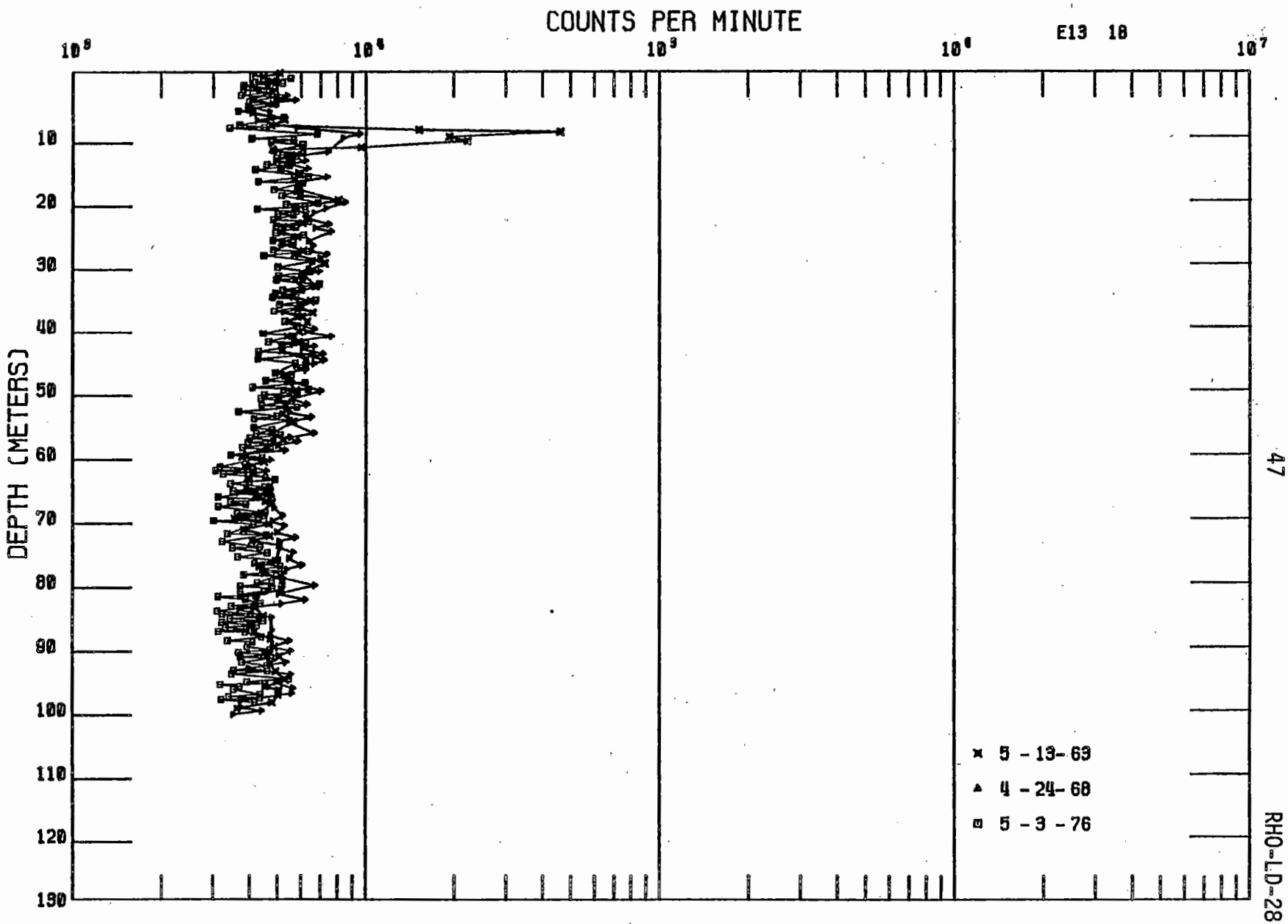

COUNTS PER MINUTE
E13 15
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 13- 63
▲ 4 - 23- 68
□ 5 - 3 - 76

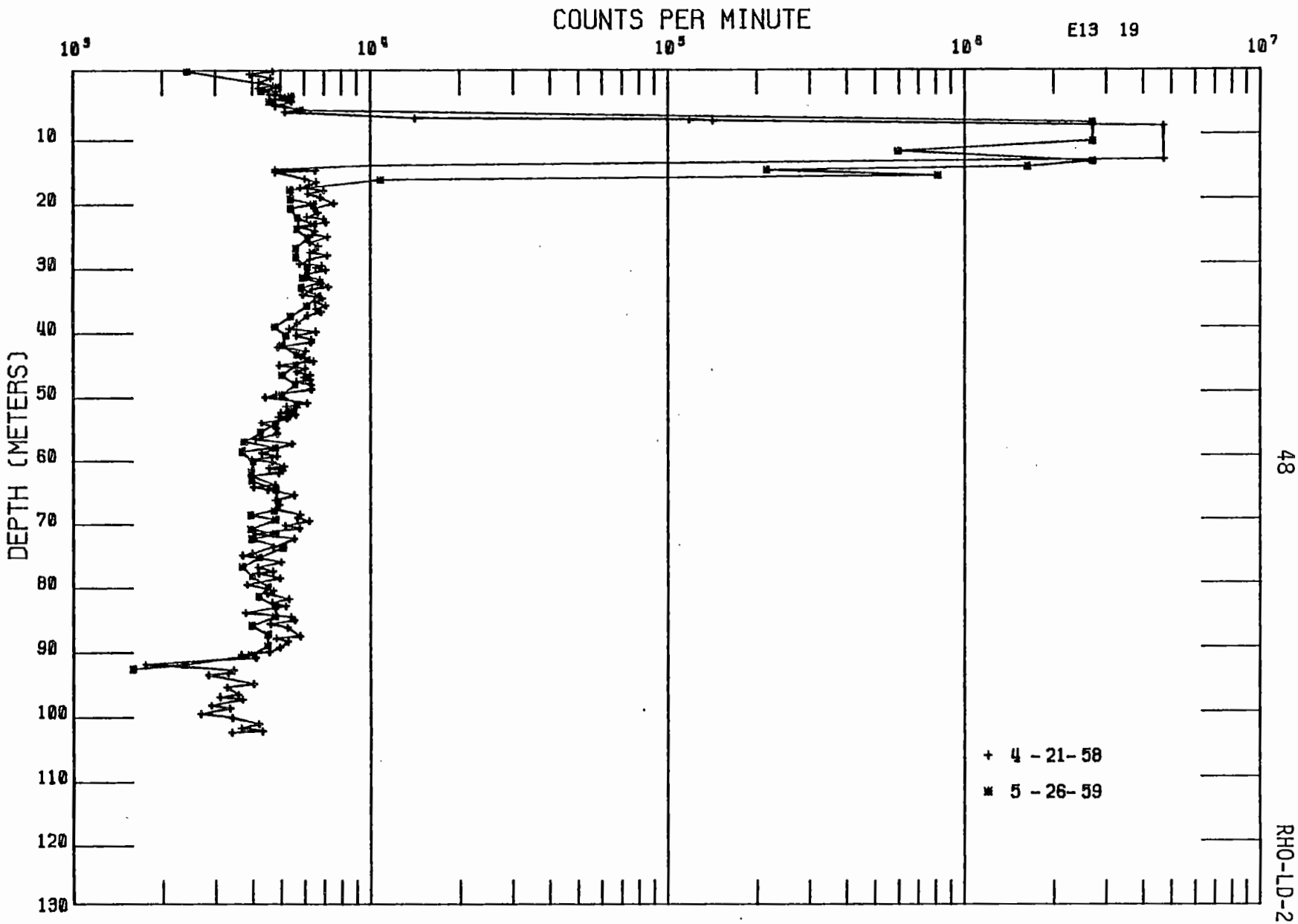

COUNTS PER MINUTE
E13 16
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
* 5 - 26- 59

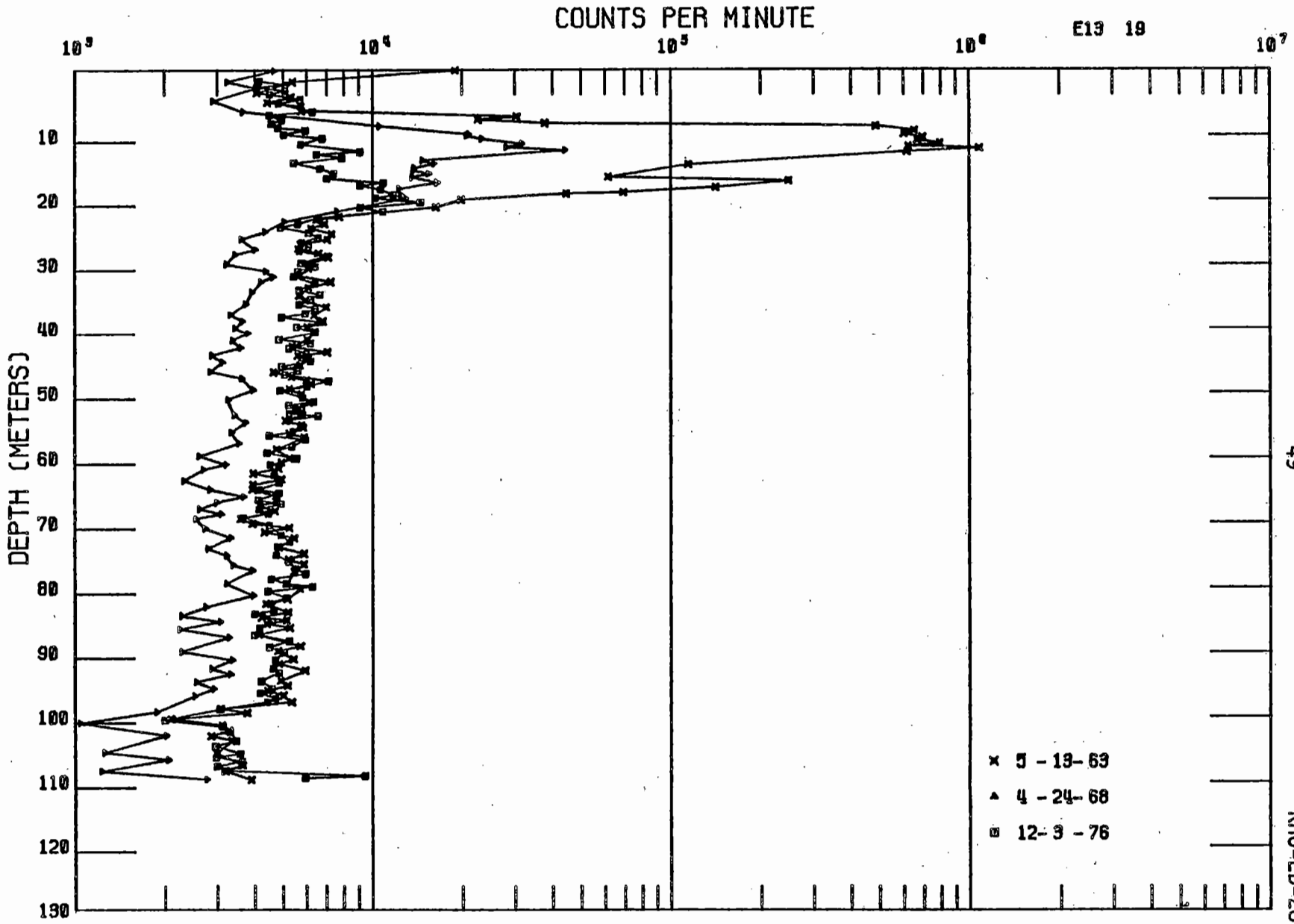

COUNTS PER MINUTE
E13 16
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 13- 63
▲ 4 - 25- 68
□ 4 - 30- 76

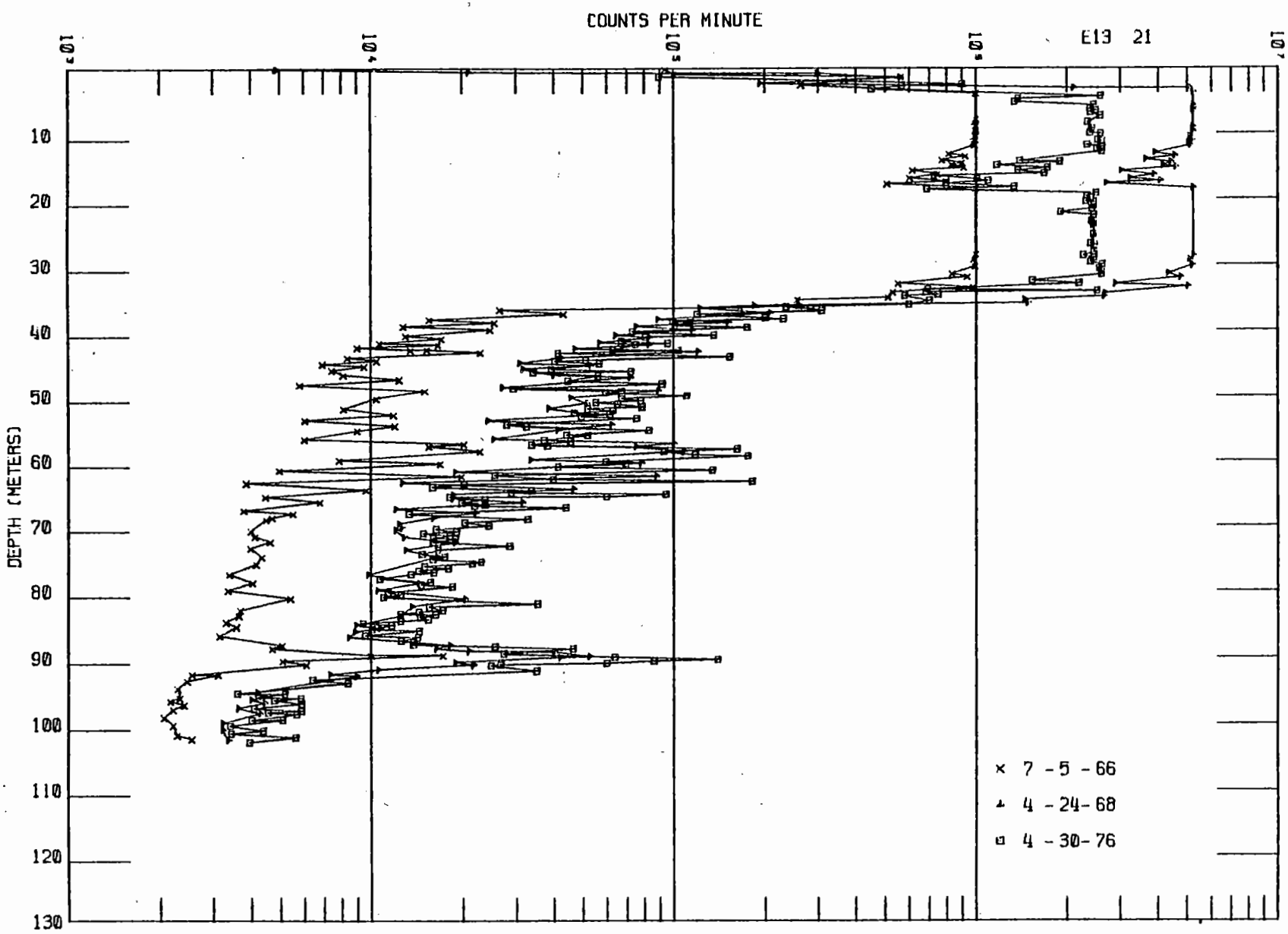

COUNTS PER MINUTE
E13 17
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 27- 59
□ 5 - 3 - 76


COUNTS PER MINUTE
E13 18
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
+ 5 - 2 - 58
* 5 - 27- 59


COUNTS PER MINUTE
E13 18
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 13- 69
▲ 4 - 24- 68
▫ 5 - 3 - 76


COUNTS PER MINUTE
E13 19
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
+ 4 - 21- 58
* 5 - 26- 59


COUNTS PER MINUTE
E13 19
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 13- 63
▲ 4 - 24- 68
▫ 12- 3 - 76


COUNTS PER MINUTE
E13 21
DEPTH (METERS)
10
20
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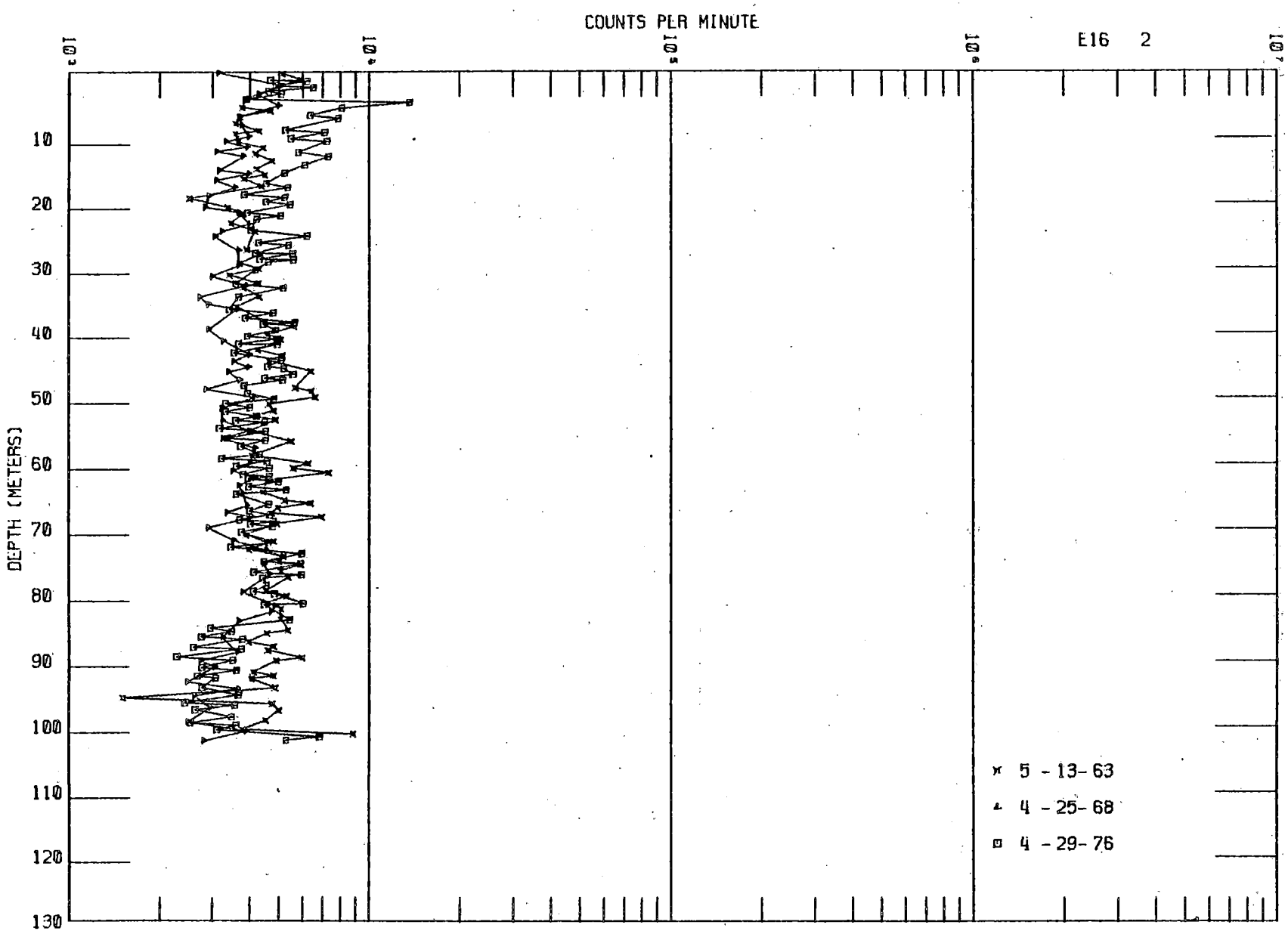
50
60
70
80
90
100
110
120
130
× 7 - 5 - 66
▲ 4 - 24- 68
□ 4 - 30- 76


COUNTS PER MINUTE
E16 2
DEPTH (METERS)
10
20
30
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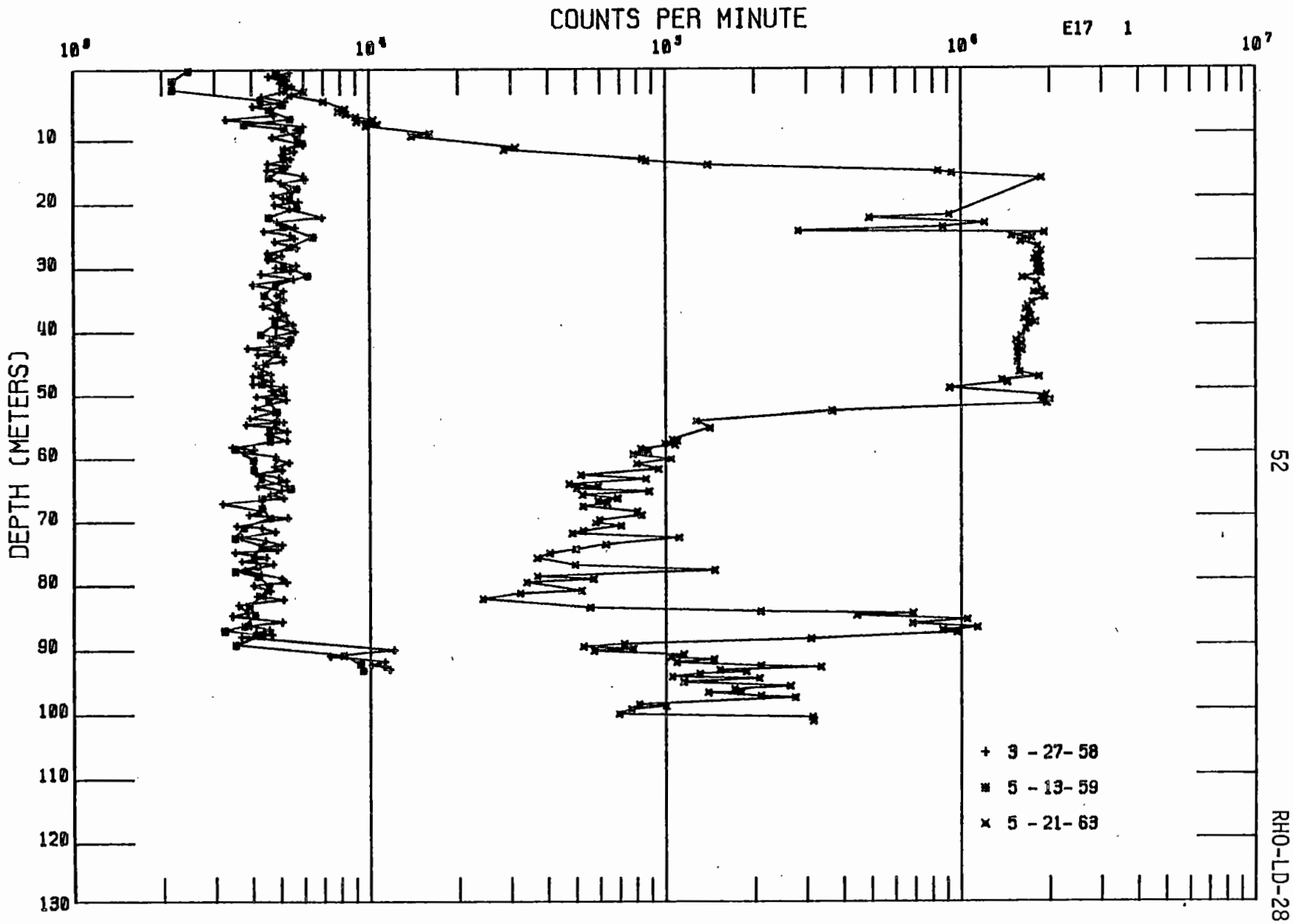
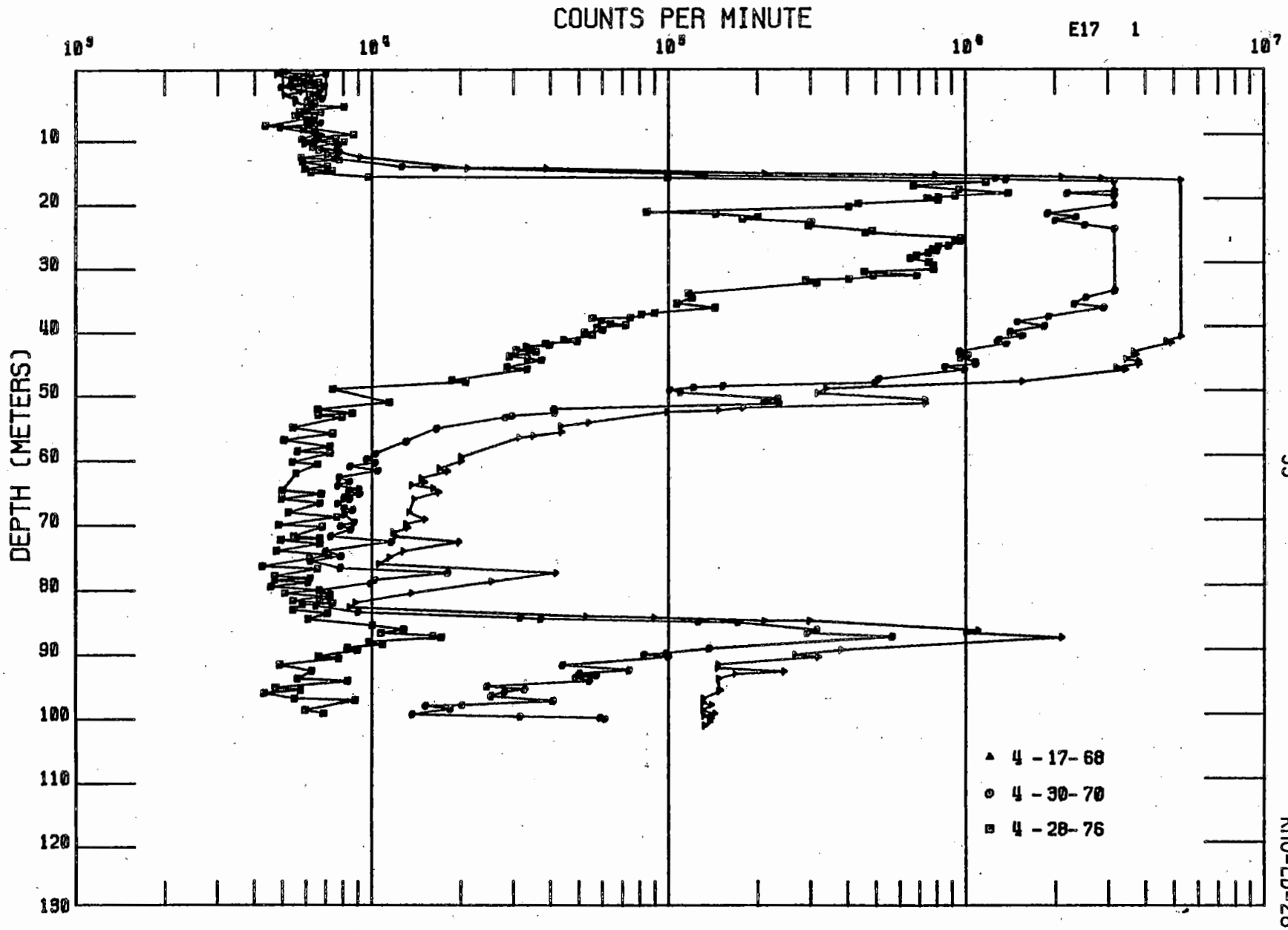
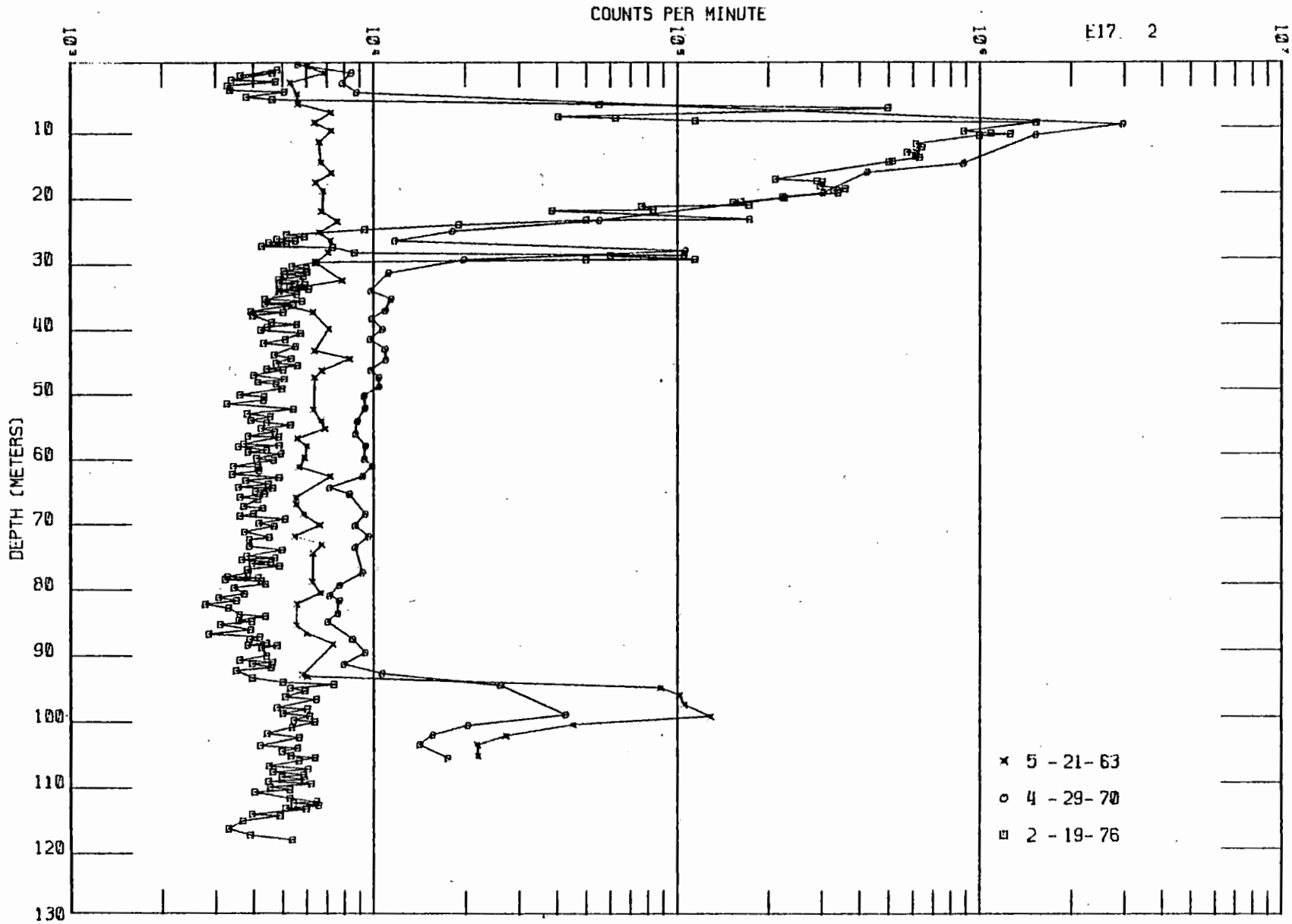
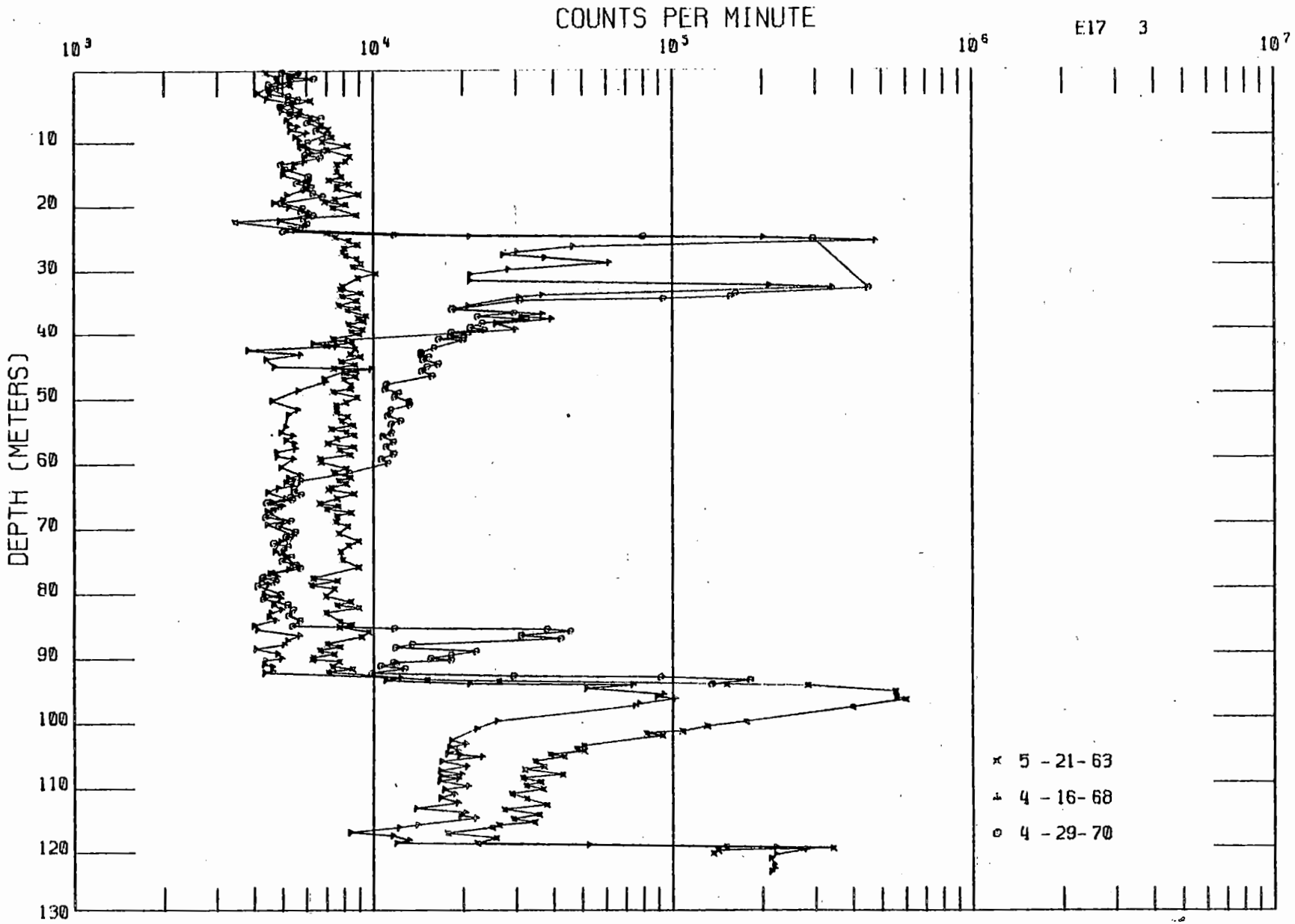
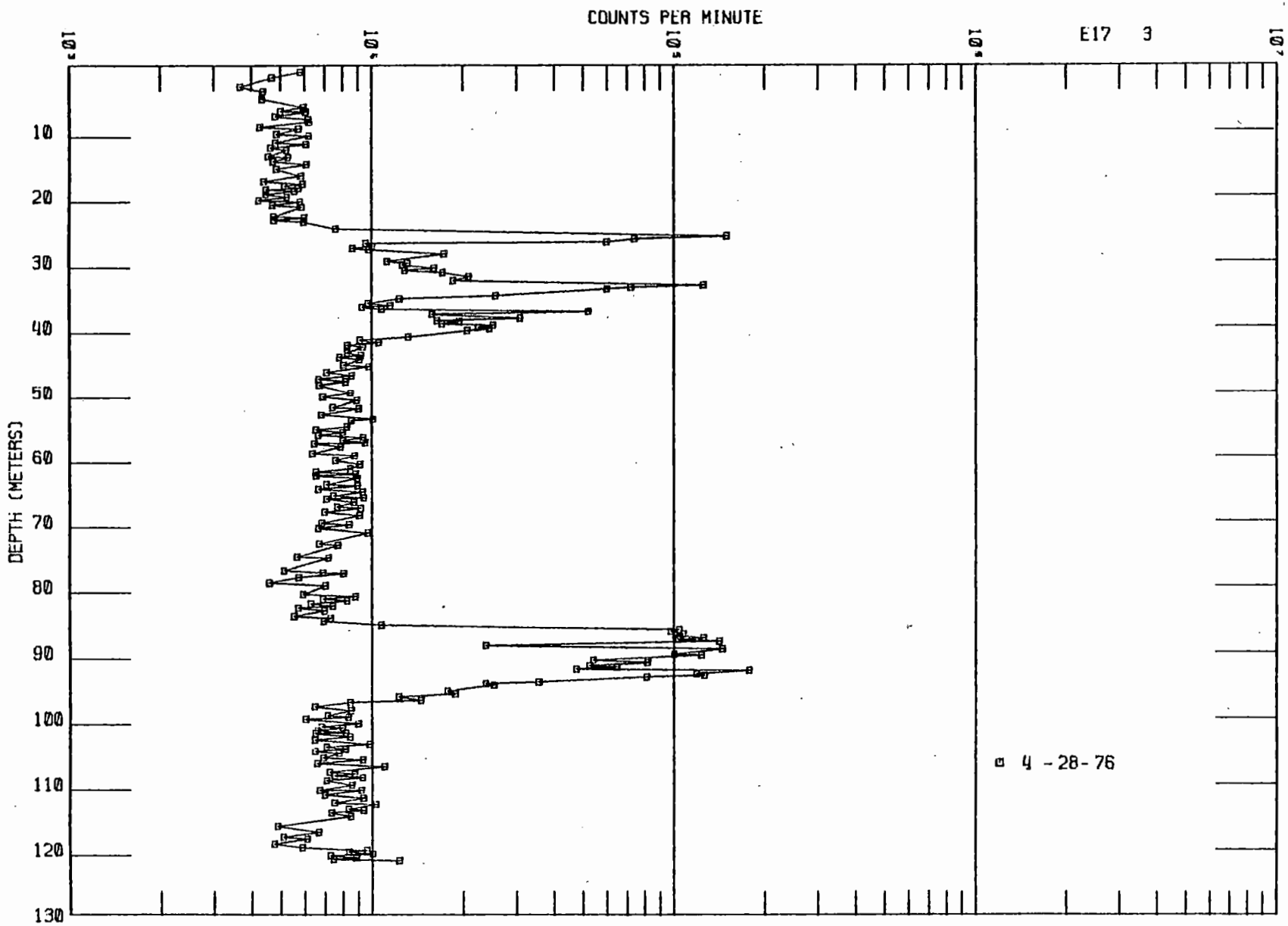
50
60
70
80
90
100
110
120
130
5 - 13- 63
4 - 25- 68
4 - 29- 76

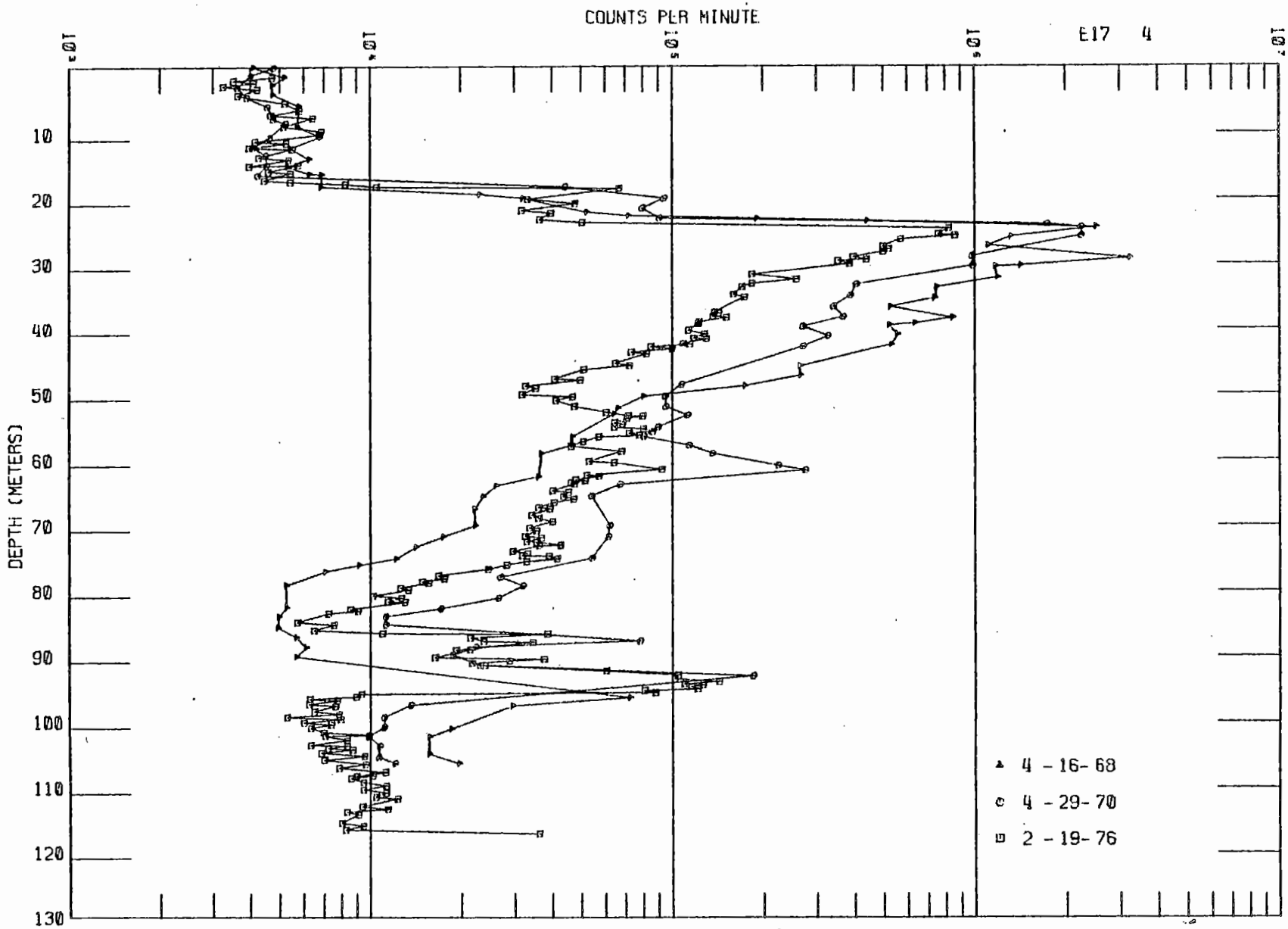

COUNTS PER MINUTE
E17 1
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
+ 3 - 27- 58
■ 5 - 13- 59
× 5 - 21- 63

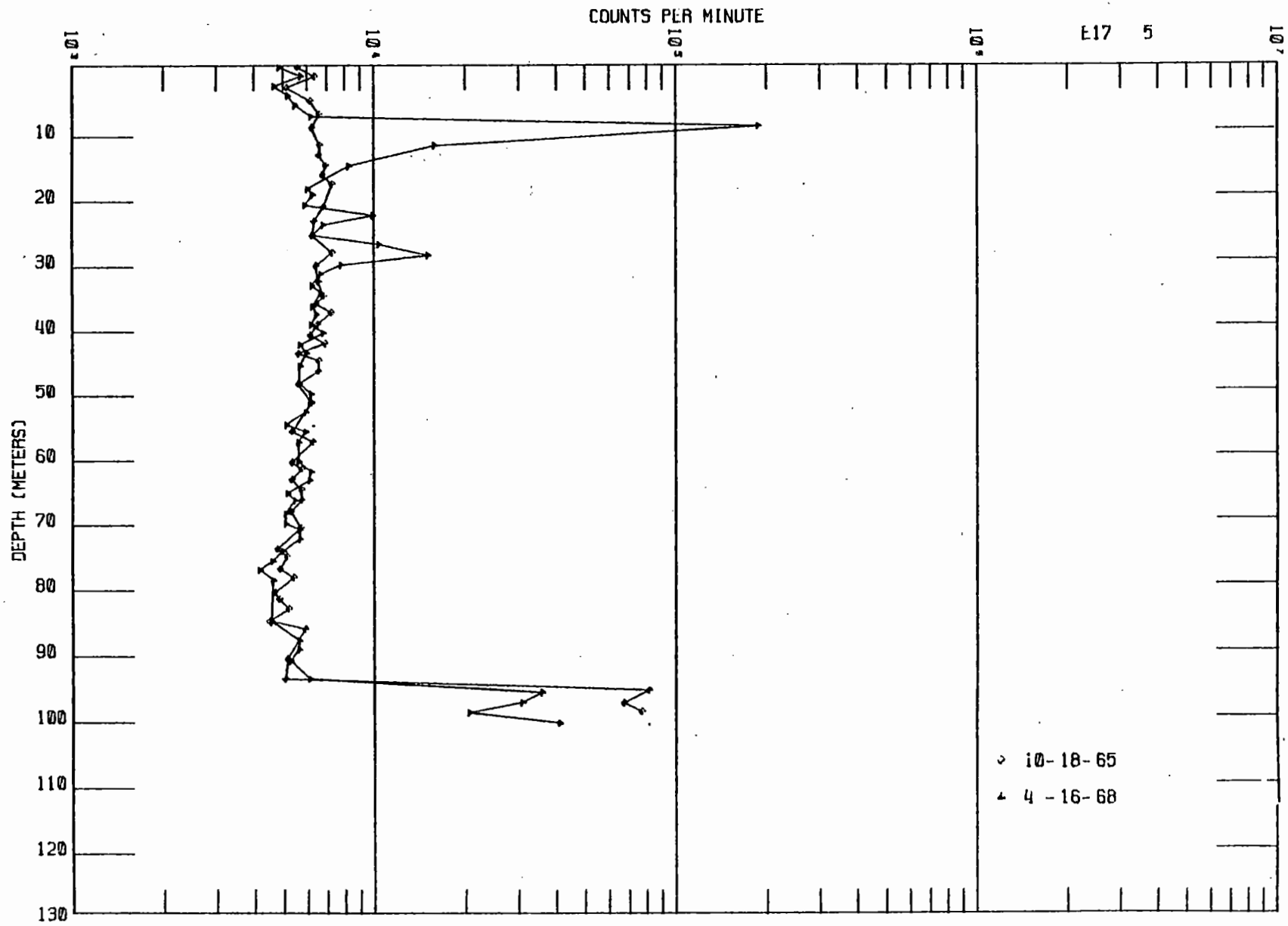

COUNTS PER MINUTE
E17 1
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
4 - 17- 68
4 - 30- 70
4 - 28- 76


COUNTS PER MINUTE
E17. 2
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 21- 63
○ 4 - 29- 70
□ 2 - 19- 76


COUNTS PER MINUTE
E17 3
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 21- 63
+ 4 - 16- 68
o 4 - 29- 70


COUNTS PER MINUTE
E17 3
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
4 -28-76


COUNTS PER MINUTE
E17 4
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
4 - 16- 68
4 - 29- 70
2 - 19- 76


COUNTS PER MINUTE
E17 5
DEPTH (METERS)
10
20
30
40
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80
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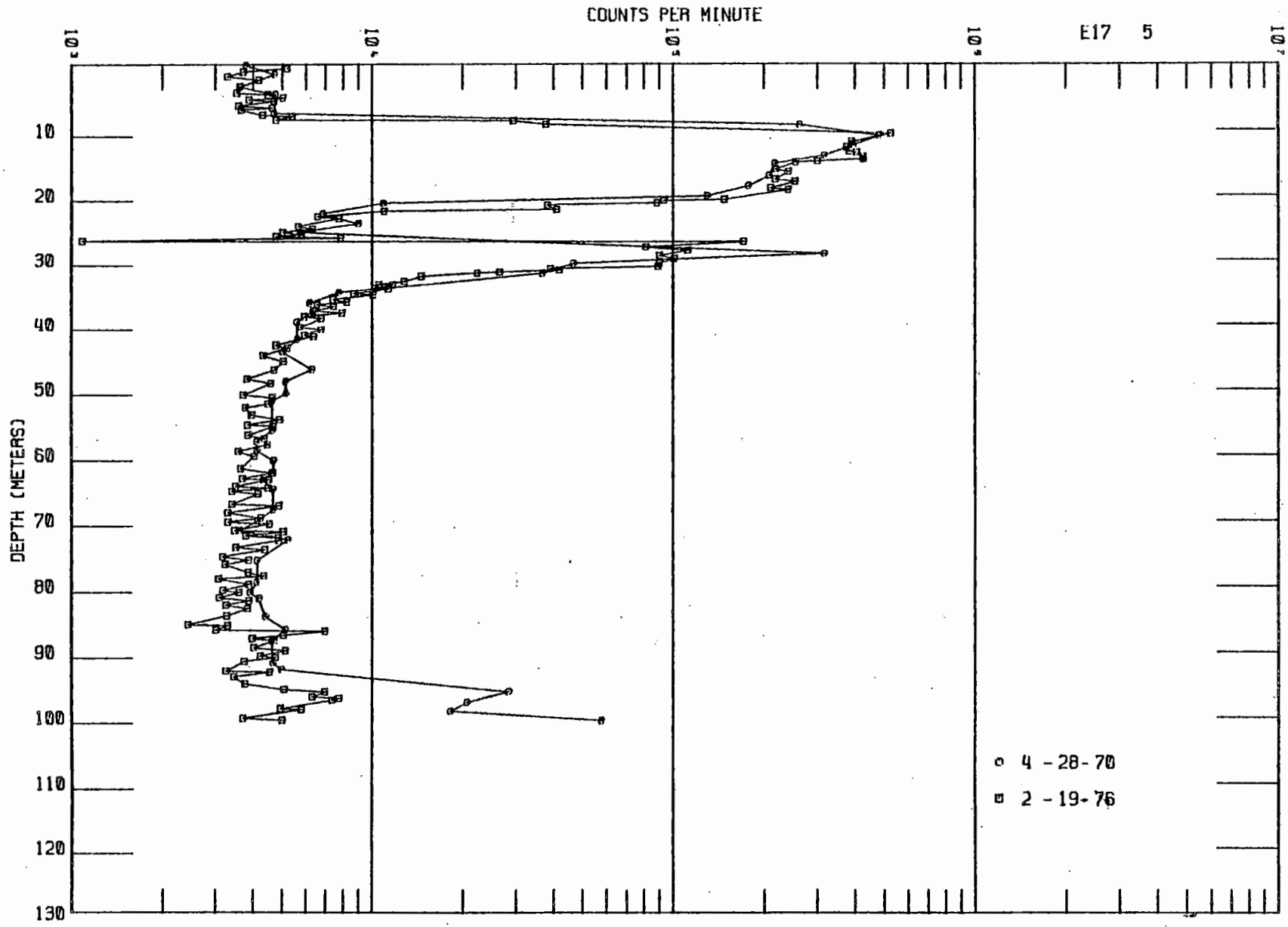
100
110
120
130
10- 18- 65
4 - 16- 68


COUNTS PER MINUTE
E17 5
DEPTH (METERS)
10
20
30
40
50
60
70
80
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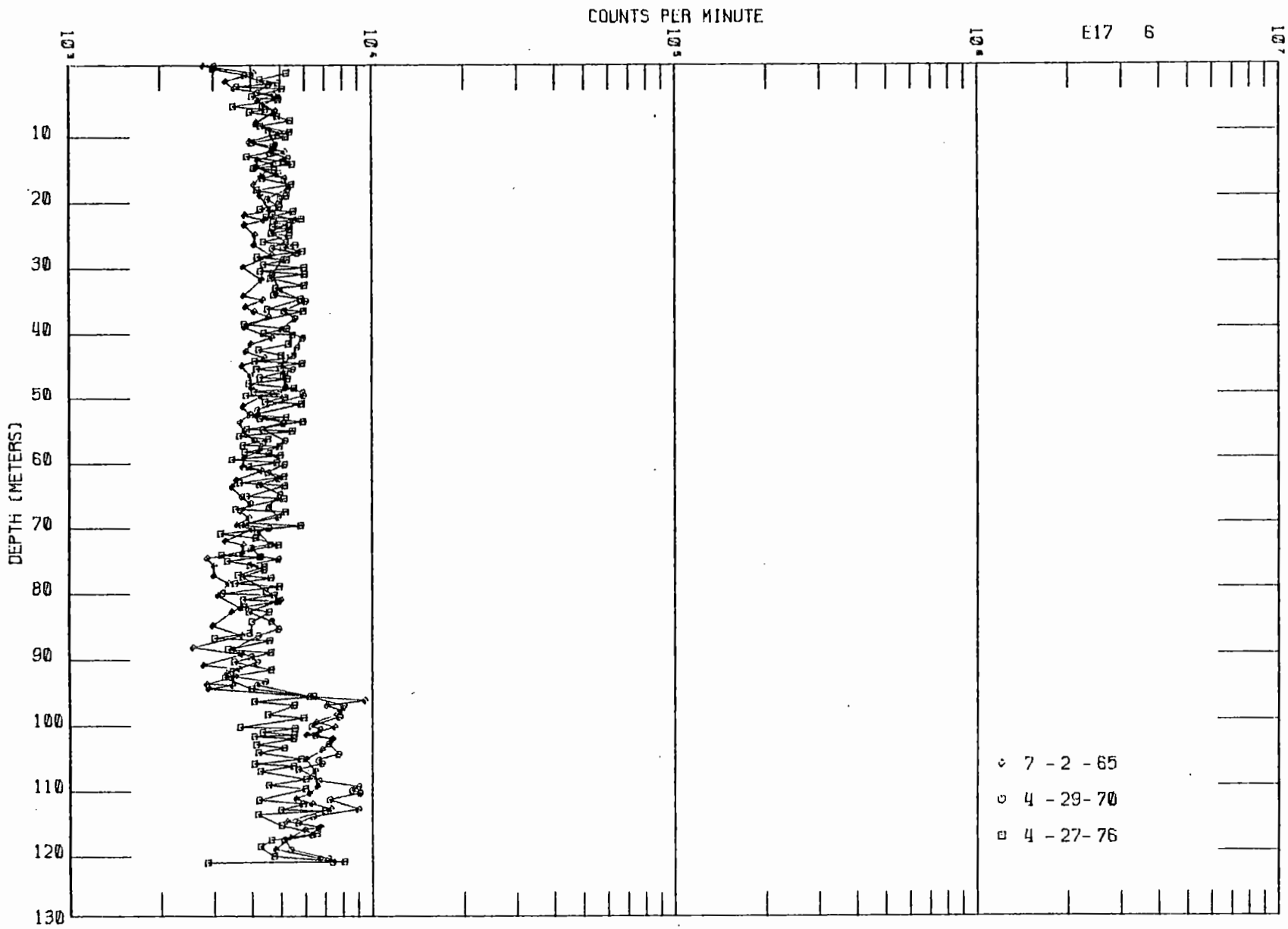
100
110
120
130
4 -28-70
2 -19-76


COUNTS PER MINUTE
10³
10⁴
10⁵
10⁶
10⁷
E17 6
DEPTH (METERS)
10
20
30
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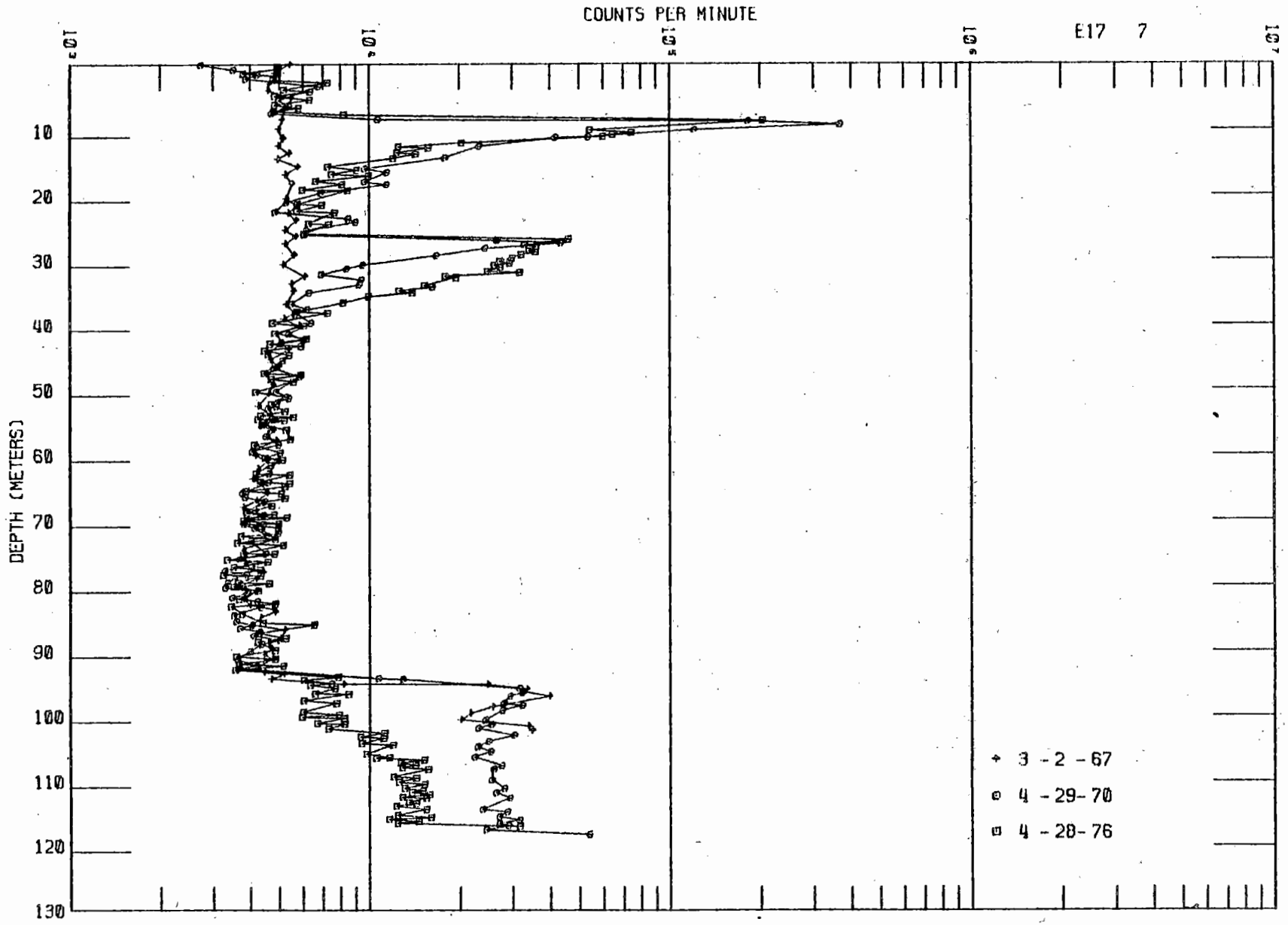
130
7 - 2 - 65
4 - 29- 70
4 - 27- 76


COUNTS PER MINUTE
E17 7
DEPTH (METERS)
10
20
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50
60
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80
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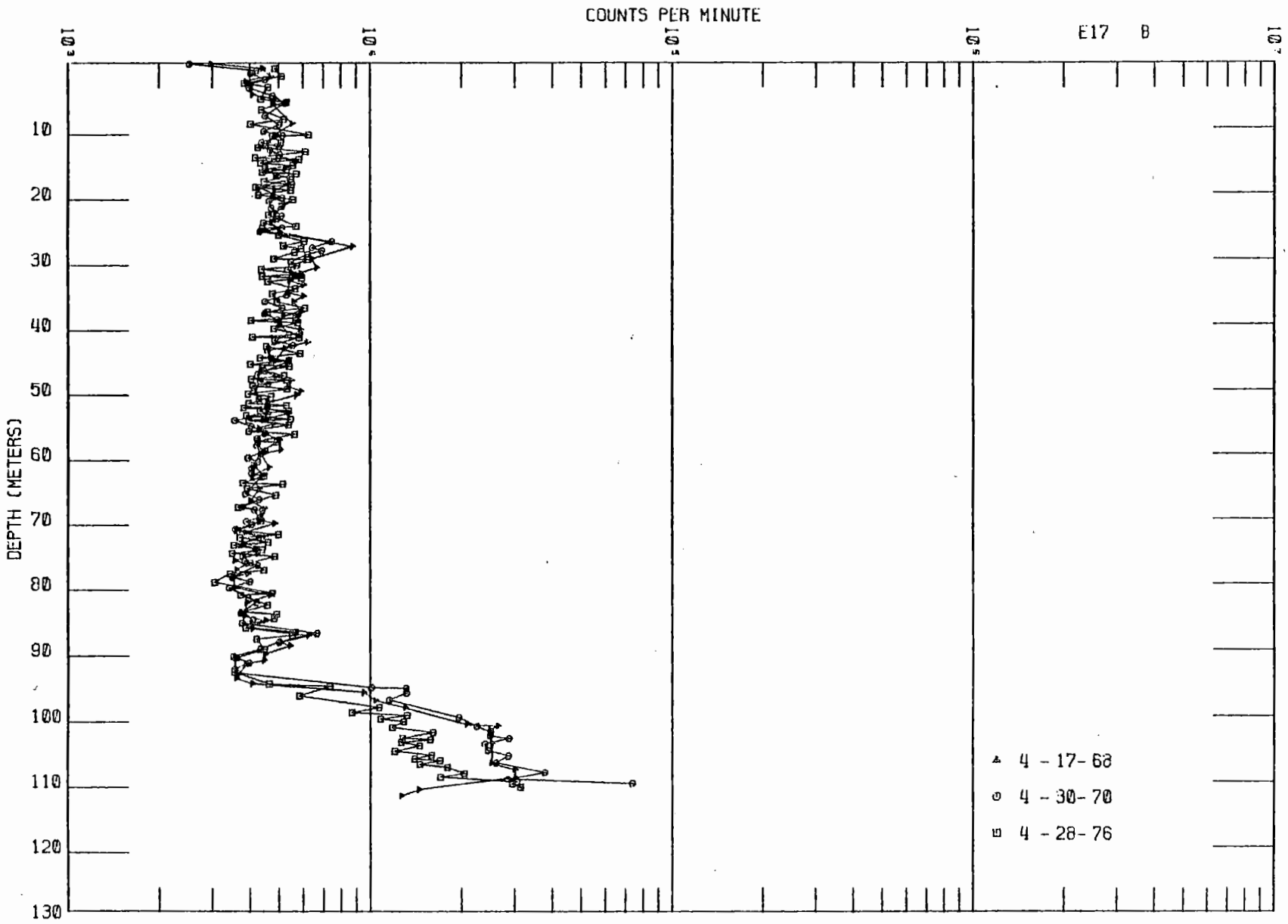
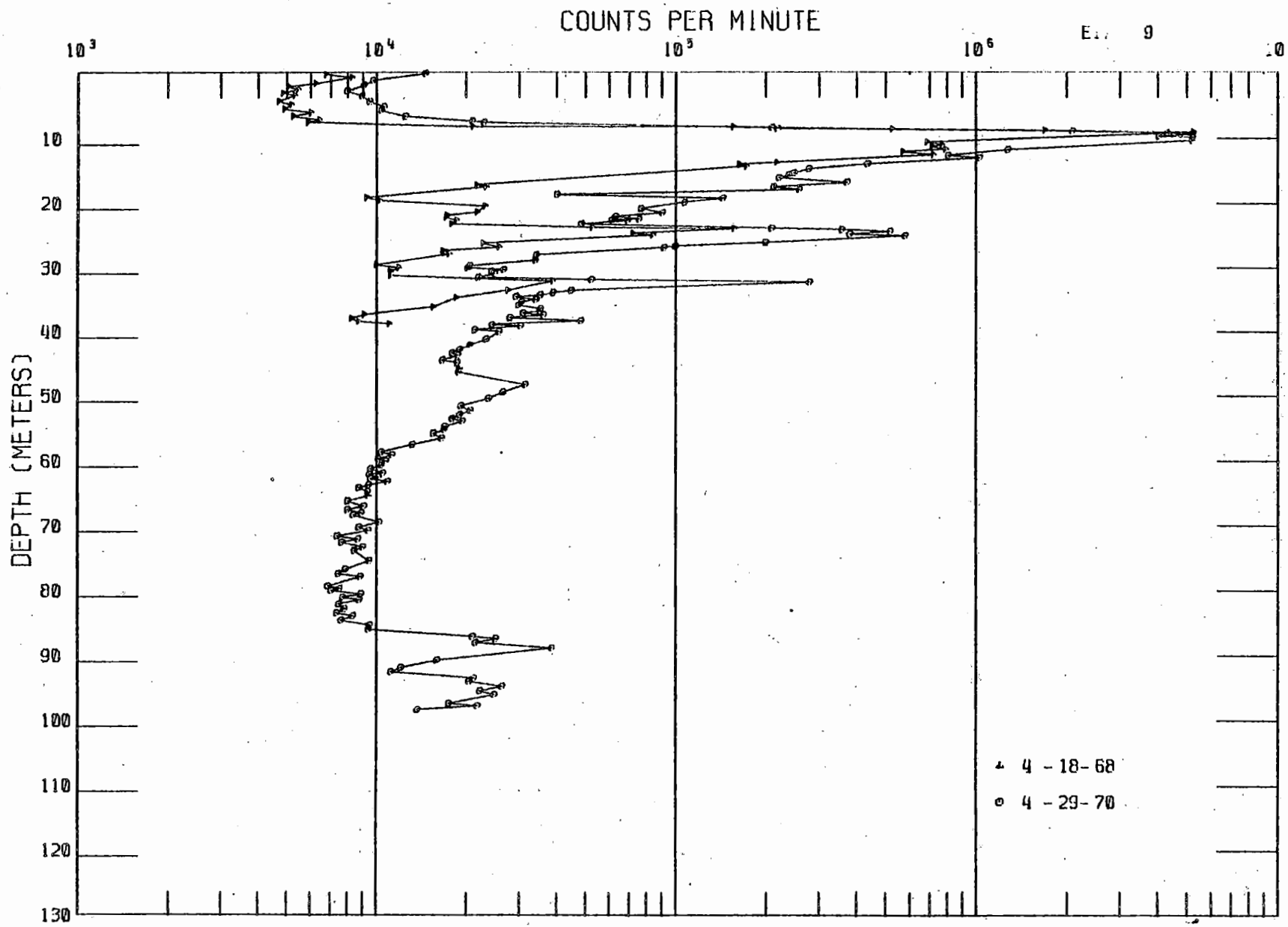
100
110
120
130
3 - 2 - 67
4 - 29- 70
4 - 28- 76


COUNTS PER MINUTE
E17 B
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
4 - 17- 68
4 - 30- 70
4 - 28- 76


COUNTS PER MINUTE
10^3
10^4
10^5
10^6
DEPTH (METERS)
10
20
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40
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60
70
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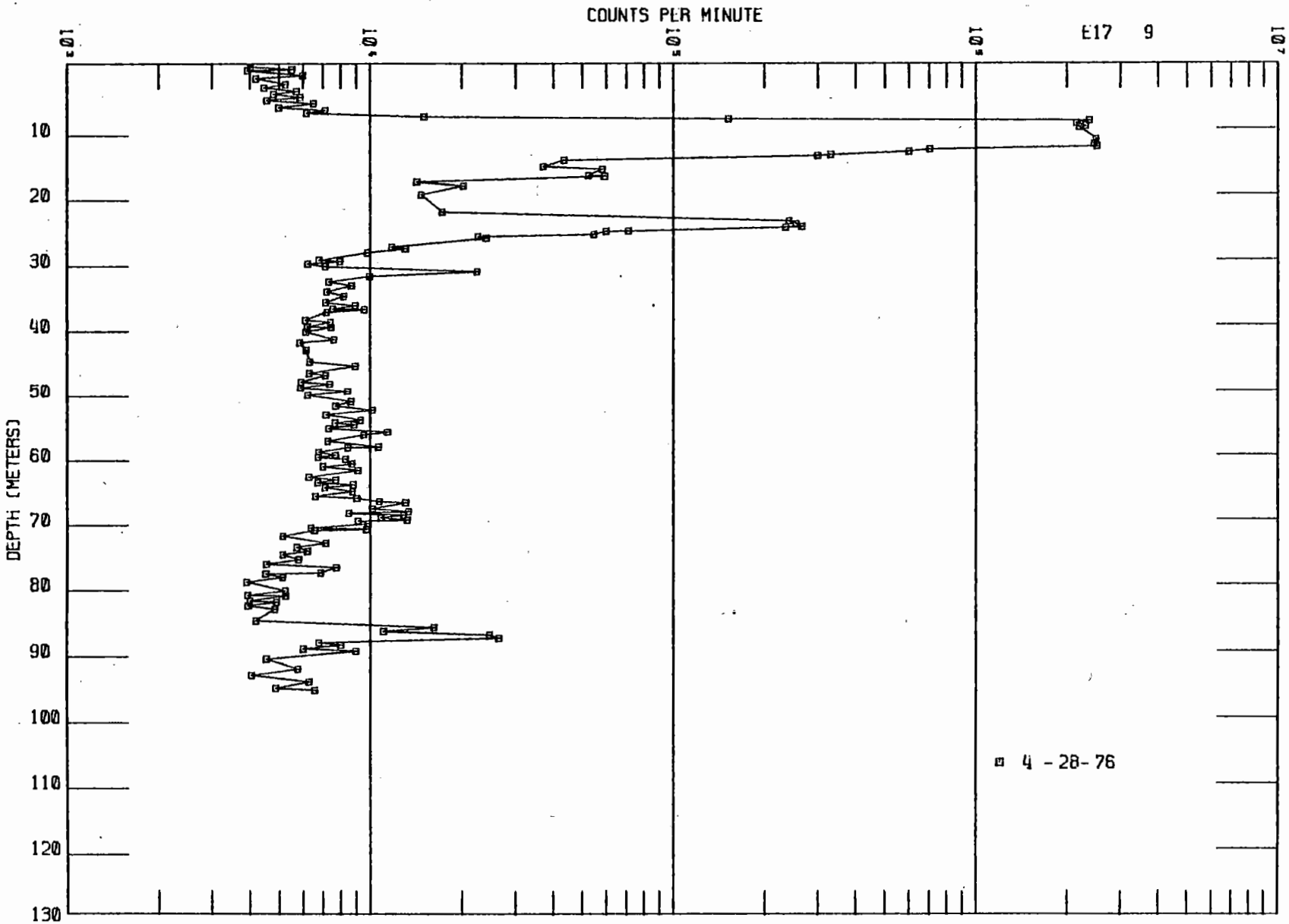
120
130
4 - 18- 68
4 - 29- 70


COUNTS PER MINUTE
E17 9
DEPTH (METERS)
10
20
30
40
50
60
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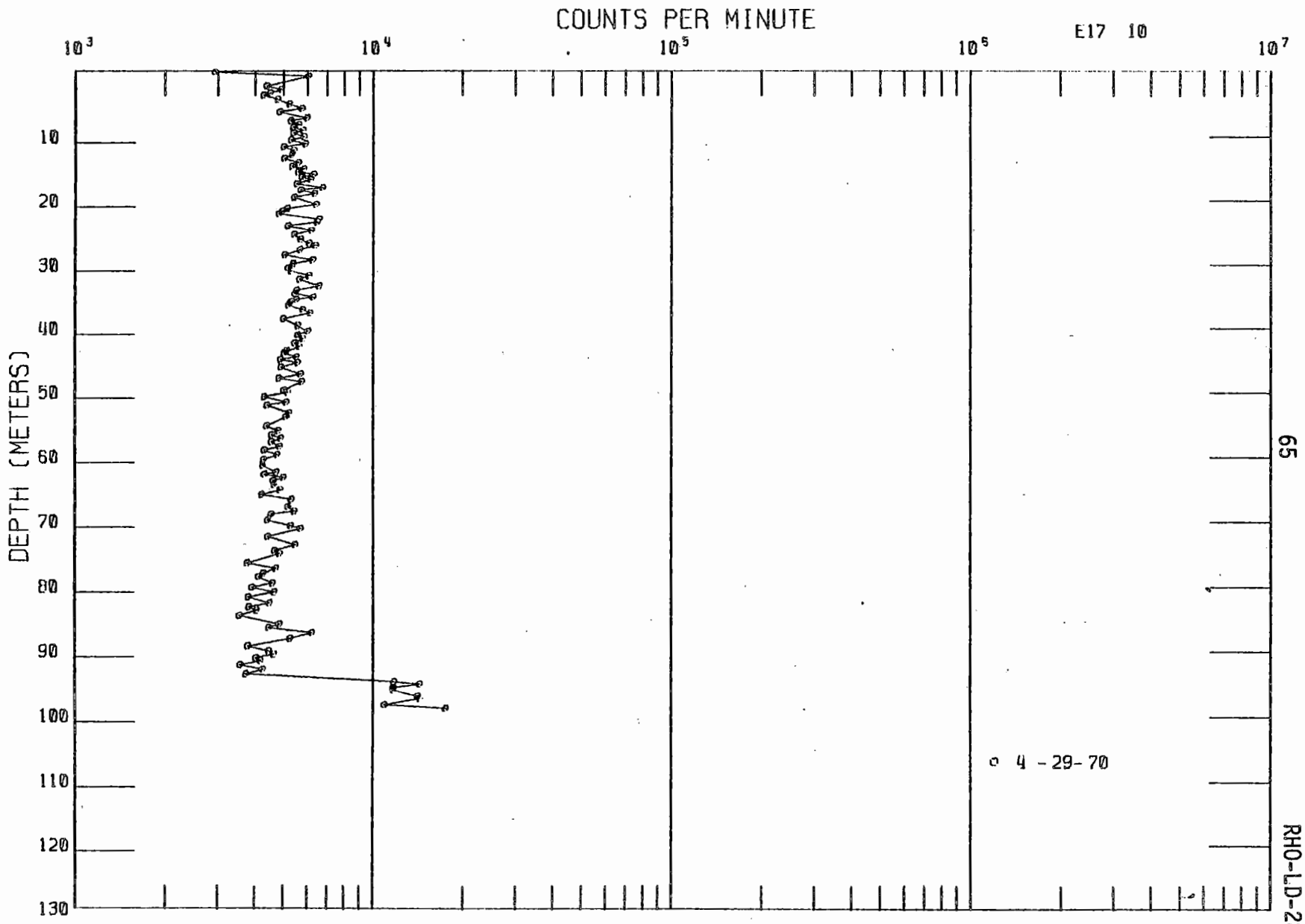
80
90
100
110
120
130
4 - 28- 76


COUNTS PER MINUTE
E17 10
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
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60
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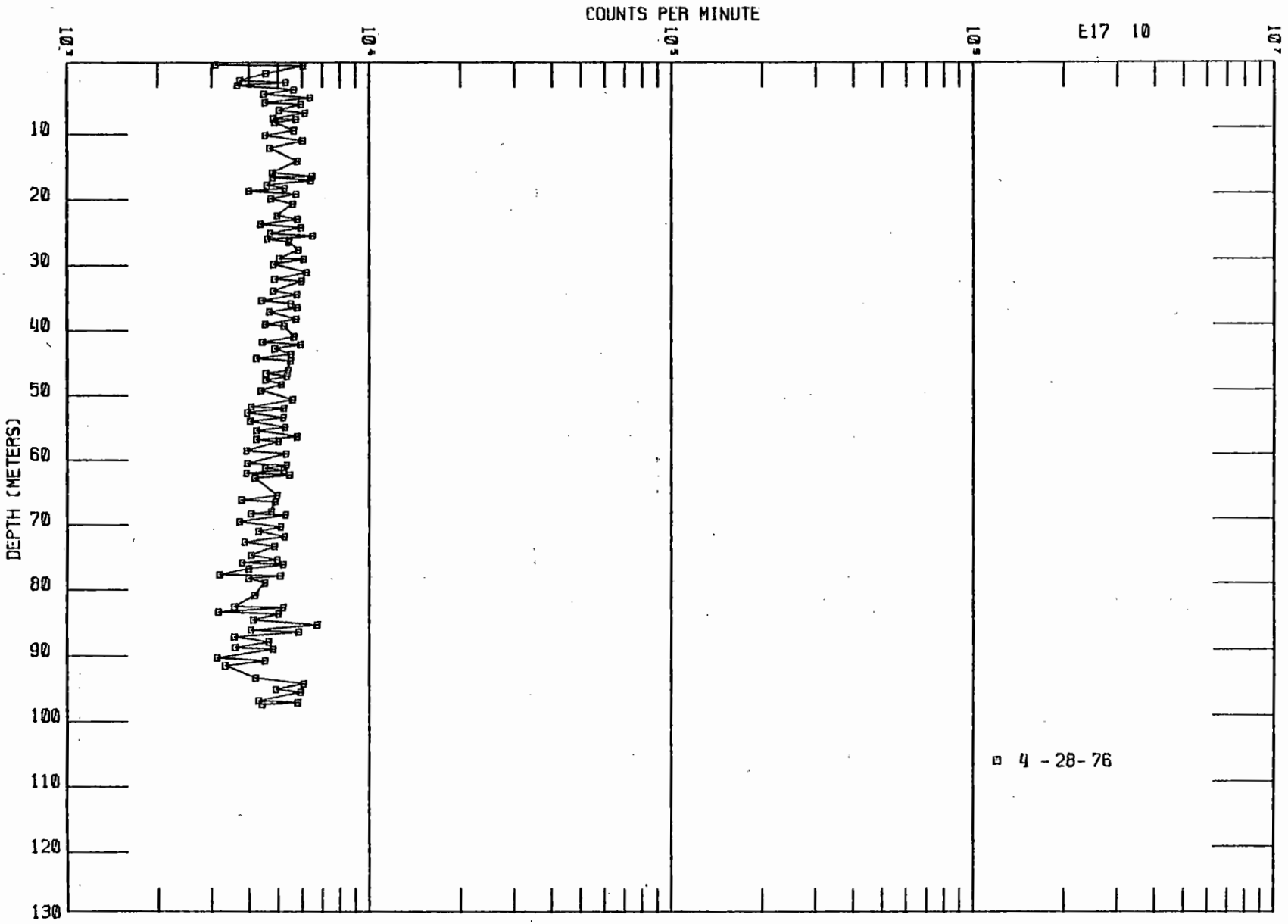
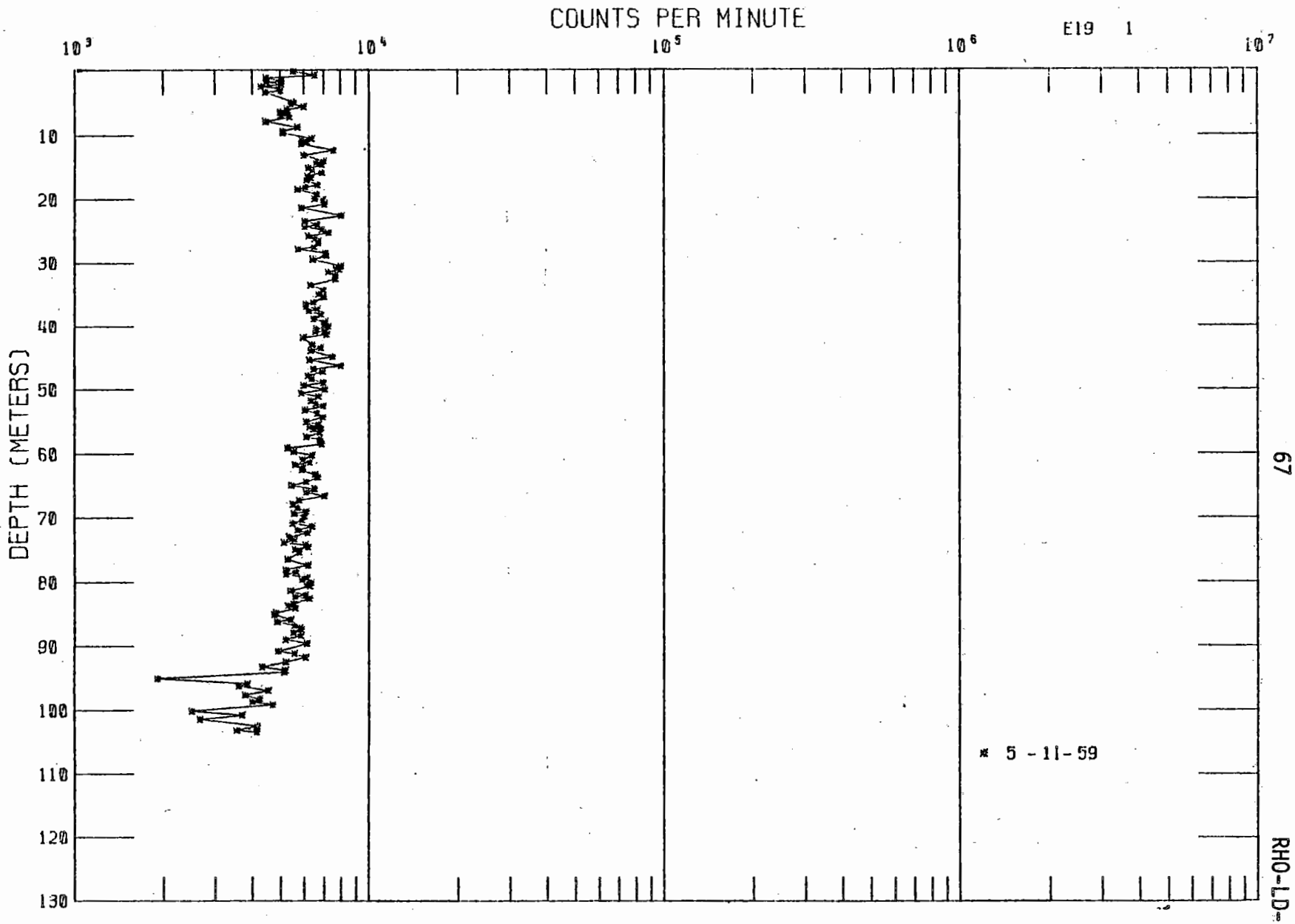
100
110
120
130
o 4-29-70


COUNTS PER MINUTE
E17 10
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
4 -28-76


COUNTS PER MINUTE
E19 1
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
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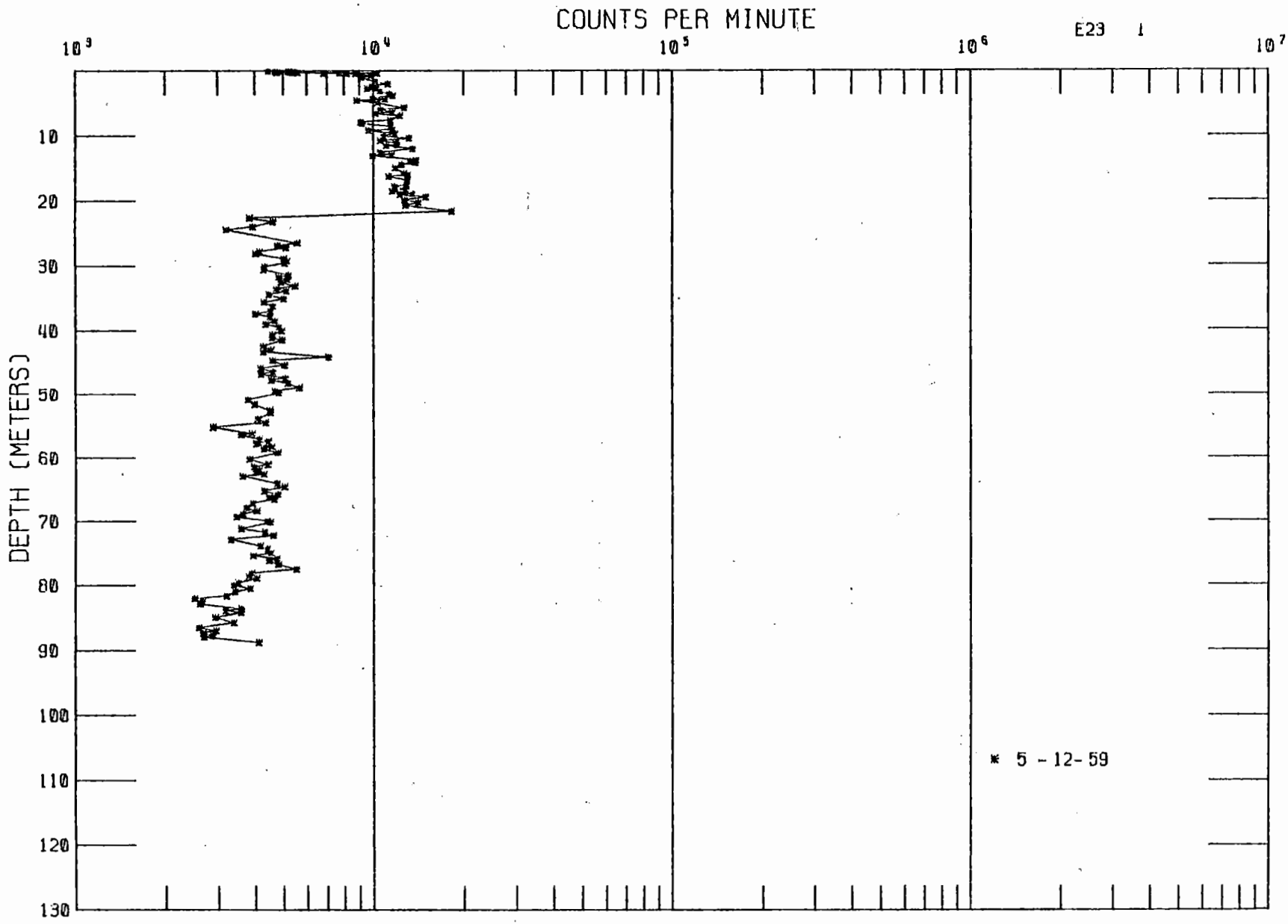
80
90
100
110
120
130
* 5 - 11 - 59


COUNTS PER MINUTE
E23 1
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
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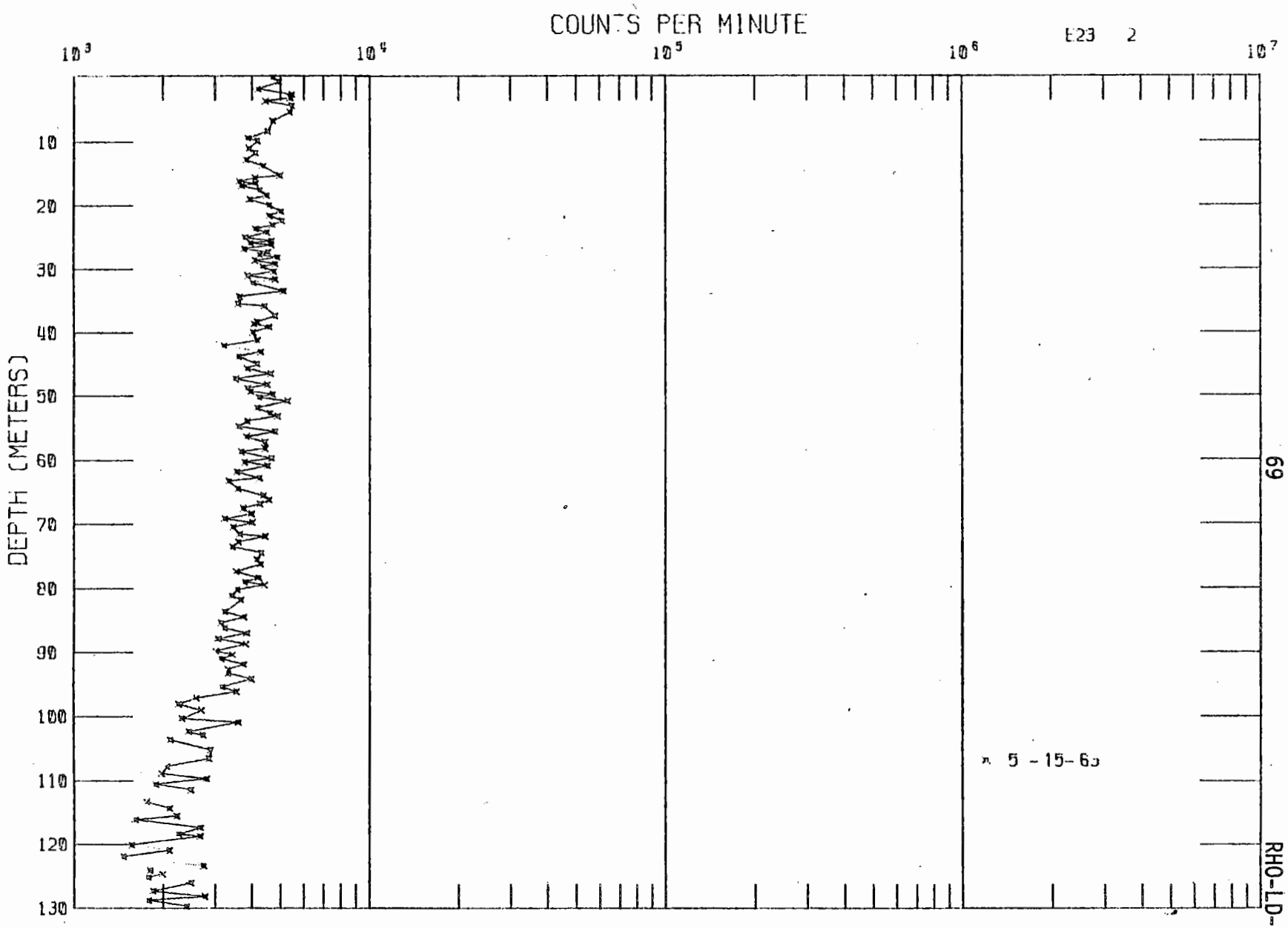
80
90
100
110
120
130
* 5 - 12- 59


COUNTS PER MINUTE
10^3
10^4
10^5
10^6
10^7
E23 2
DEPTH (METERS)
10
20
30
40
50
60
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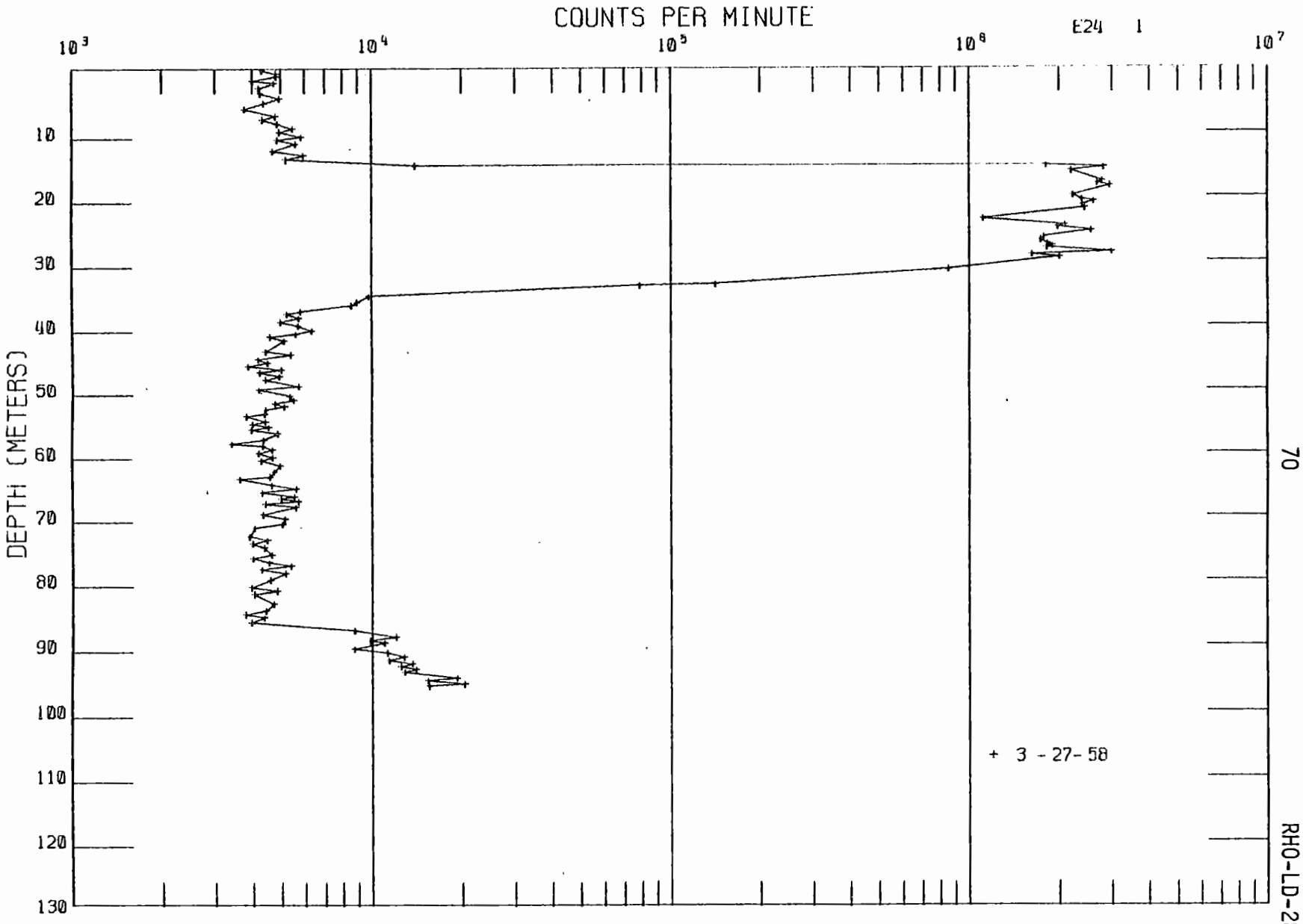
80
90
100
110
120
130
5 - 15- 65


COUNTS PER MINUTE
E24 1
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
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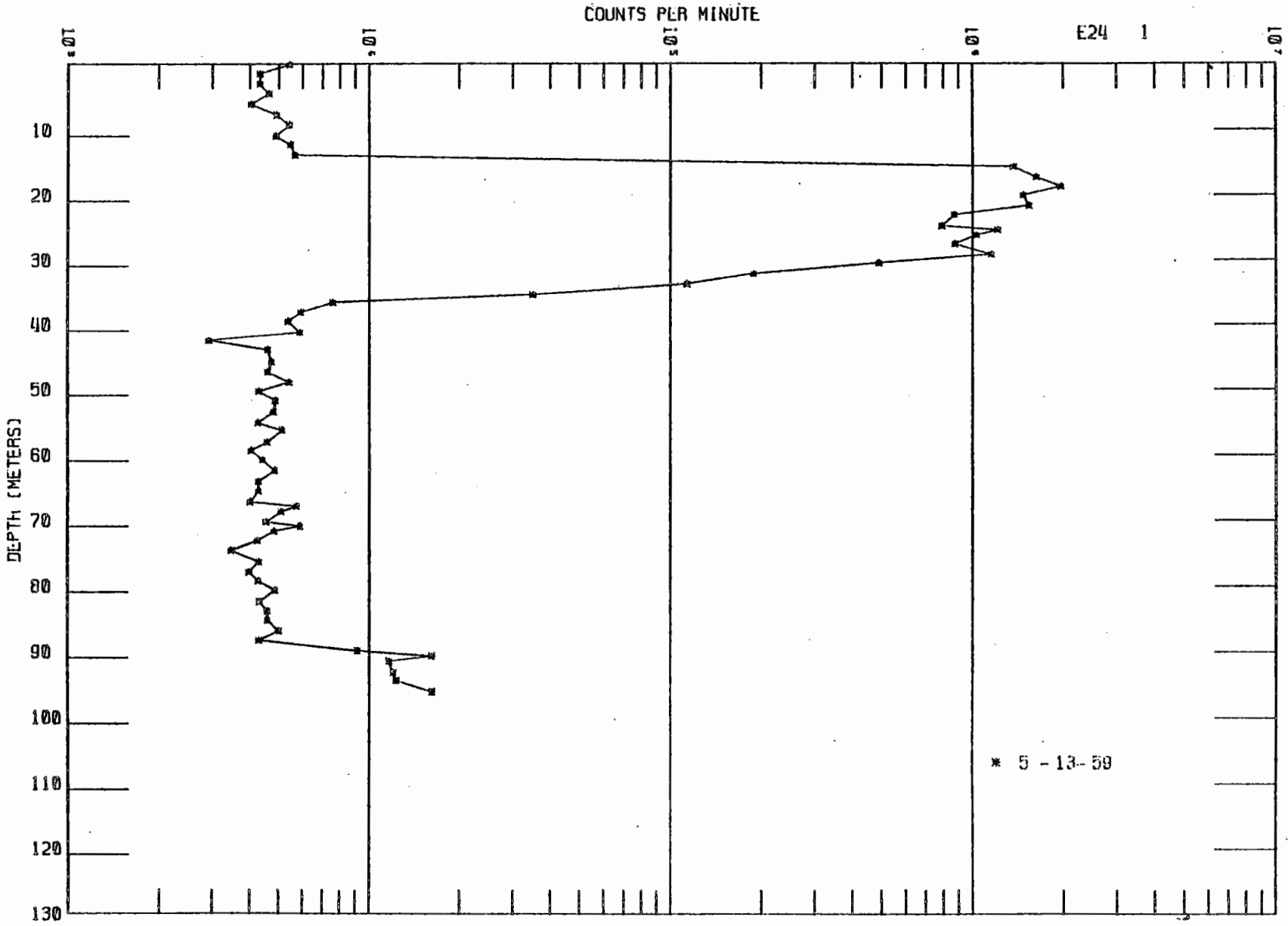
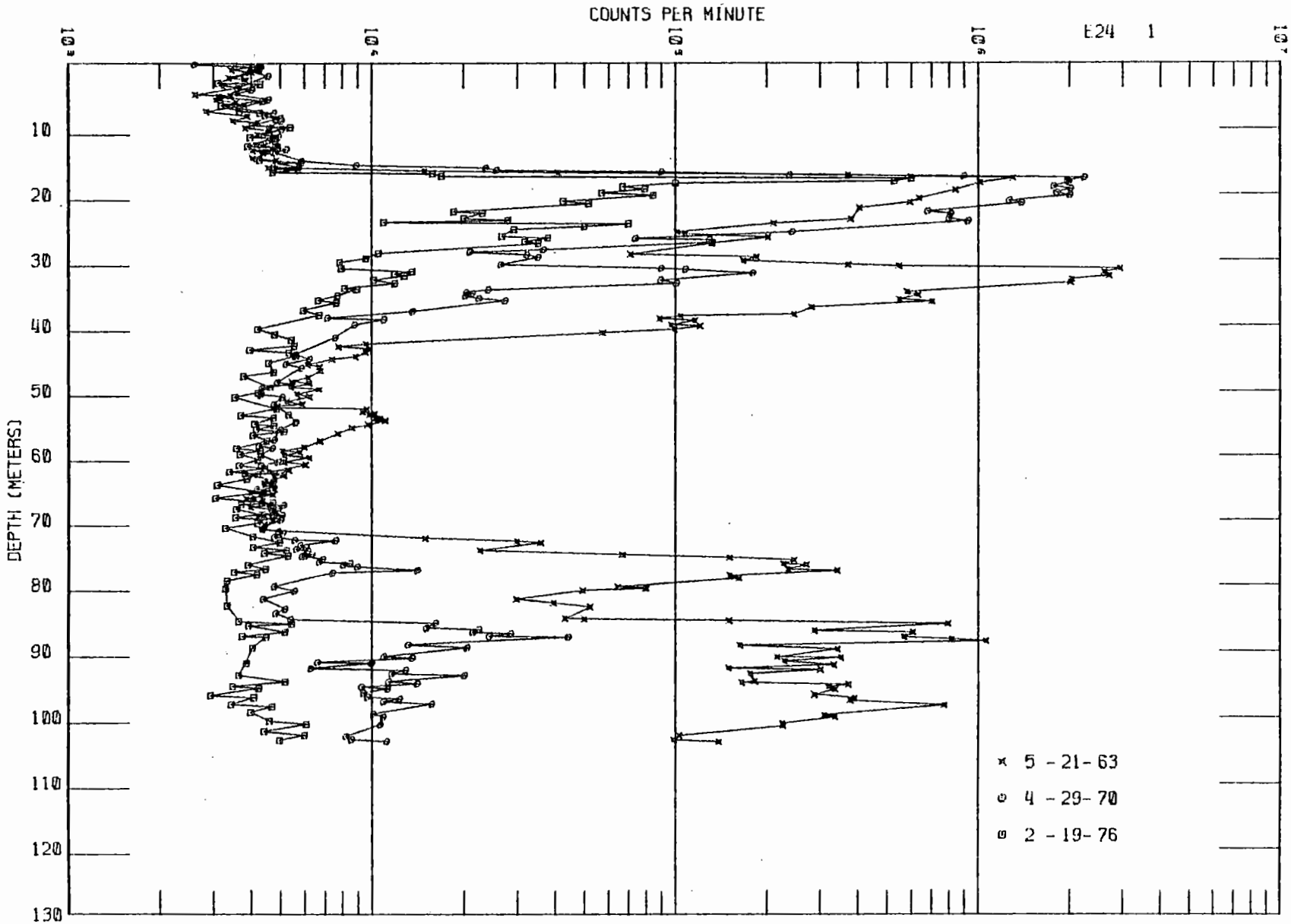
80
90
100
110
120
130
+ 3 - 27- 58


COUNTS PER MINUTE
E24 1
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
* 5 - 13- 59


COUNTS PER MINUTE
E24 1
DEPTH (METERS)
10
20
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40
50
60
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80
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100
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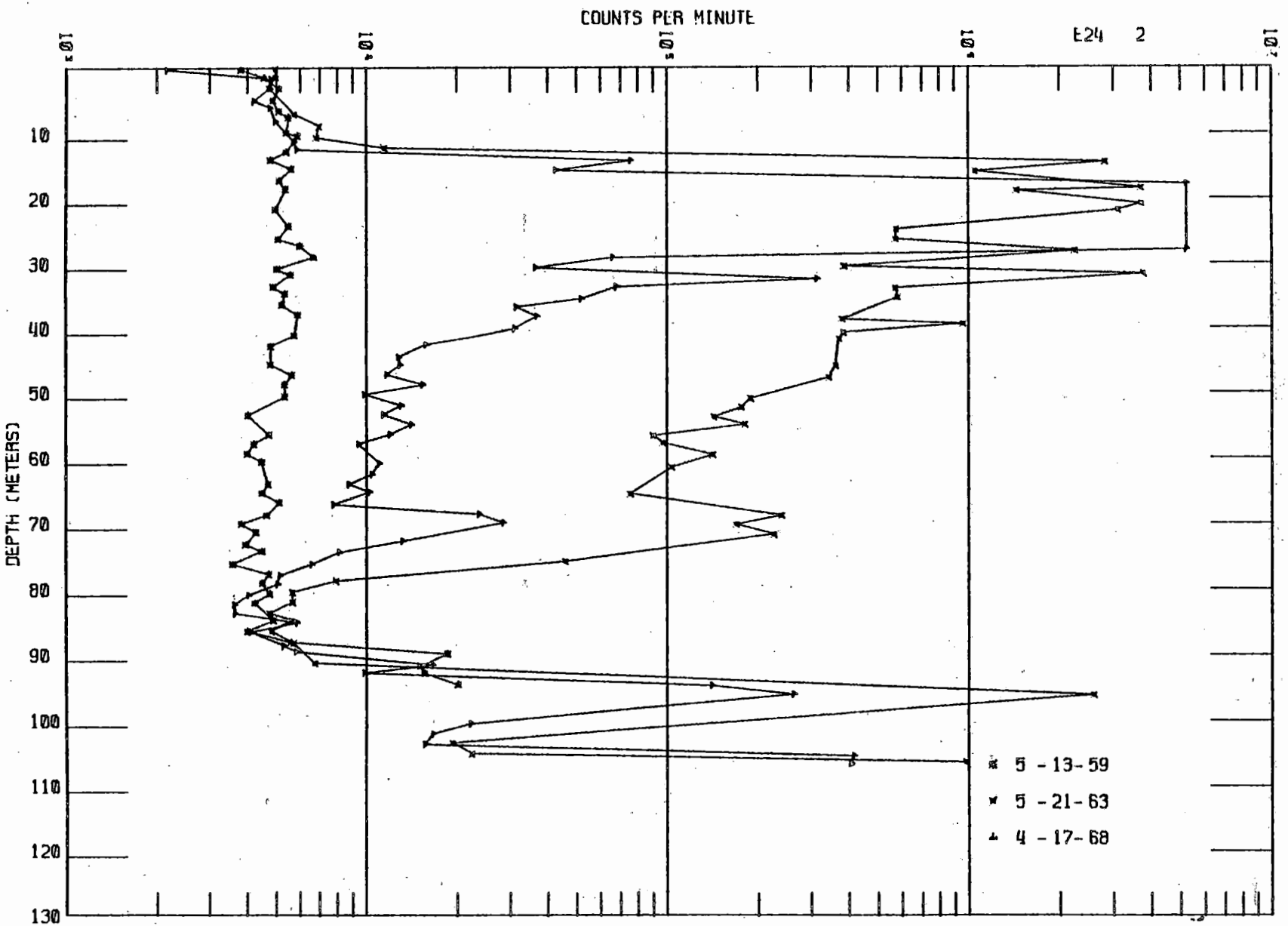
120
130
5 - 21 - 63
4 - 29 - 70
2 - 19 - 76


COUNTS PER MINUTE
E24 2
DEPTH (METERS)
10
20
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40
50
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80
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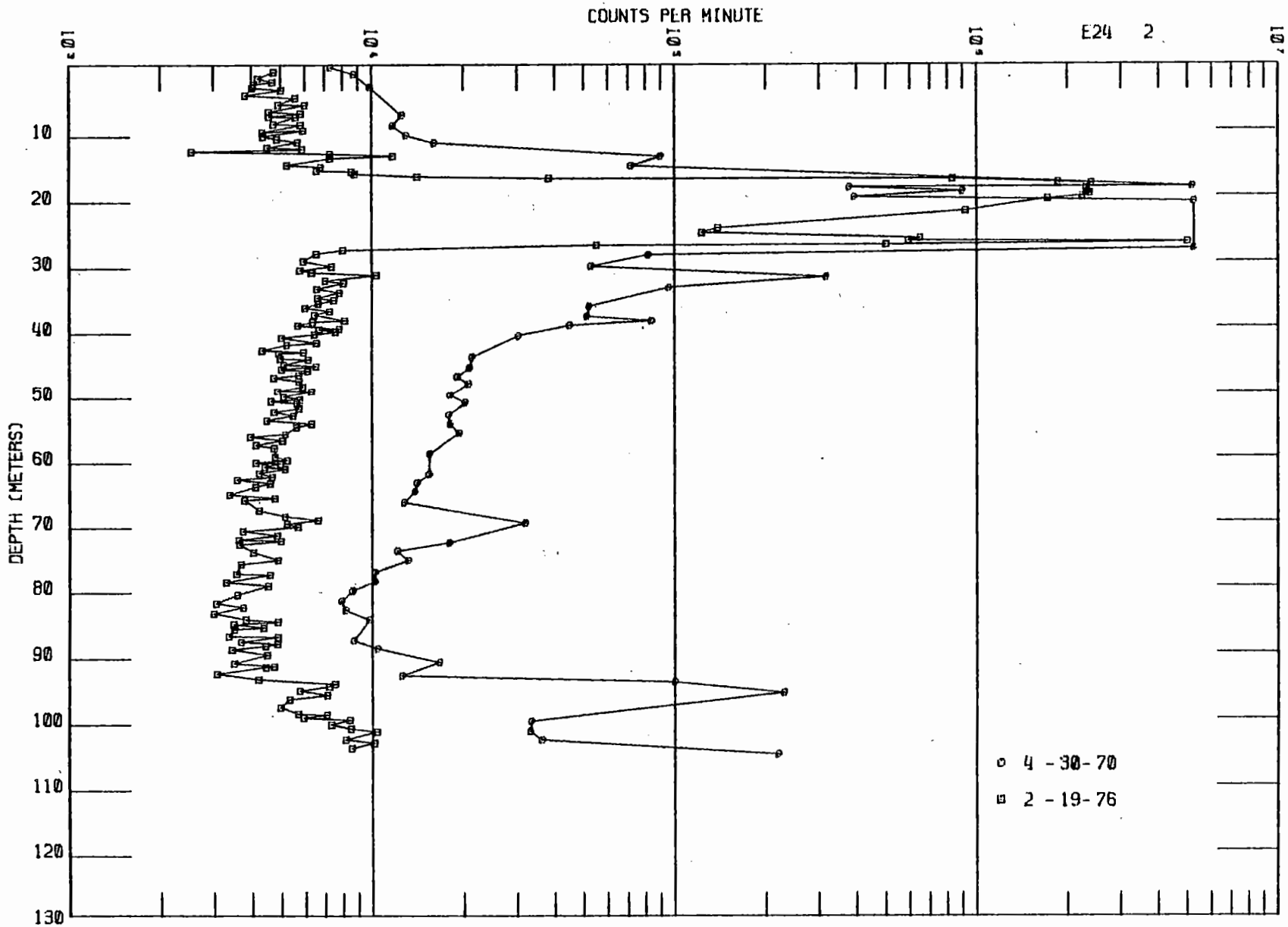
100
110
120
130
5 - 13 - 59
5 - 21 - 63
4 - 17 - 68


COUNTS PER MINUTE
E24 2
DEPTH (METERS)
10
20
30
40
50
60
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80
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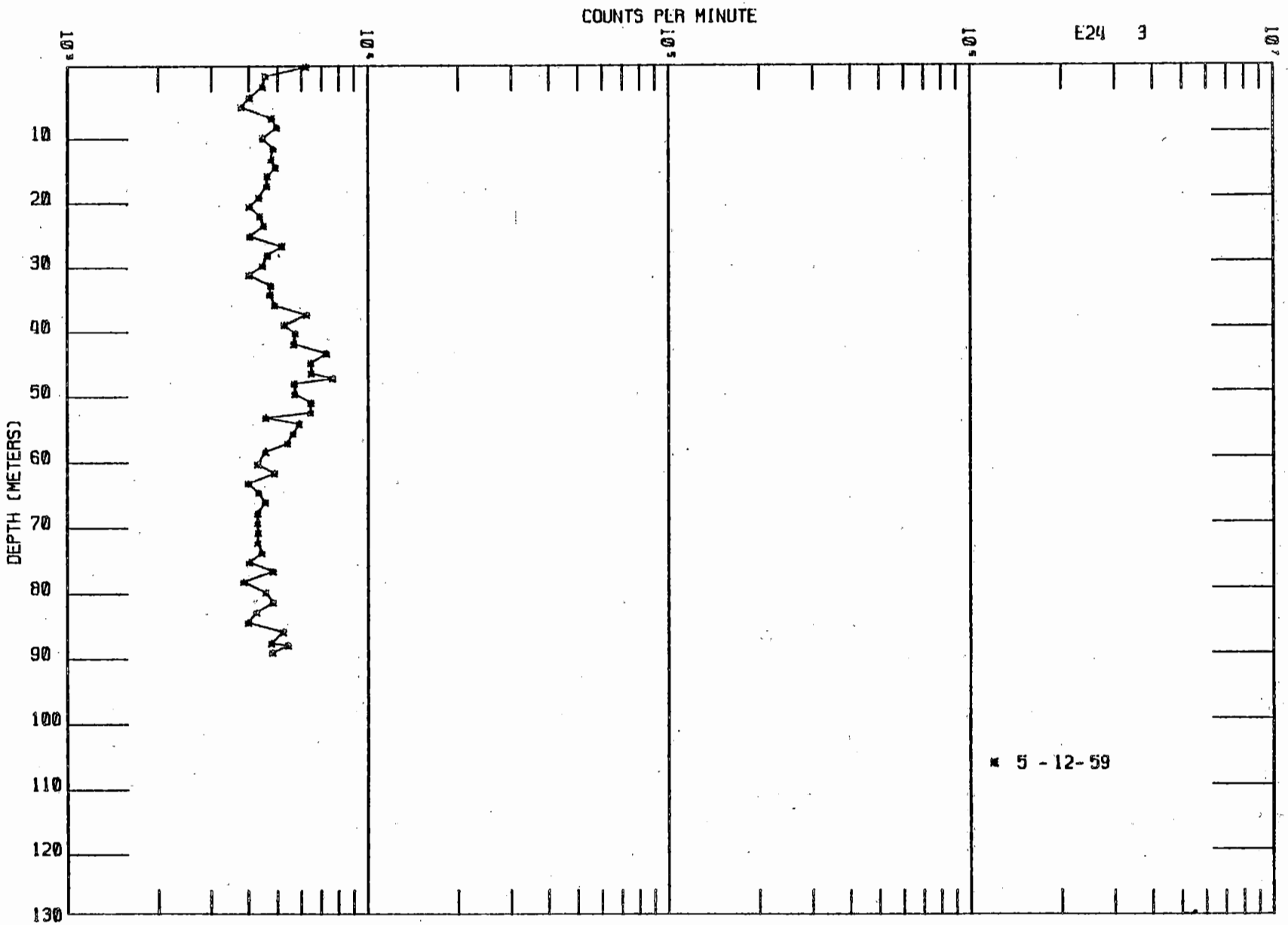
100
110
120
130
4 - 30 - 70
2 - 19 - 76


COUNTS PER MINUTE
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DEPTH (METERS)
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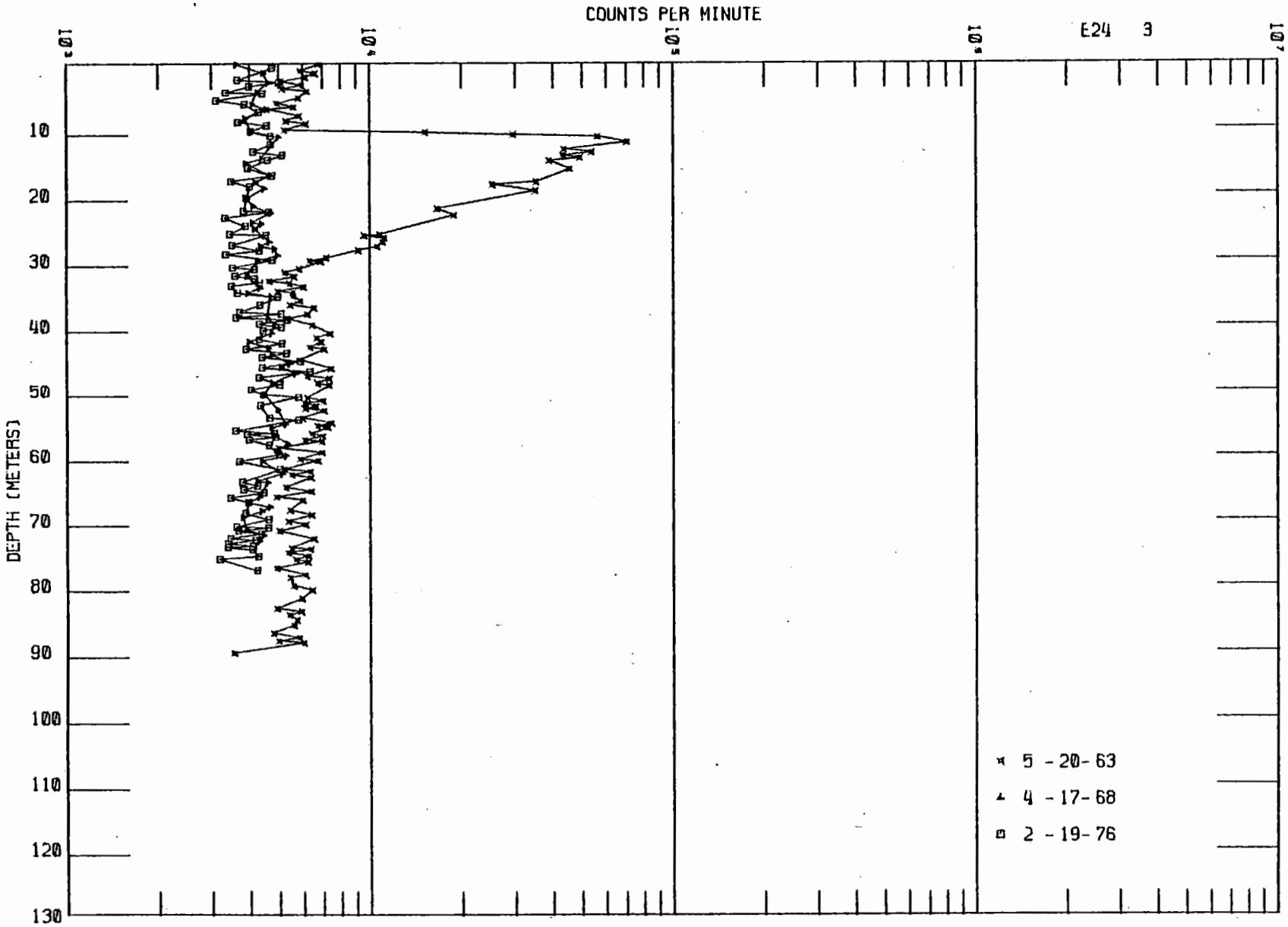
120
130
5 - 12- 59


COUNTS PER MINUTE
E24 3
DEPTH (METERS)
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130
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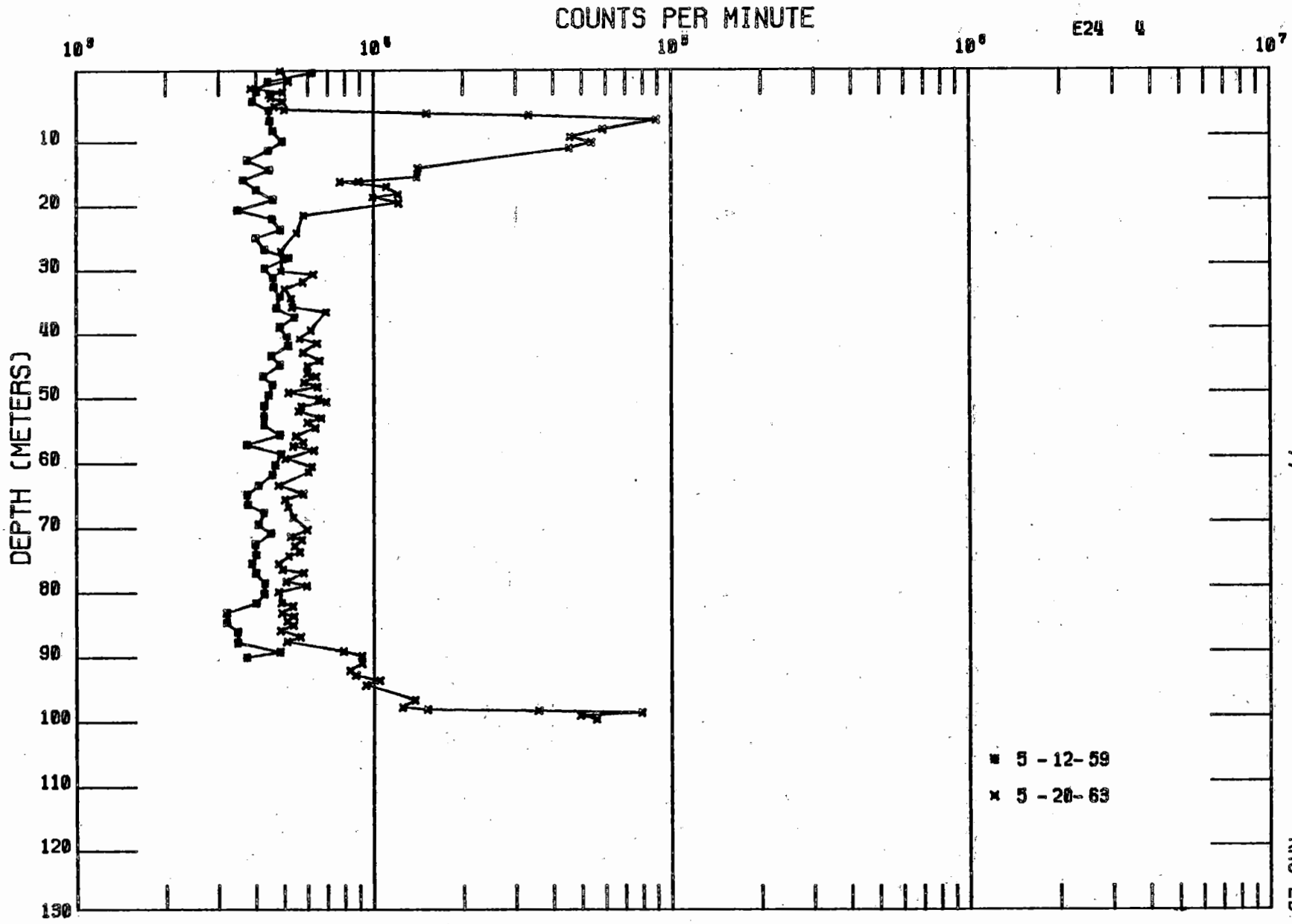
4 - 17- 68
2 - 19- 76


COUNTS PER MINUTE
E24 4
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
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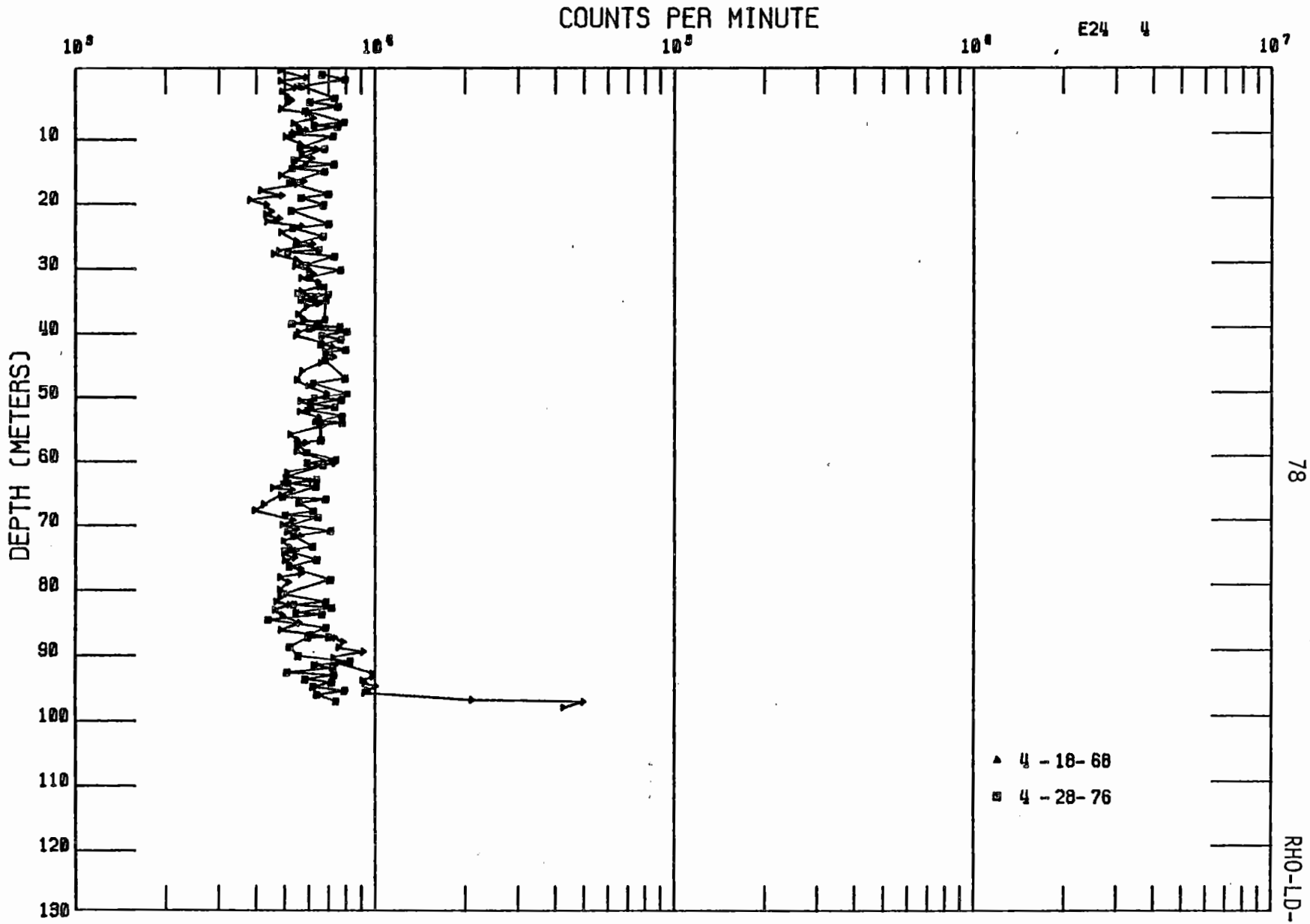
20
30
40
50
60
70
80
90
100
110
120
130
5 - 12- 59
5 - 20- 63


COUNTS PER MINUTE
E24 4
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
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20
30
40
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80
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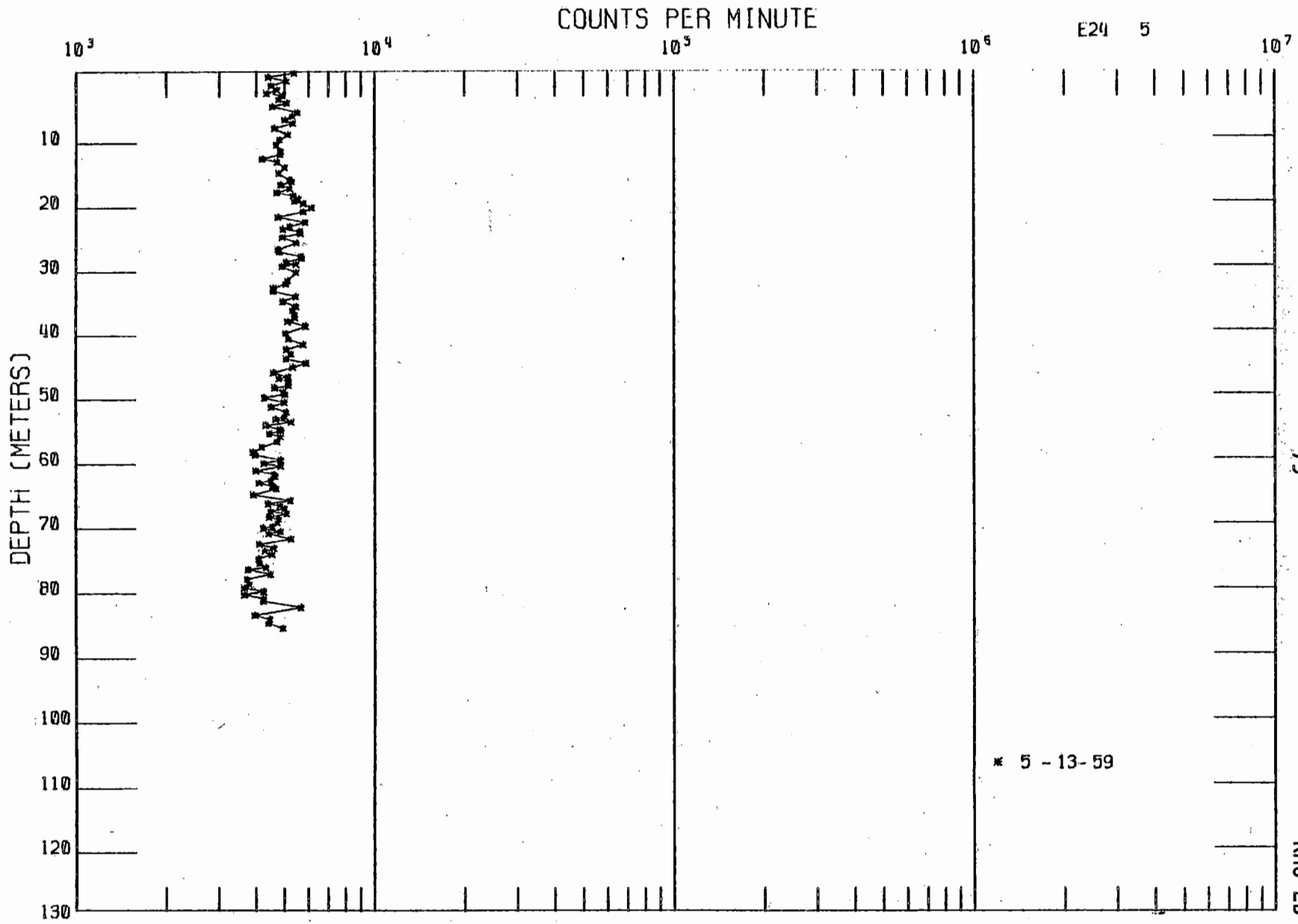
100
110
120
130
4 - 18- 68
4 - 28- 76


COUNTS PER MINUTE
10^3
10^4
10^5
10^6
10^7
E24 5
DEPTH (METERS)
10
20
30
40
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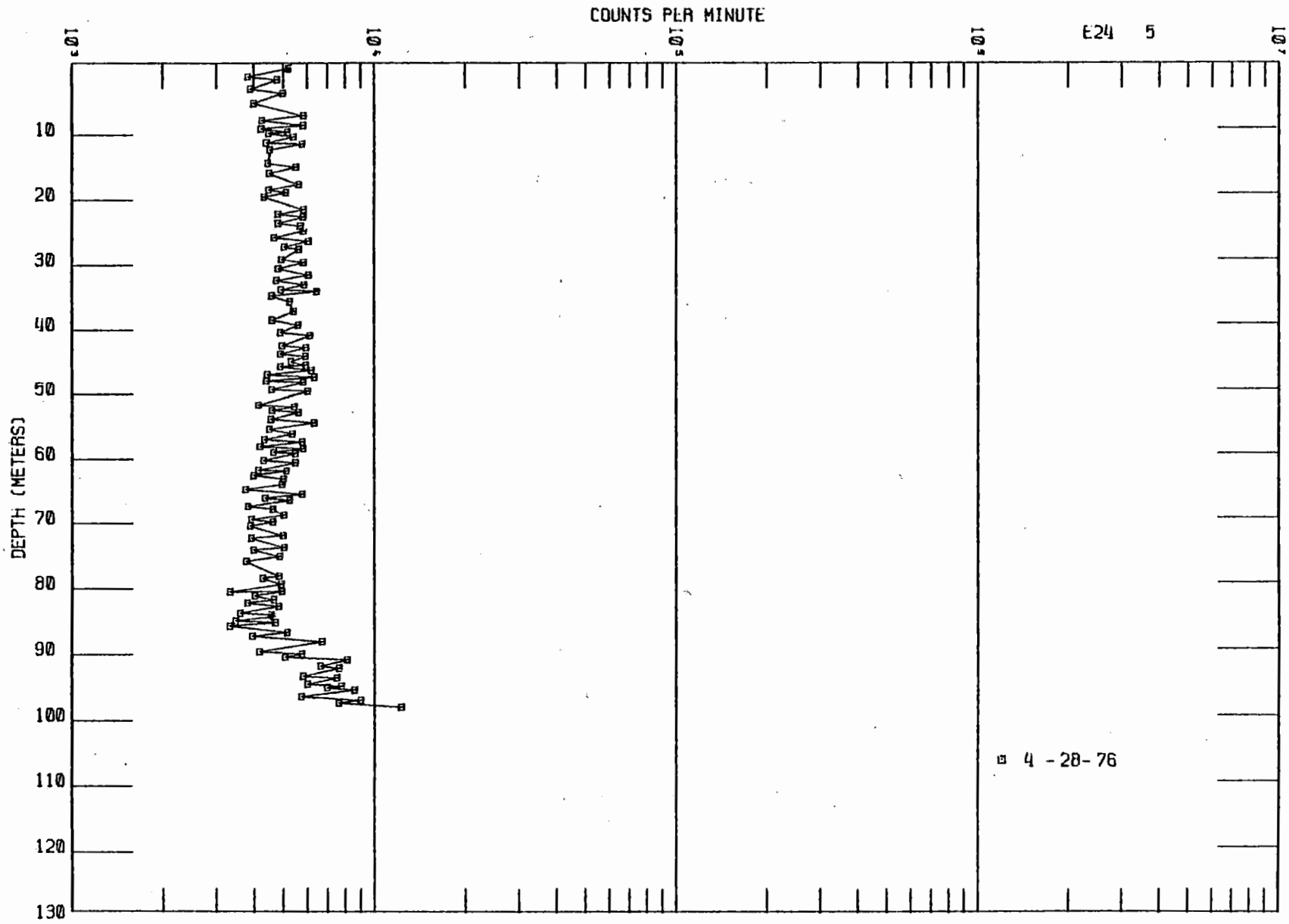
100
110
120
130
* 5 - 13- 59


COUNTS PER MINUTE
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DEPTH (METERS)
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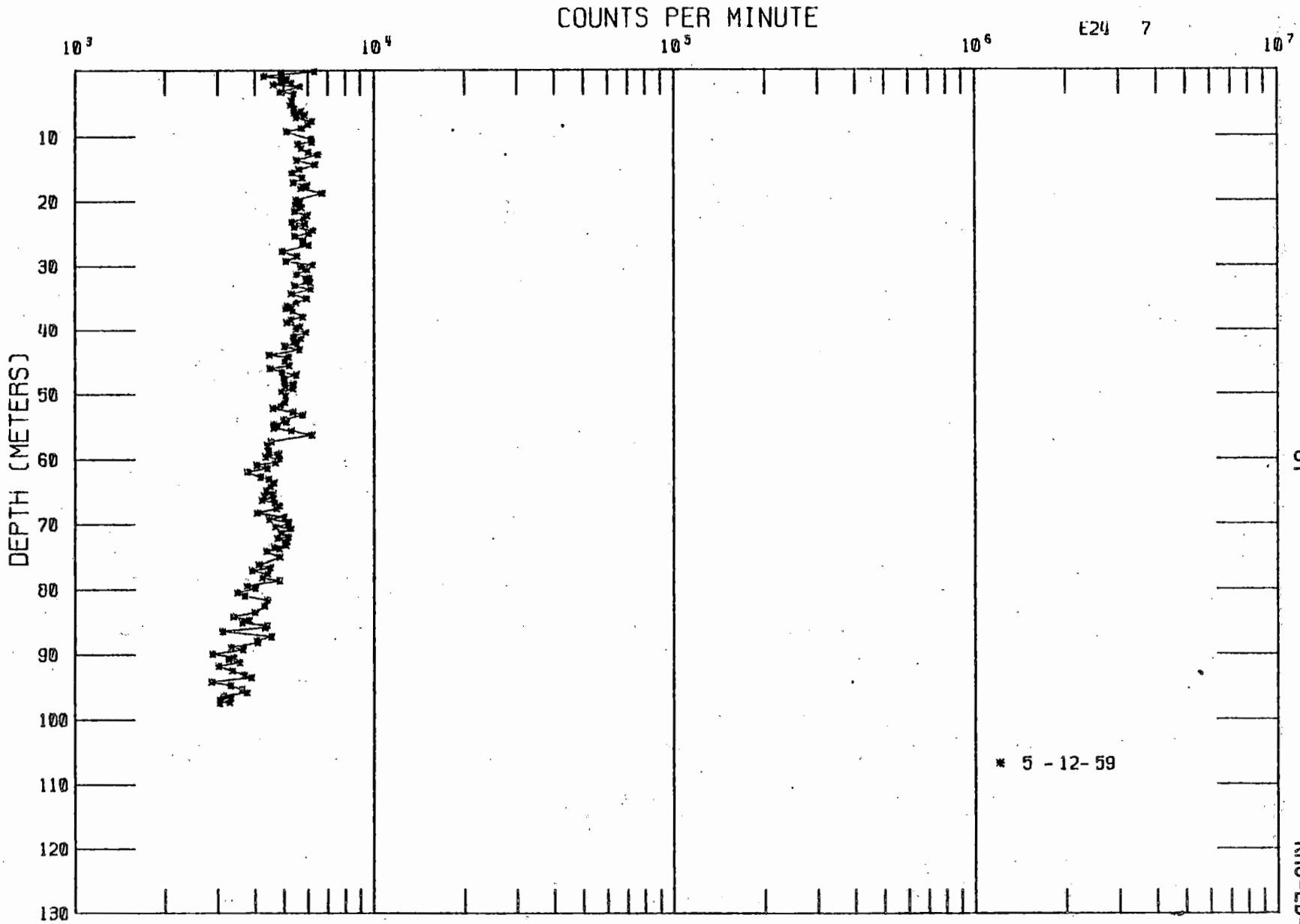
120
130
4 -28-76


COUNTS PER MINUTE
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10^4
10^5
10^6
10^7
E24 7
DEPTH (METERS)
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20
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40
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100
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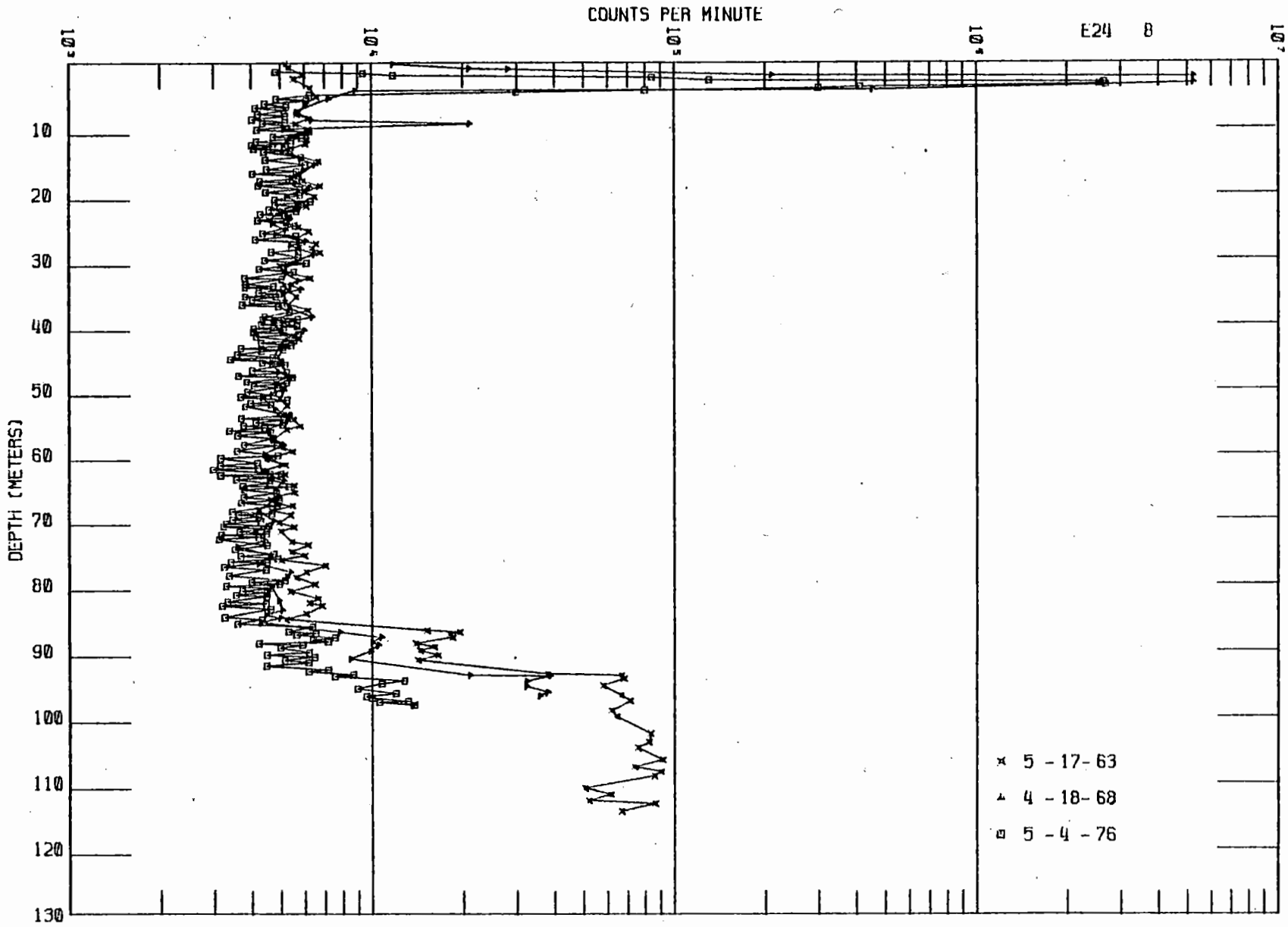
120
130
* 5 -12-59


COUNTS PER MINUTE
E24 8
DEPTH (METERS)
10
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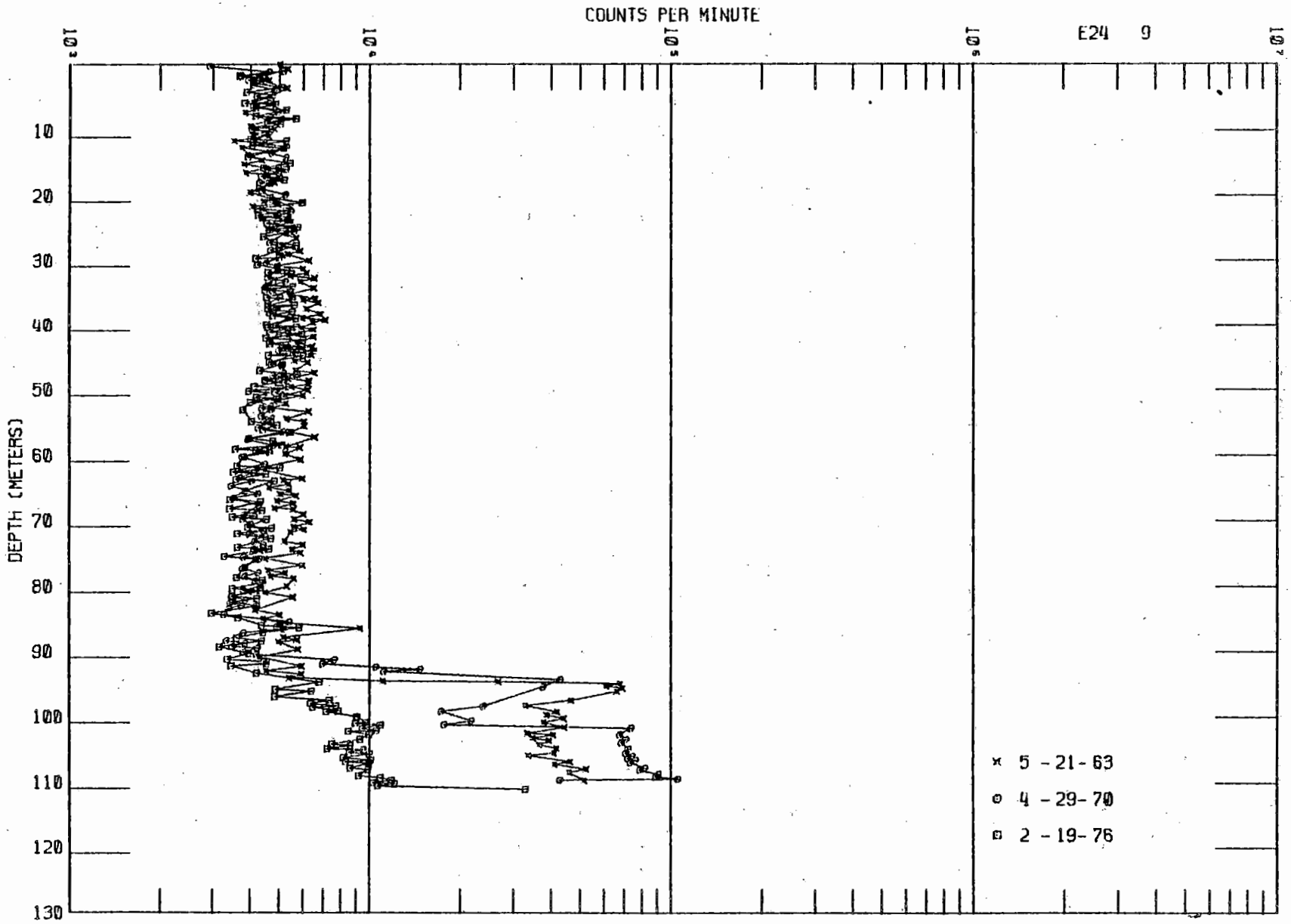
90
100
110
120
130
5 - 17- 63
4 - 18- 68
5 - 4 - 76

9 2 1 2 4 6 6 0 6 7 6



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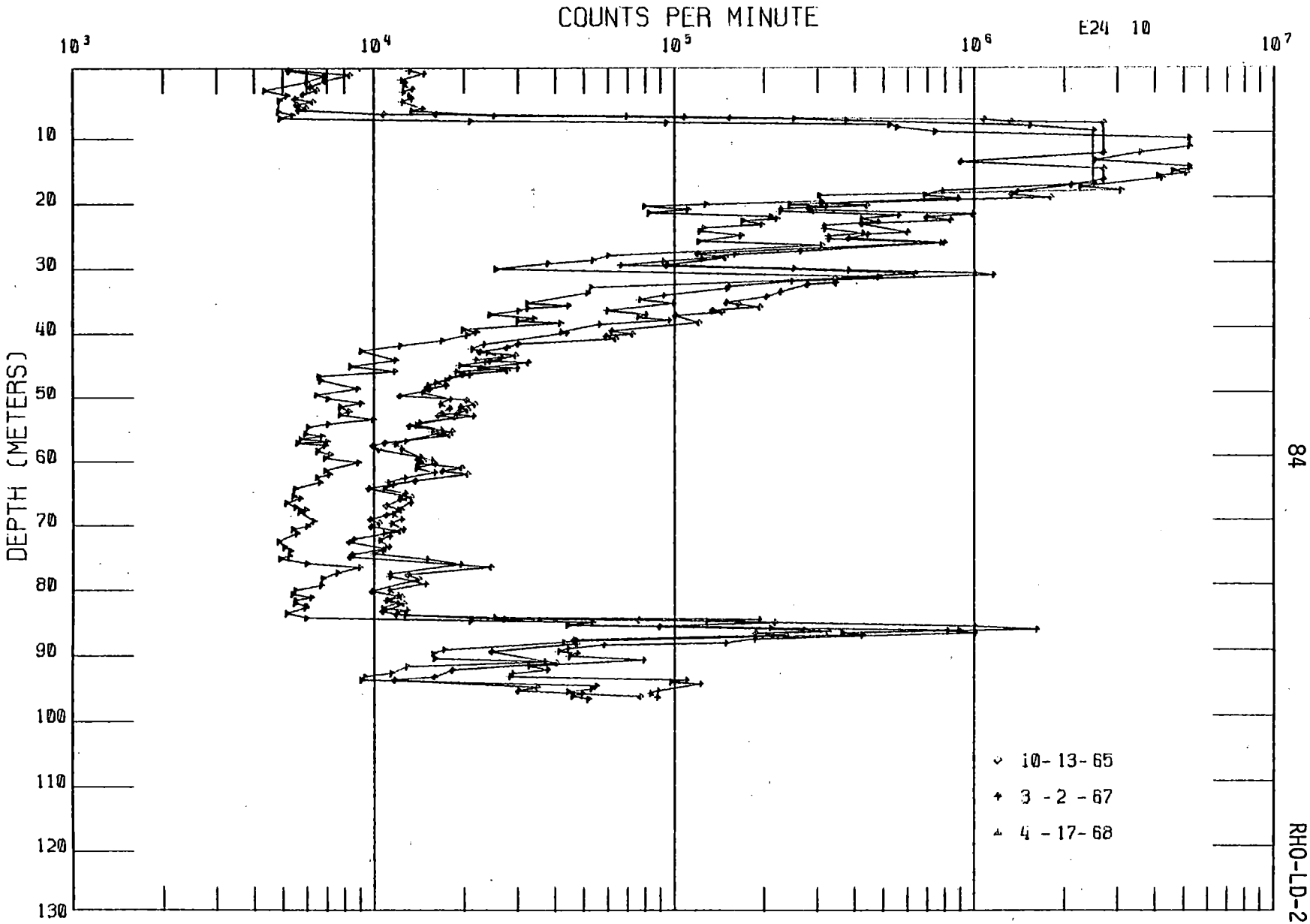
COUNTS PER MINUTE
E24 10
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
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60
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80
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100
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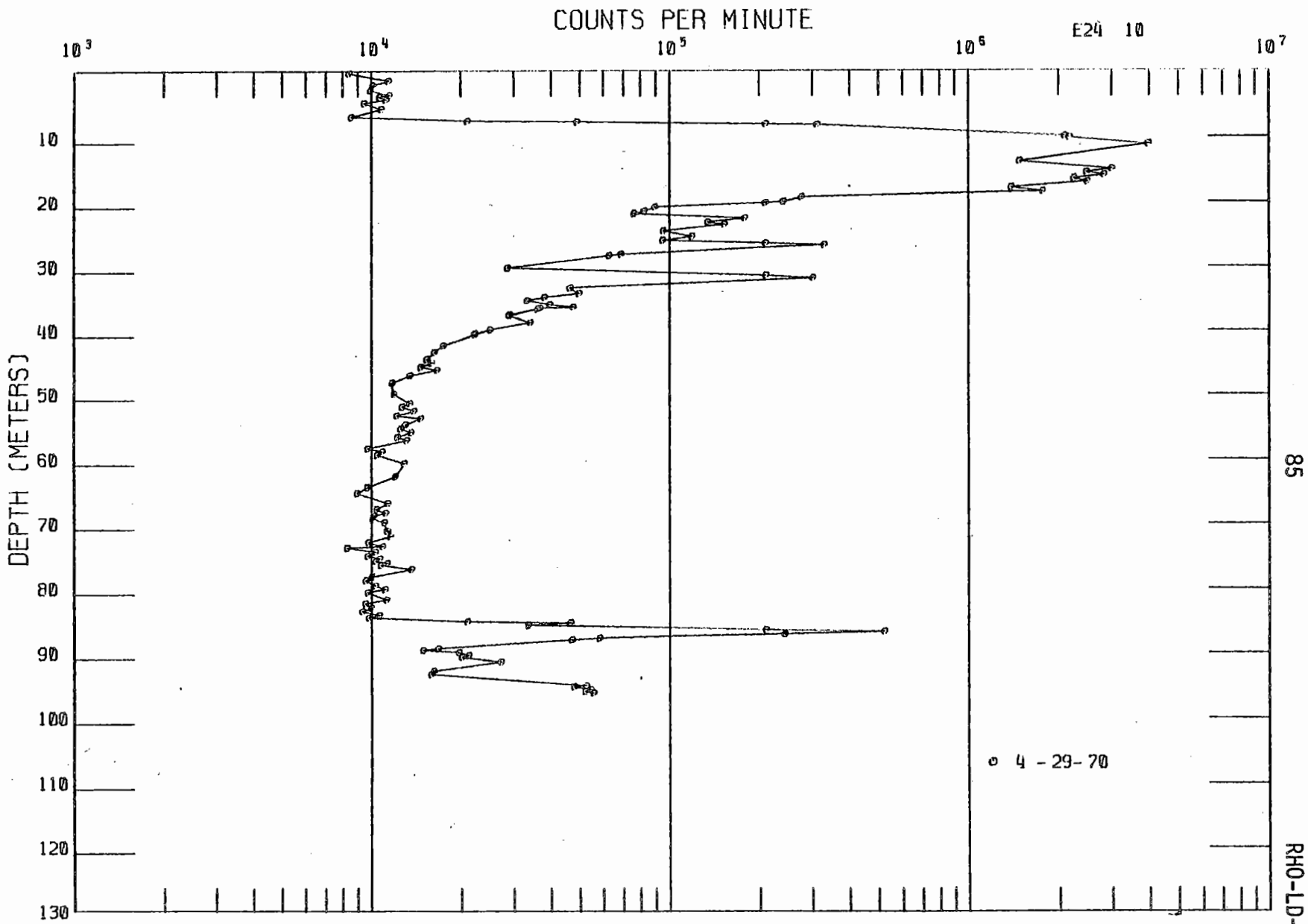
120
130
10-13-65
3 -2 -67
4 -17-68


COUNTS PER MINUTE
E24 10
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
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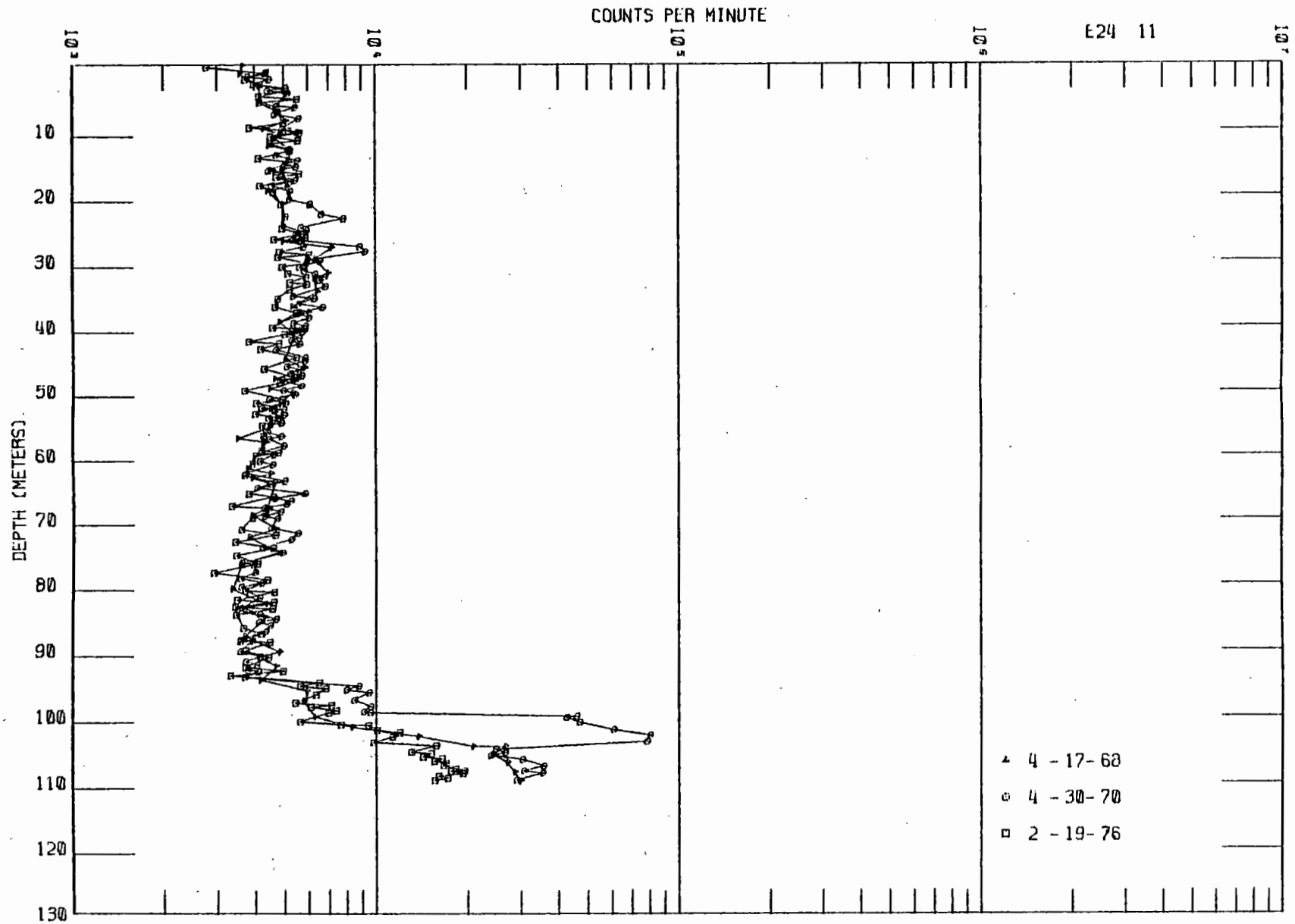
100
110
120
130
o 4 - 29- 70


COUNTS PER MINUTE
E24 11
DEPTH (METERS)
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120
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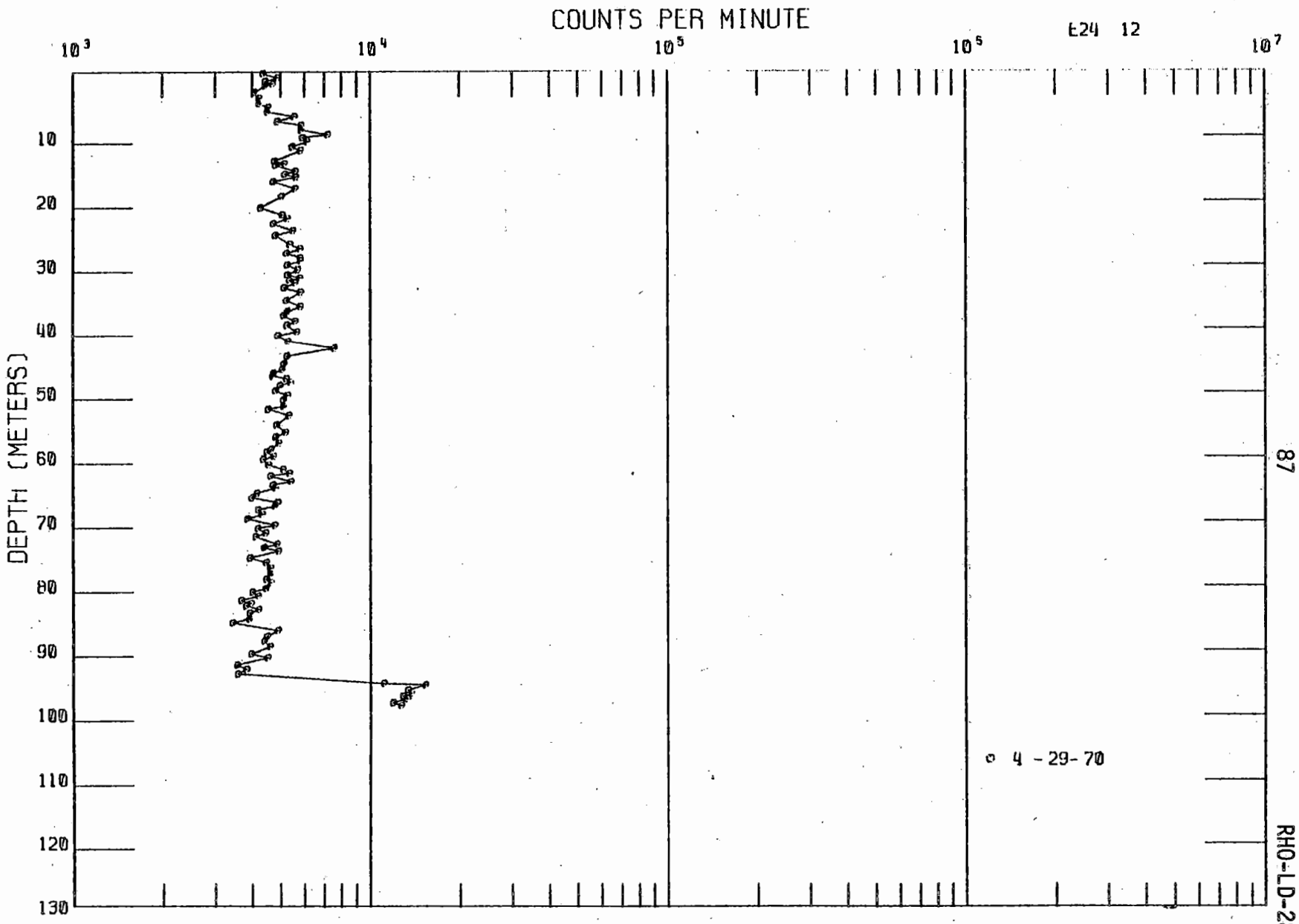
4 - 30- 70
2 - 19- 76


COUNTS PER MINUTE
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10^4
10^5
10^5
10^7
DEPTH (METERS)
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20
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40
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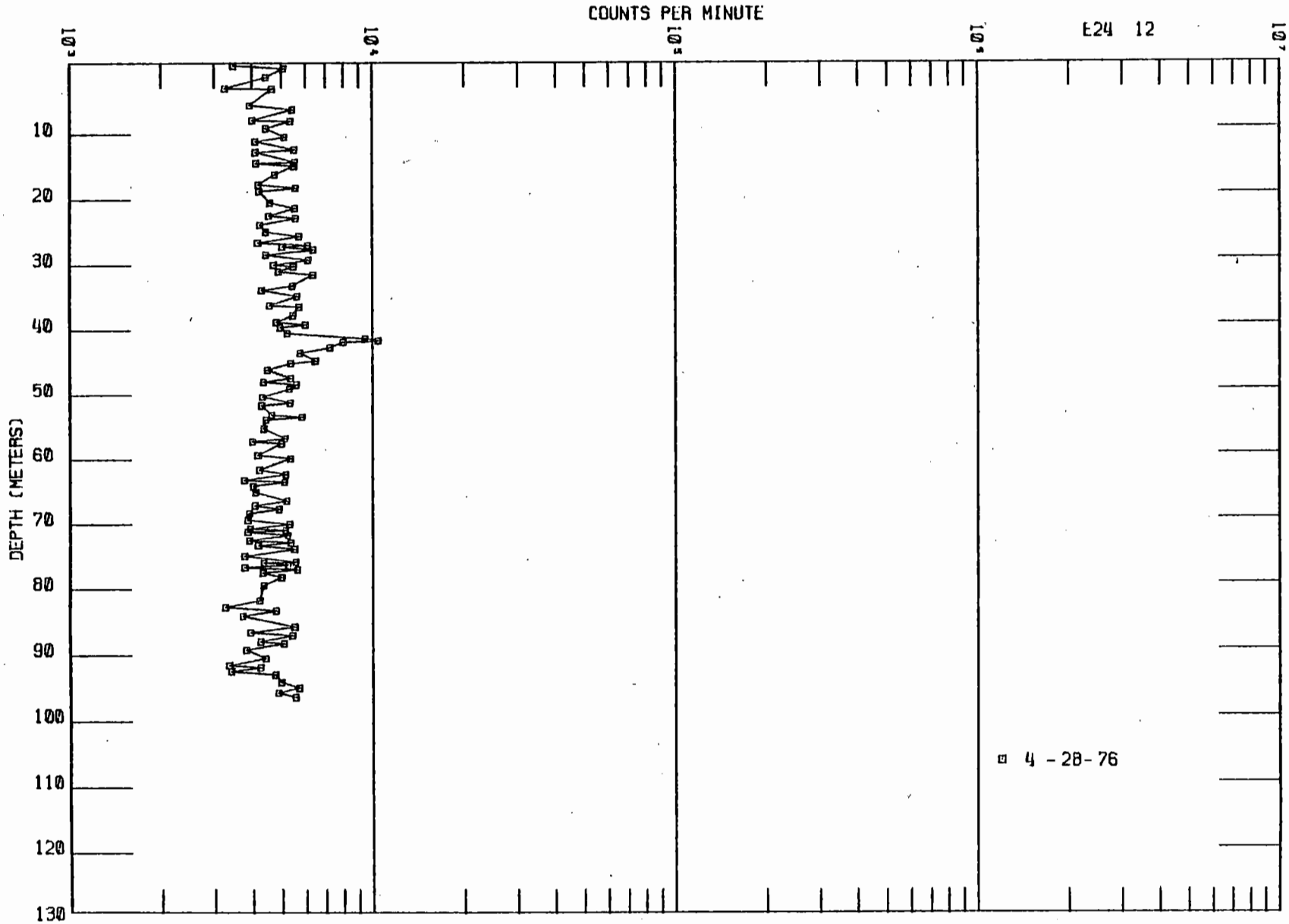
100
110
120
130
o 4 - 29- 70


COUNTS PER MINUTE
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120
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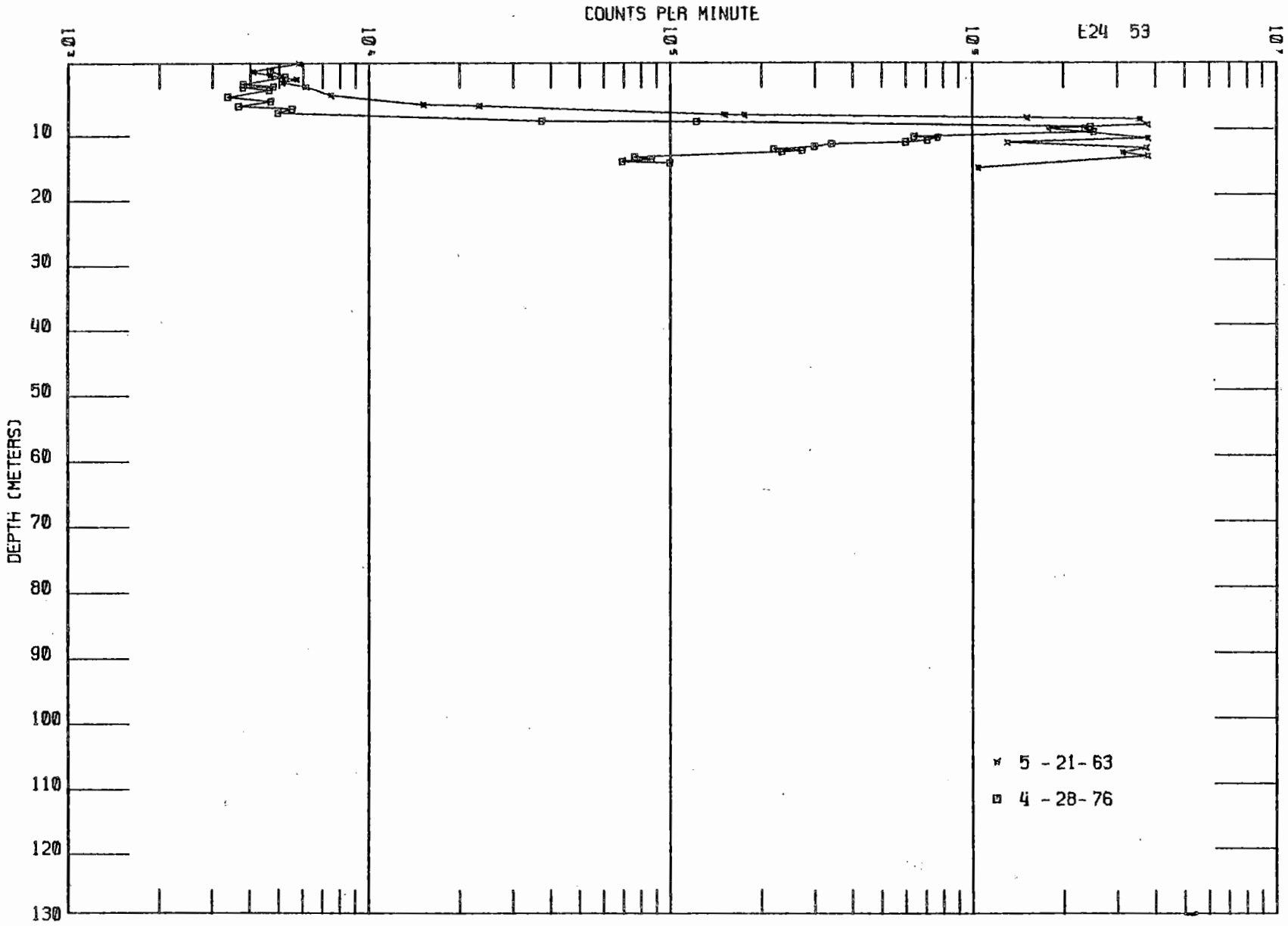
4 - 28 - 76


COUNTS PER MINUTE
E24 53
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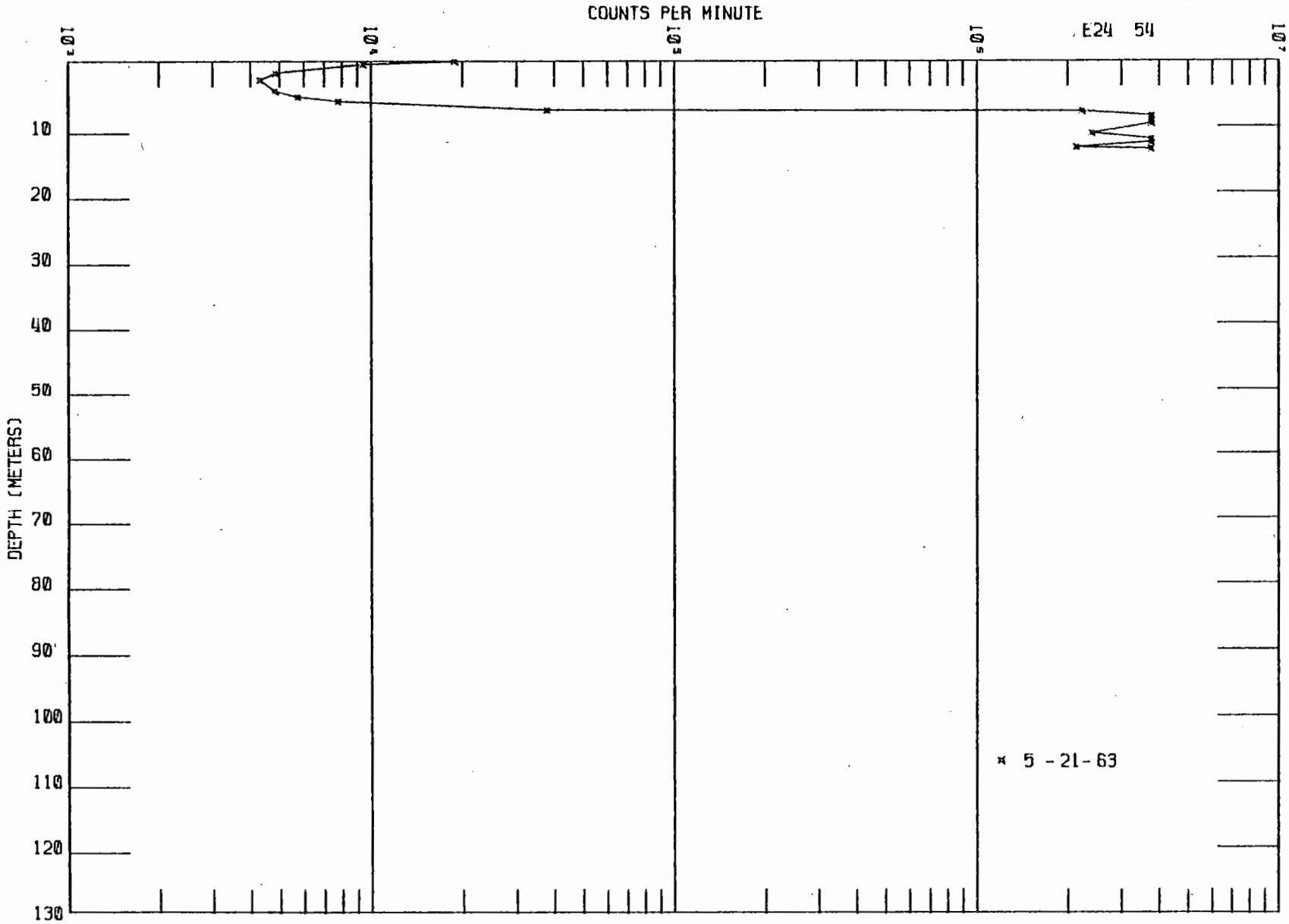
5 - 21- 63
4 - 28- 76


COUNTS PER MINUTE
10³
10⁴
10⁵
10⁶
10⁷
E24 54
DEPTH (METERS)
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20
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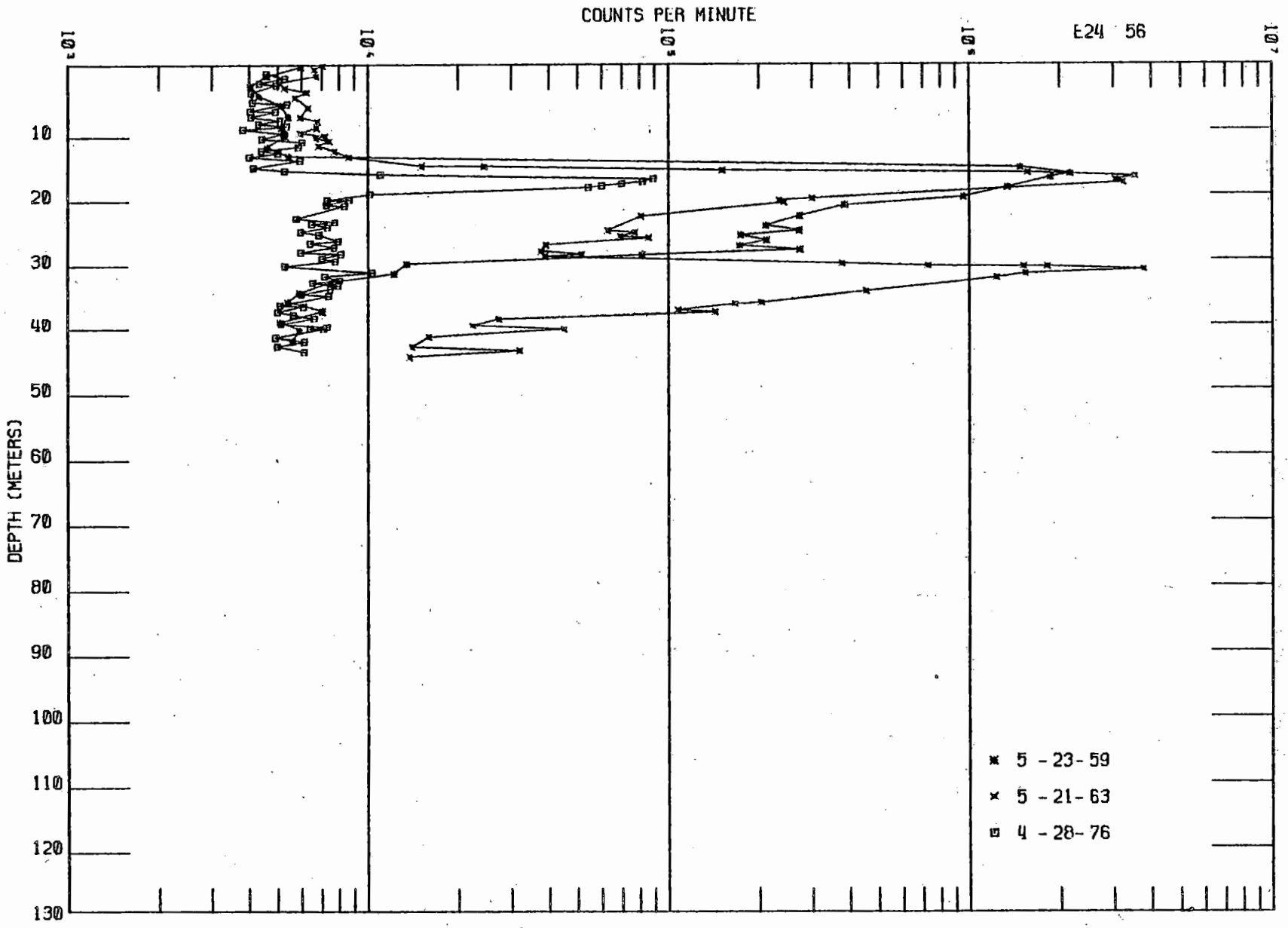
130
× 5 - 21 - 63


COUNTS PER MINUTE
E24 56
DEPTH (METERS)
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130
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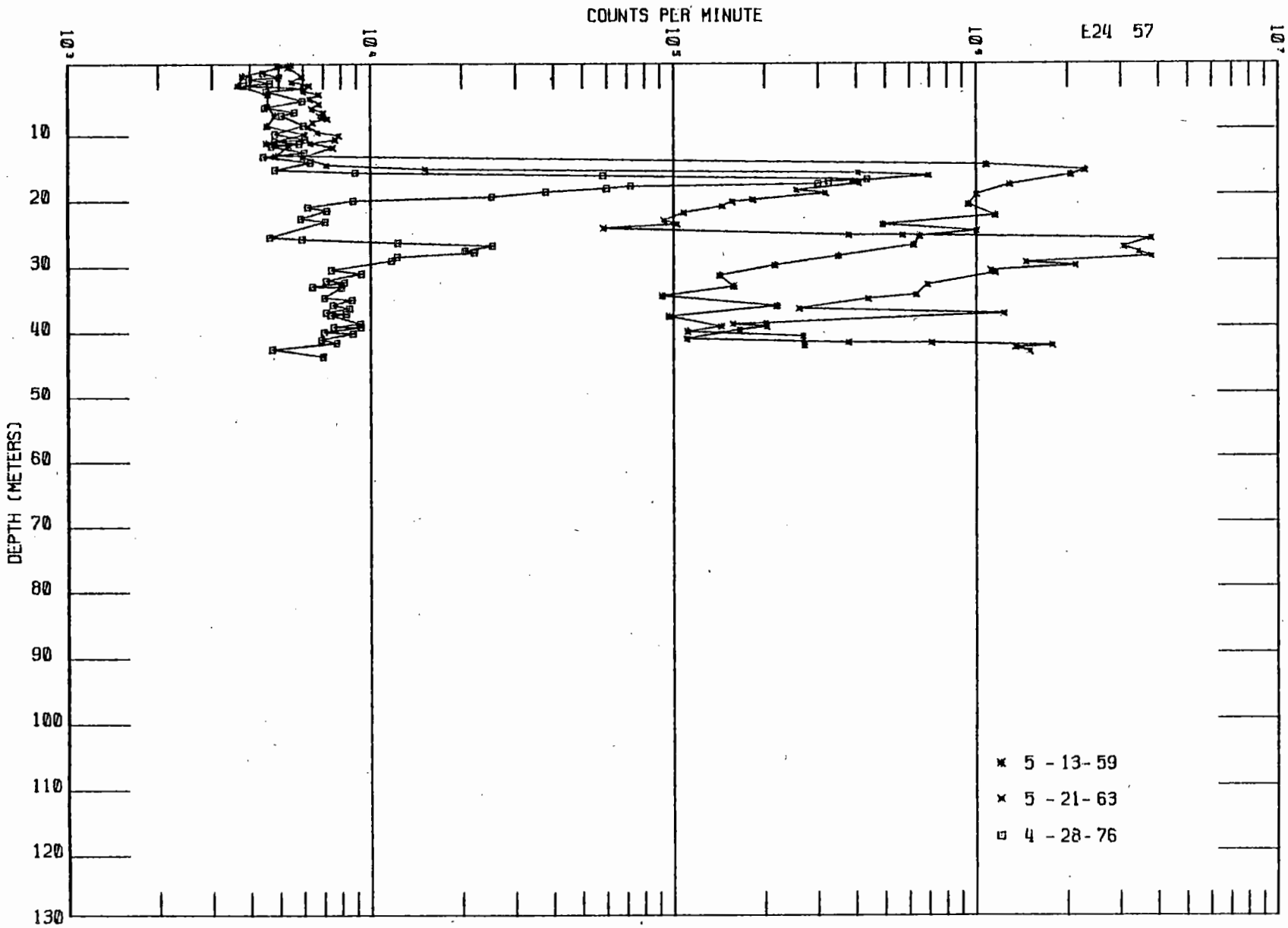
5 - 21- 63
4 - 28- 76


COUNTS PER MINUTE
E24 57
DEPTH (METERS)
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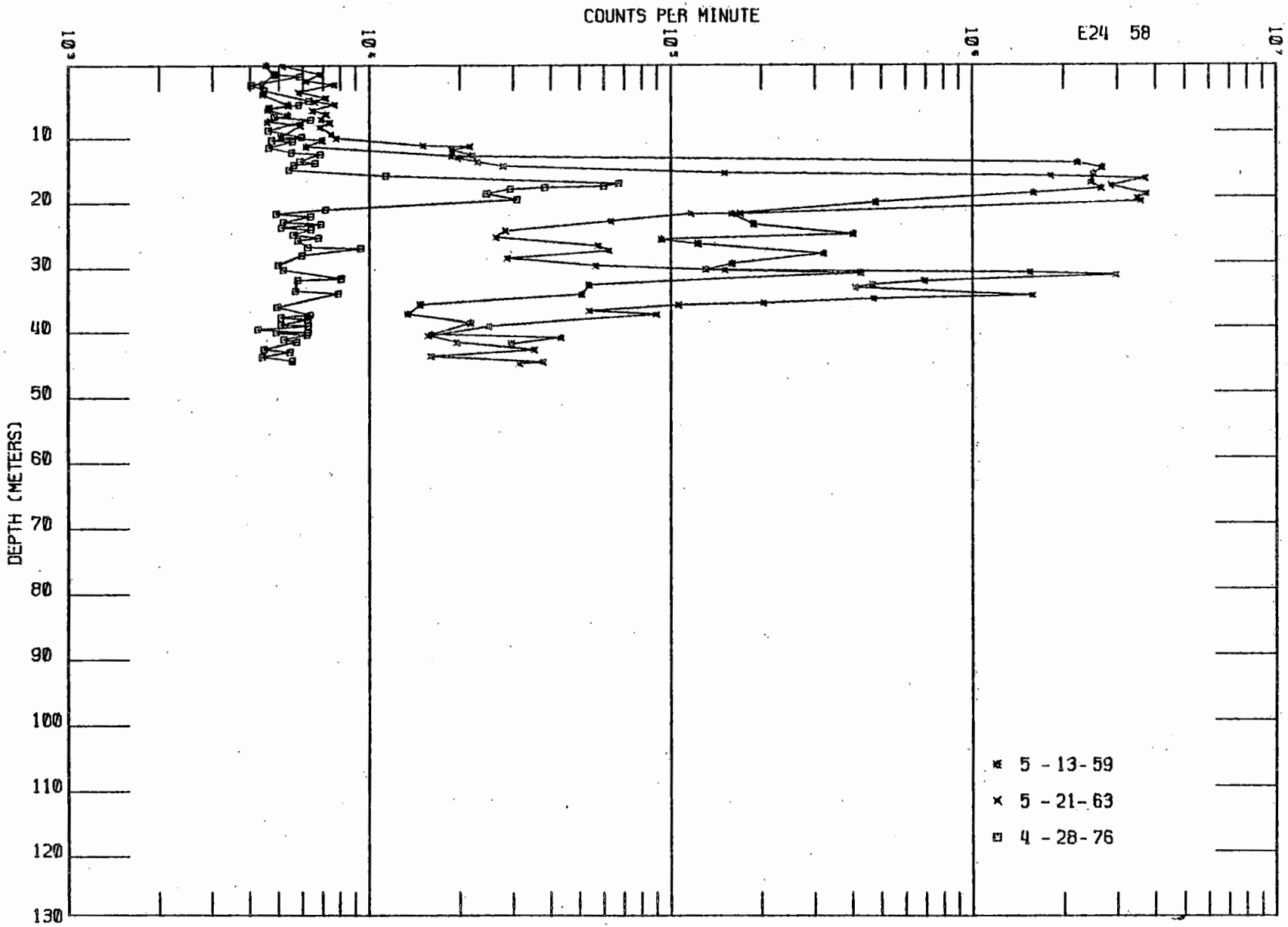
5 - 13- 59
5 - 21- 63
4 - 28- 76


COUNTS PER MINUTE
E24 58
DEPTH (METERS)
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130
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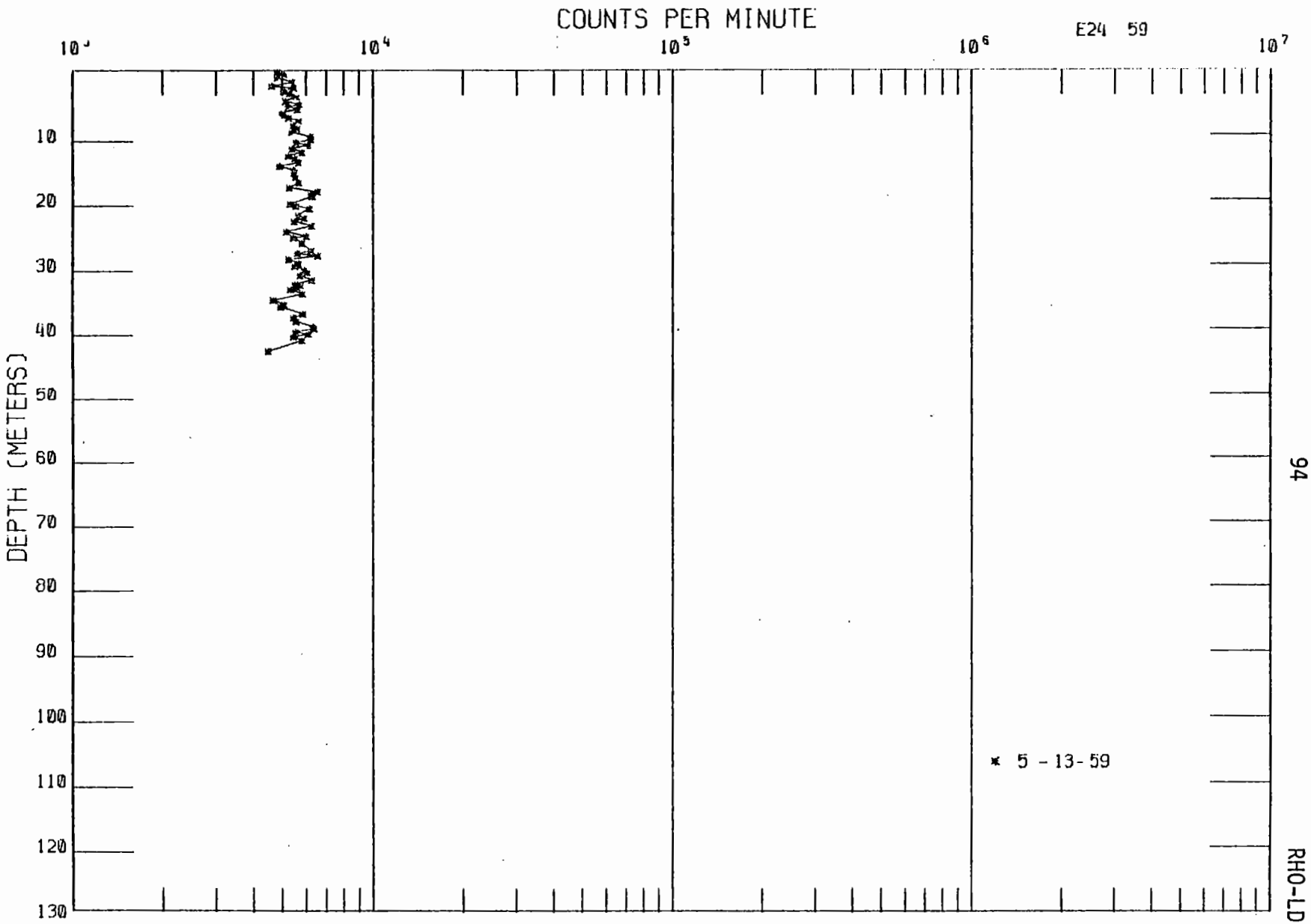
5 - 21- 63
4 - 28- 76


COUNTS PER MINUTE
E24 59
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
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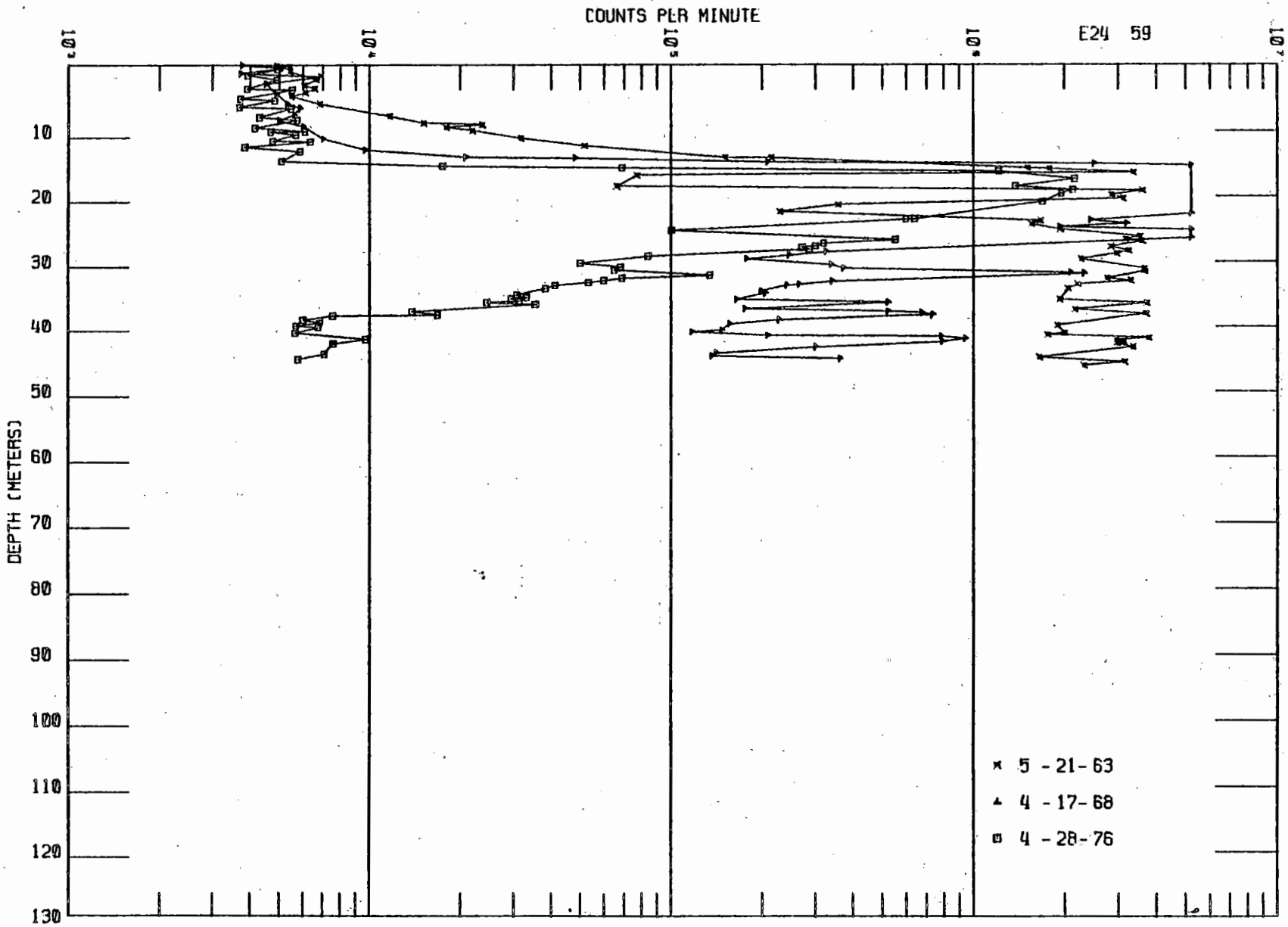
100
110
120
130
* 5 - 13 - 59


COUNTS PER MINUTE
E24 59
DEPTH (METERS)
10
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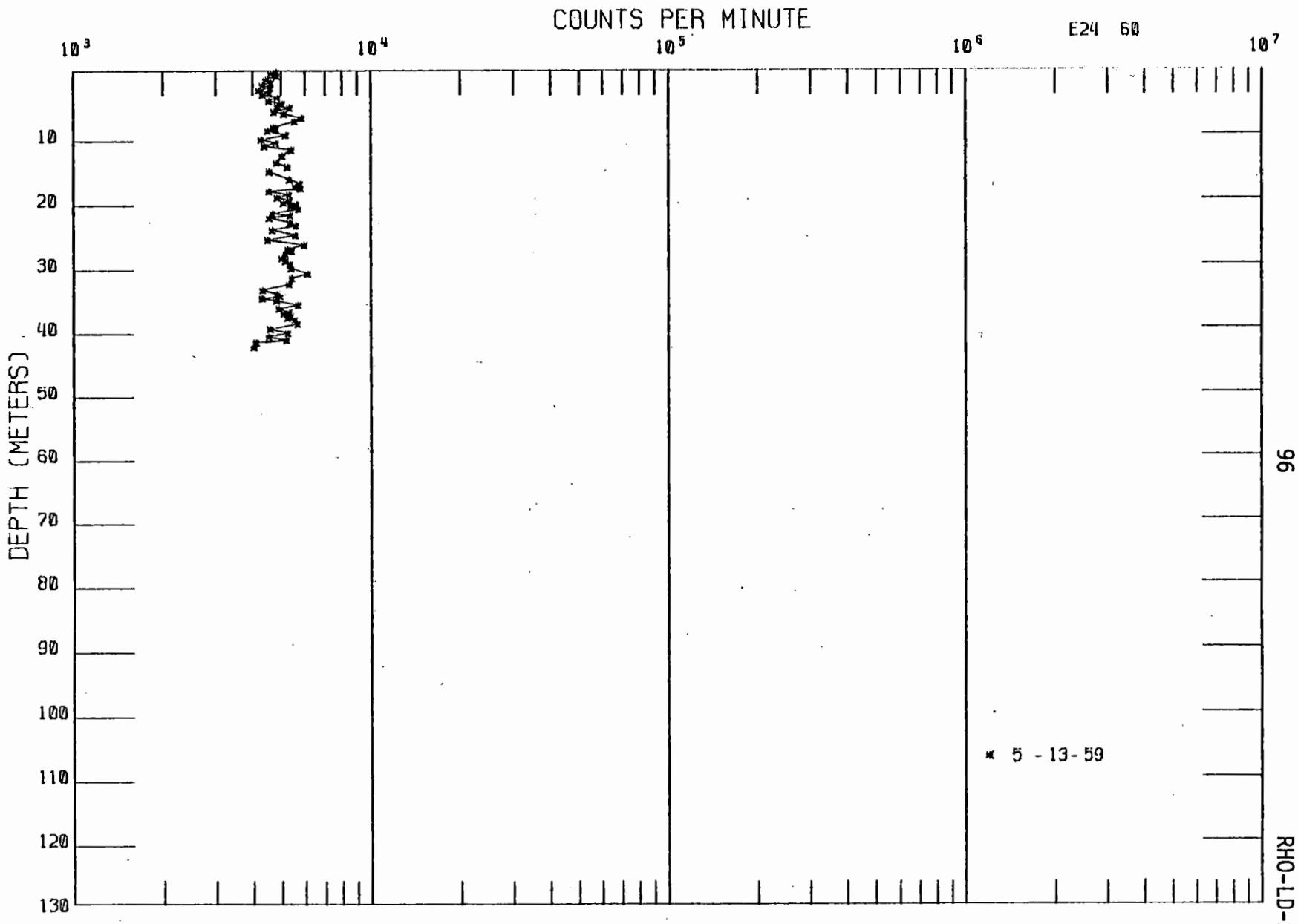
100
110
120
130
× 5 - 21- 63
▲ 4 - 17- 68
▫ 4 - 28- 76


COUNTS PER MINUTE
10^3
10^4
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10^6
10^7
E24 60
DEPTH (METERS)
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20
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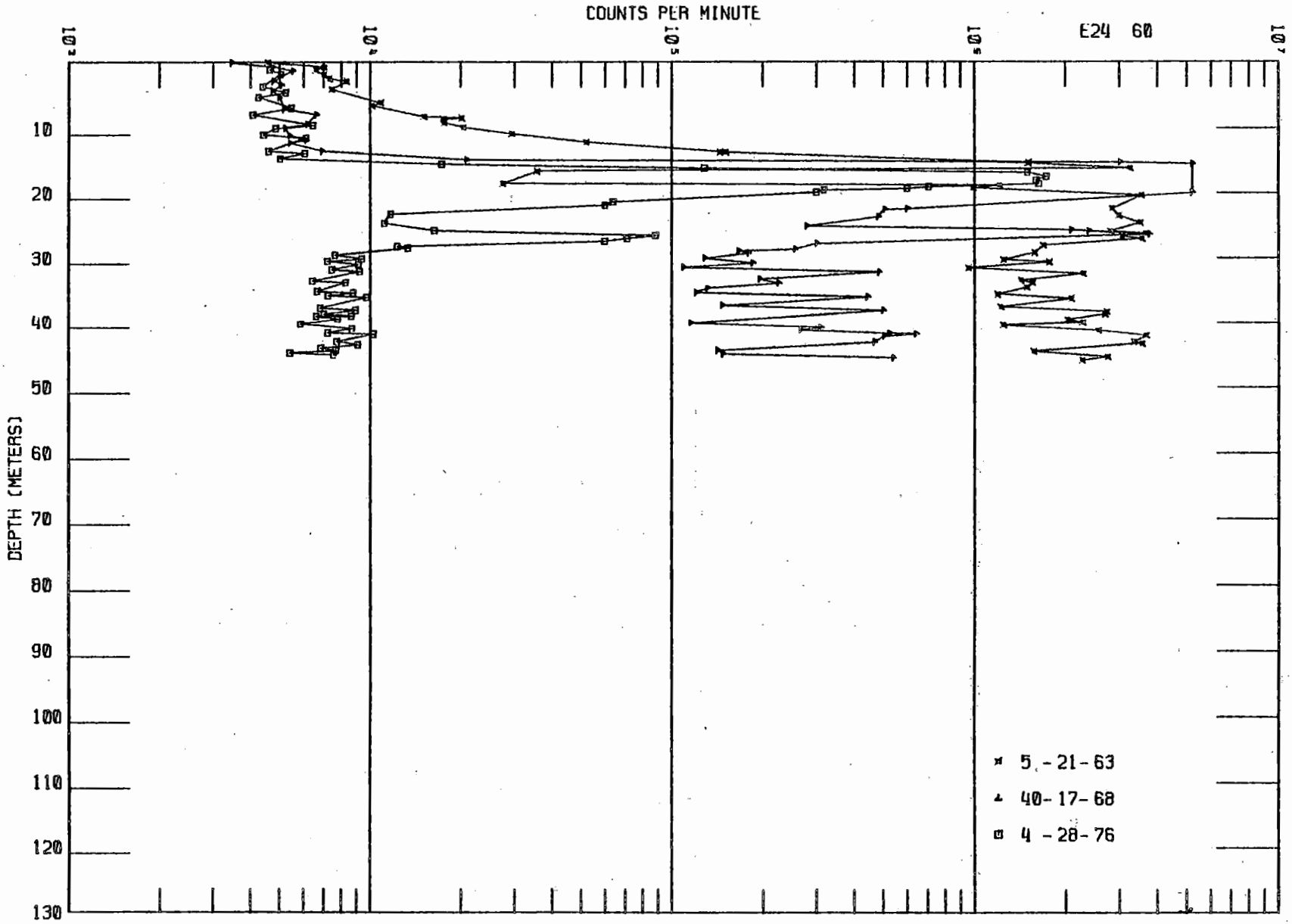
120
130
* 5 - 13 - 59


COUNTS PER MINUTE
E24 60
DEPTH (METERS)
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100
110
120
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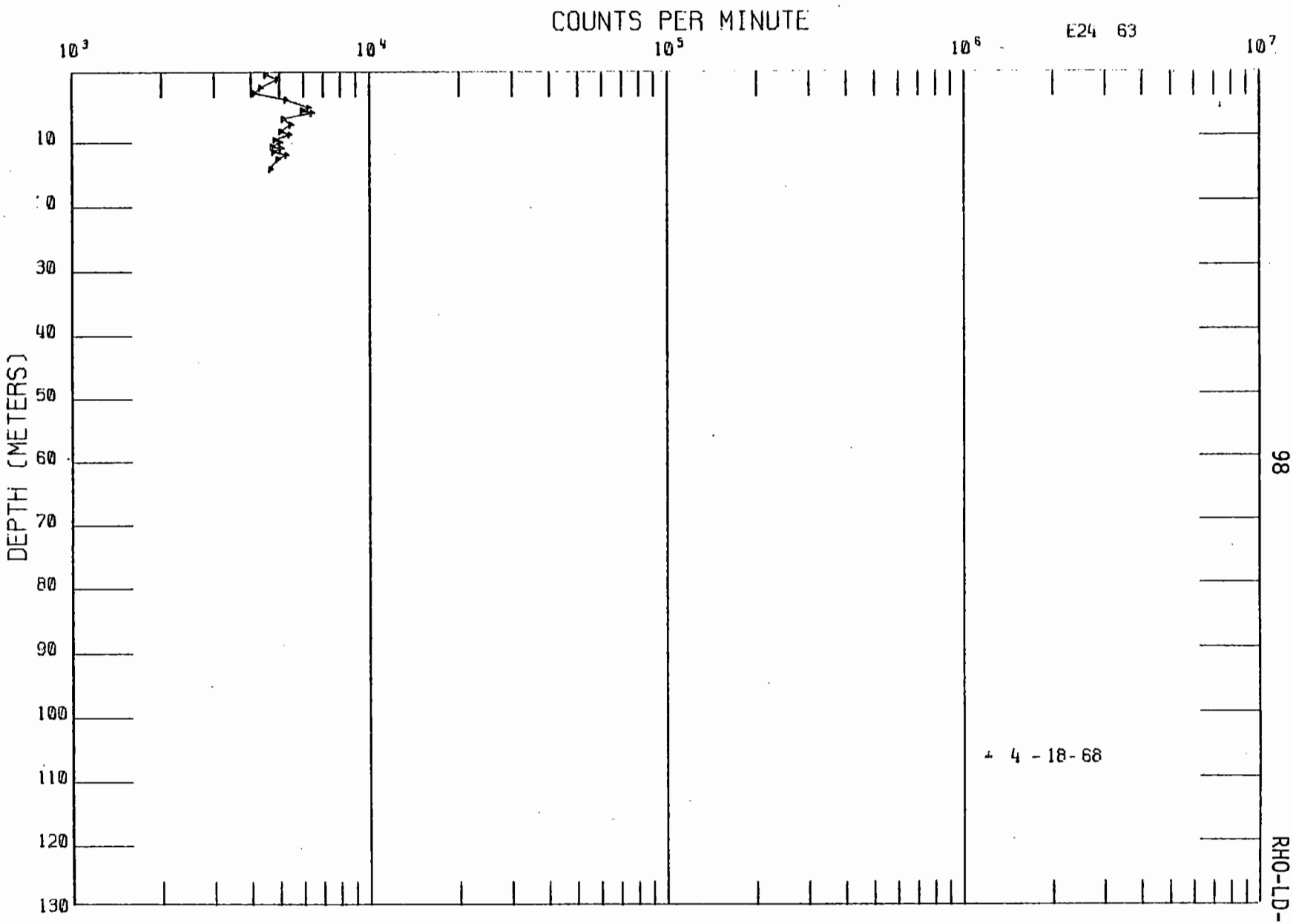
40 - 17 - 68
4 - 28 - 76


COUNTS PER MINUTE
10^3
10^4
10^5
10^6
10^7
E24 63
DEPTH (METERS)
10
20
30
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100
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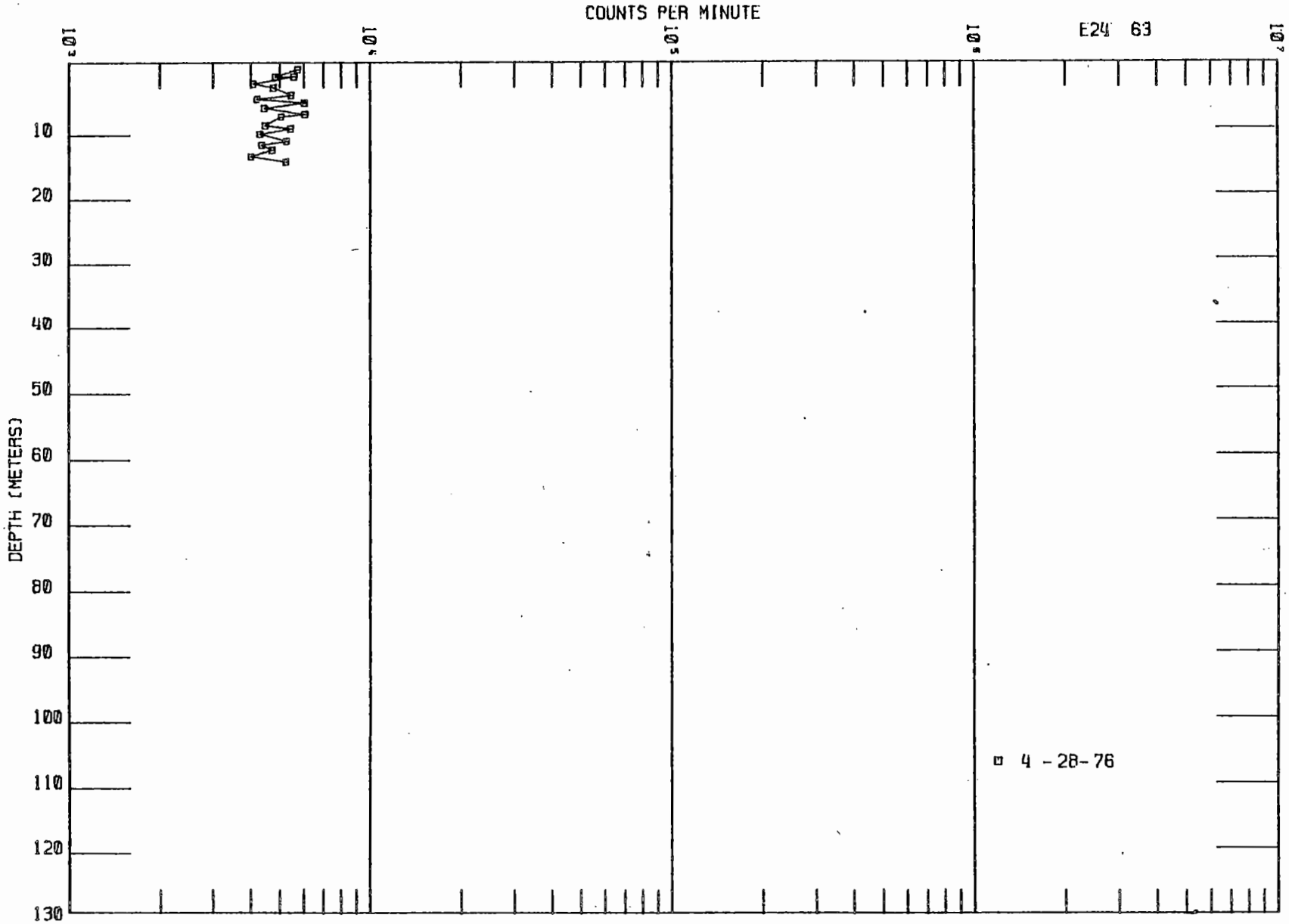
120
130
4 - 18 - 68


COUNTS PER MINUTE
E24 63
DEPTH (METERS)
10
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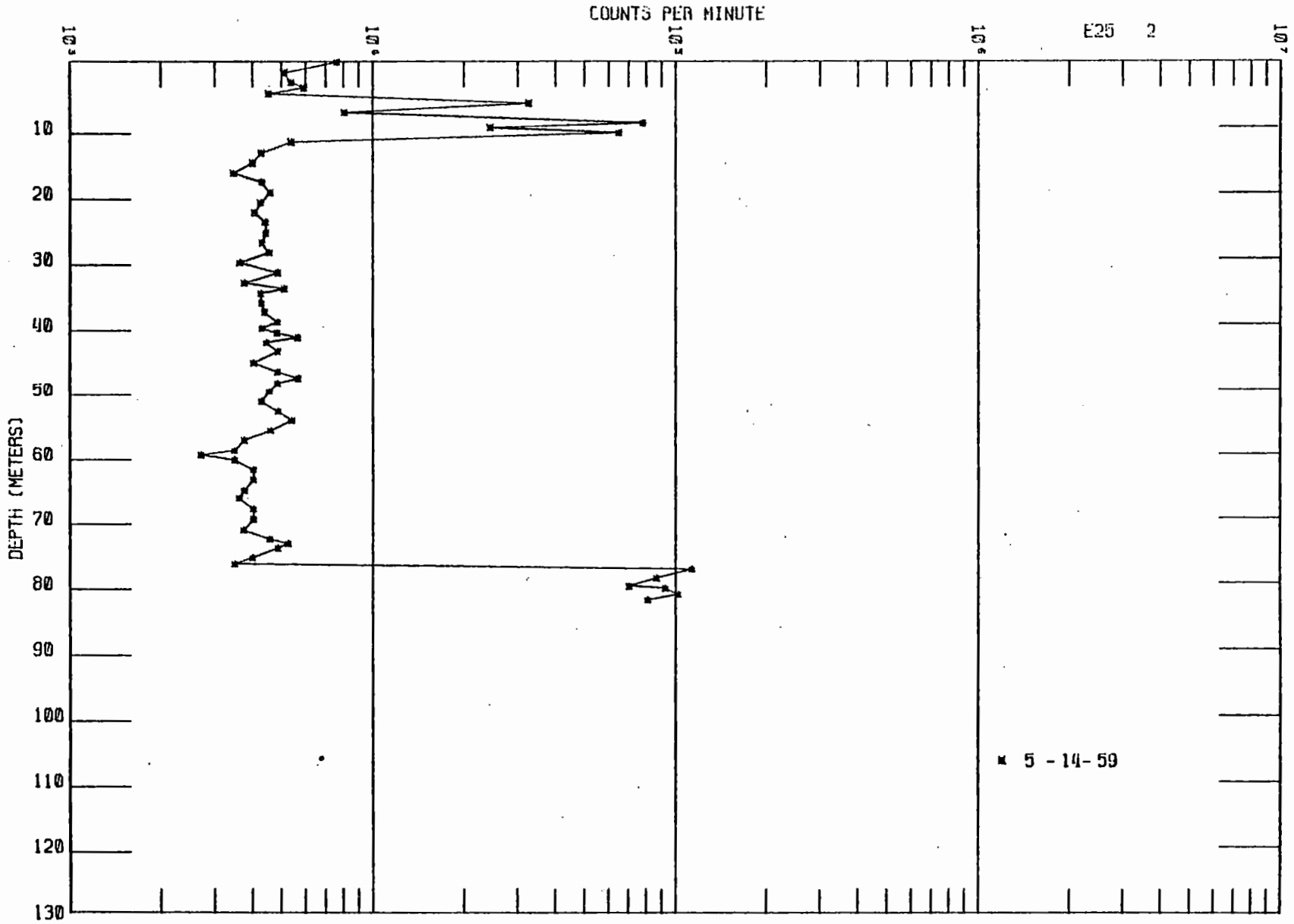
120
130
4 - 28 - 76


COUNTS PER MINUTE
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DEPTH (METERS)
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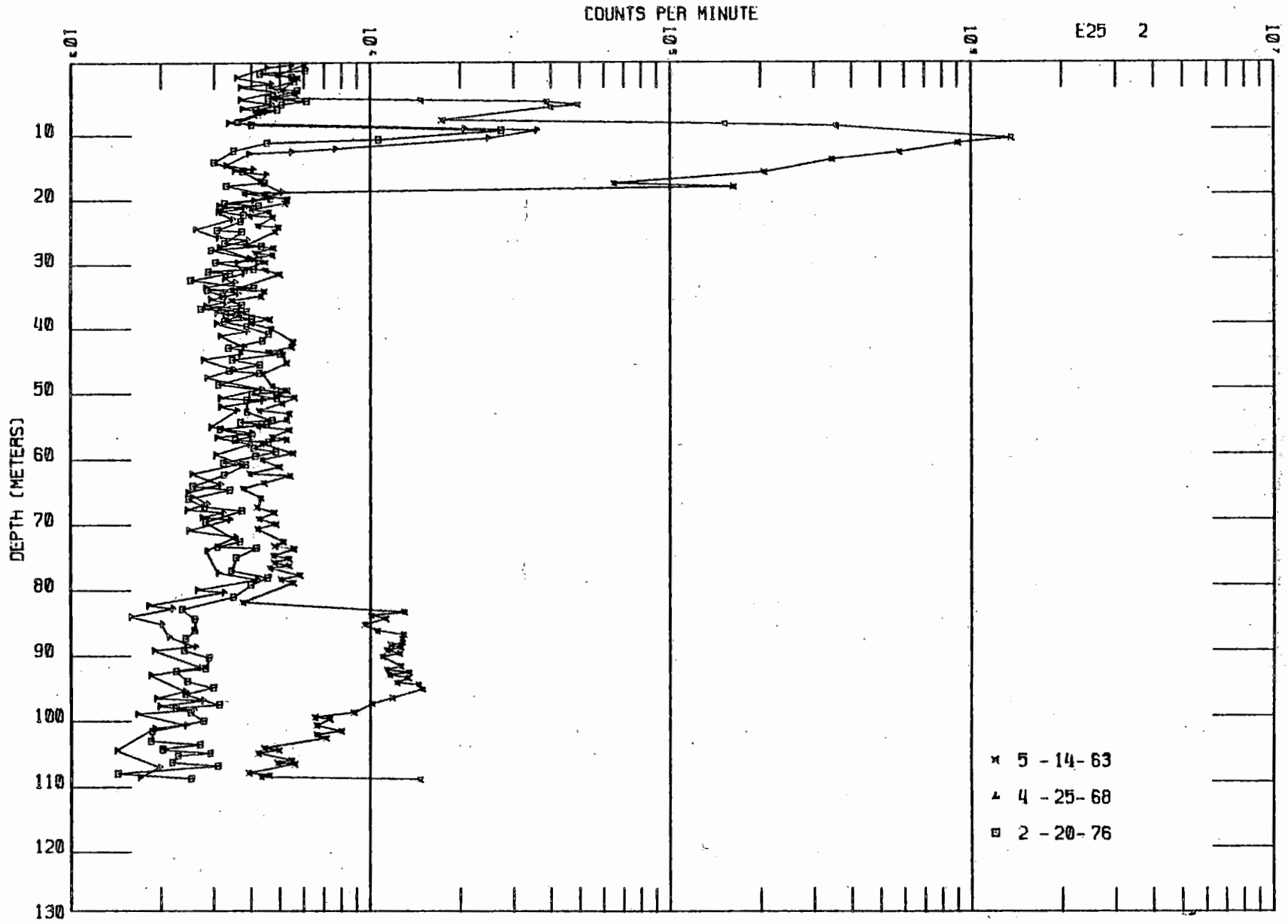
5 - 14- 59


COUNTS PER MINUTE
E25 2
DEPTH (METERS)
10
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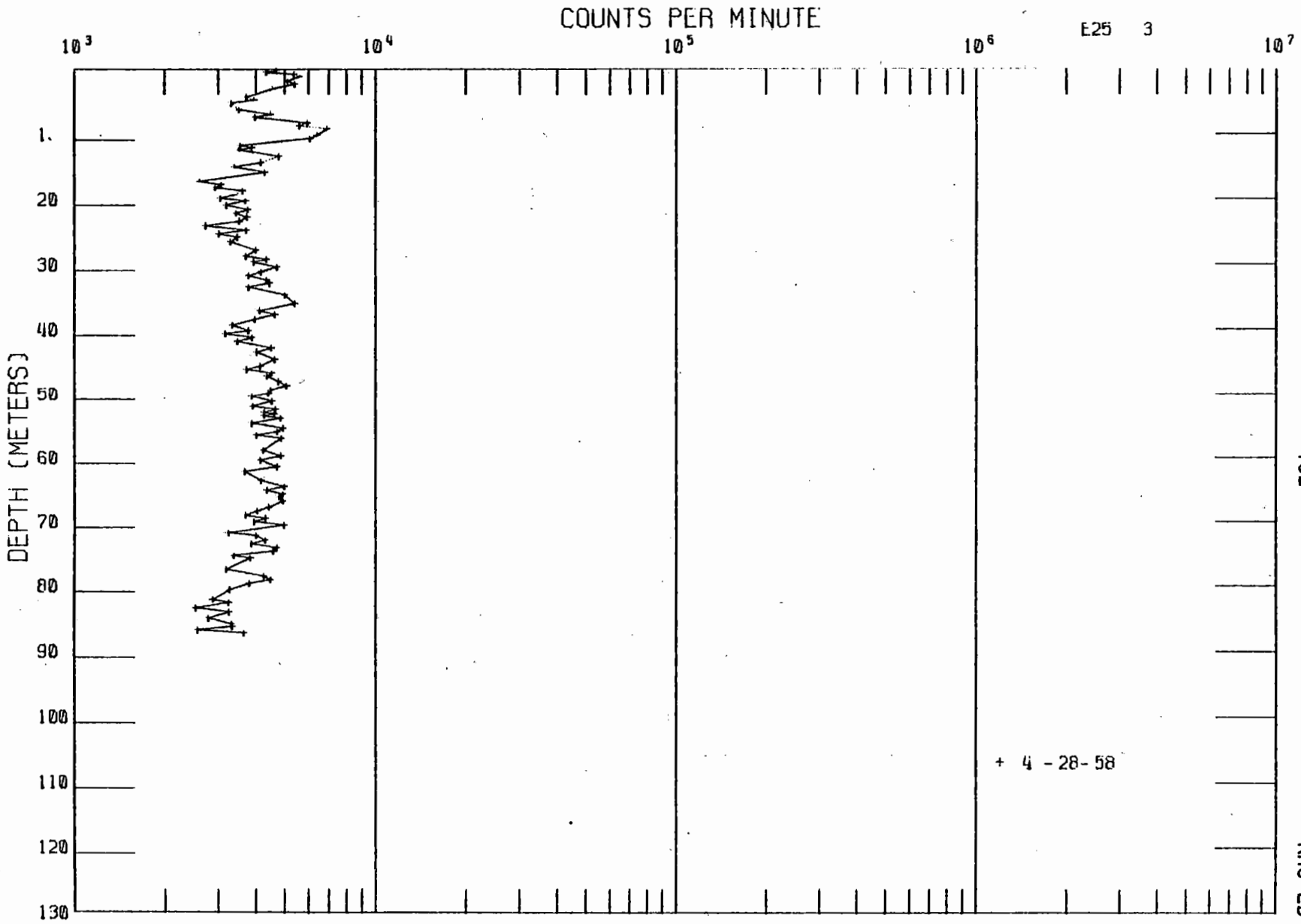
90
100
110
120
130
× 5 - 14- 63
▲ 4 - 25- 68
□ 2 - 20- 76


COUNTS PER MINUTE
10^3
10^4
10^5
10^6
10^7
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DEPTH (METERS)
1.
20
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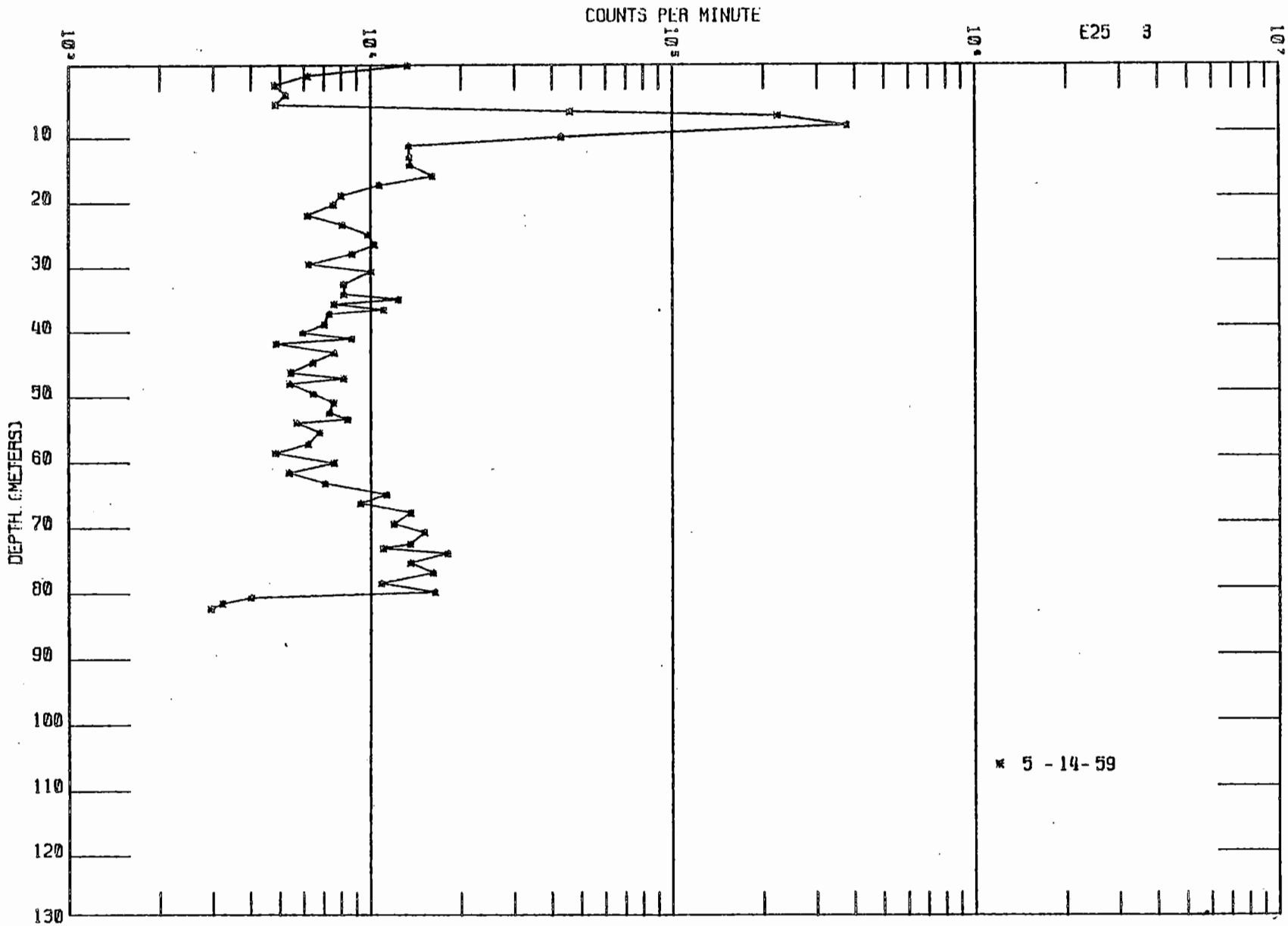
+ 4 -28-58


COUNTS PER MINUTE
10^3
10^4
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10^6
10^7
E25 3
DEPTH (METERS)
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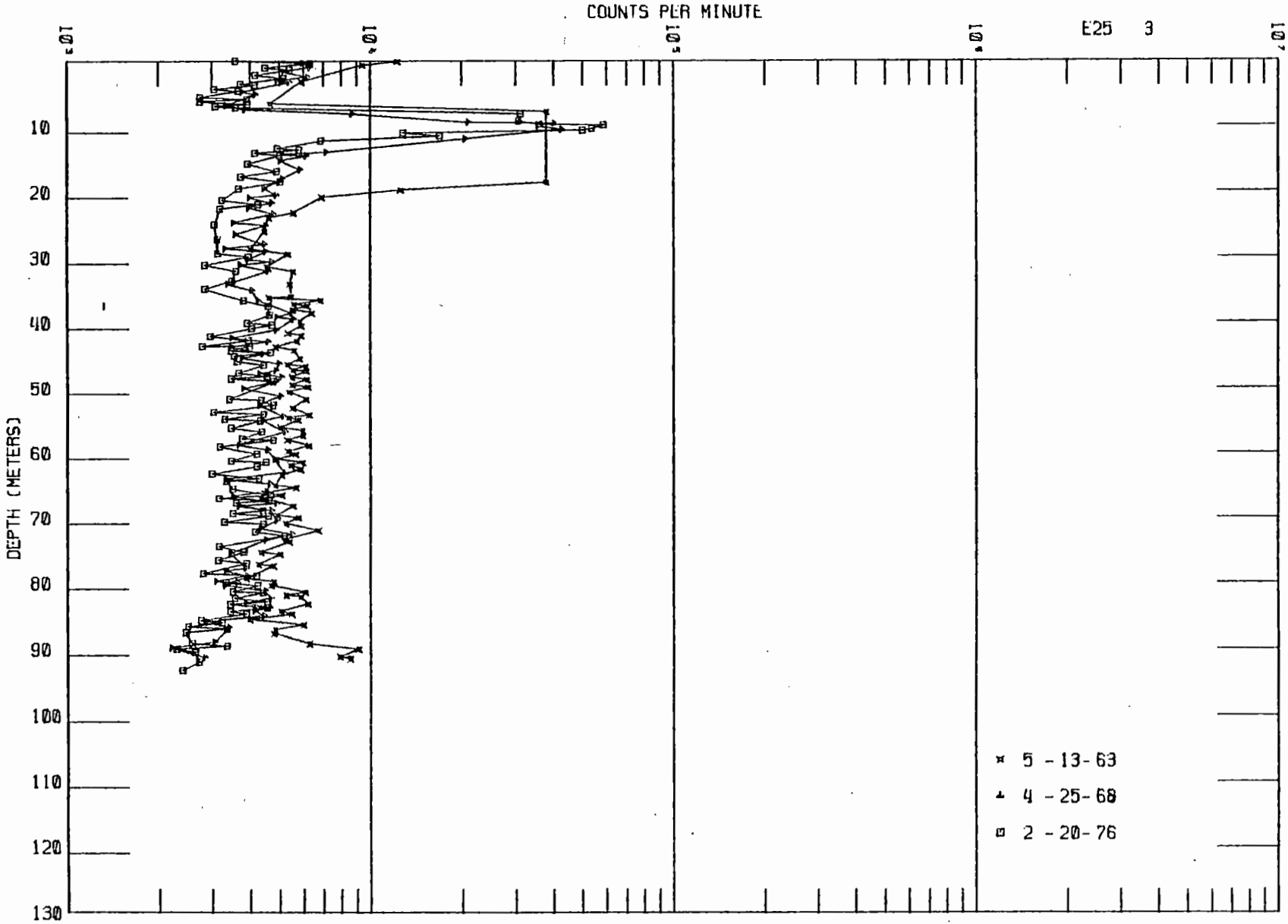
110
120
130
* 5 - 14 - 59


COUNTS PER MINUTE
E25 3
DEPTH (METERS)
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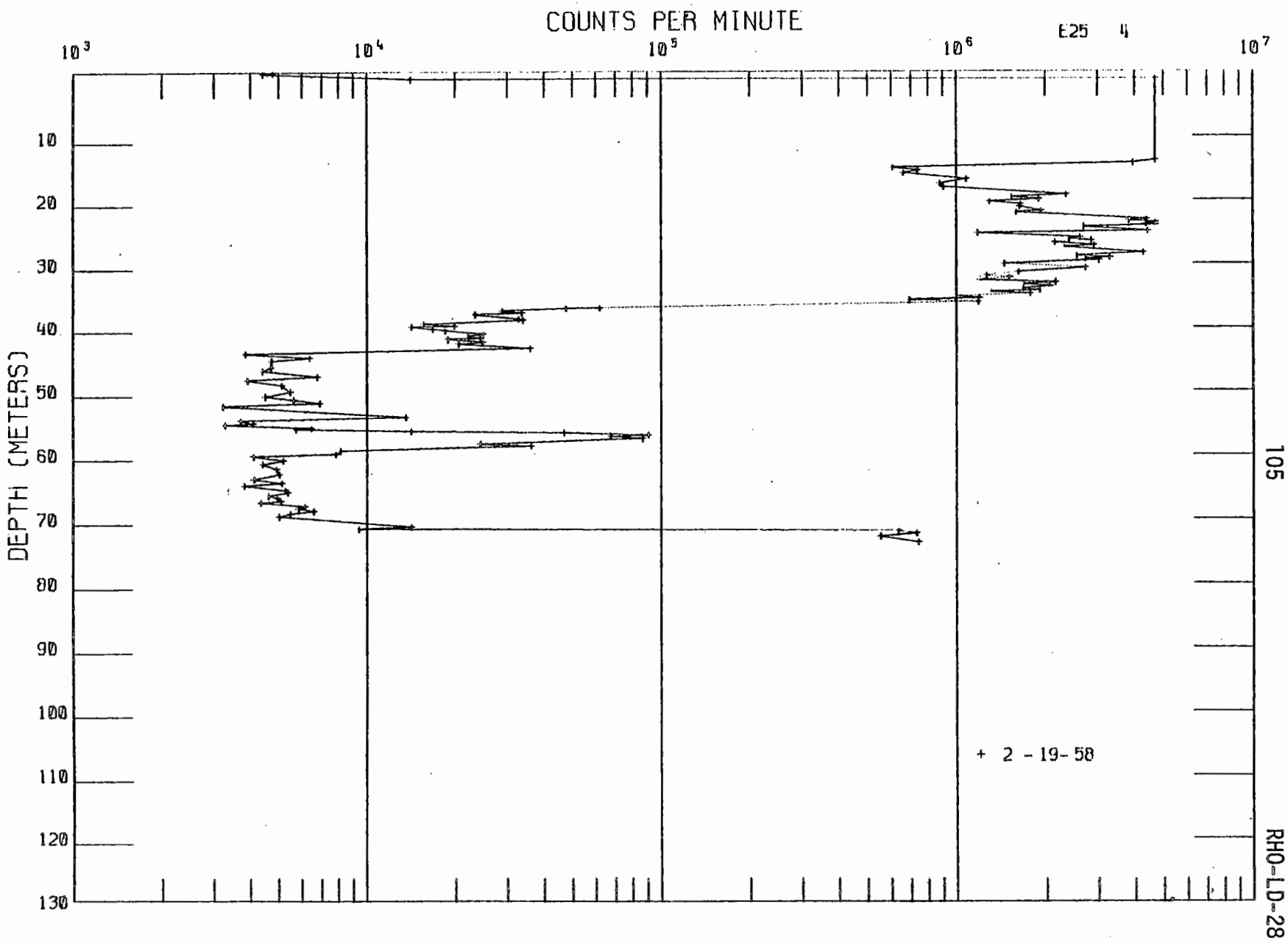
4 - 25 - 68
2 - 20 - 76

9 2 1 2 4 6 6 0 6 9 8



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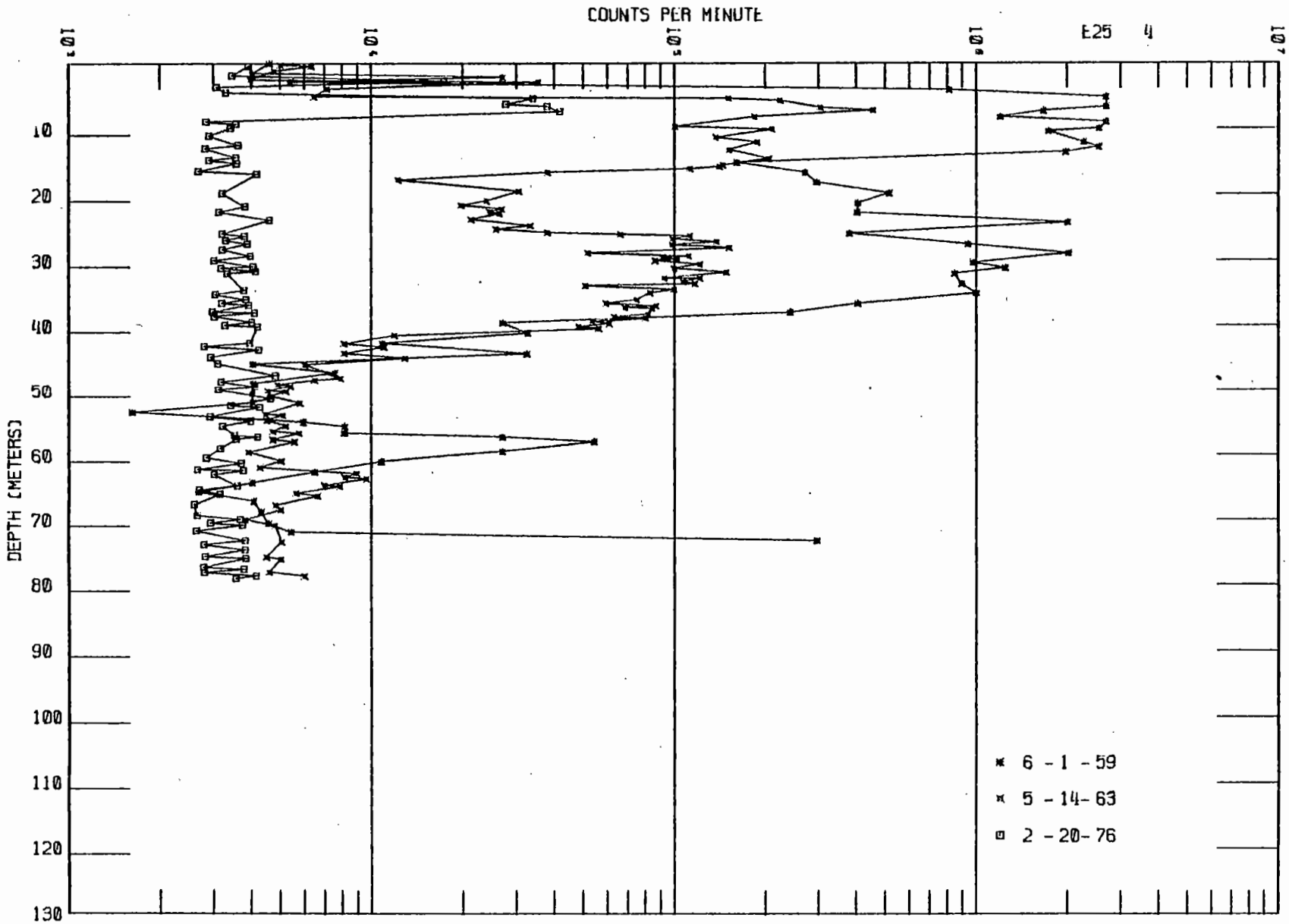
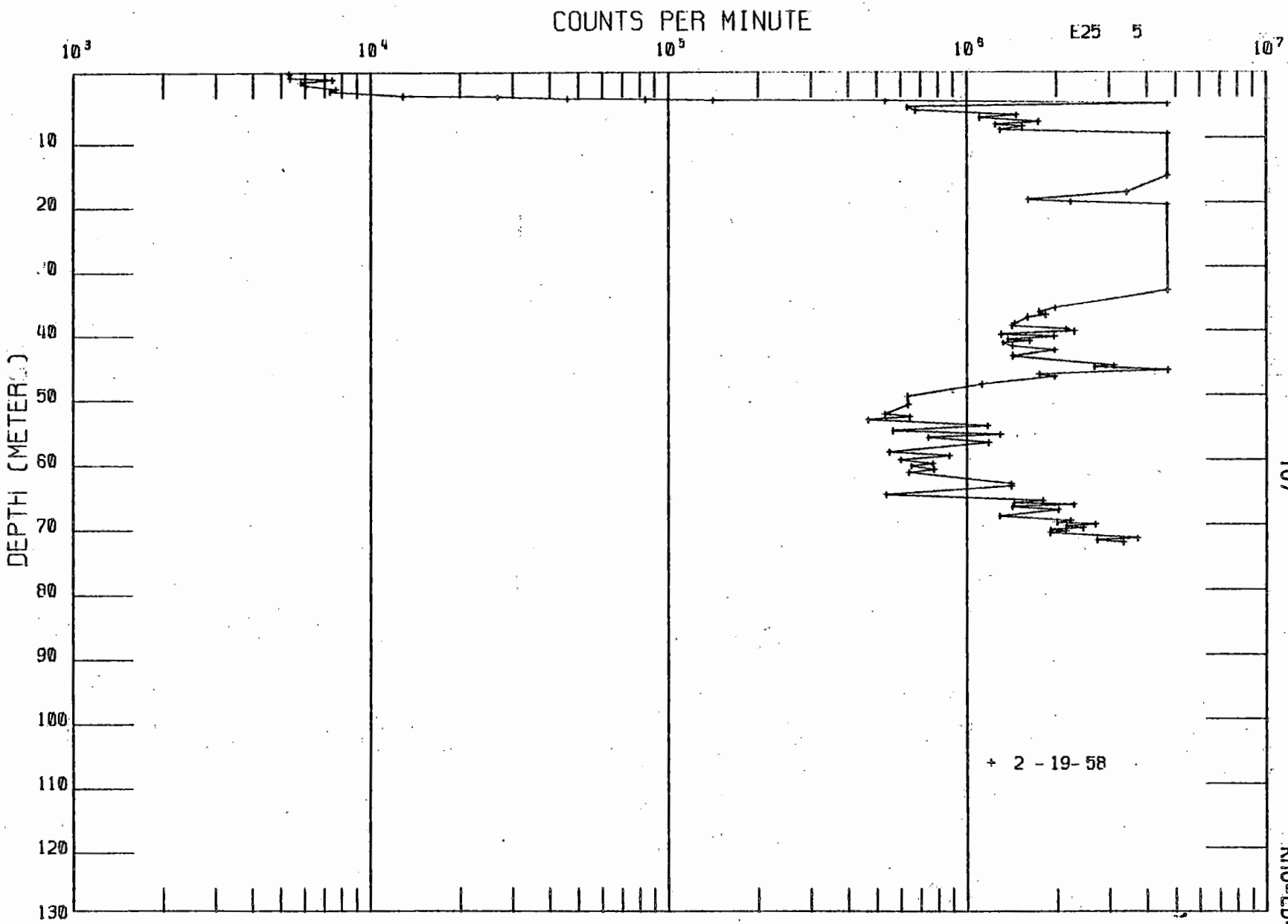
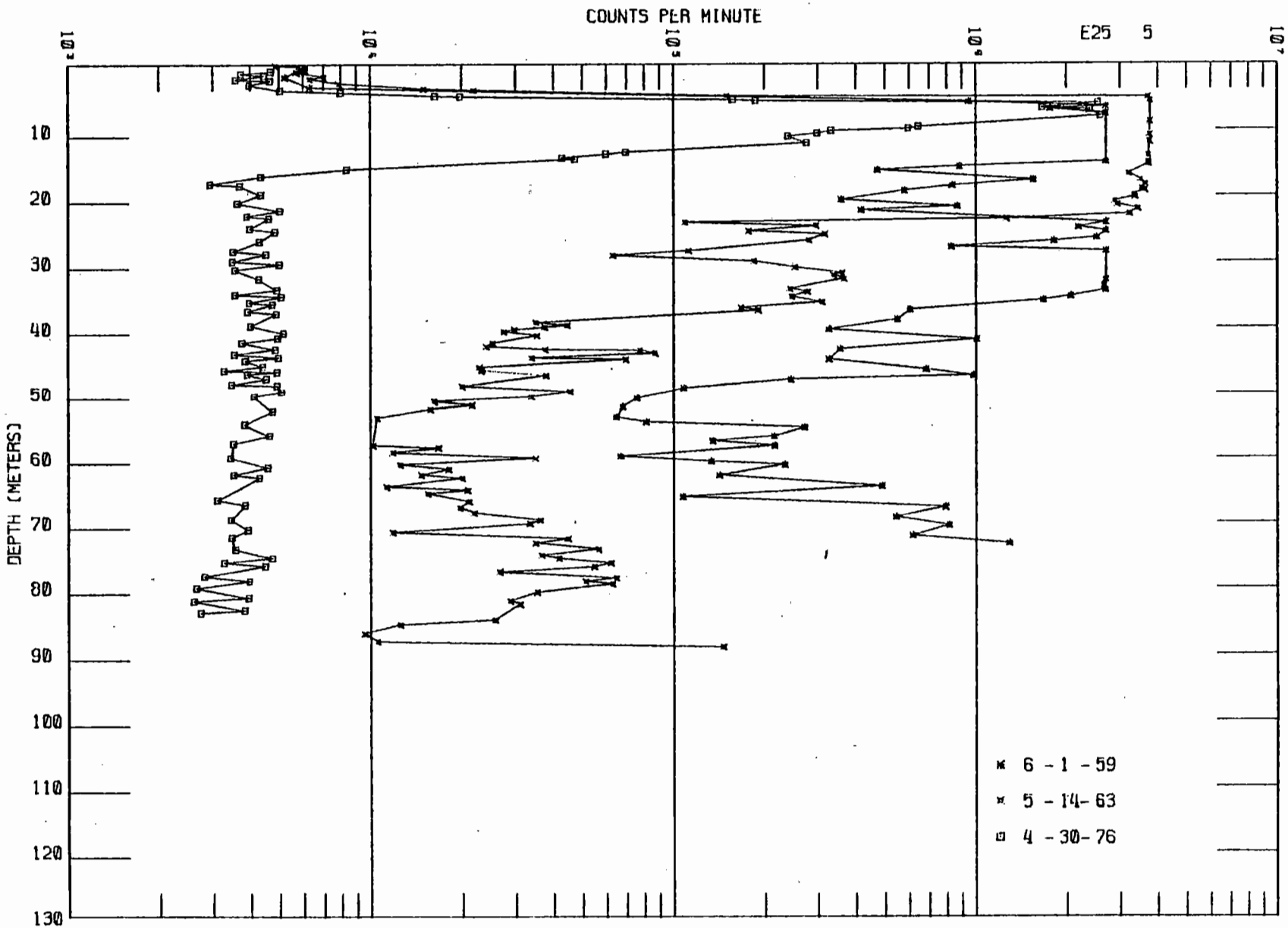
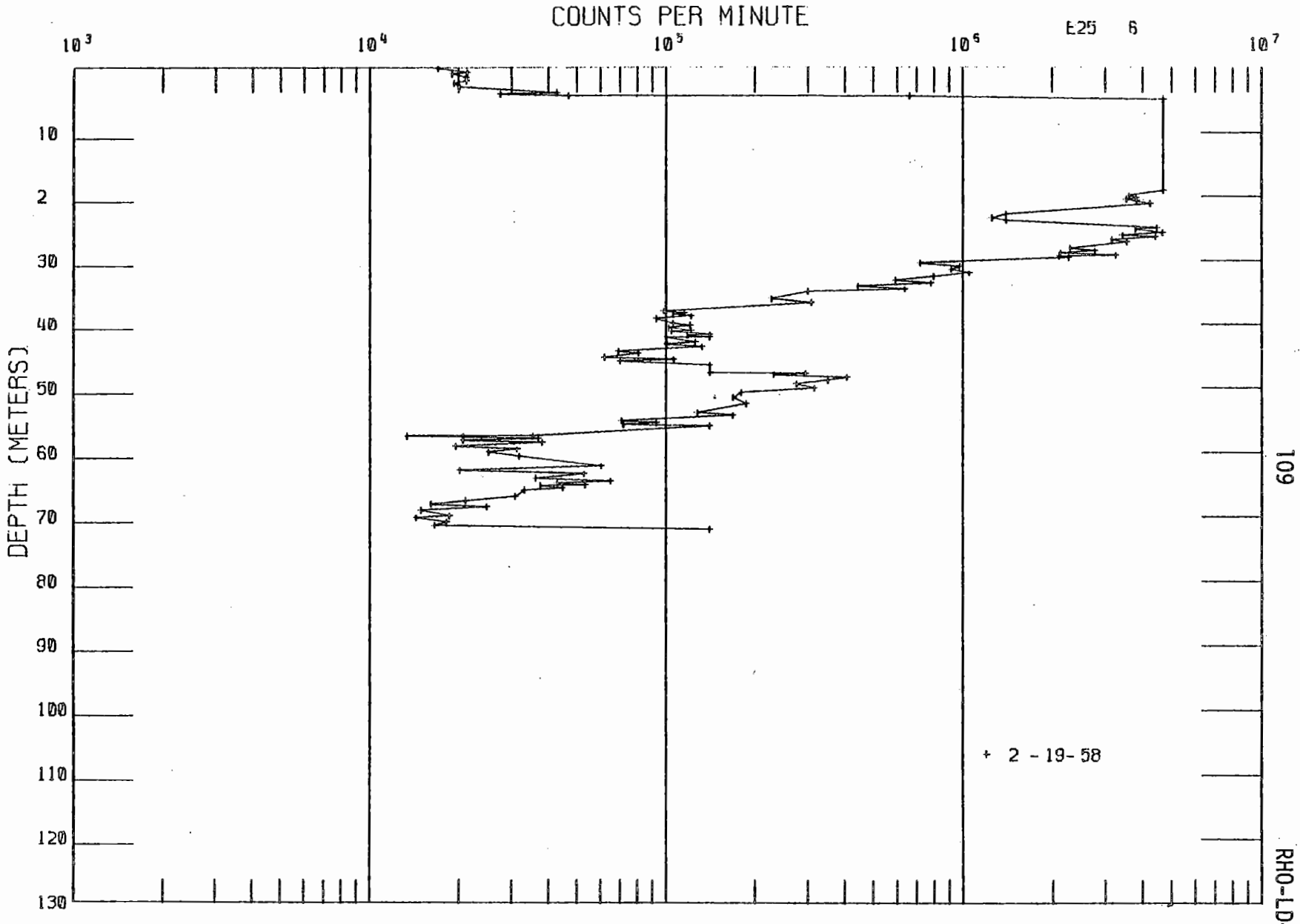

COUNTS PER MINUTE
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
6 - 1 - 59
5 - 14- 63
2 - 20- 76


COUNTS PER MINUTE
E25 5
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
+ 2 - 19- 58


COUNTS PER MINUTE
E25 5
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
6 - 1 - 59
5 - 14- 63
4 - 30- 76

9 2 1 2 4 6 6 0 7 0 2



109

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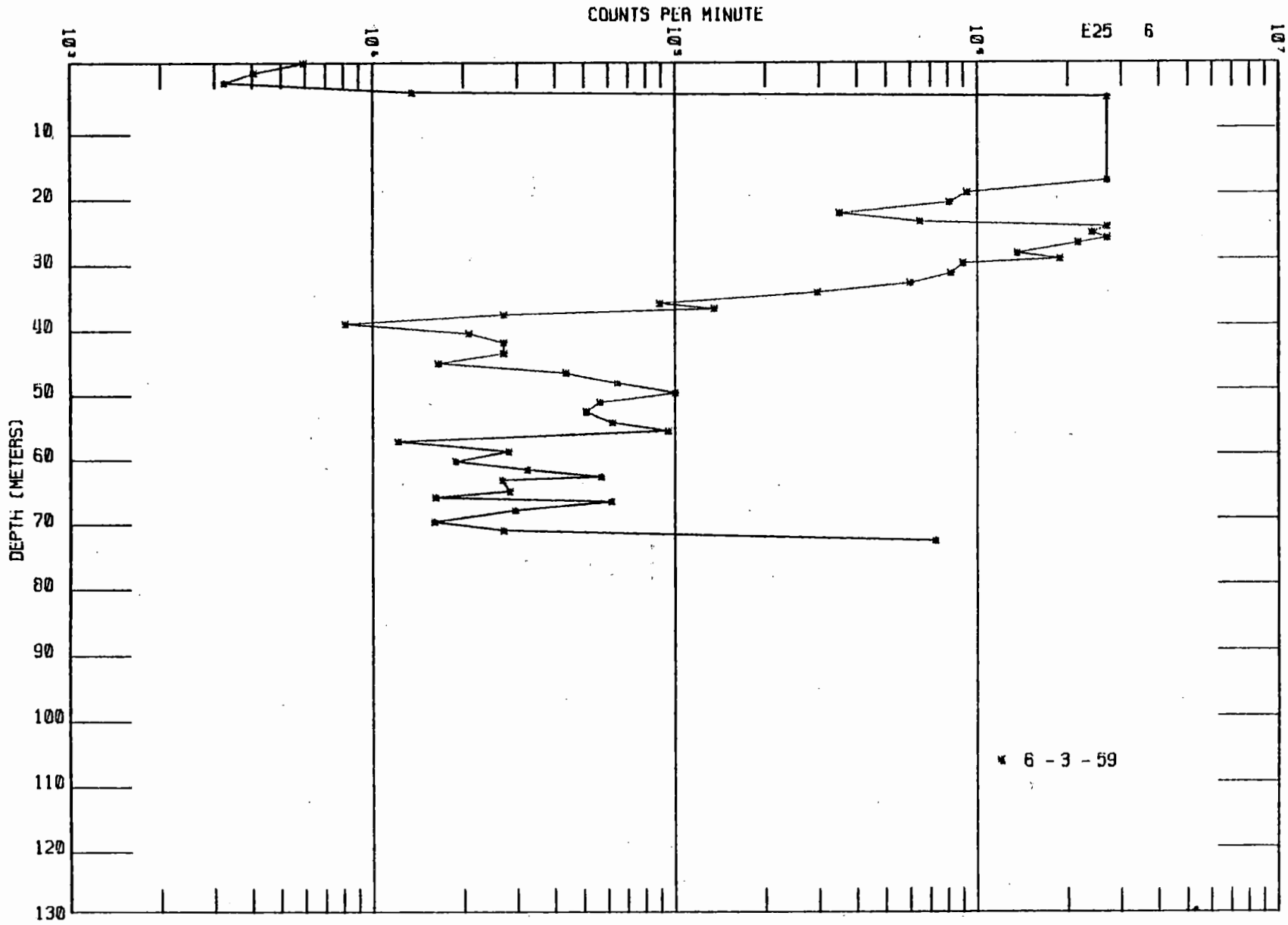
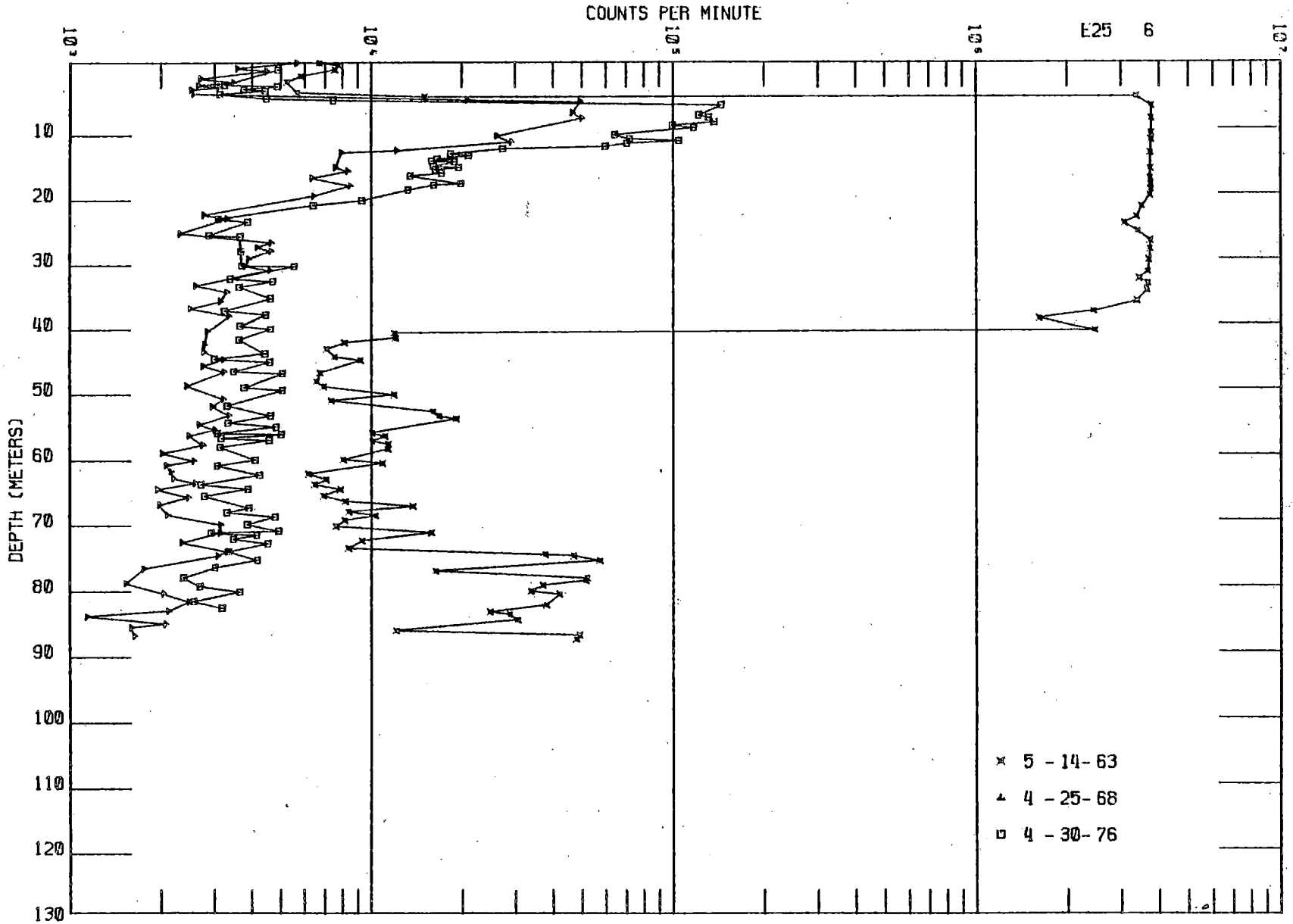

COUNTS PER MINUTE
E25 6
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
6 - 3 - 59

9 2 1 2 4 6 6 0 7 0 4



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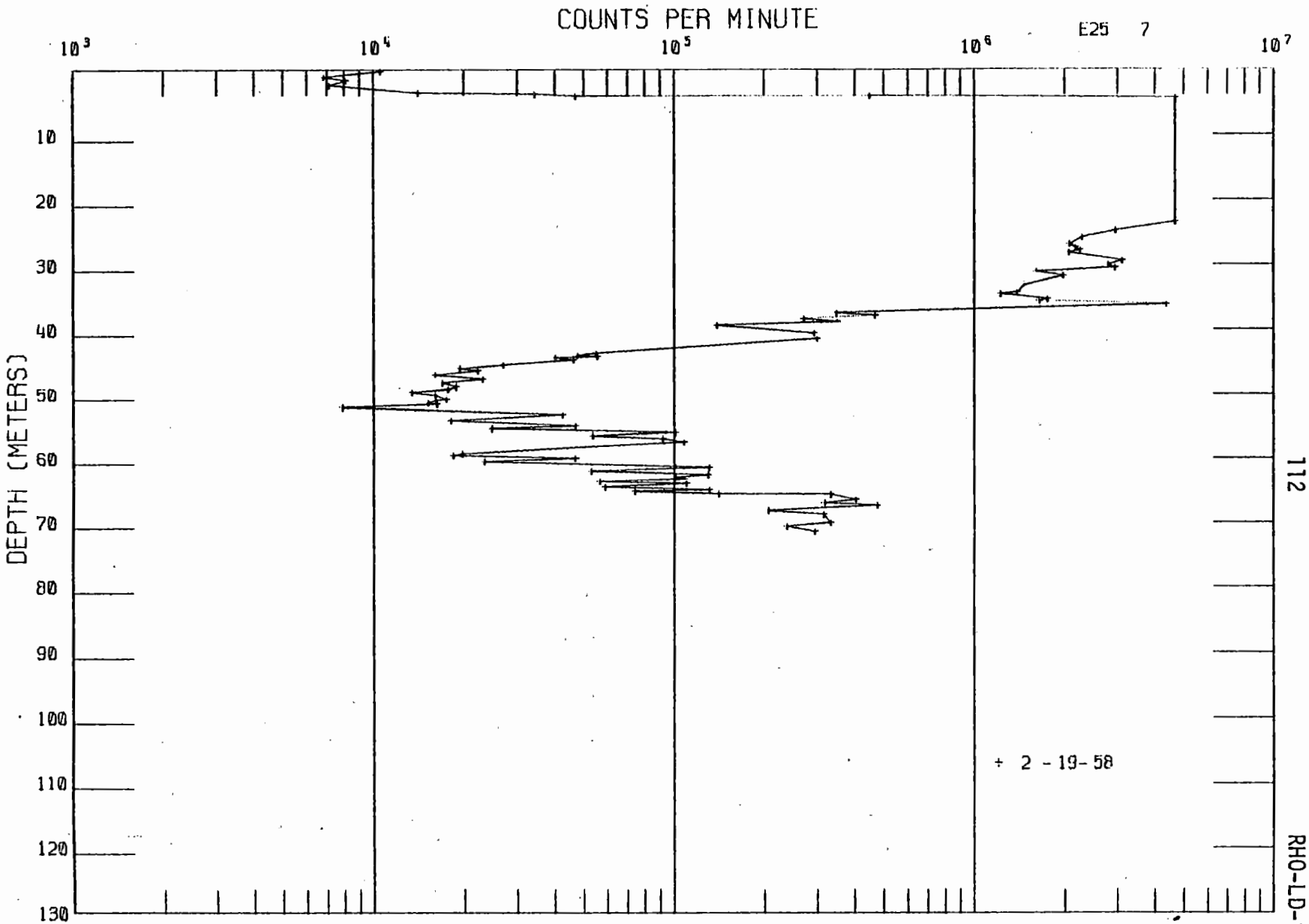
COUNTS PER MINUTE
10^3
10^4
10^5
10^6
10^7
E25 7
DEPTH (METERS)
10
20
30
40
50
60
70
80
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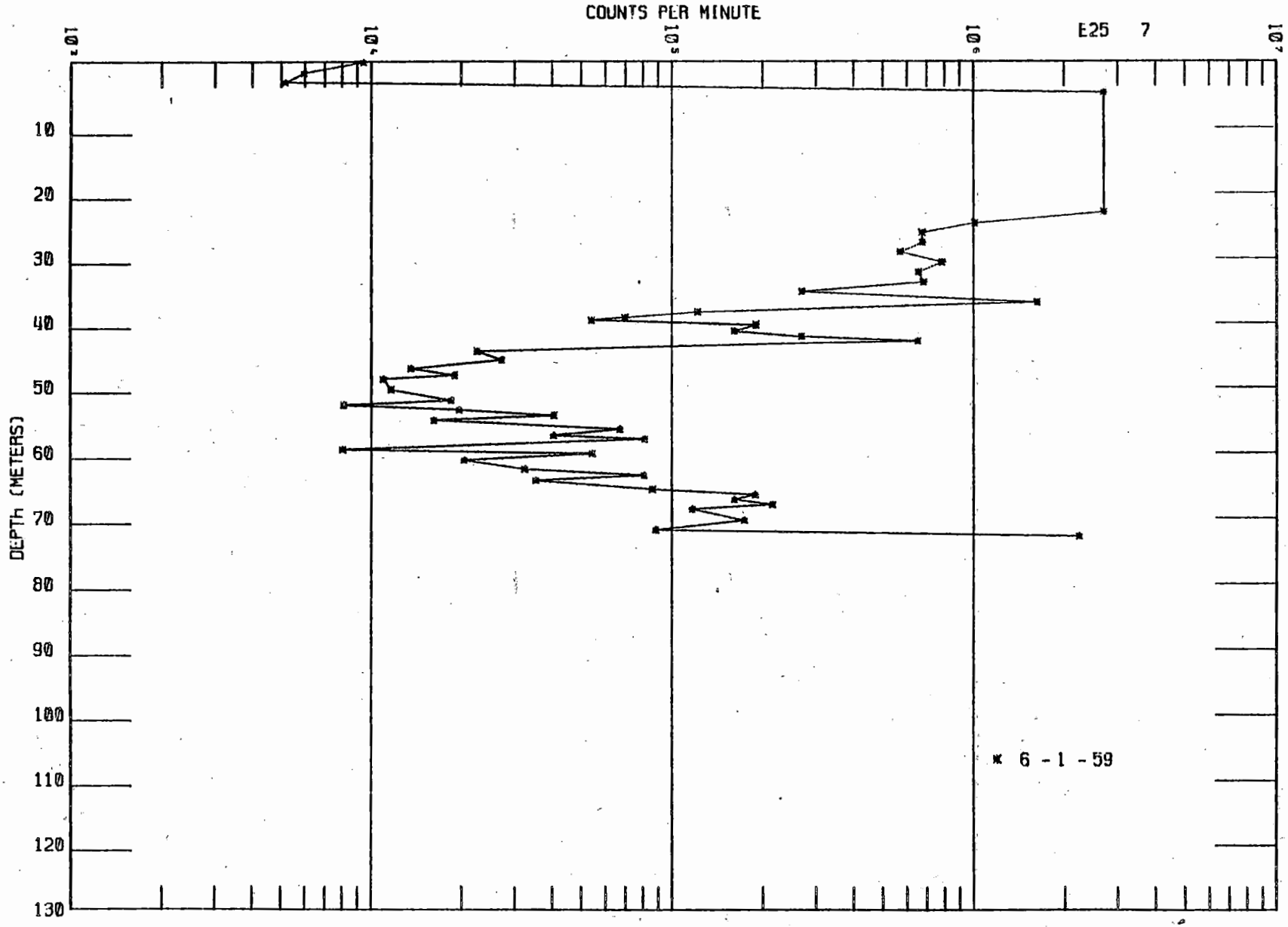
100
110
120
130
+ 2 - 19- 58

9 2 1 2 4 6 6 0 7 0 6



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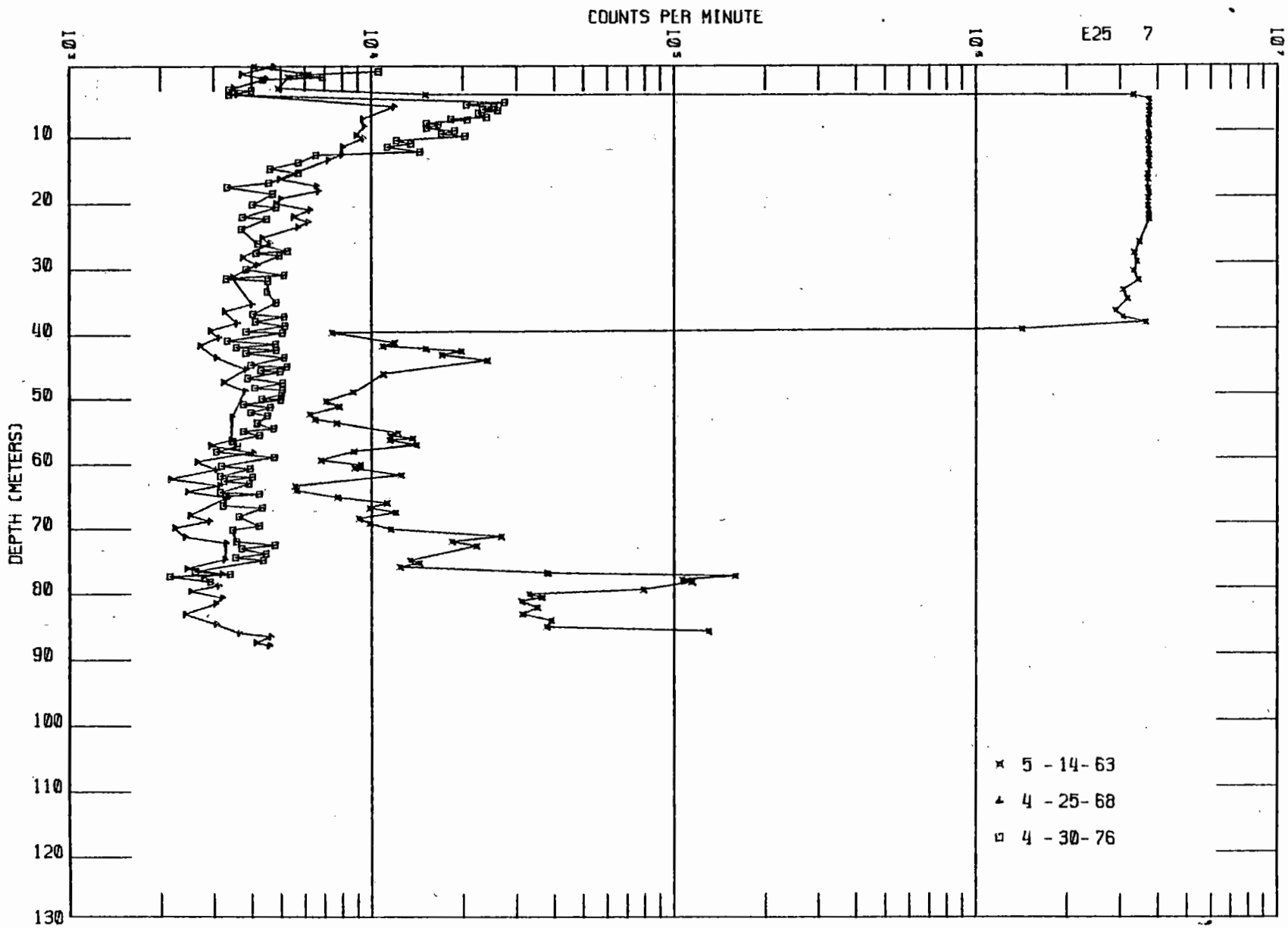
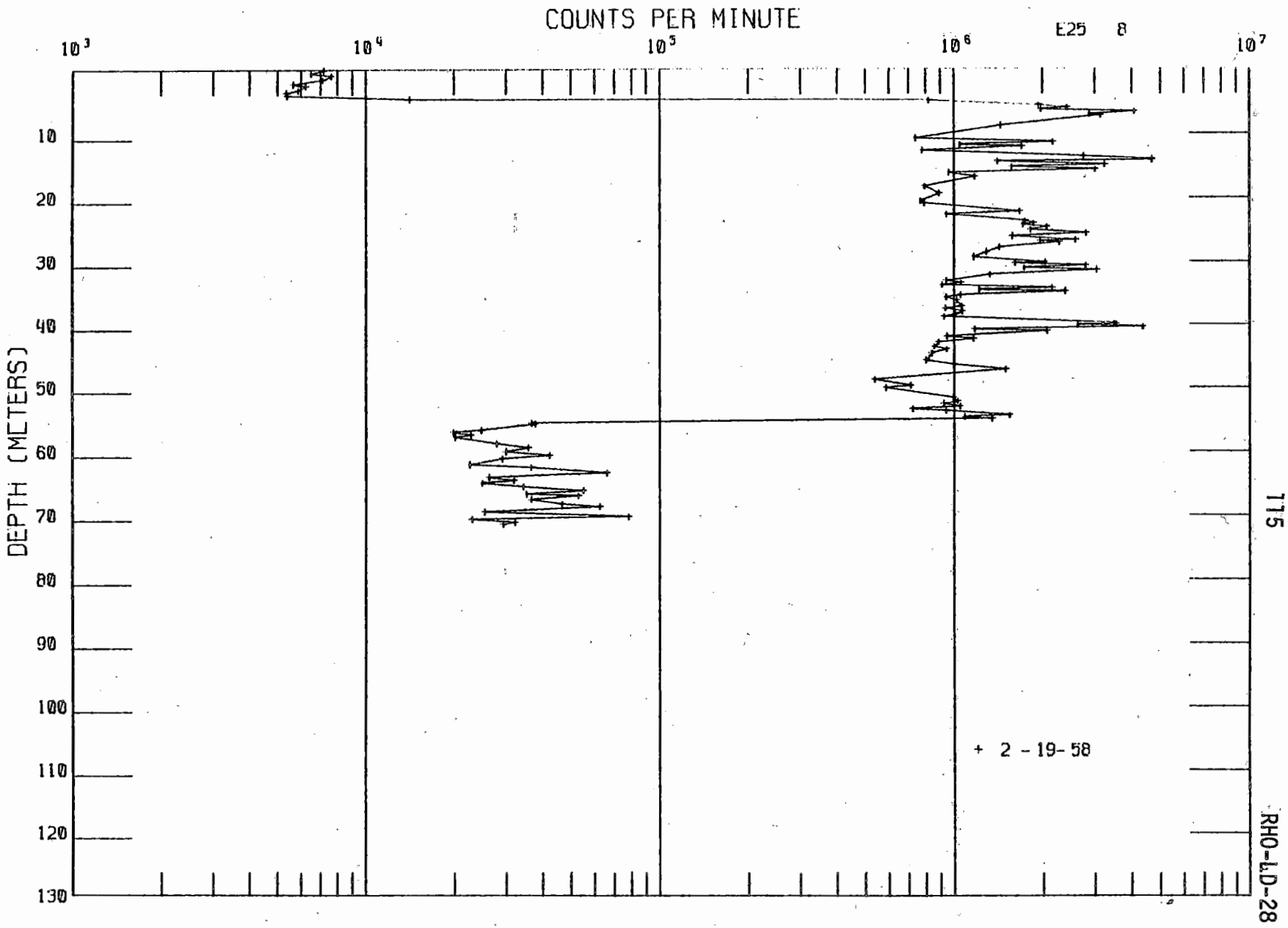
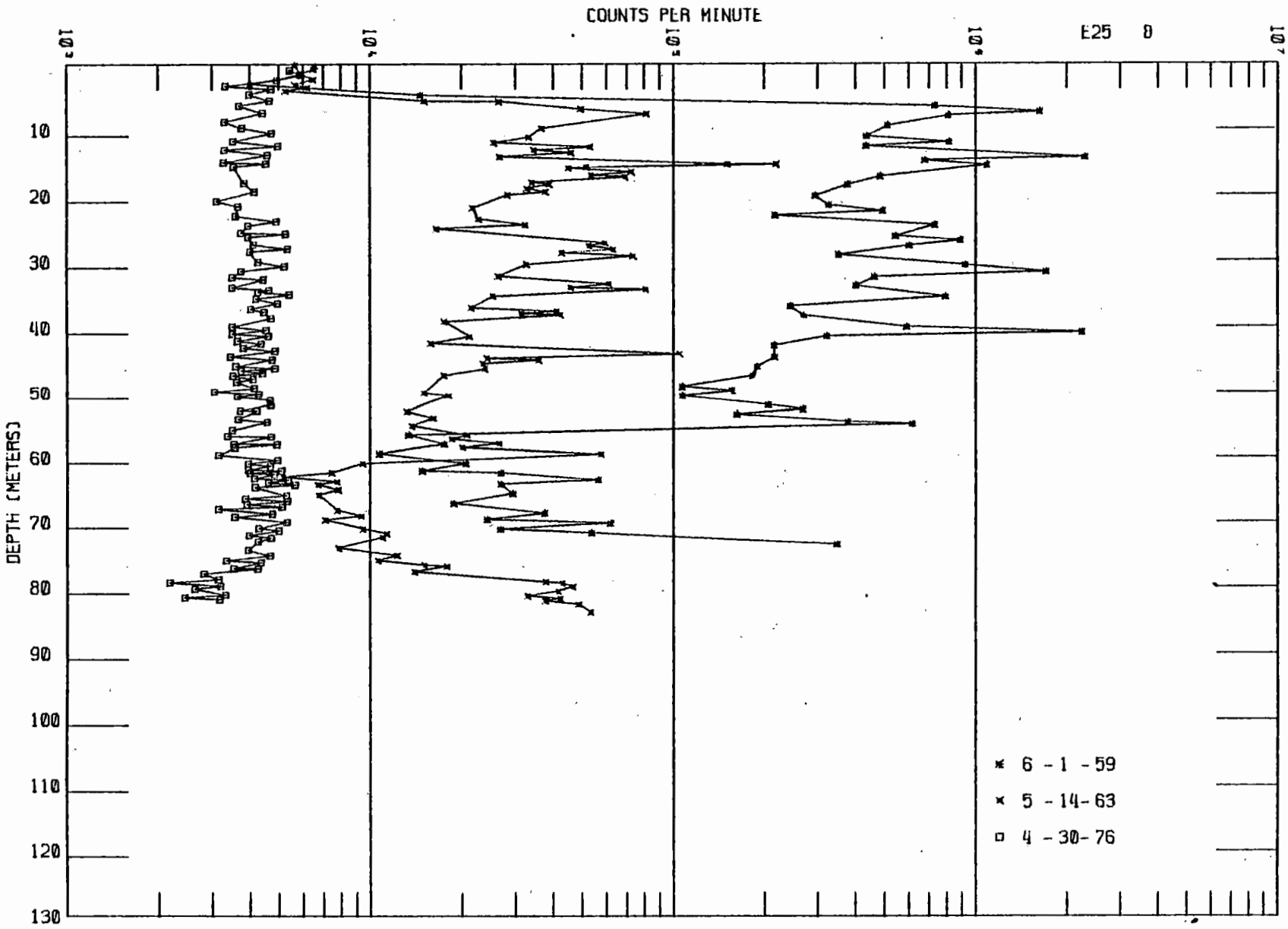

COUNTS PER MINUTE
E25 7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
5 - 14- 63
4 - 25- 68
4 - 30- 76

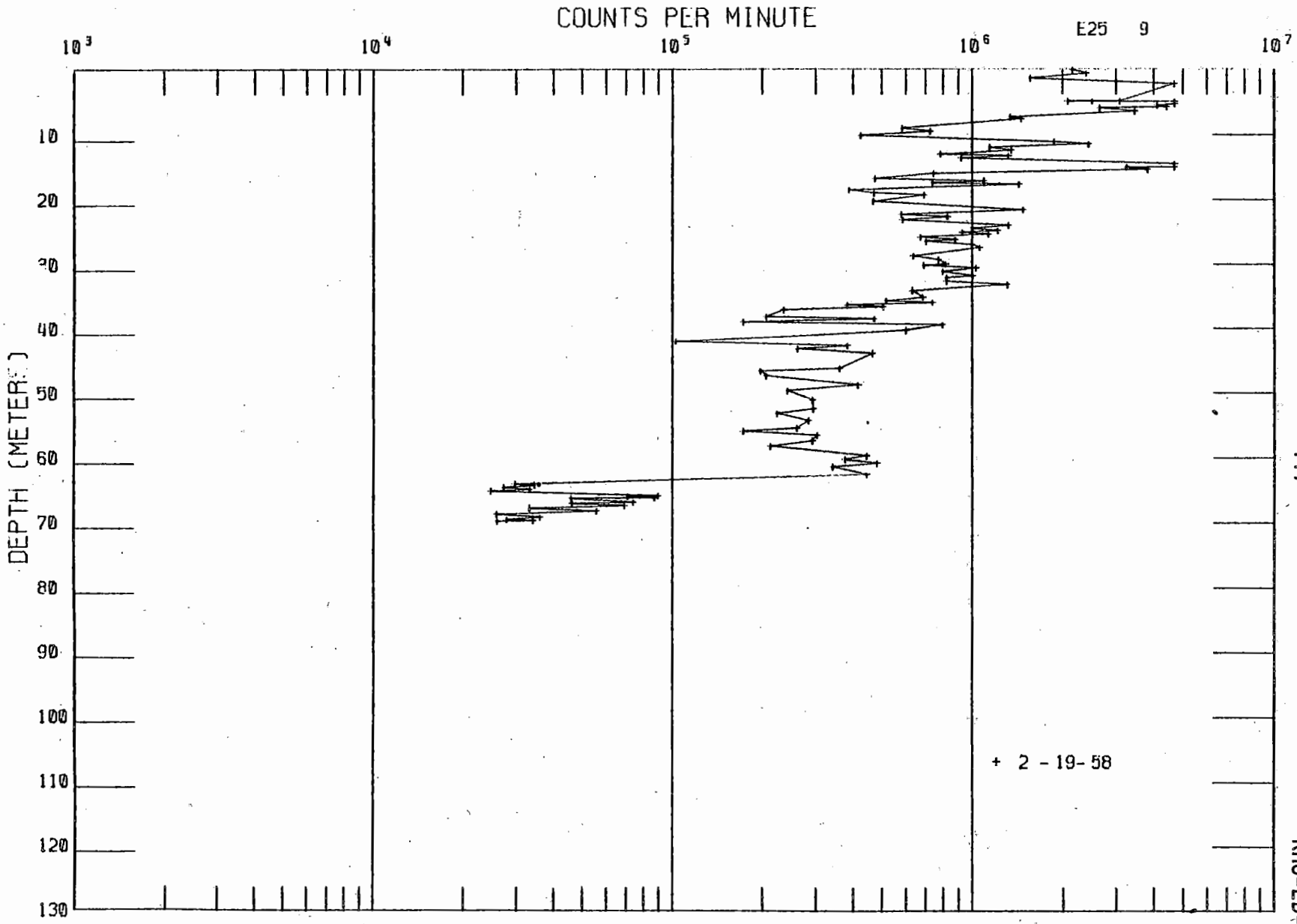
9 2 1 2 4 6 6 0 7 0 8



115

RHO-LD-28


COUNTS PER MINUTE
10³
10⁴
10⁵
10⁶
E25 0
10⁷
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
6 - 1 - 59
5 - 14- 63
4 - 30- 76


COUNTS PER MINUTE
10^3
10^4
10^5
10^6
10^7
E25 9
DEPTH (METERS)
10
20
30
40
50
60
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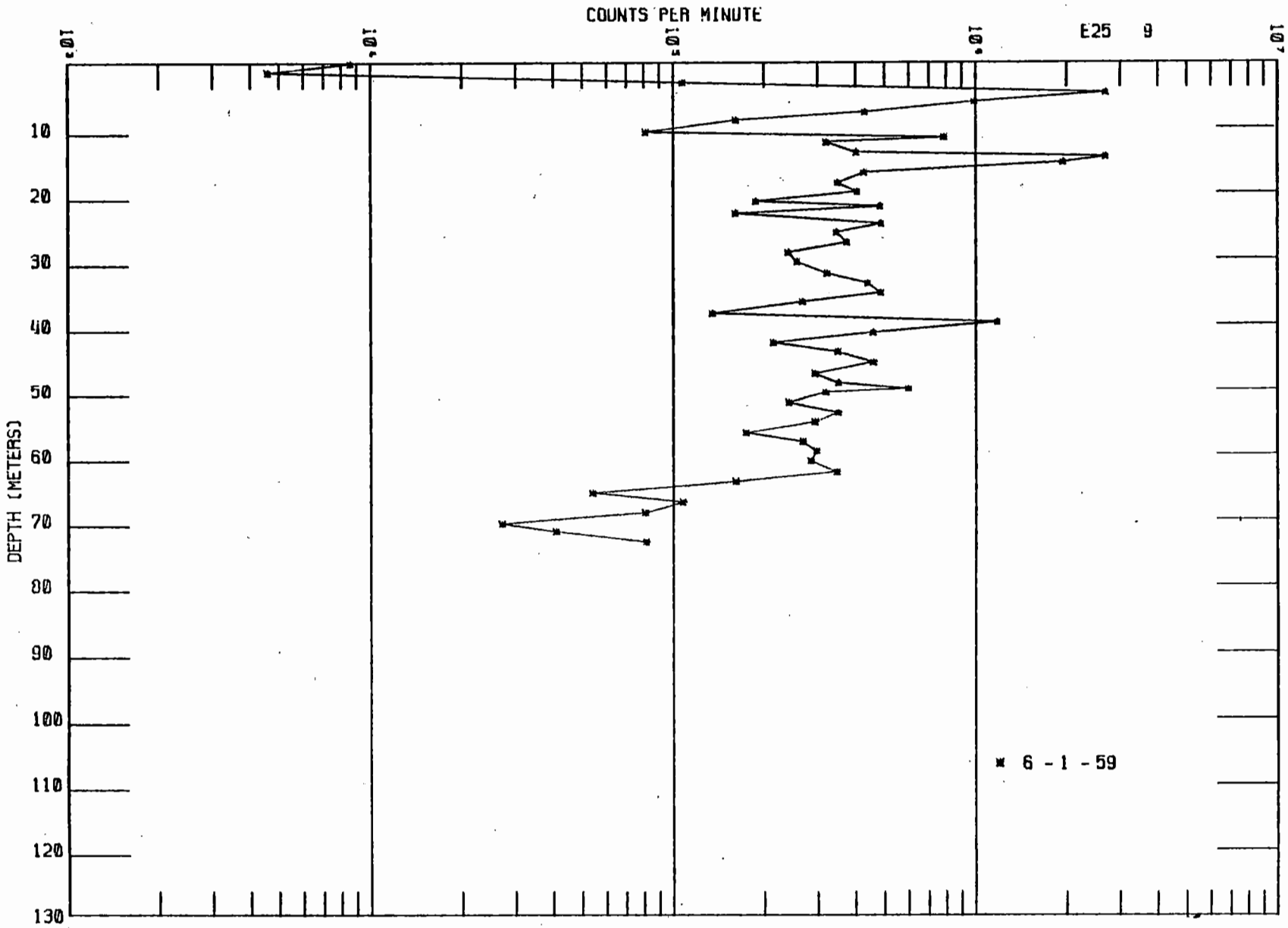
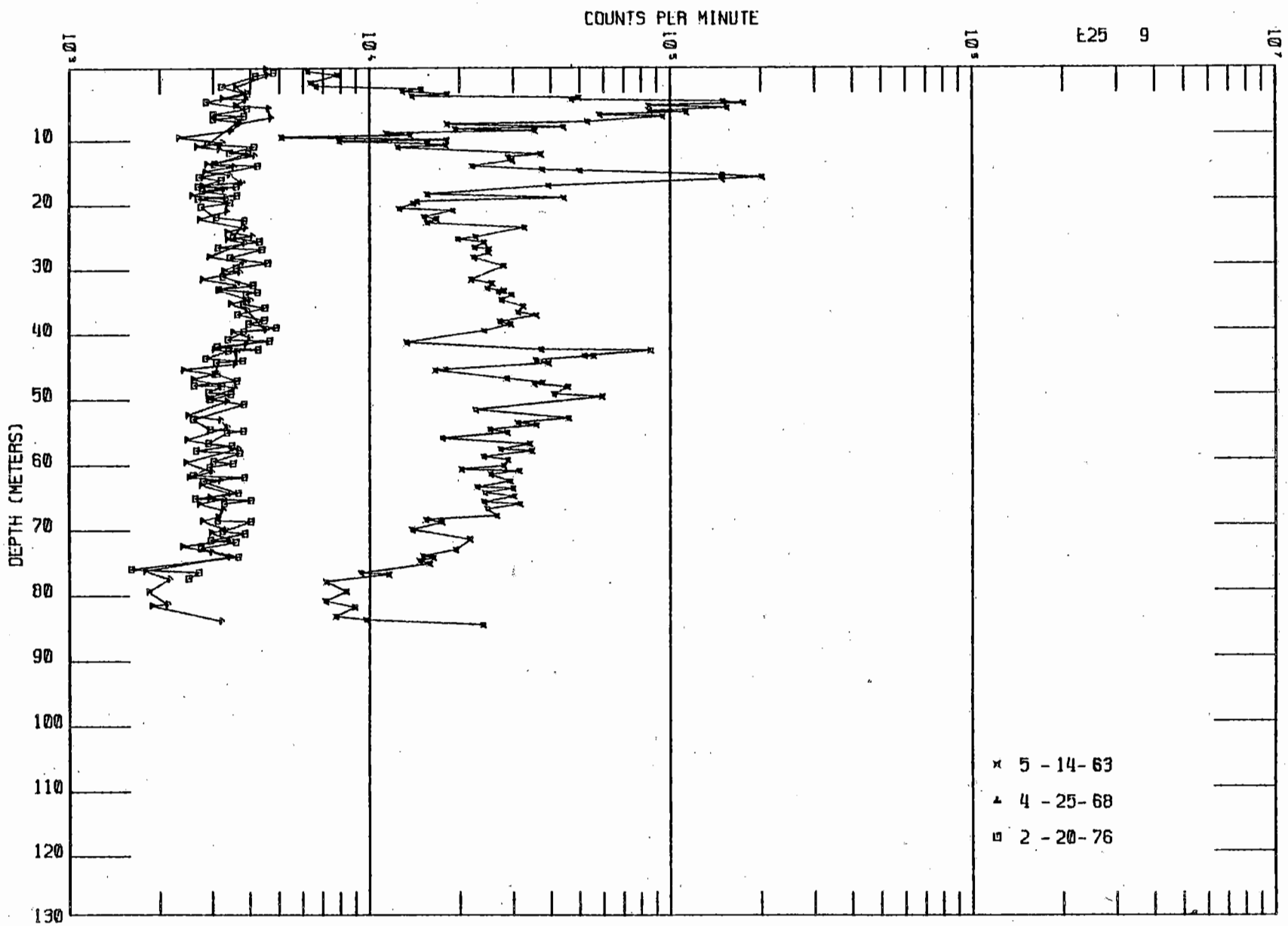
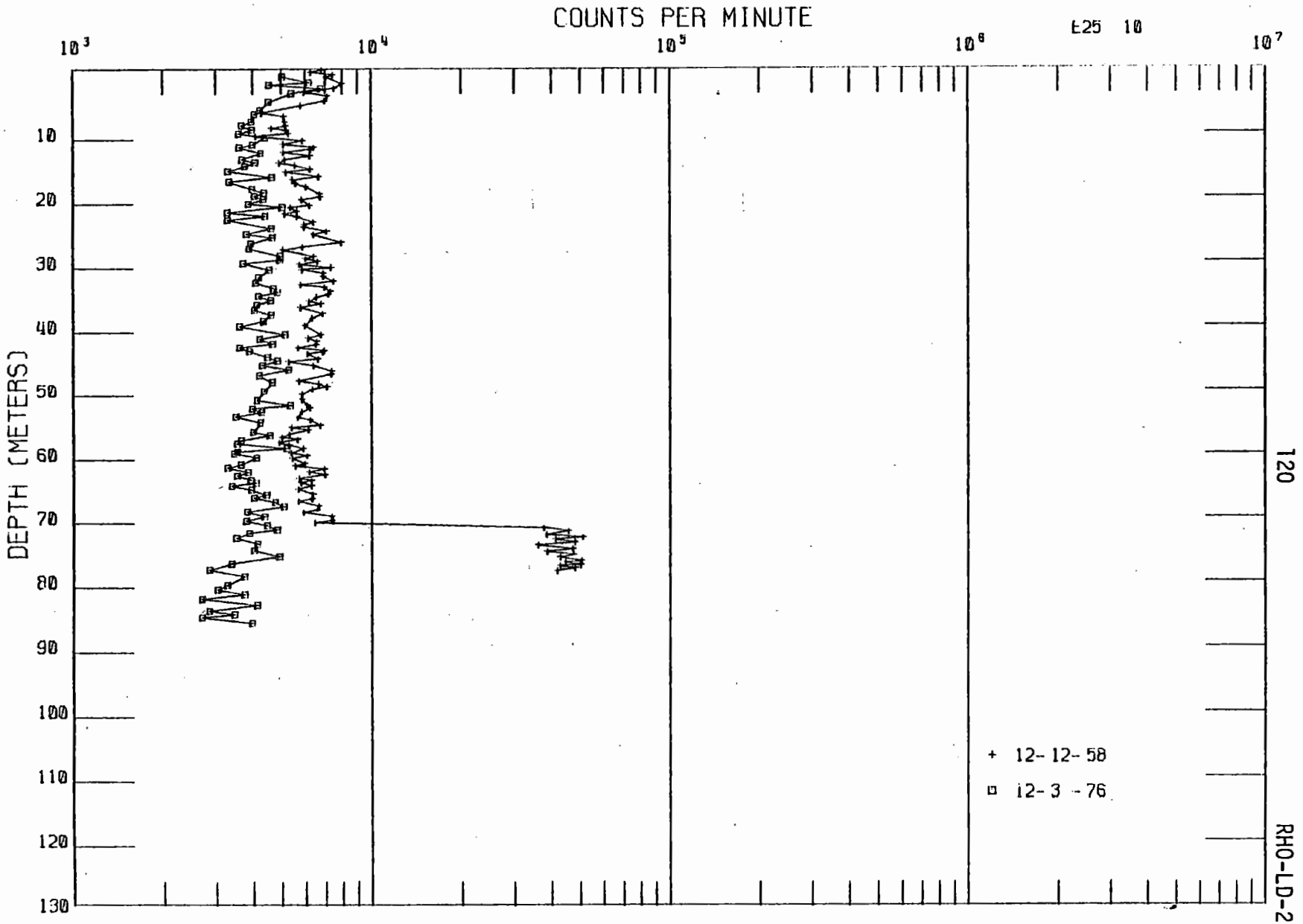
80
90
100
110
120
130
+ 2 - 19- 58


COUNTS PER MINUTE
E25 9
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
6 - 1 - 59


COUNTS PER MINUTE
E25 9
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
5 - 14- 63
4 - 25- 68
2 - 20- 76

9 2 1 2 4 6 6 0 7 1 3



120

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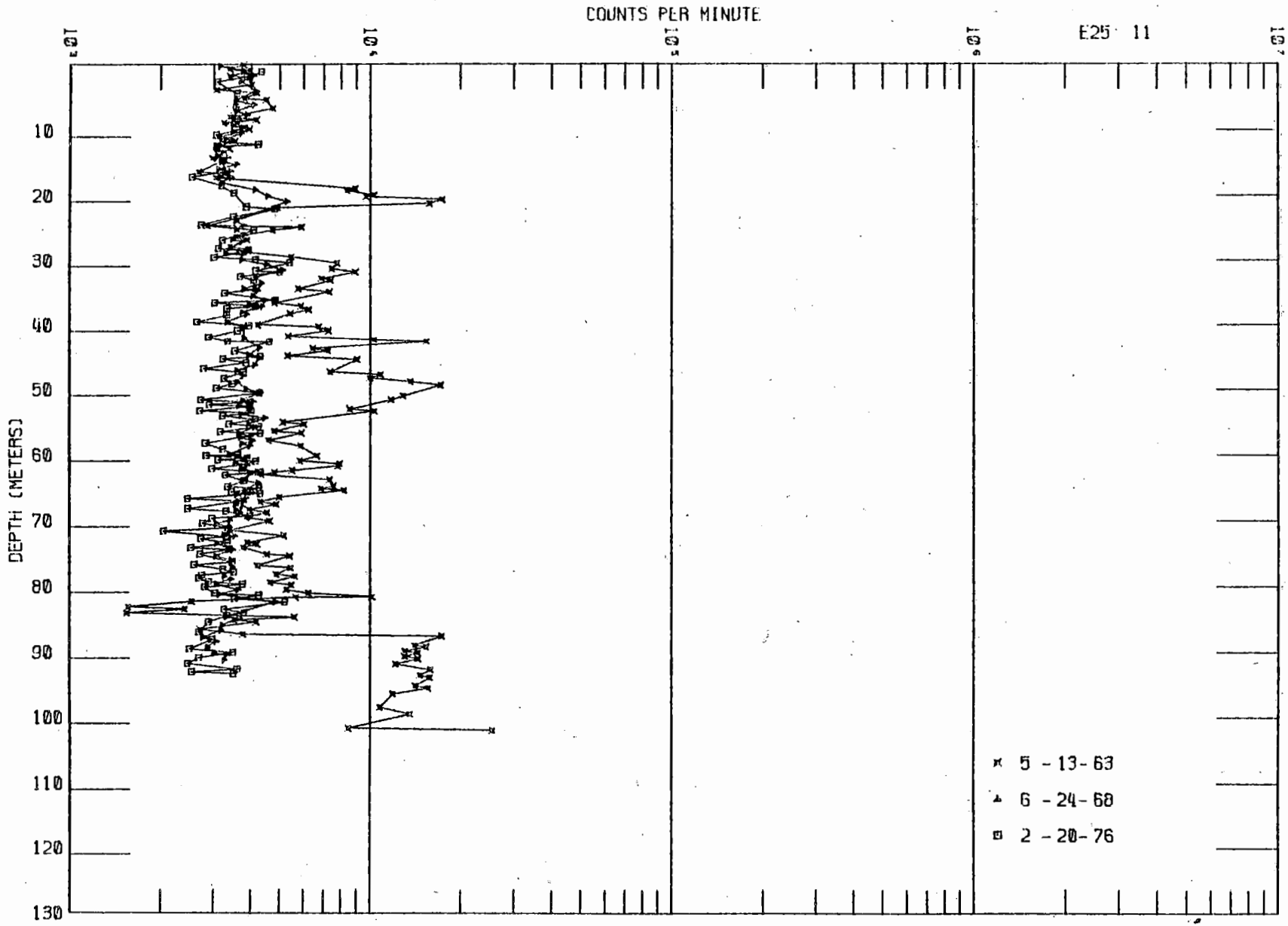
COUNTS PER MINUTE
E25 11
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
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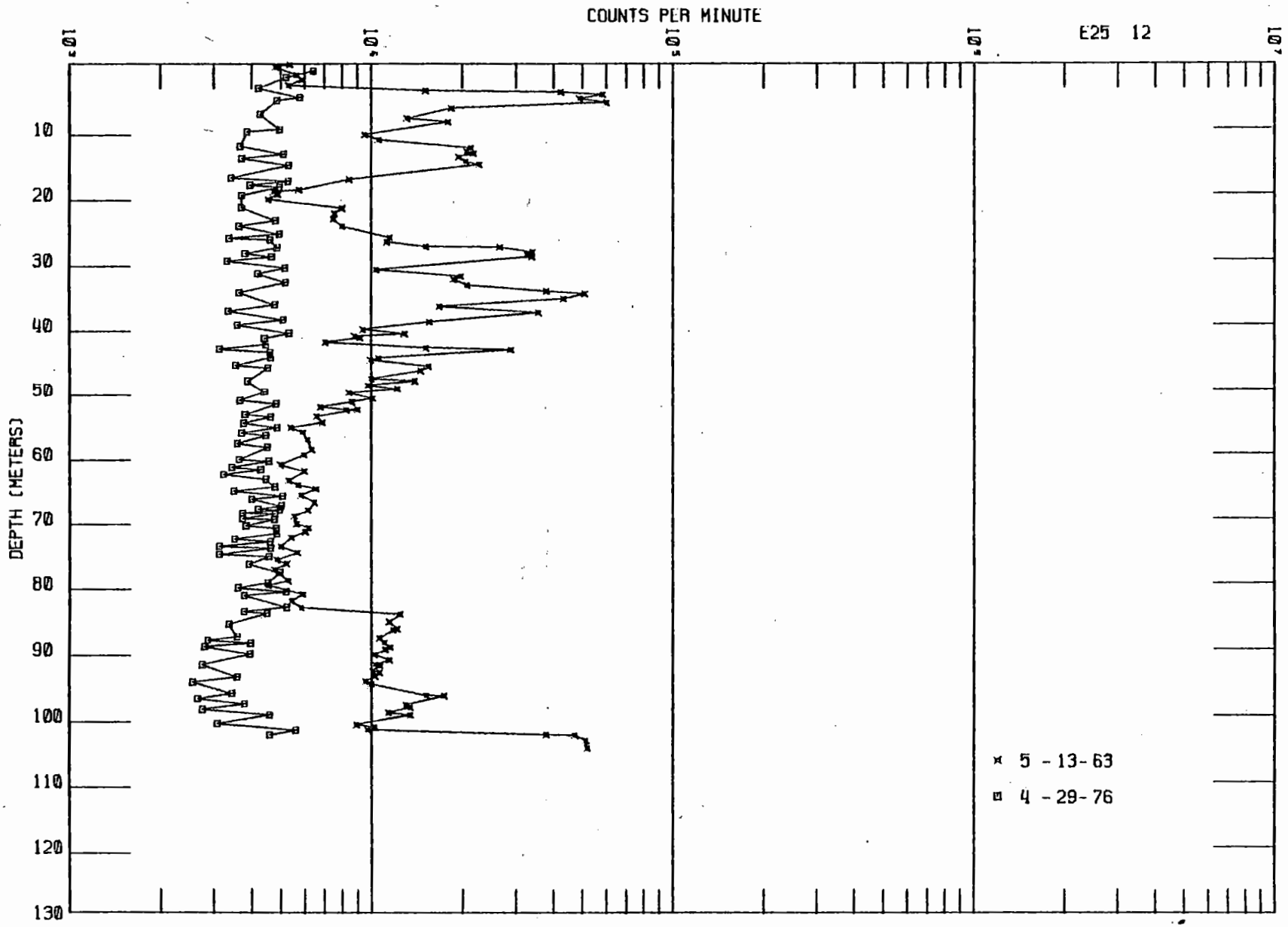
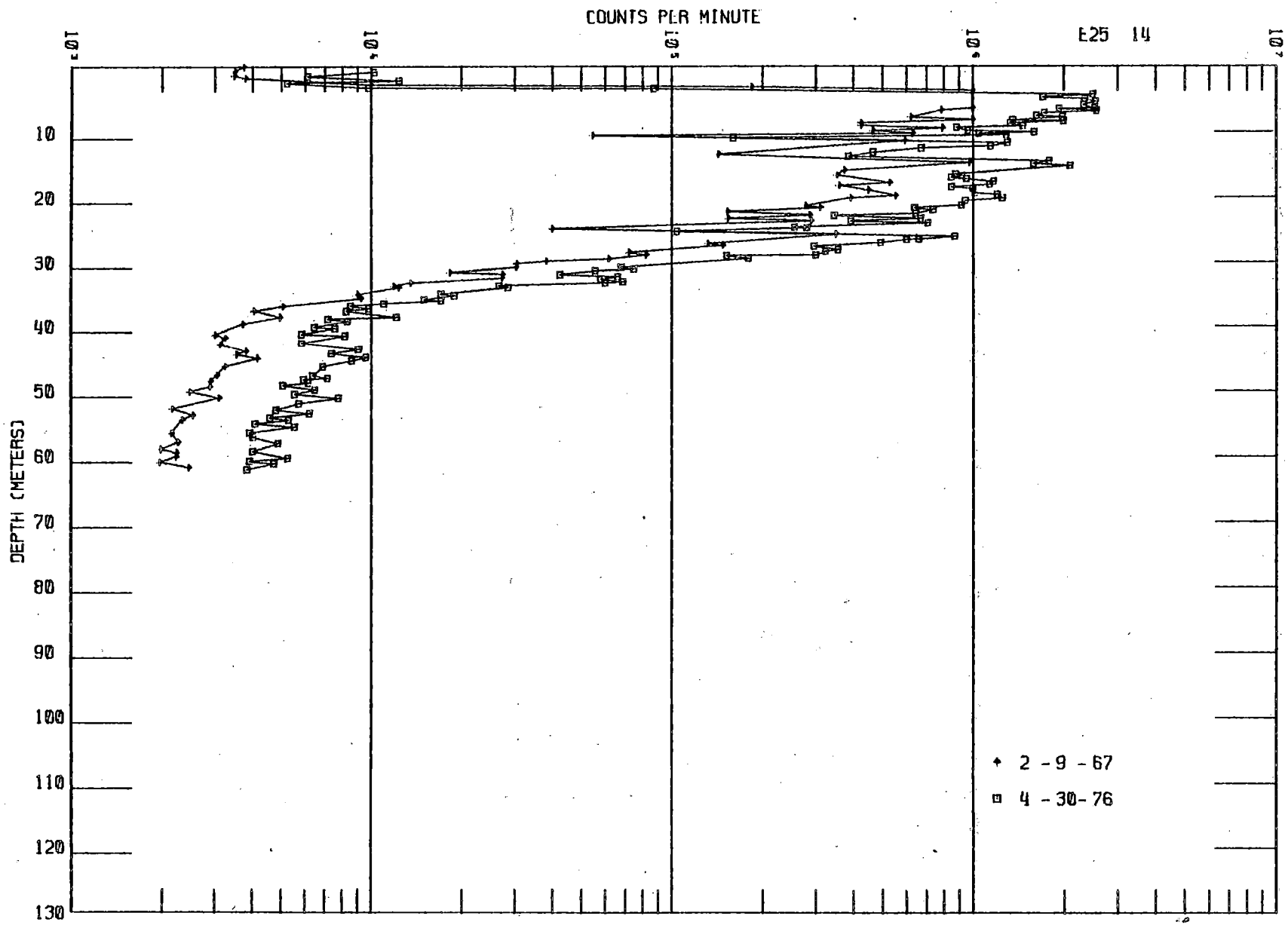
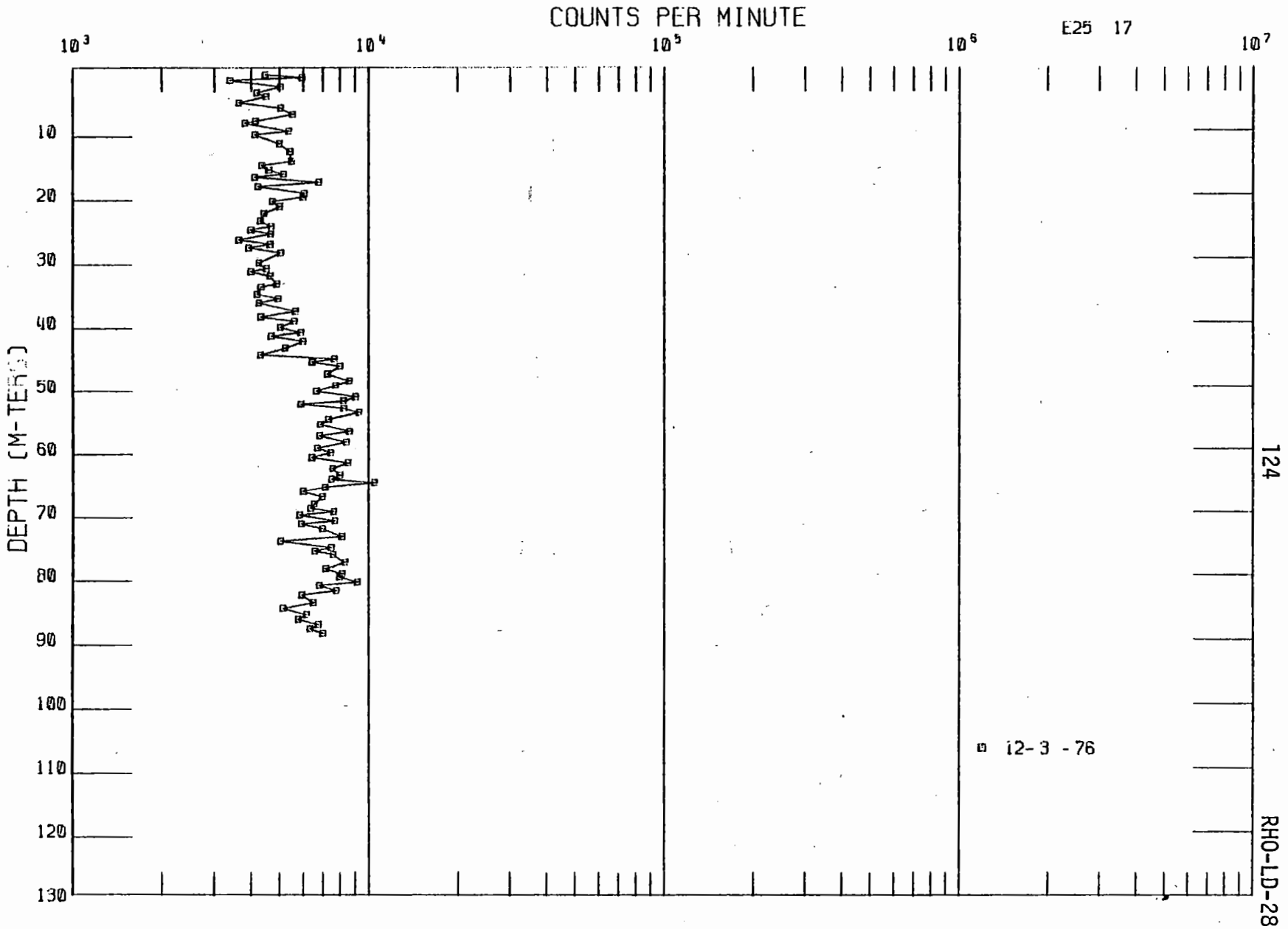
5 - 13 - 63
6 - 24 - 68
2 - 20 - 76


COUNTS PER MINUTE
E25 12
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 13- 63
▫ 4 - 29- 76


COUNTS PER MINUTE
10^3
10^4
10^5
10^6
10^7
E25 14
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
2 - 9 - 67
4 - 30 - 76

9 2 1 2 4 6 6 0 7 1 7



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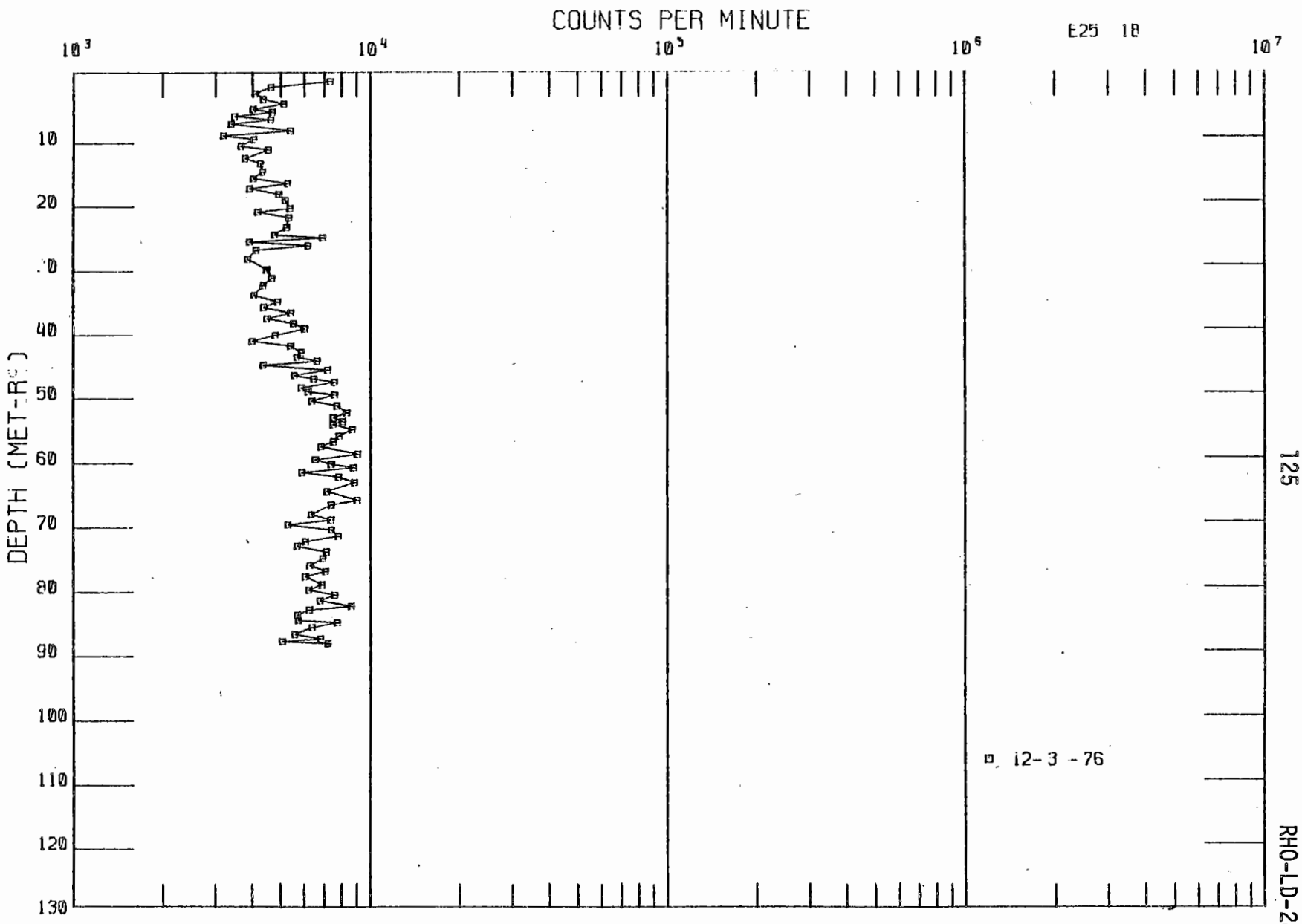
RHO-LD-28

9 2 1 2 4 6 6 0 7 1 8



125

RHO-LD-28

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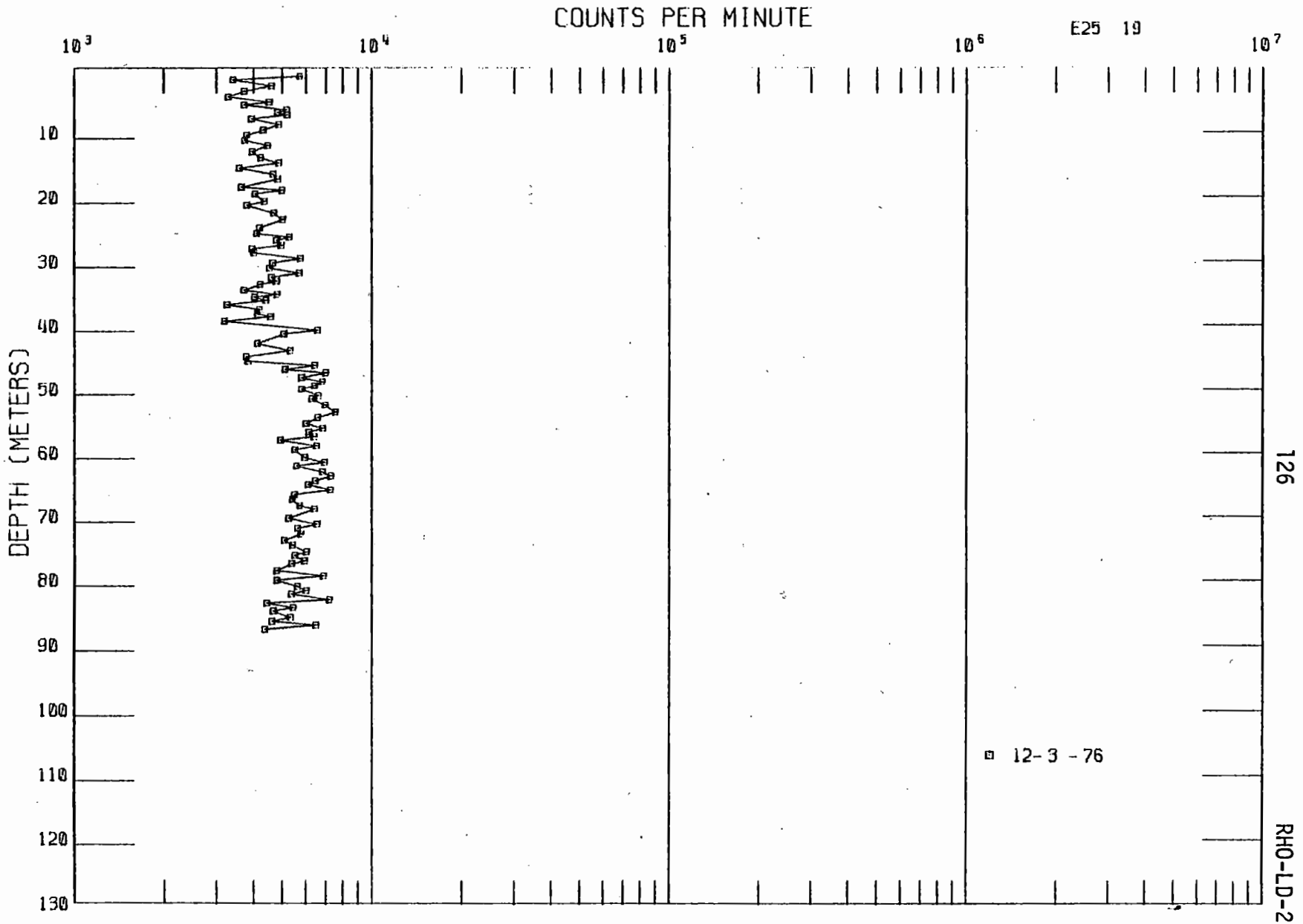

126

RHO-LD-28

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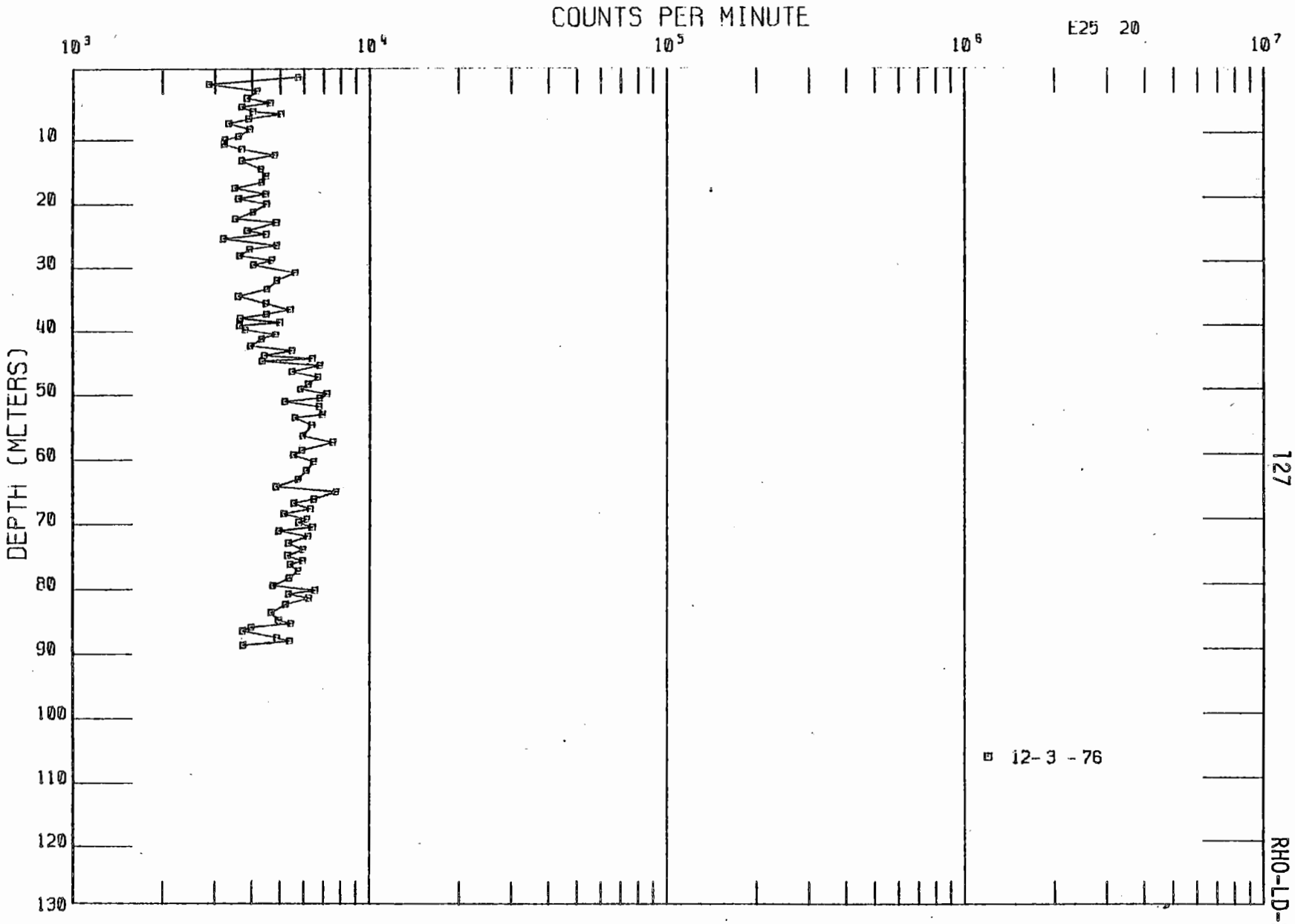

127

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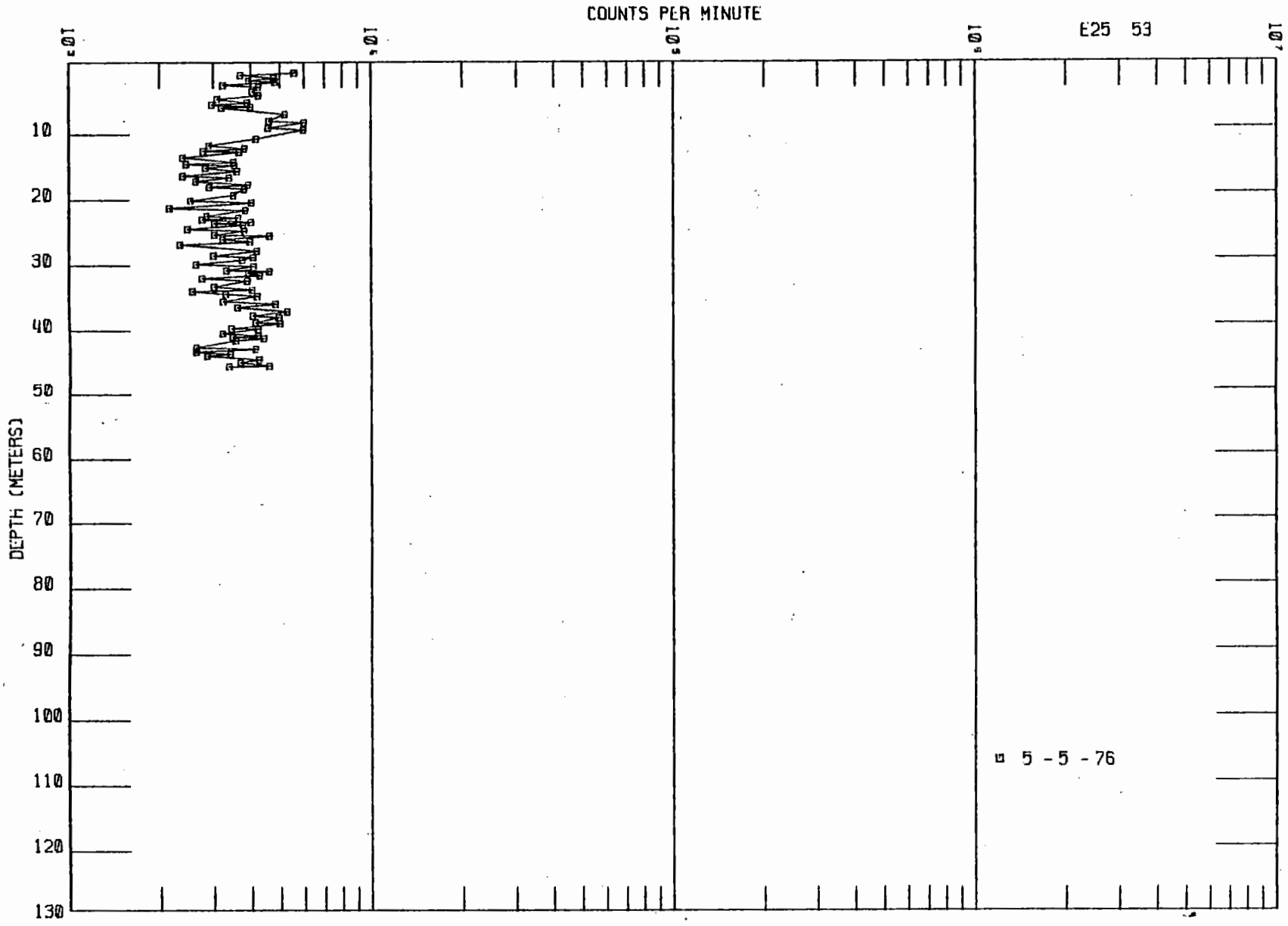

128

RHO-LD-28

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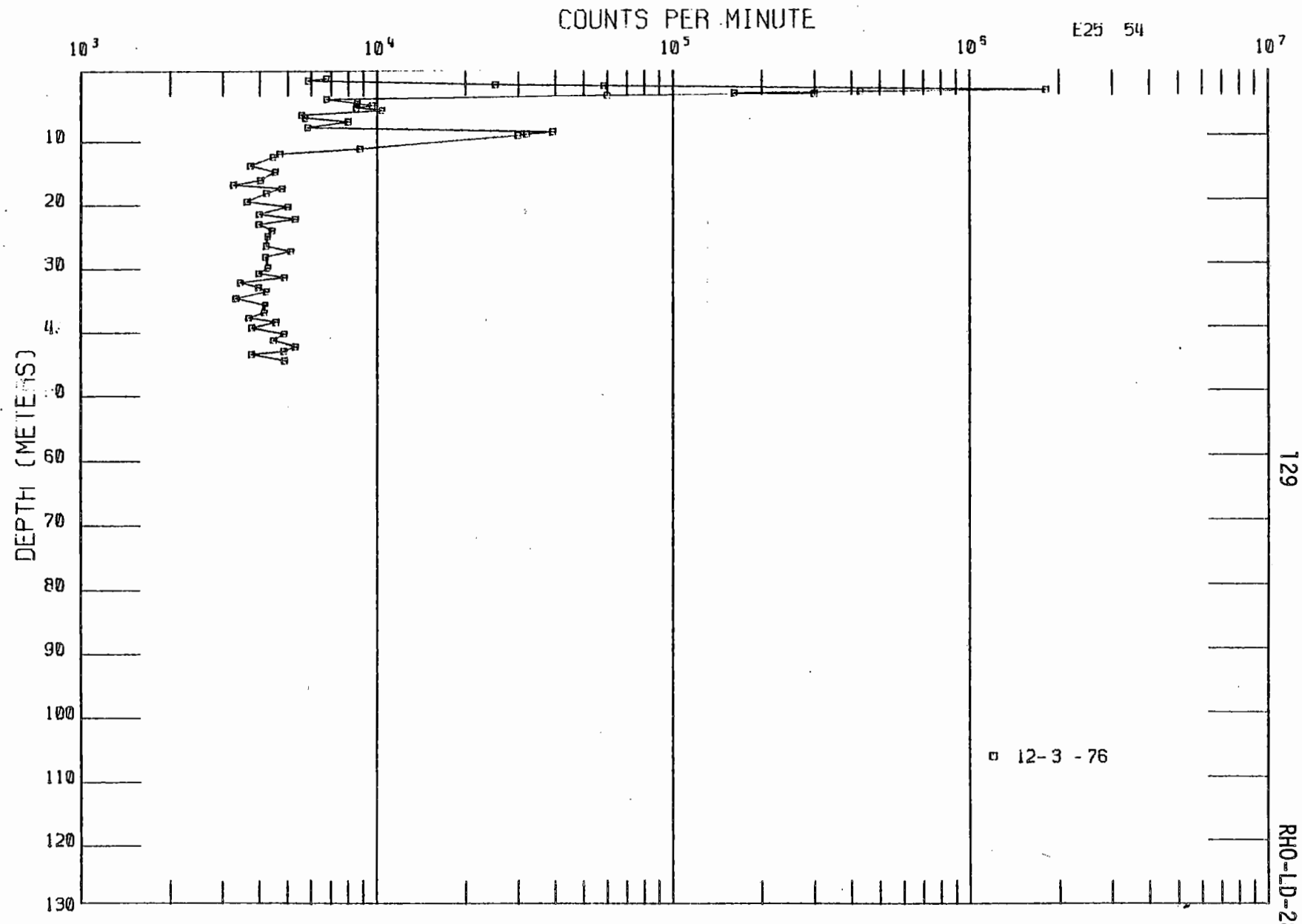

129

RHO-LD-28

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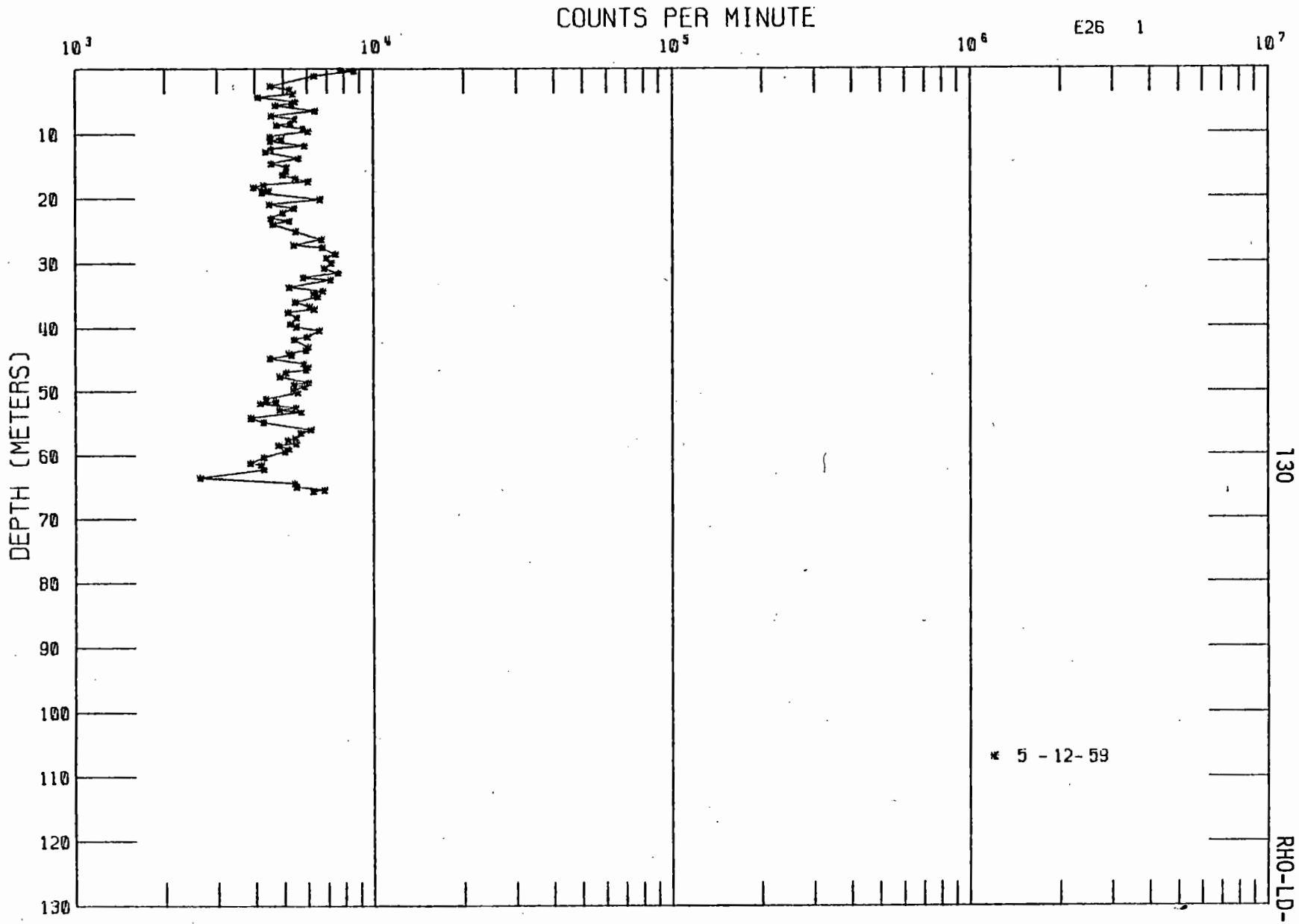
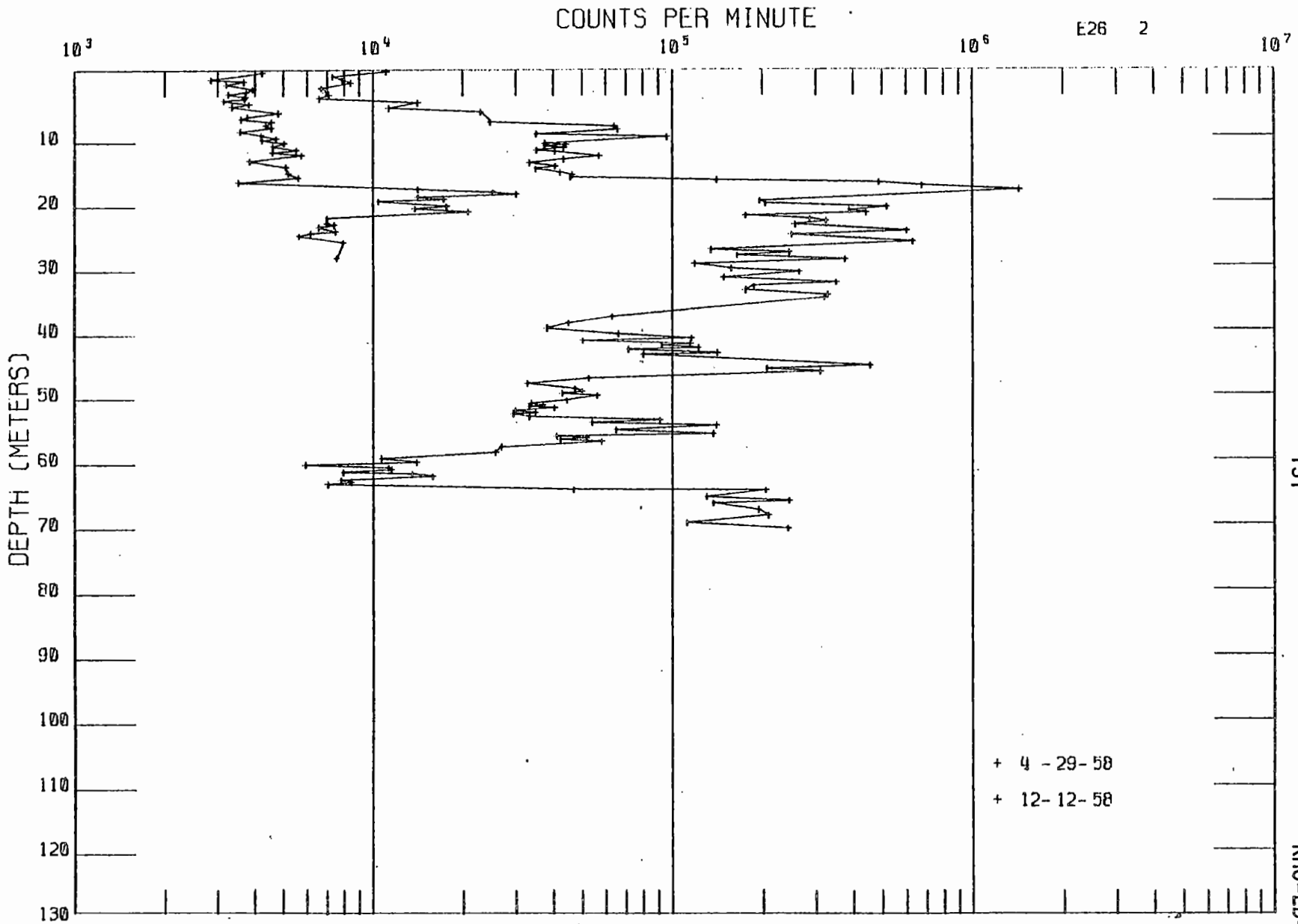
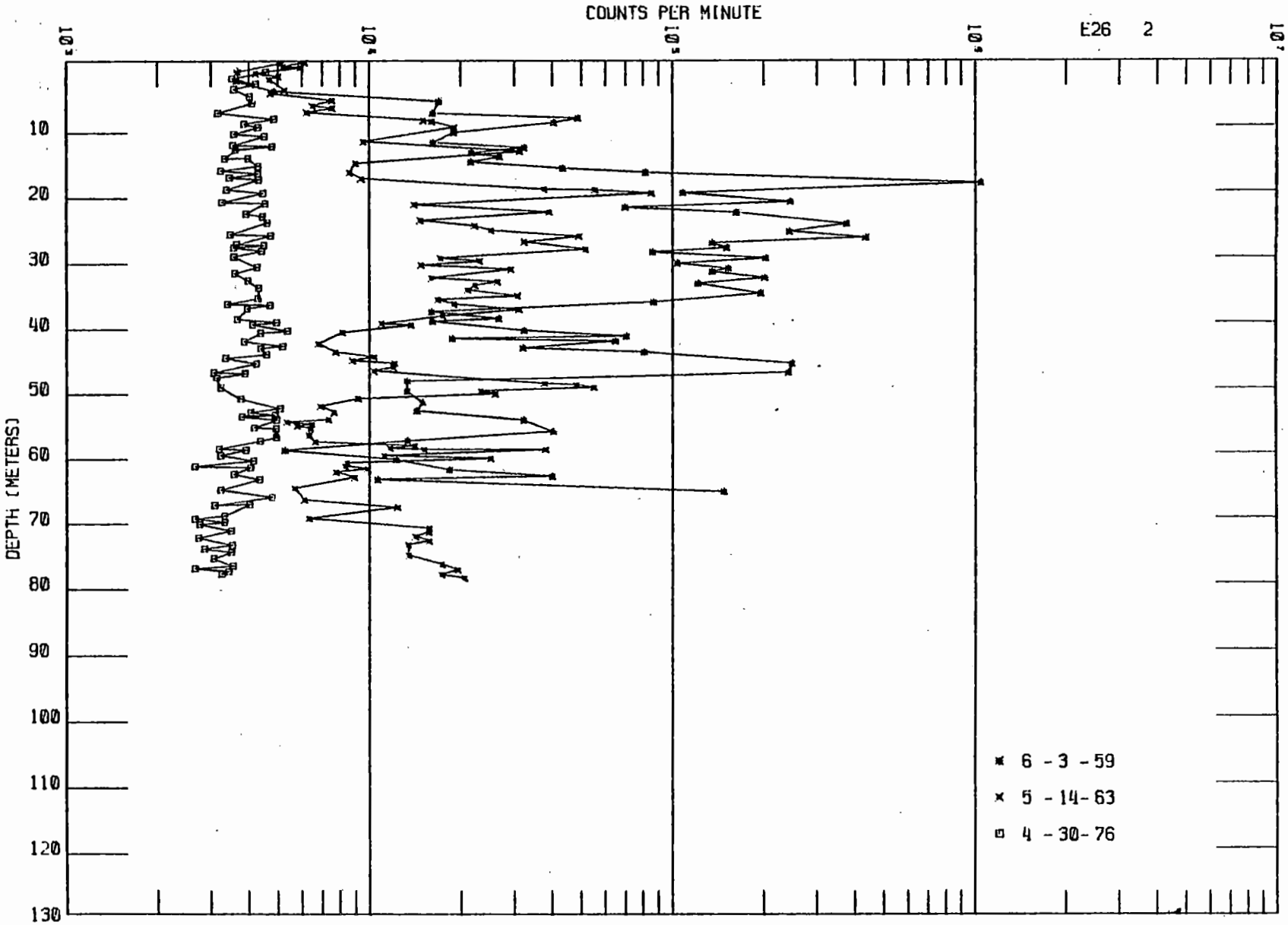
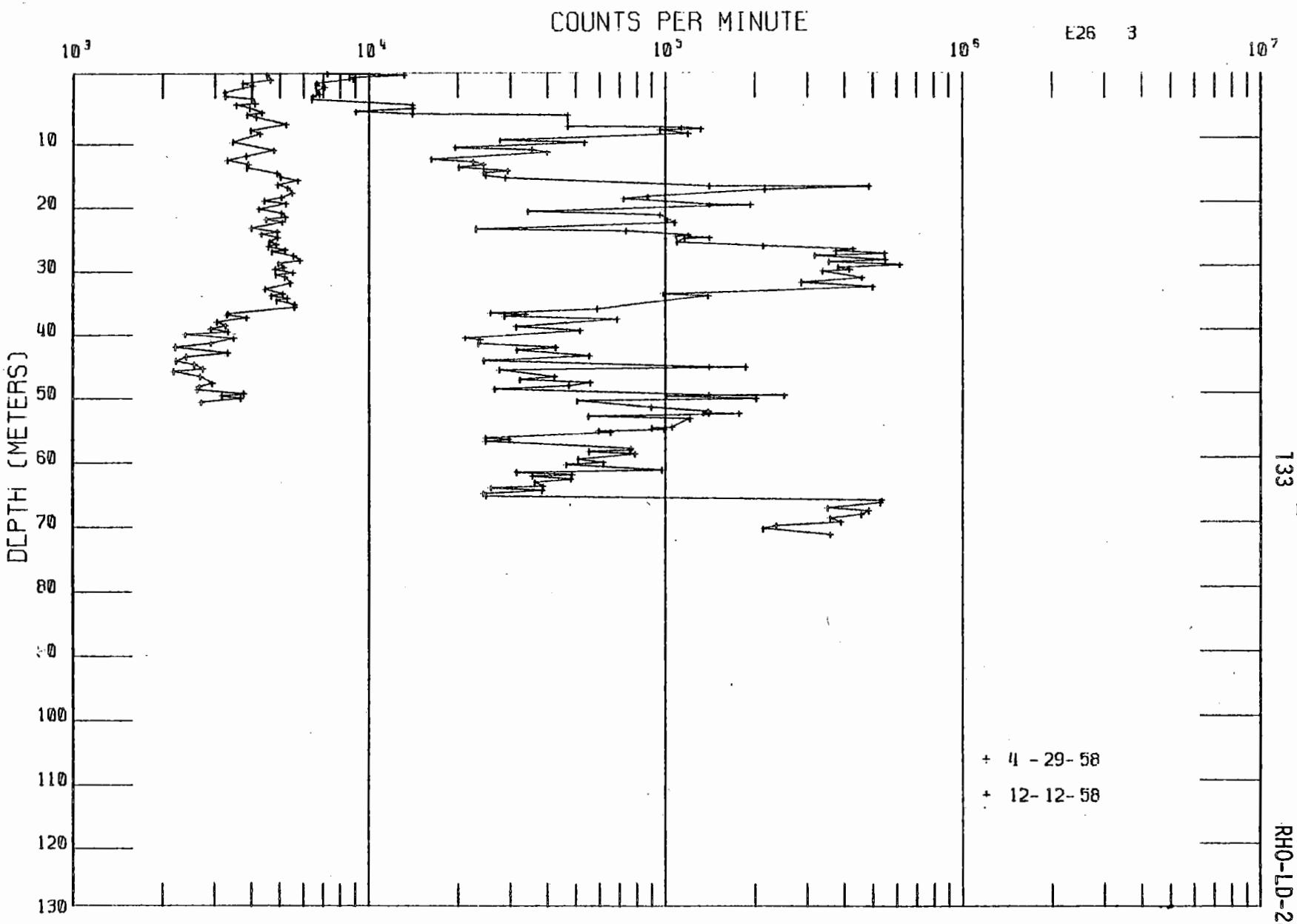


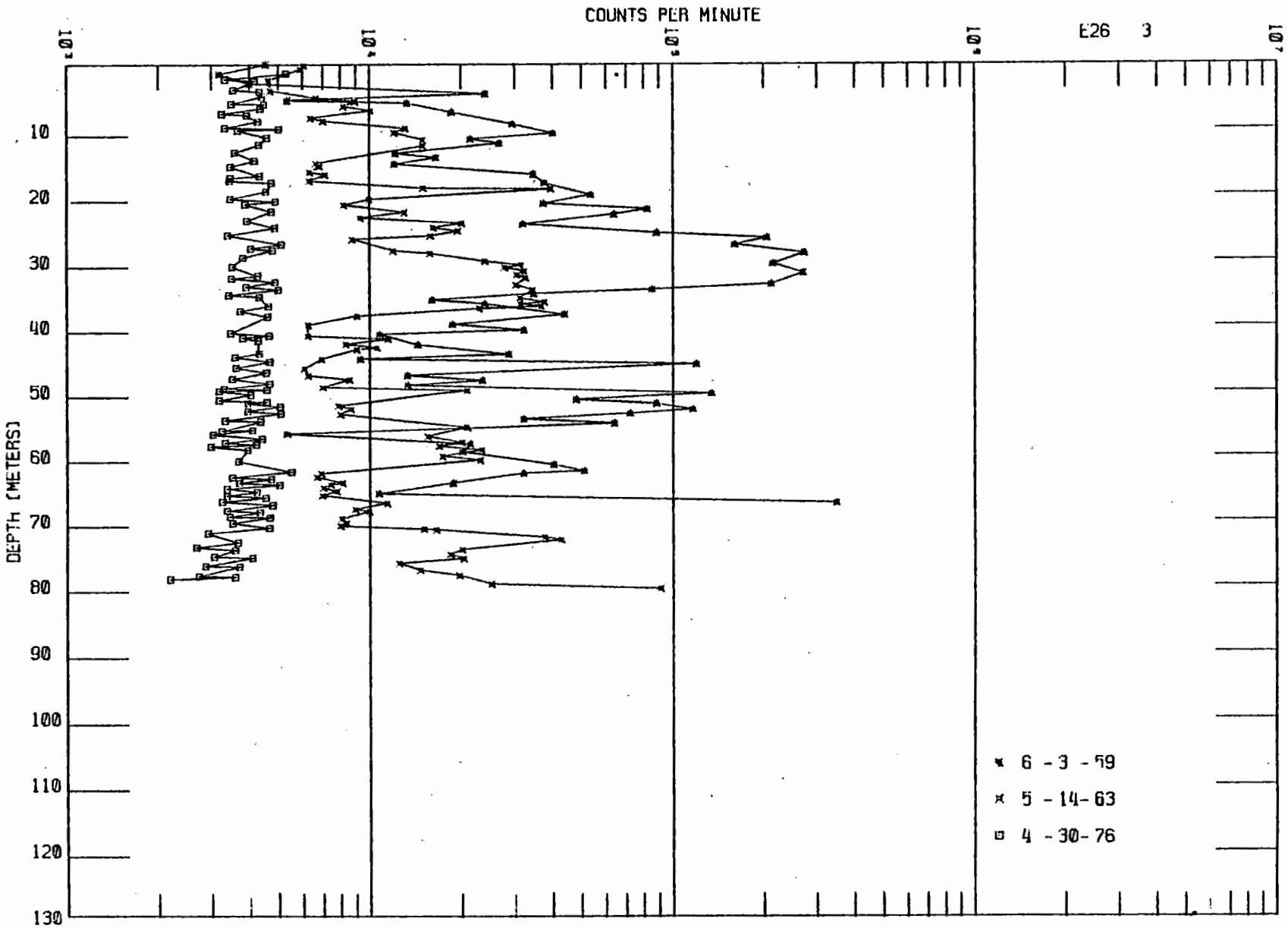
130

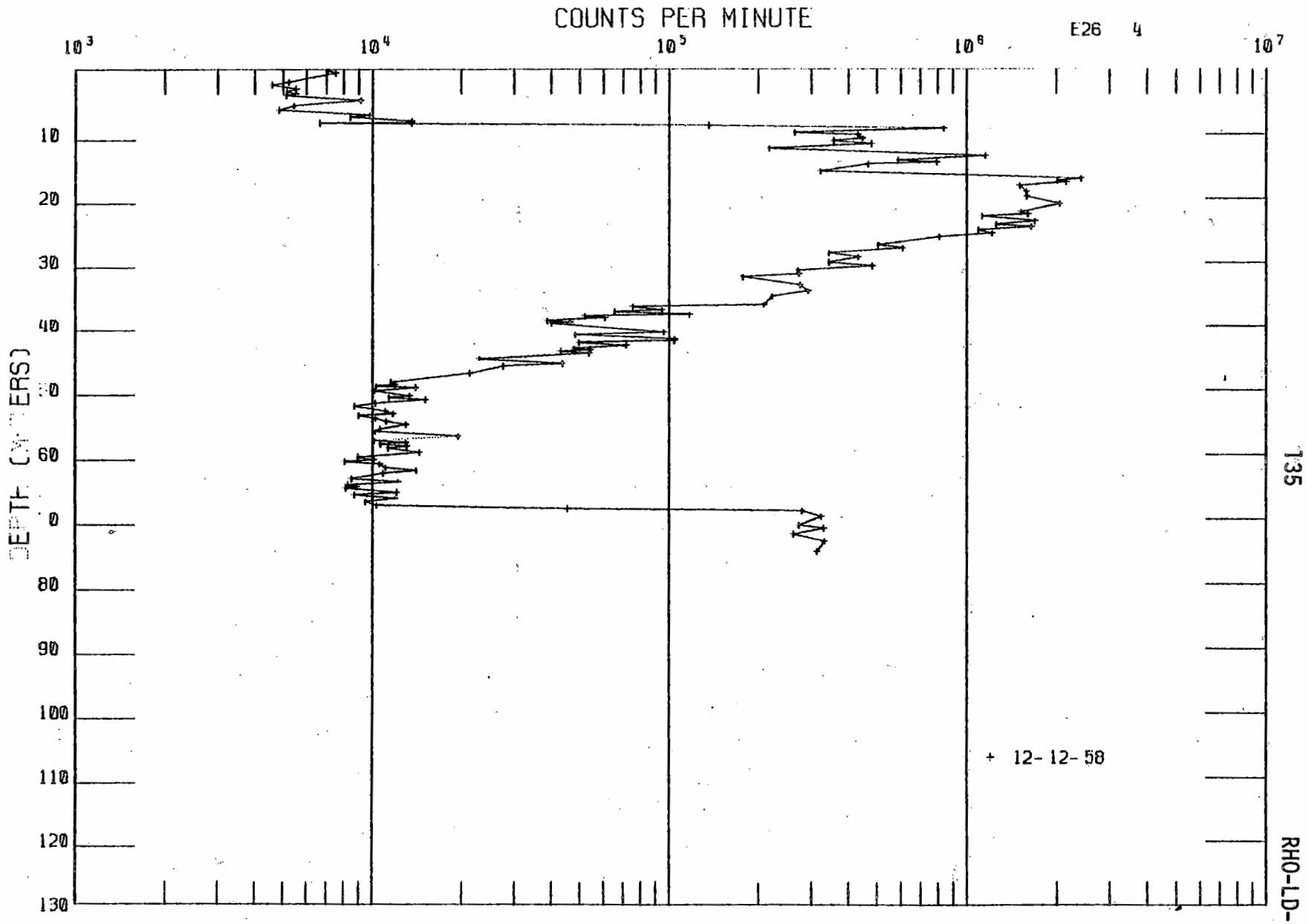
RHO-LD-28

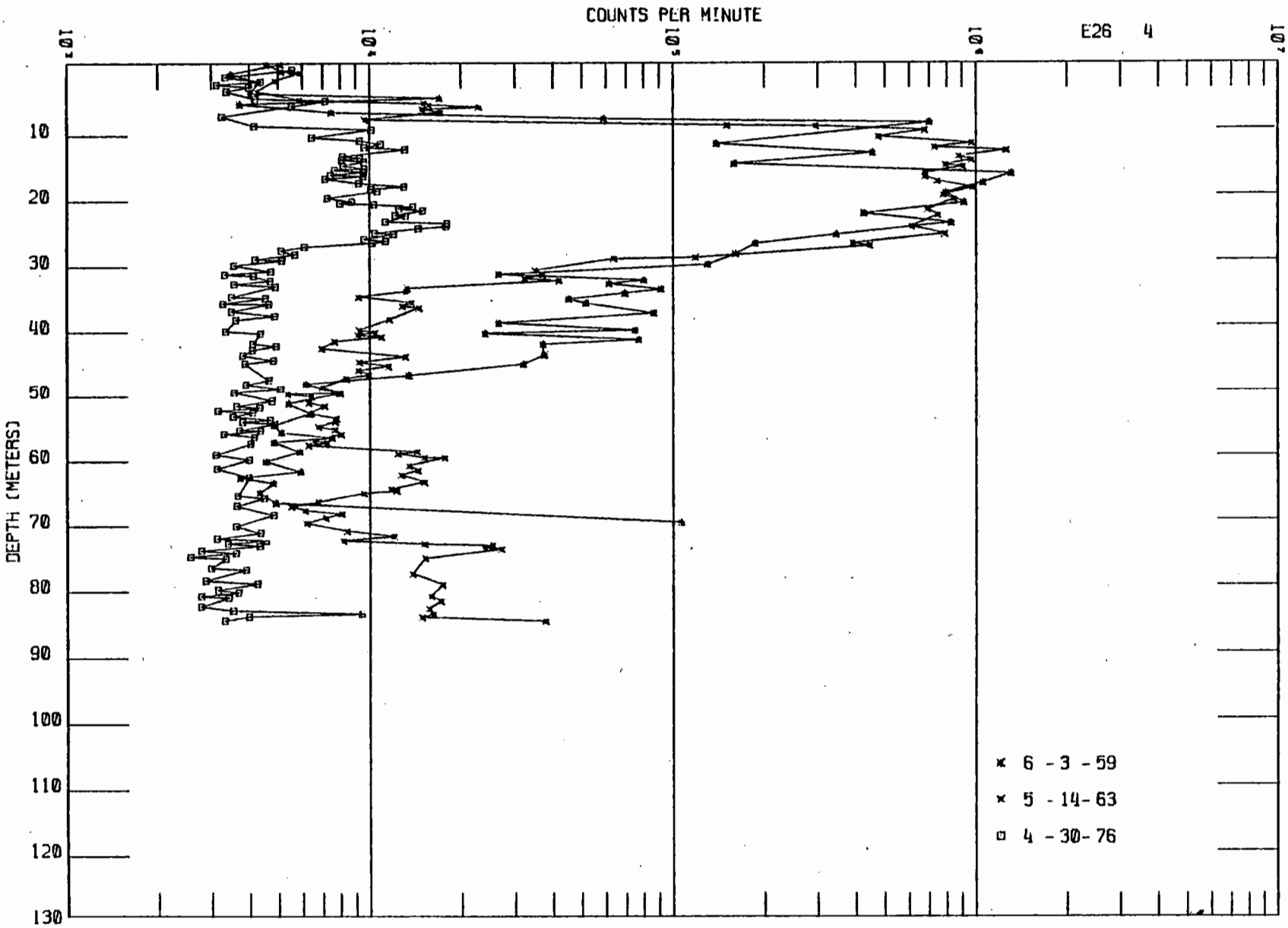

COUNTS PER MINUTE
E26 2
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
+ 4 -29-58
+ 12-12-58


COUNTS PER MINUTE
E26 2
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
6 - 3 - 59
5 - 14 - 63
4 - 30 - 76


COUNTS PER MINUTE
E26 3
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
+ 4 - 29- 58
+ 12- 12- 58


COUNTS PER MINUTE
E26 3
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
6 - 3 - 59
5 - 14- 63
4 - 30- 76


COUNTS PER MINUTE
10^3
10^4
10^5
10^6
10^7
E26 4
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
+ 12-12-58


COUNTS PER MINUTE
E26 4
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
6 - 3 - 59
5 - 14 - 63
4 - 30 - 76

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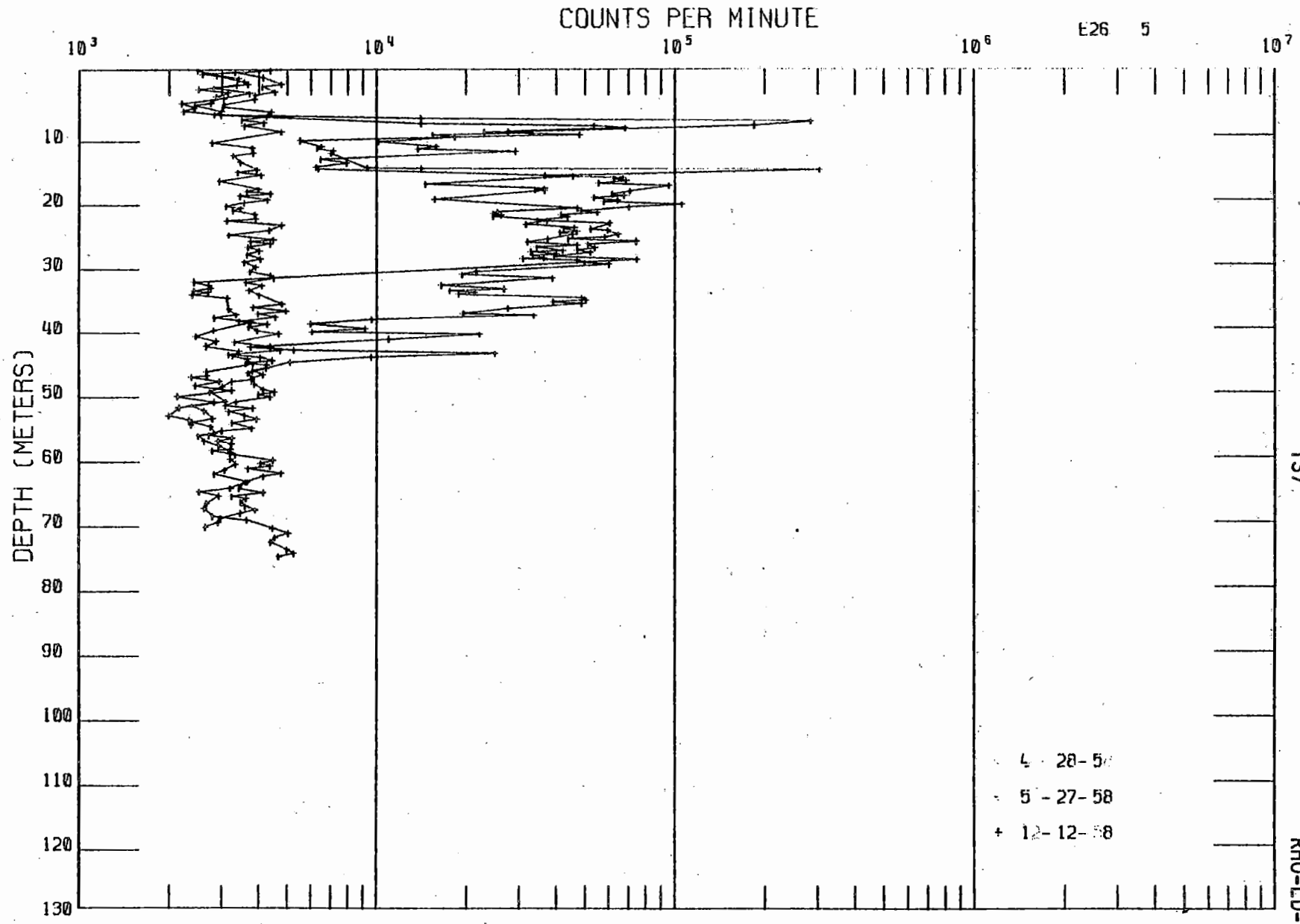
9 2 1 2 4 6 6 0 7 3 0



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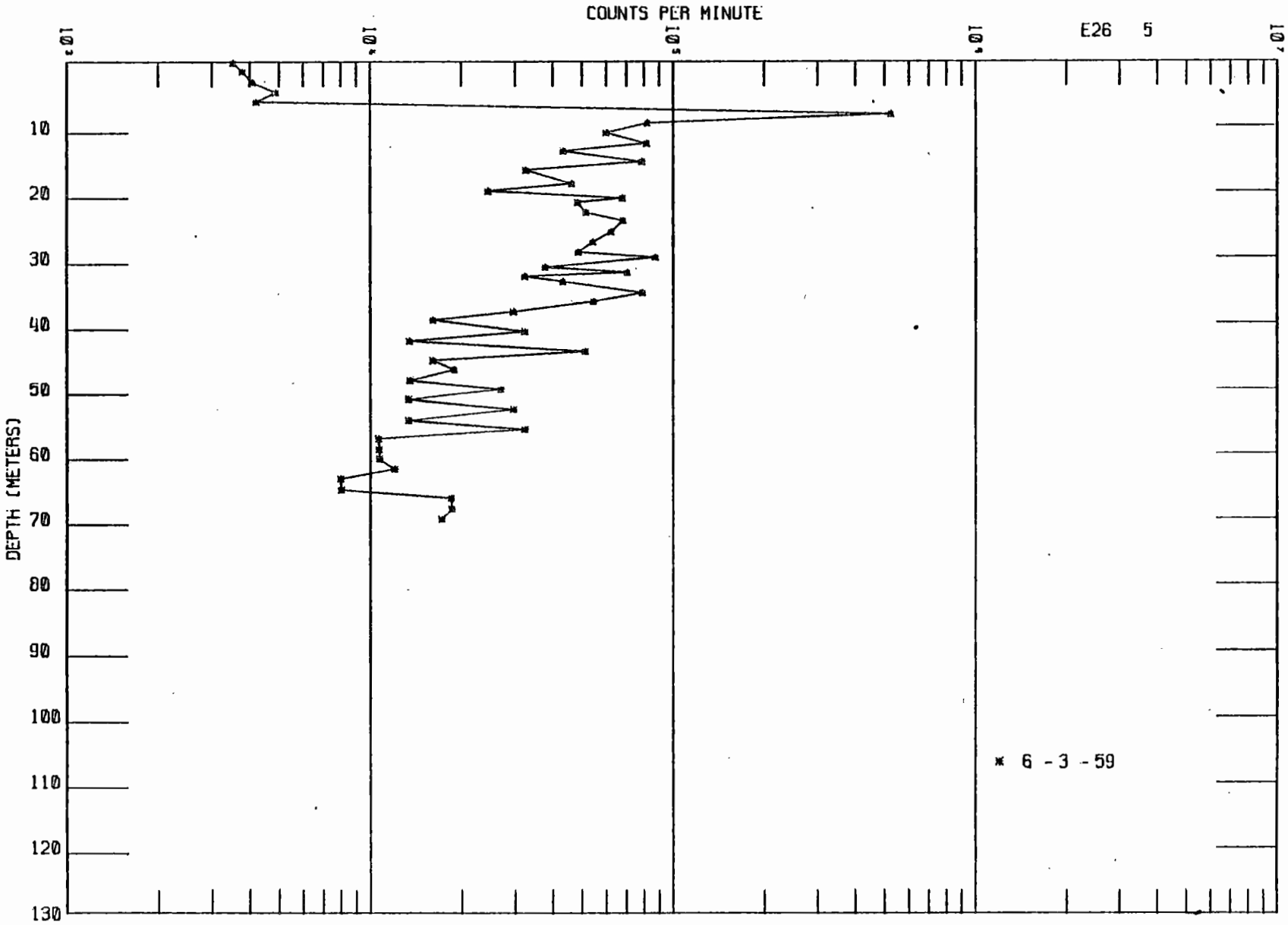
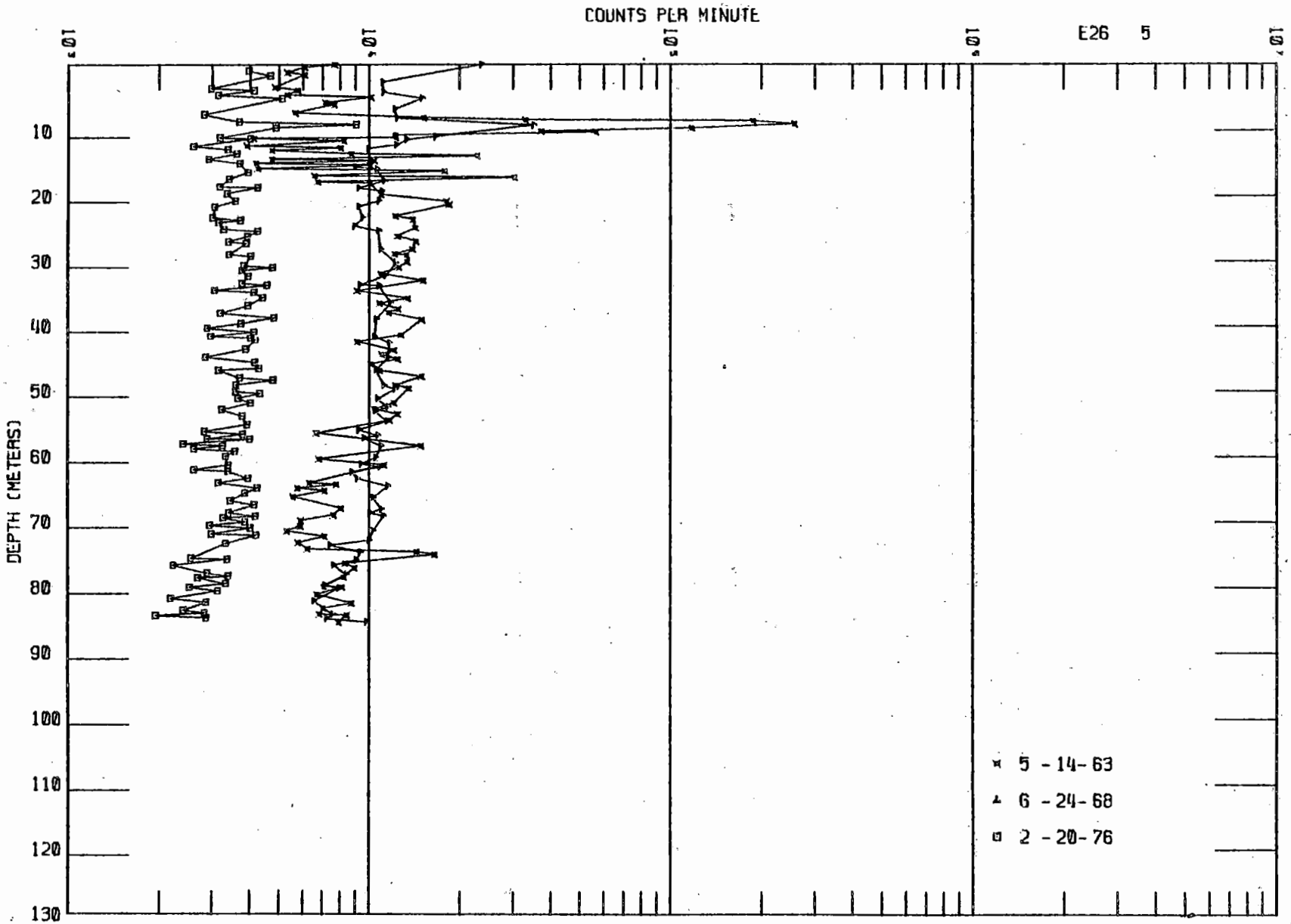
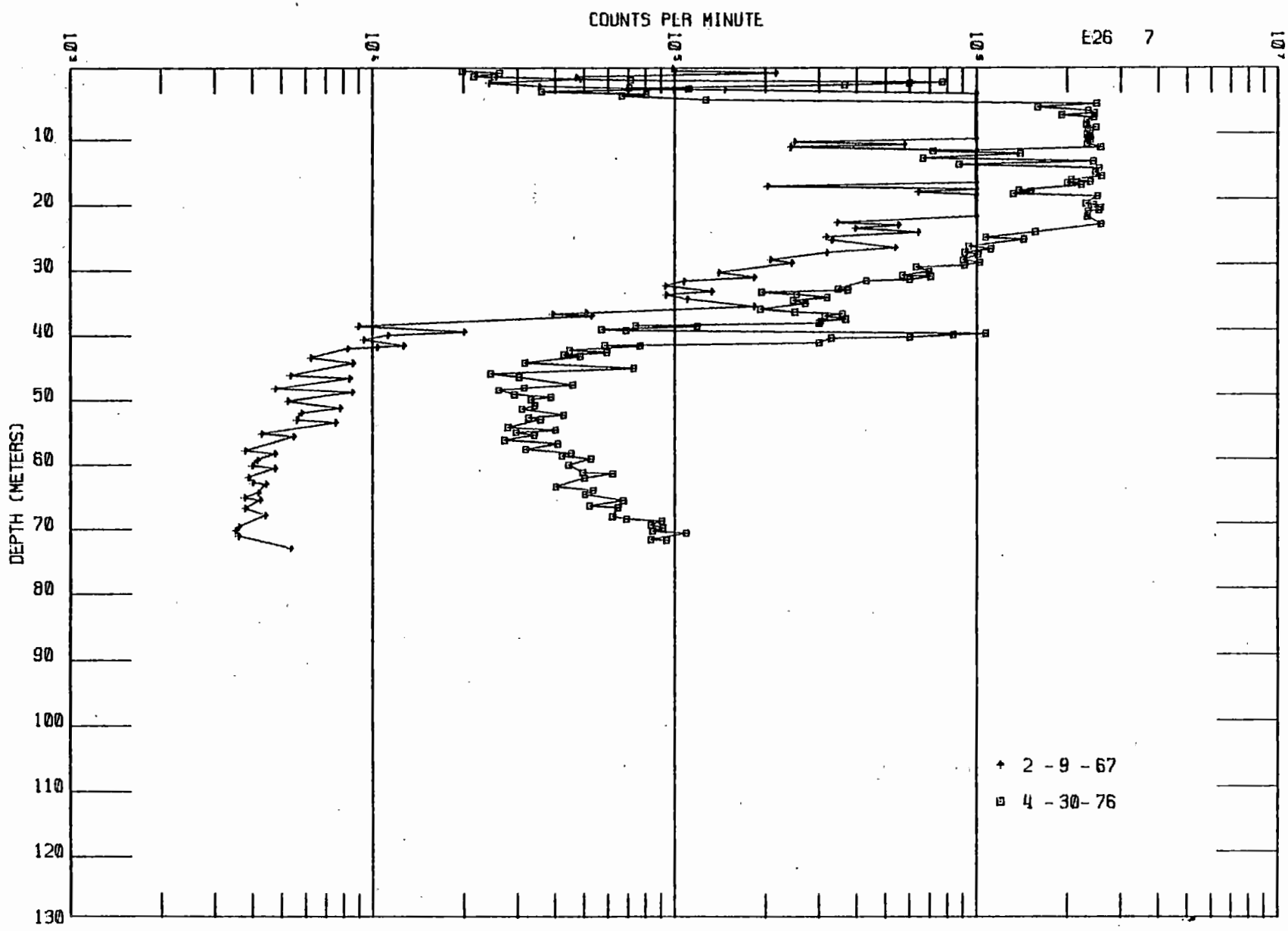
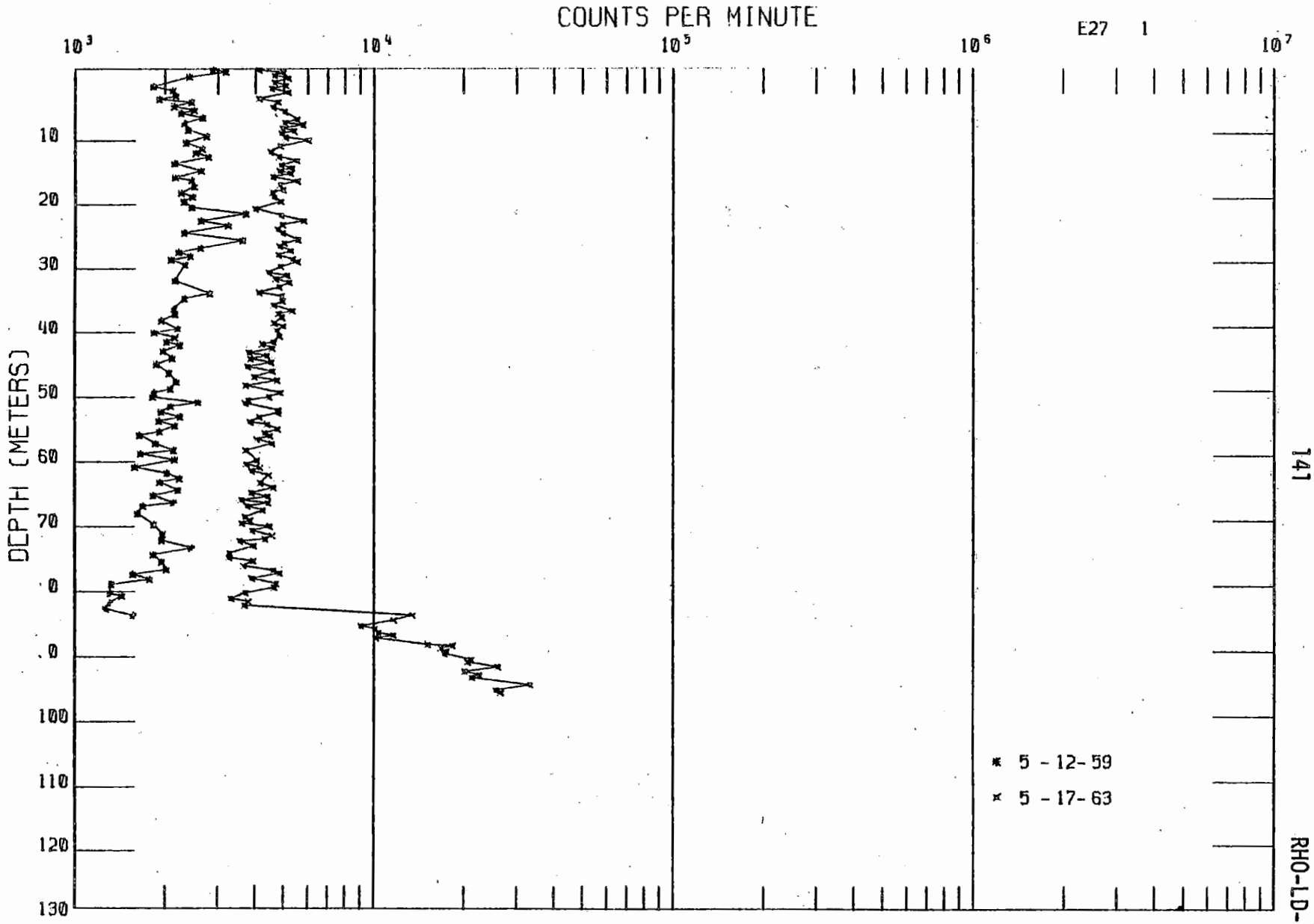
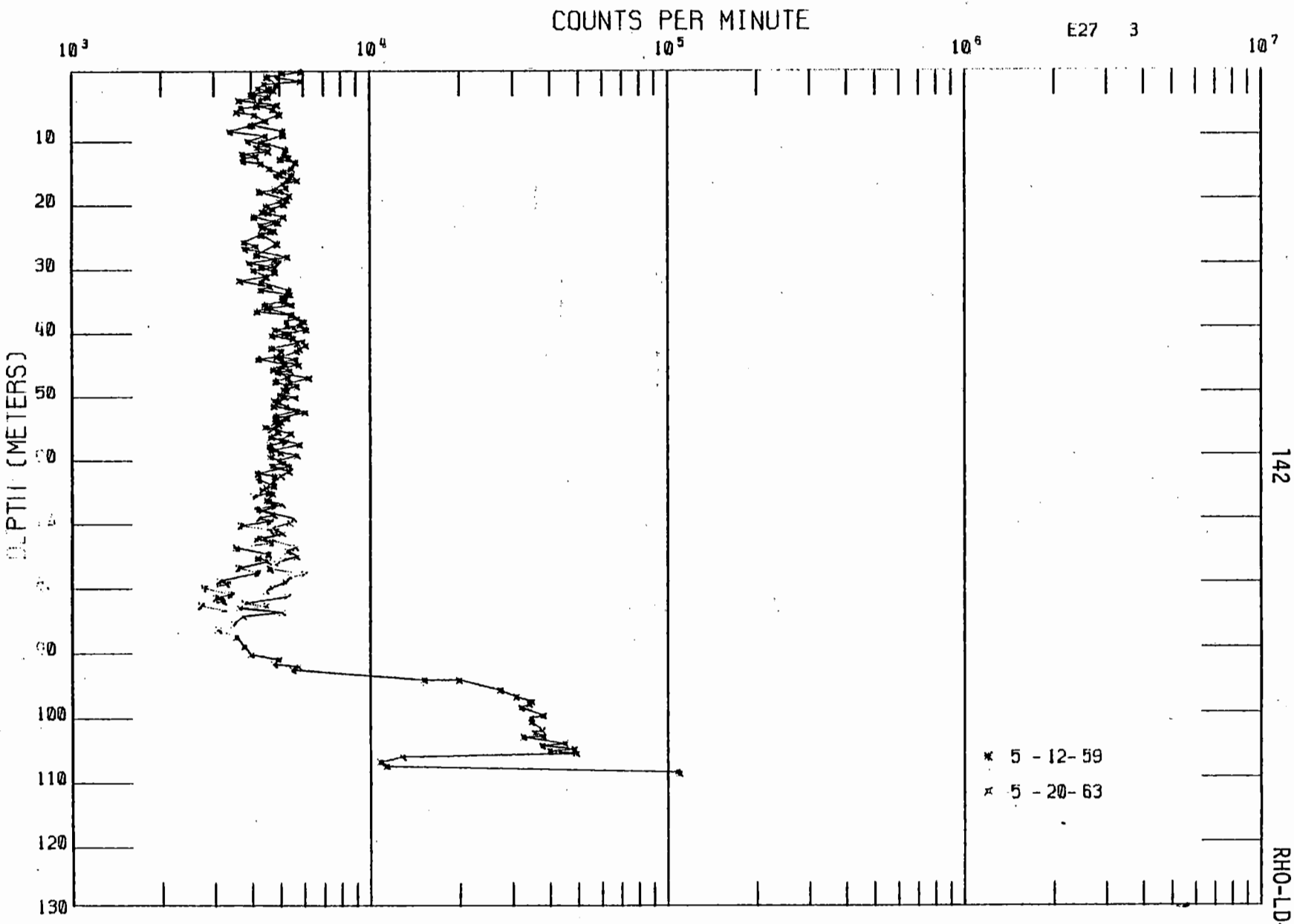
RHO-LD-28


COUNTS PER MINUTE
E26 5
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
* 6 - 3 - 59


COUNTS PER MINUTE
E26 5
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
5 - 14- 63
6 - 24- 68
2 - 20- 76


COUNTS PER MINUTE
E26 7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
+ 2 - 9 - 67
▫ 4 - 30- 76


COUNTS PER MINUTE
E27 1
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
0
0
100
110
120
130
* 5 - 12- 59
× 5 - 17- 63


COUNTS PER MINUTE
E27 3
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
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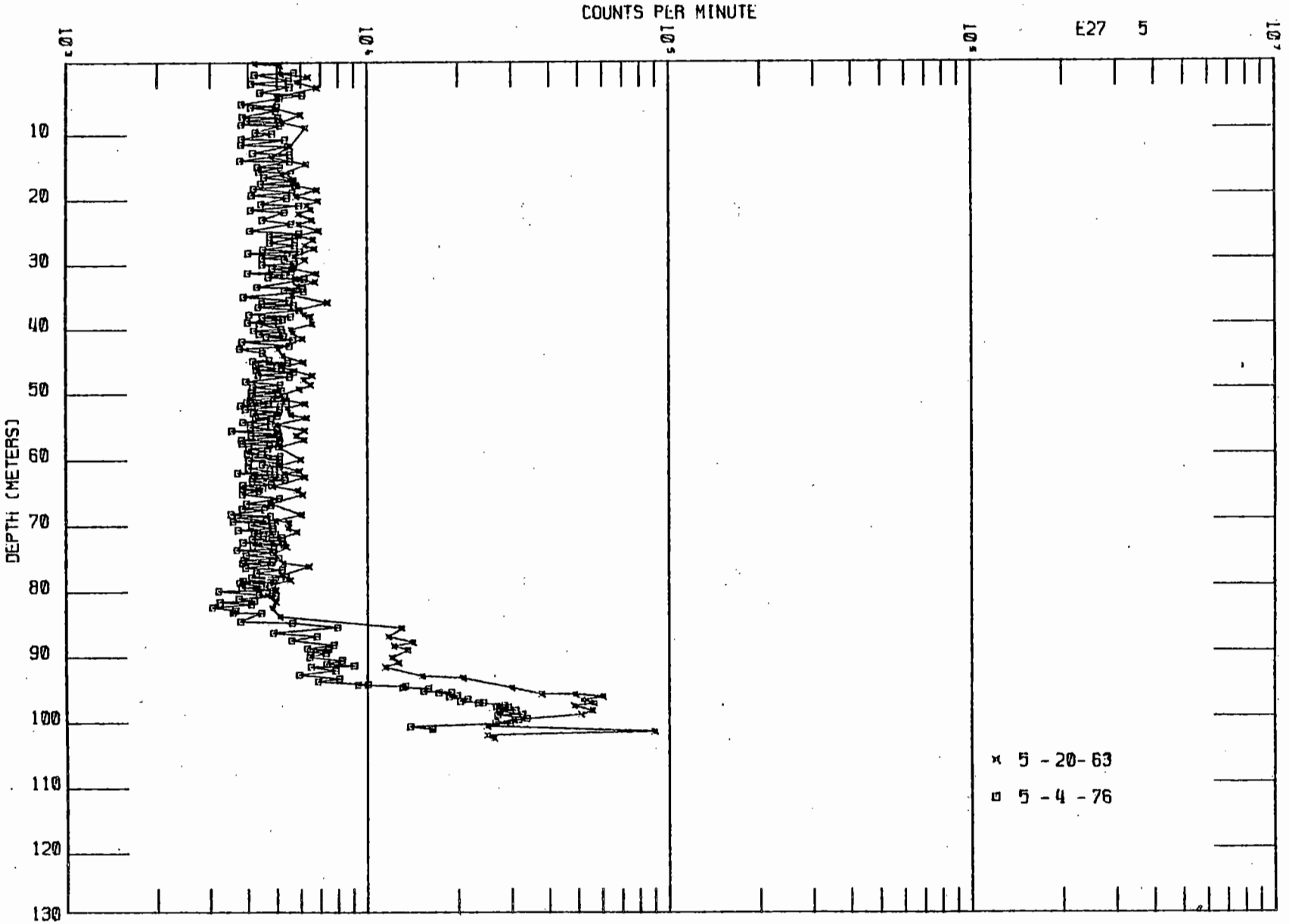
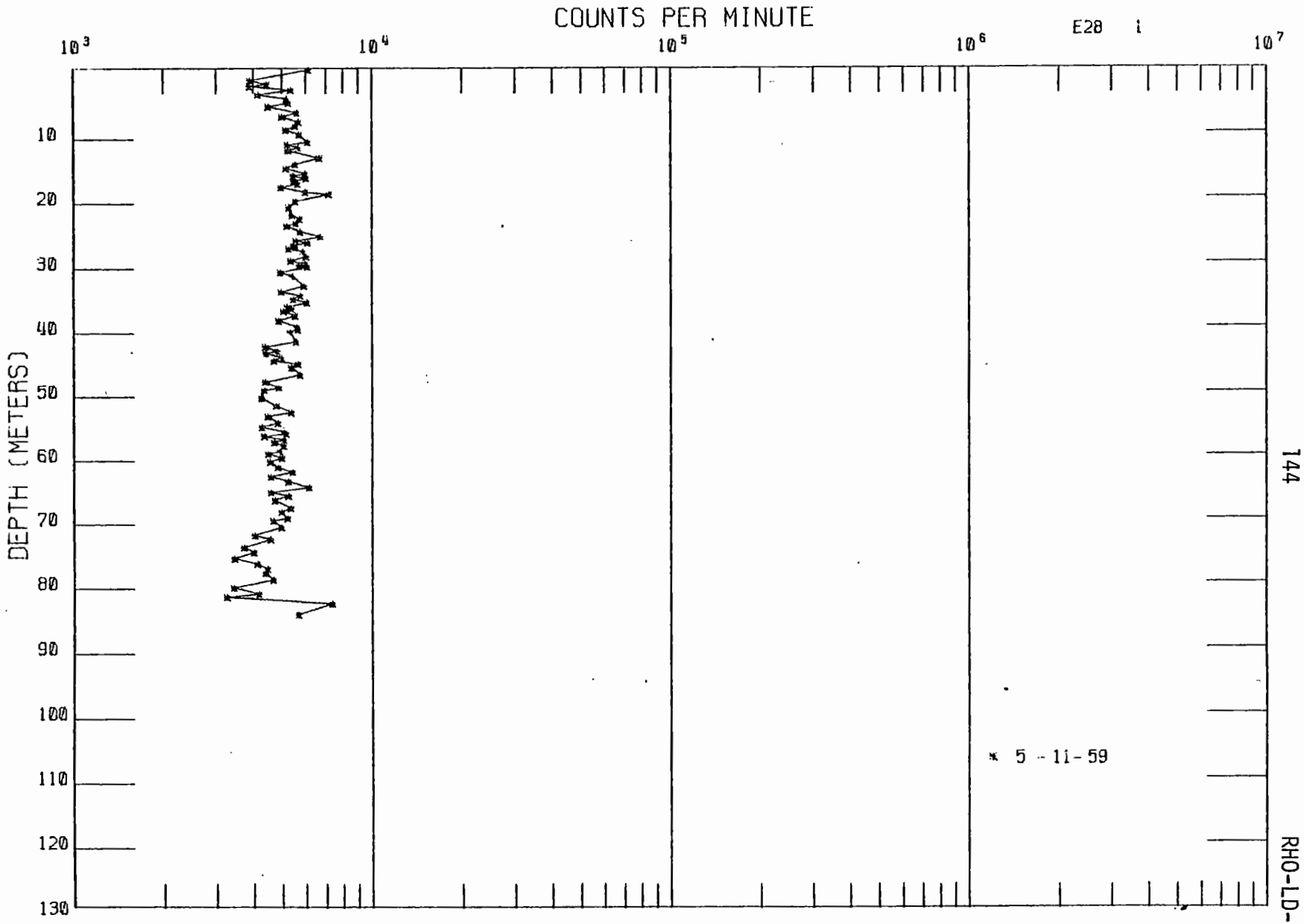
110
120
130
5 - 12- 59
5 - 20- 63


COUNTS PER MINUTE
E27 5
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 20- 63
□ 5 - 4 - 76


COUNTS PER MINUTE
E28 1
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
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60
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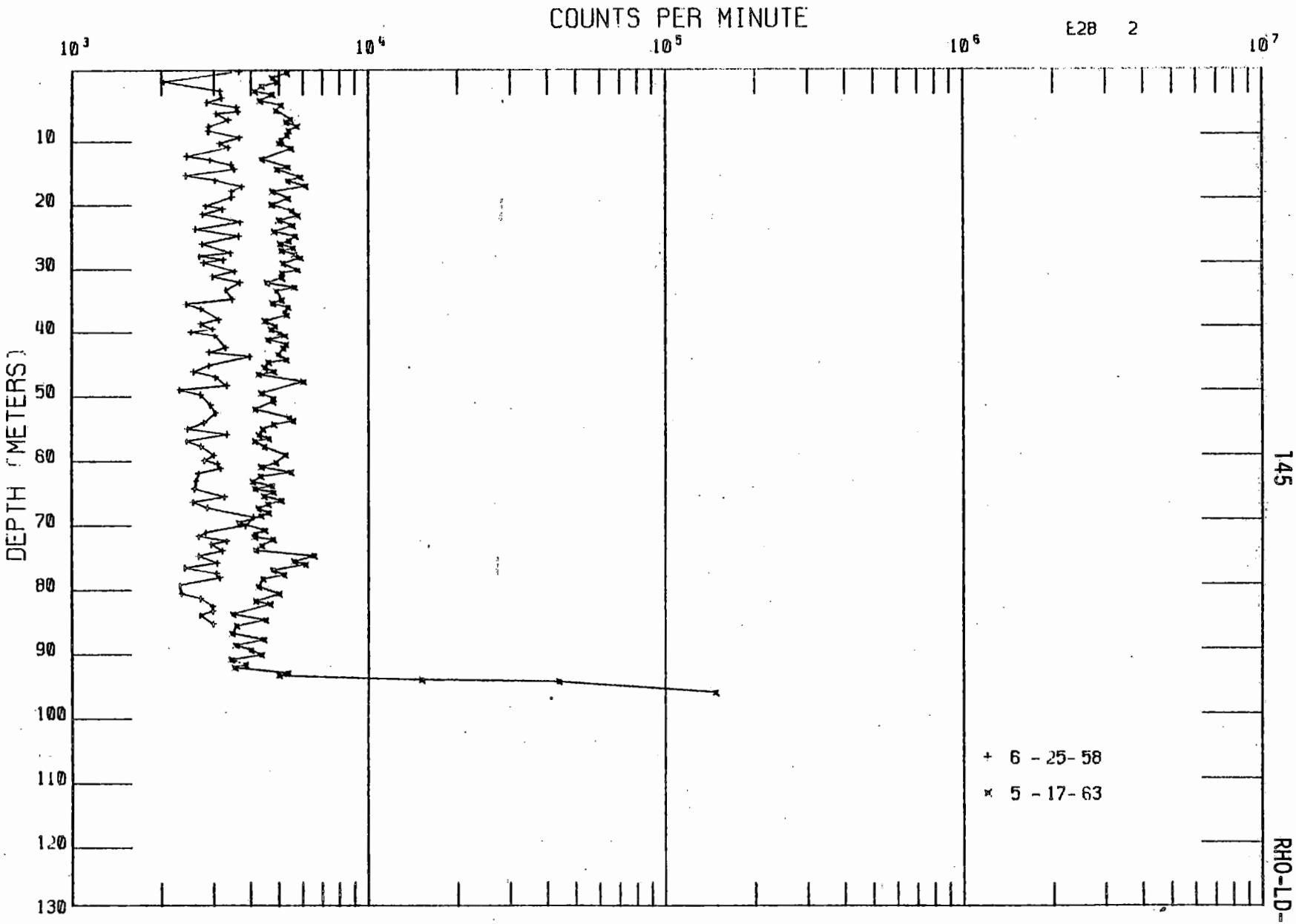
80
90
100
110
120
130
* 5 - 11 - 59


COUNTS PER MINUTE
E28 2
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
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70
80
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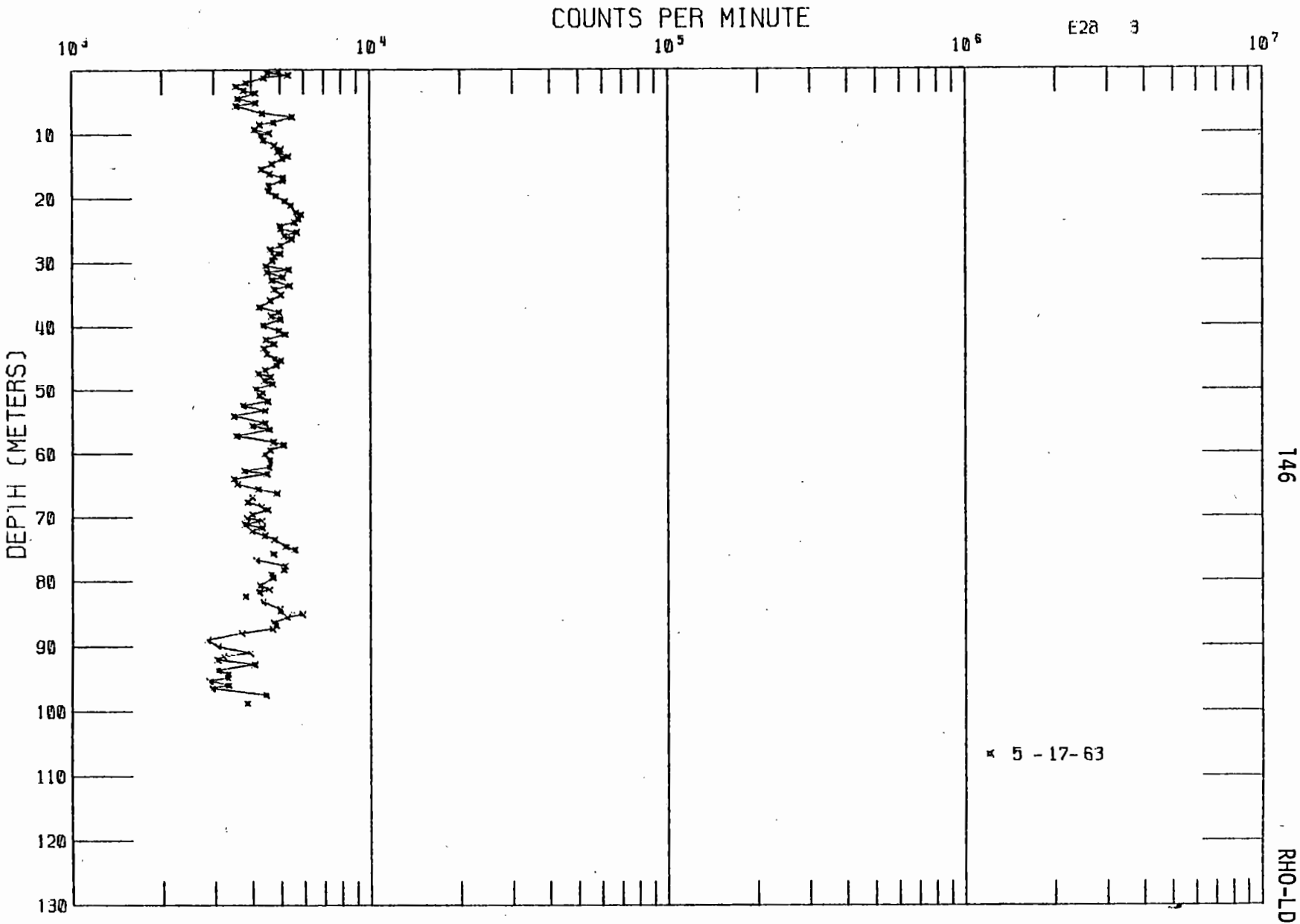
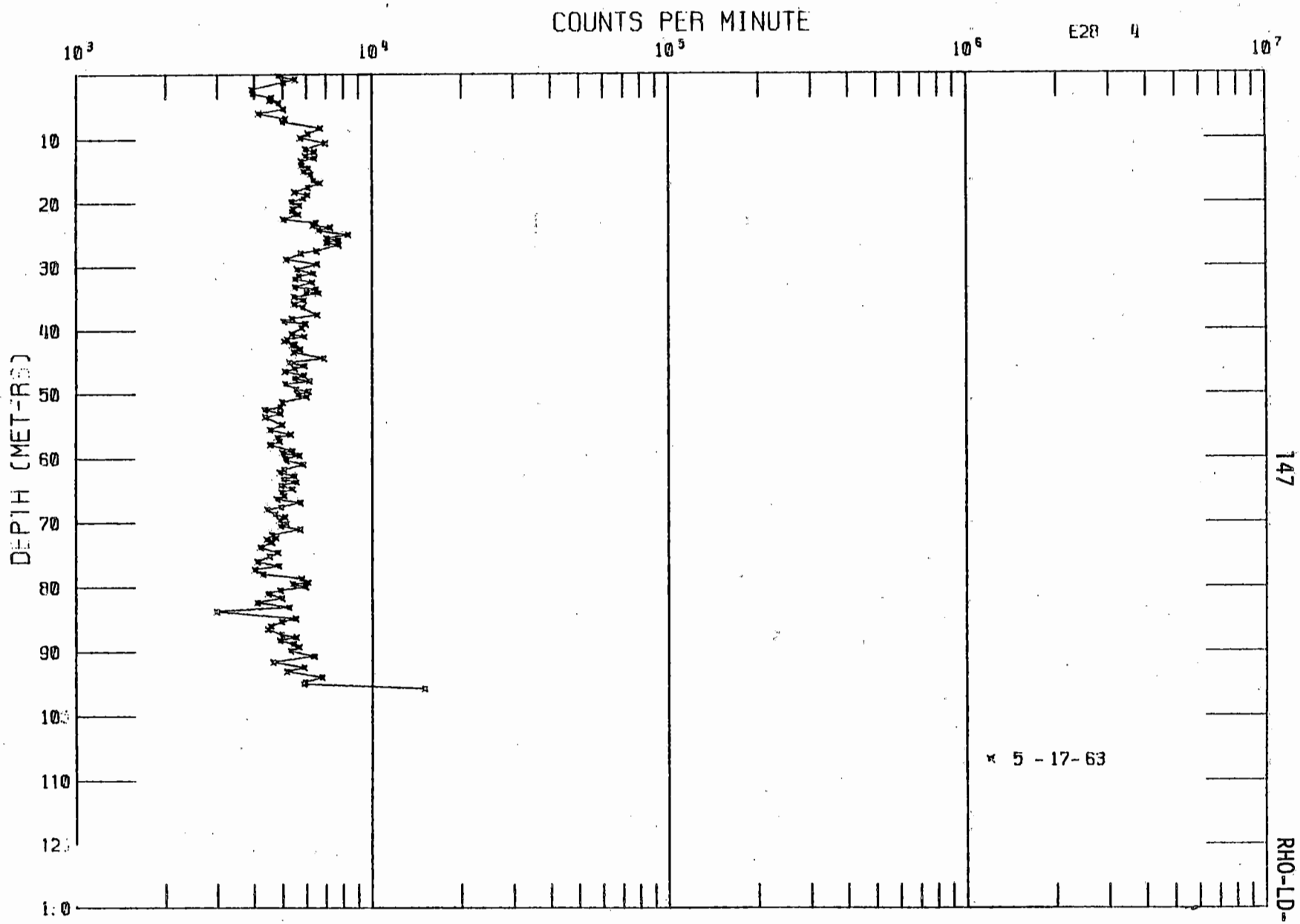
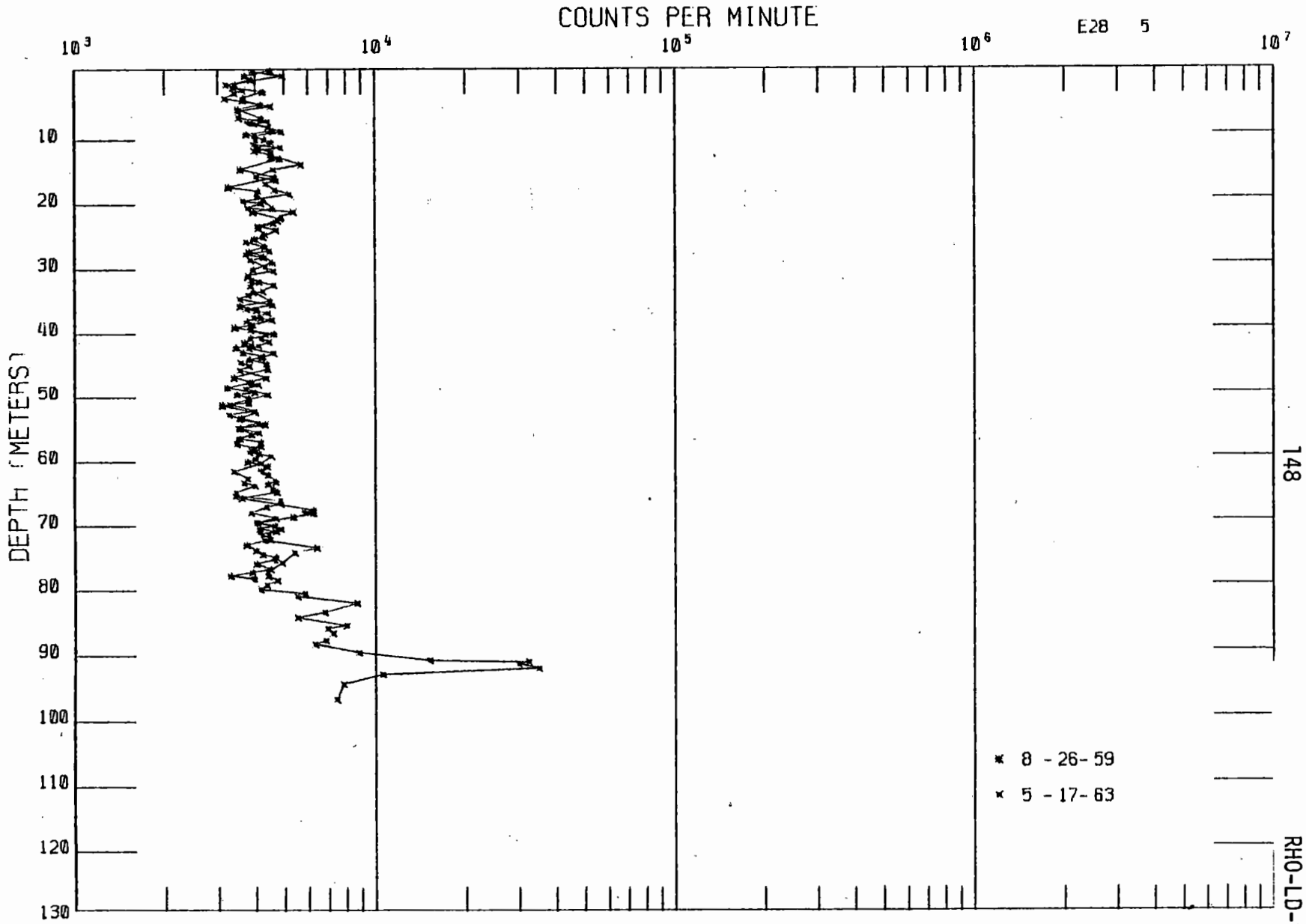
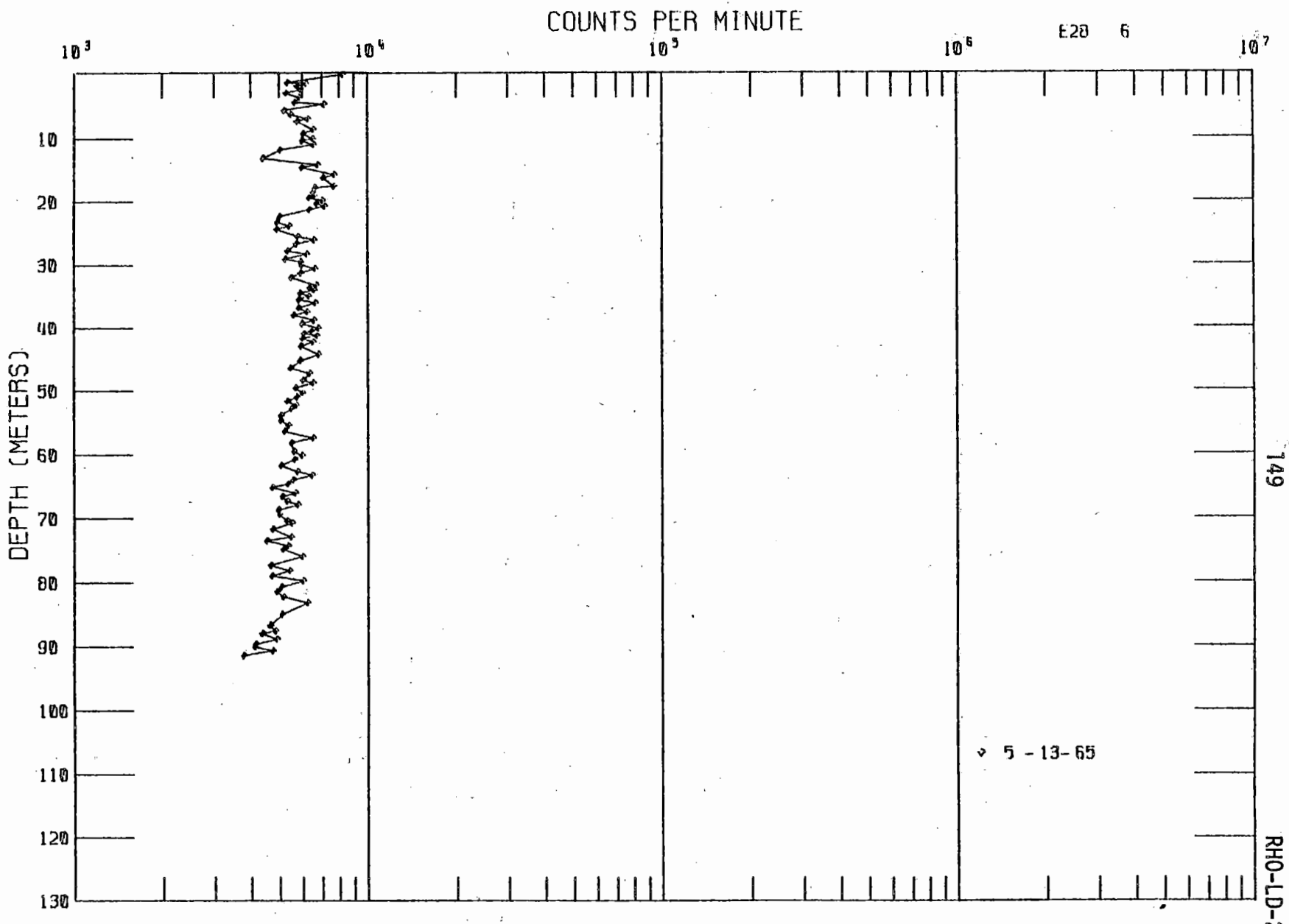
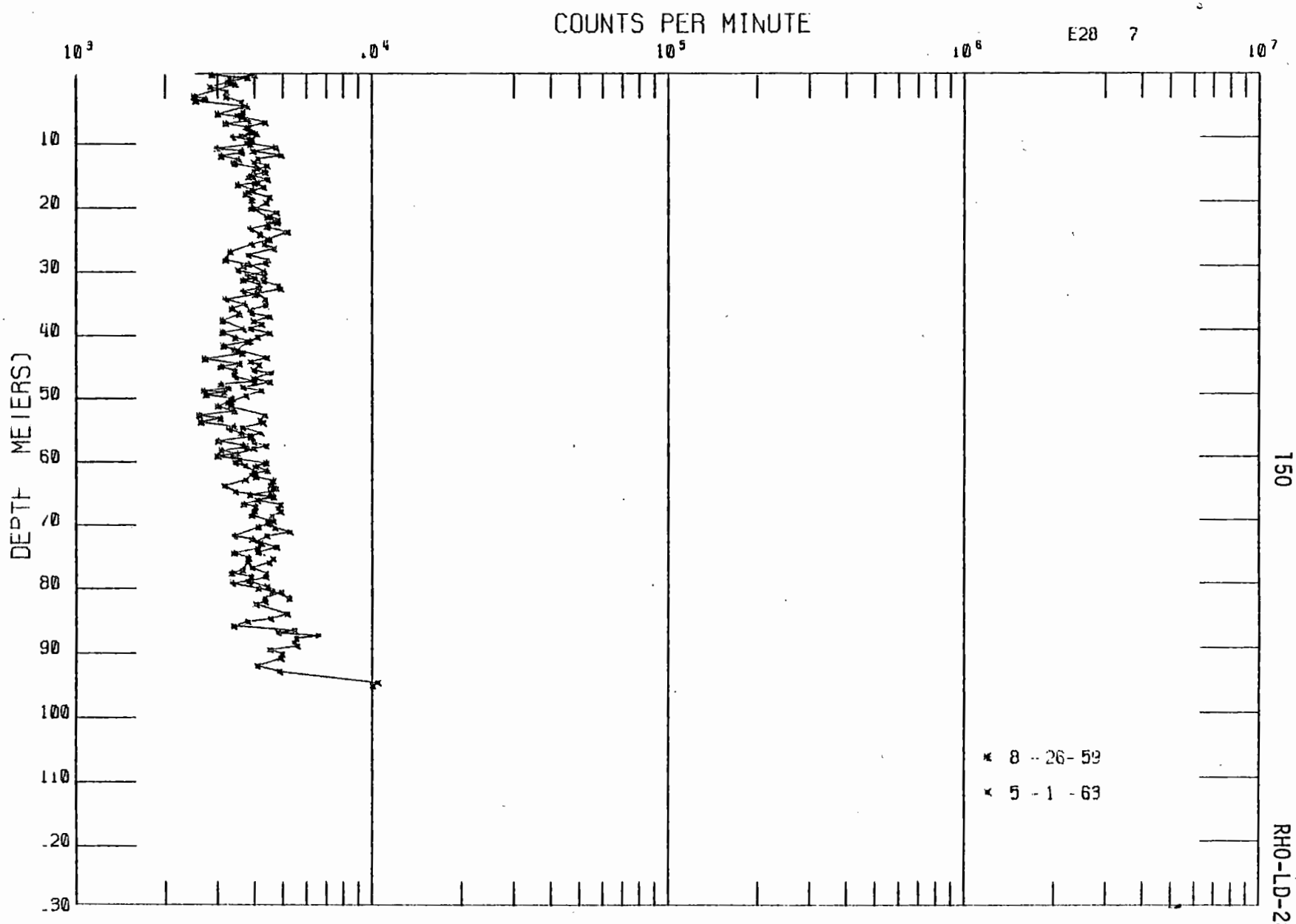
110
120
130
+ 6 - 25- 58
× 5 - 17- 63


COUNTS PER MINUTE
E2a 3
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 17- 63


COUNTS PER MINUTE
E28 4
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
5 - 17- 63


COUNTS PER MINUTE
E28 5
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
8 - 26- 59
5 - 17- 63


COUNTS PER MINUTE
10^3
10^4
10^5
10^6
E28 6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
5 - 13- 65


COUNTS PER MINUTE
E28 7
10³
10⁴
10⁵
10⁶
10⁷
DEPTH MEIERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 8 - 26 - 59
× 5 - 1 - 63

150

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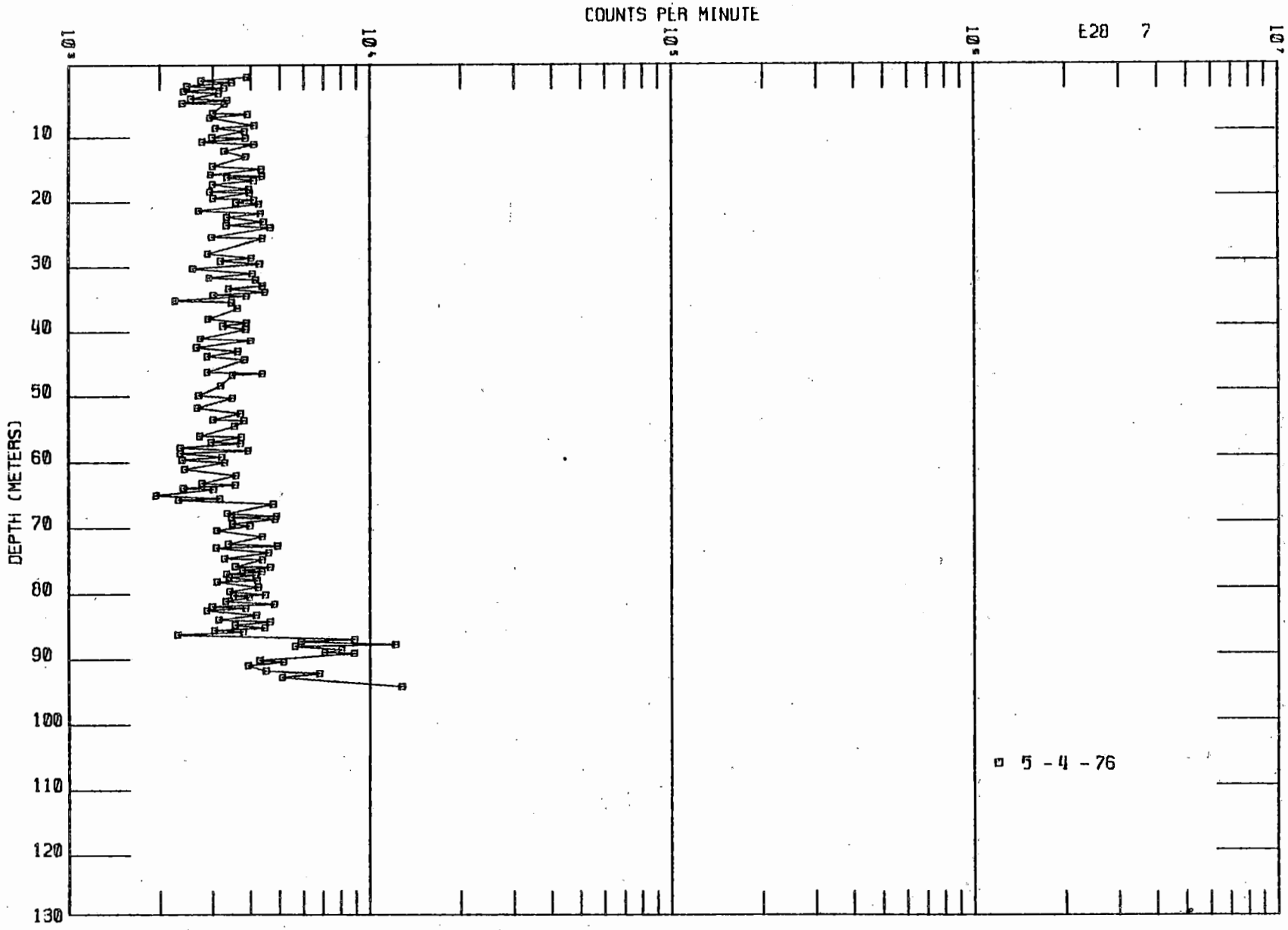
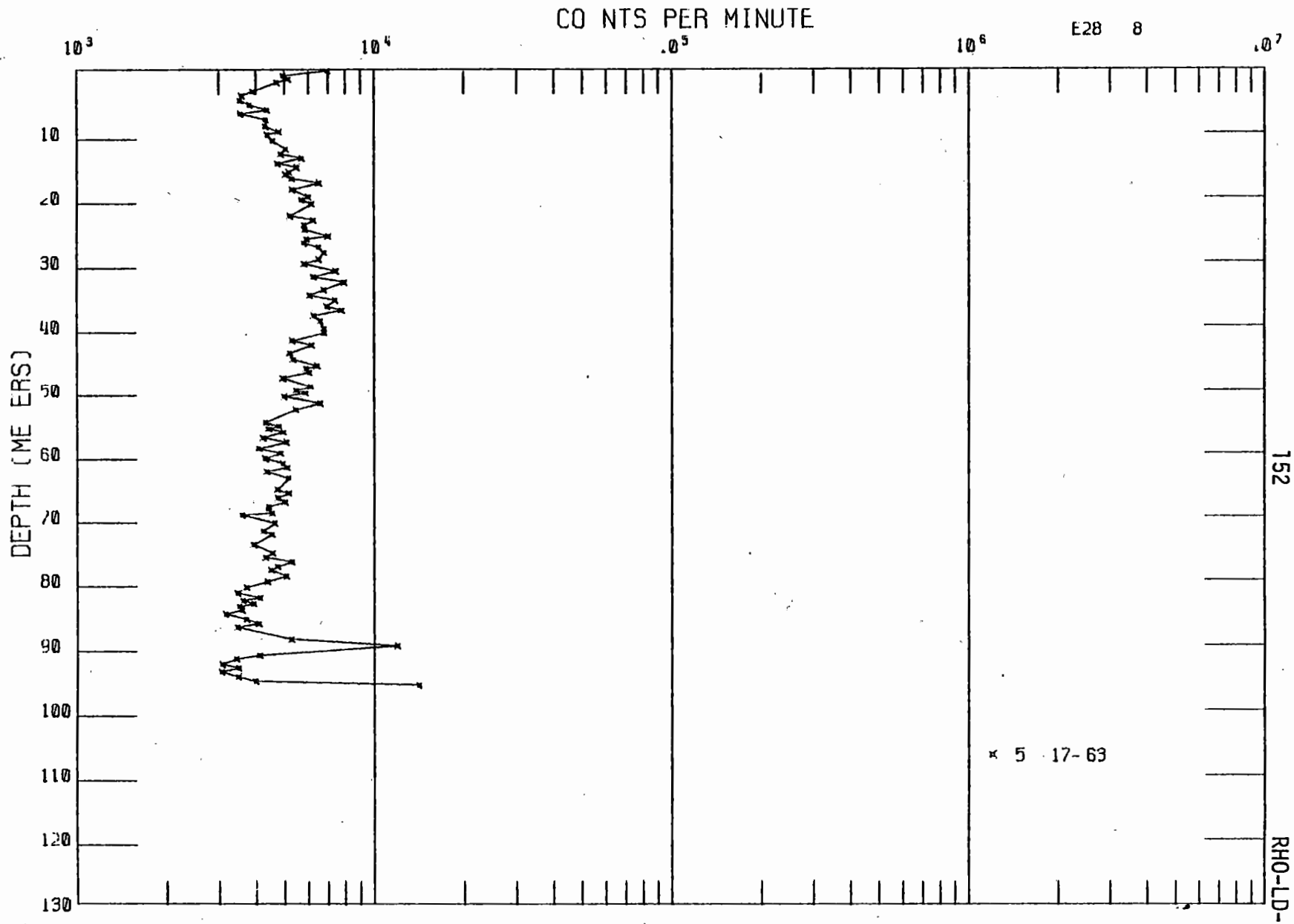
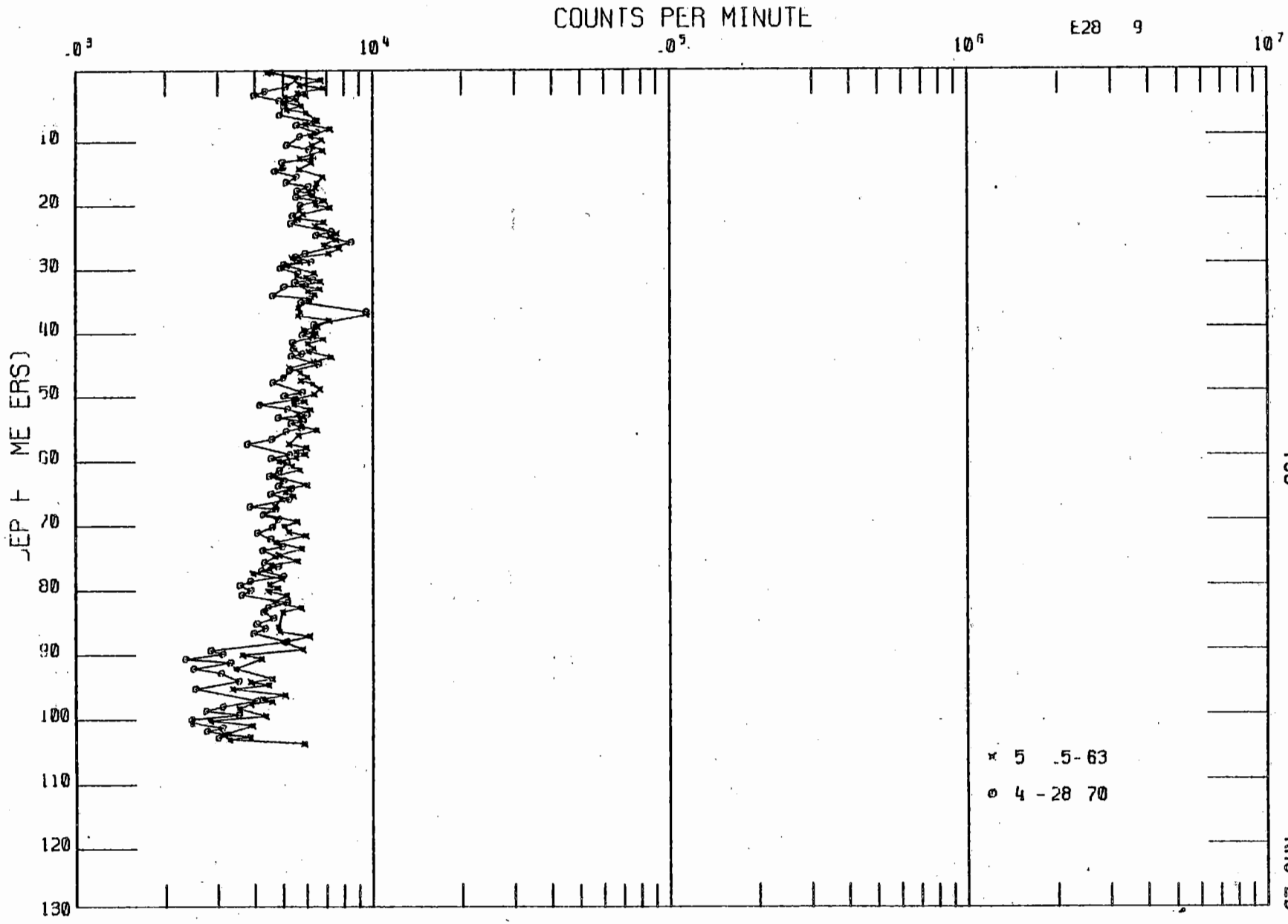
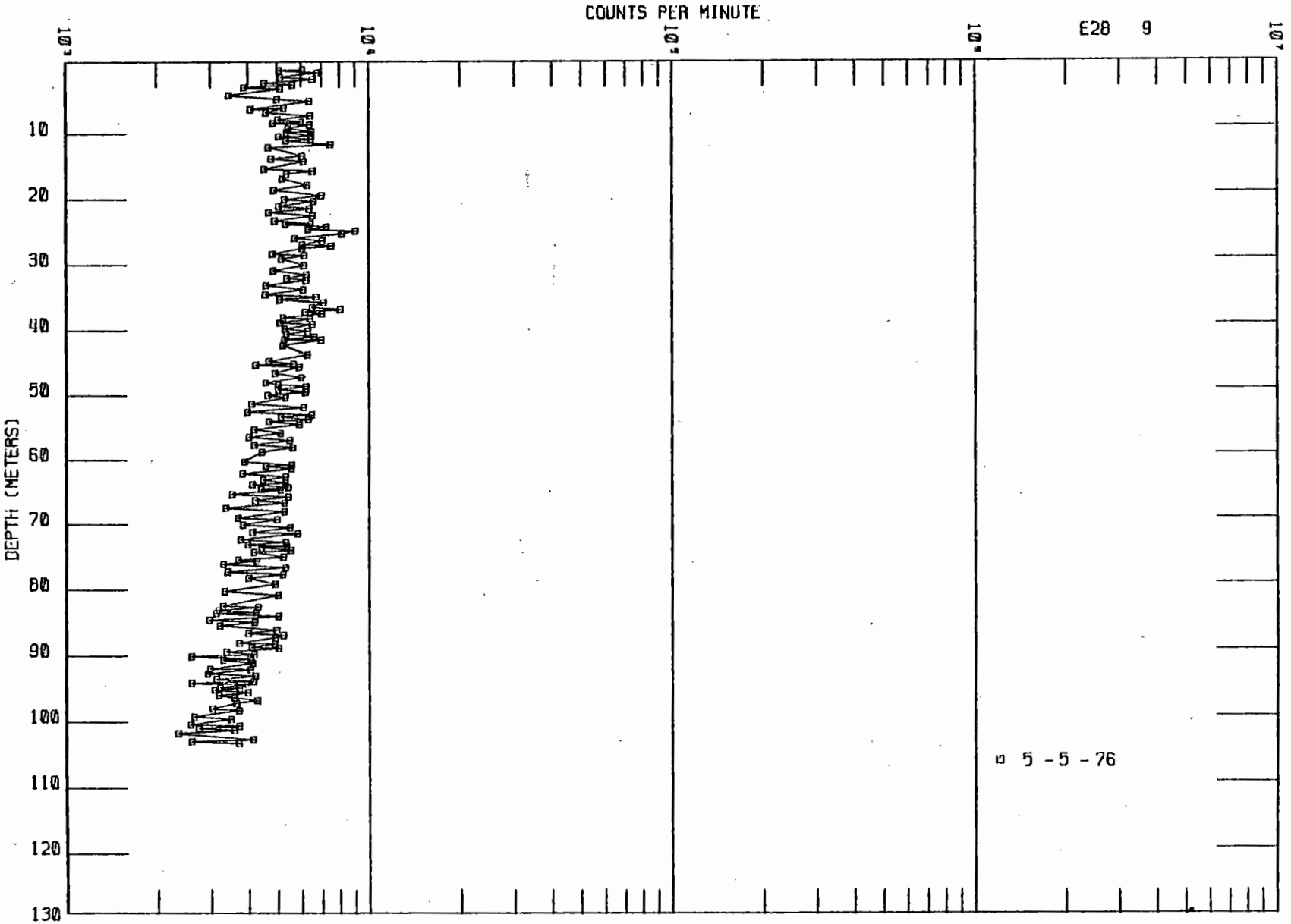
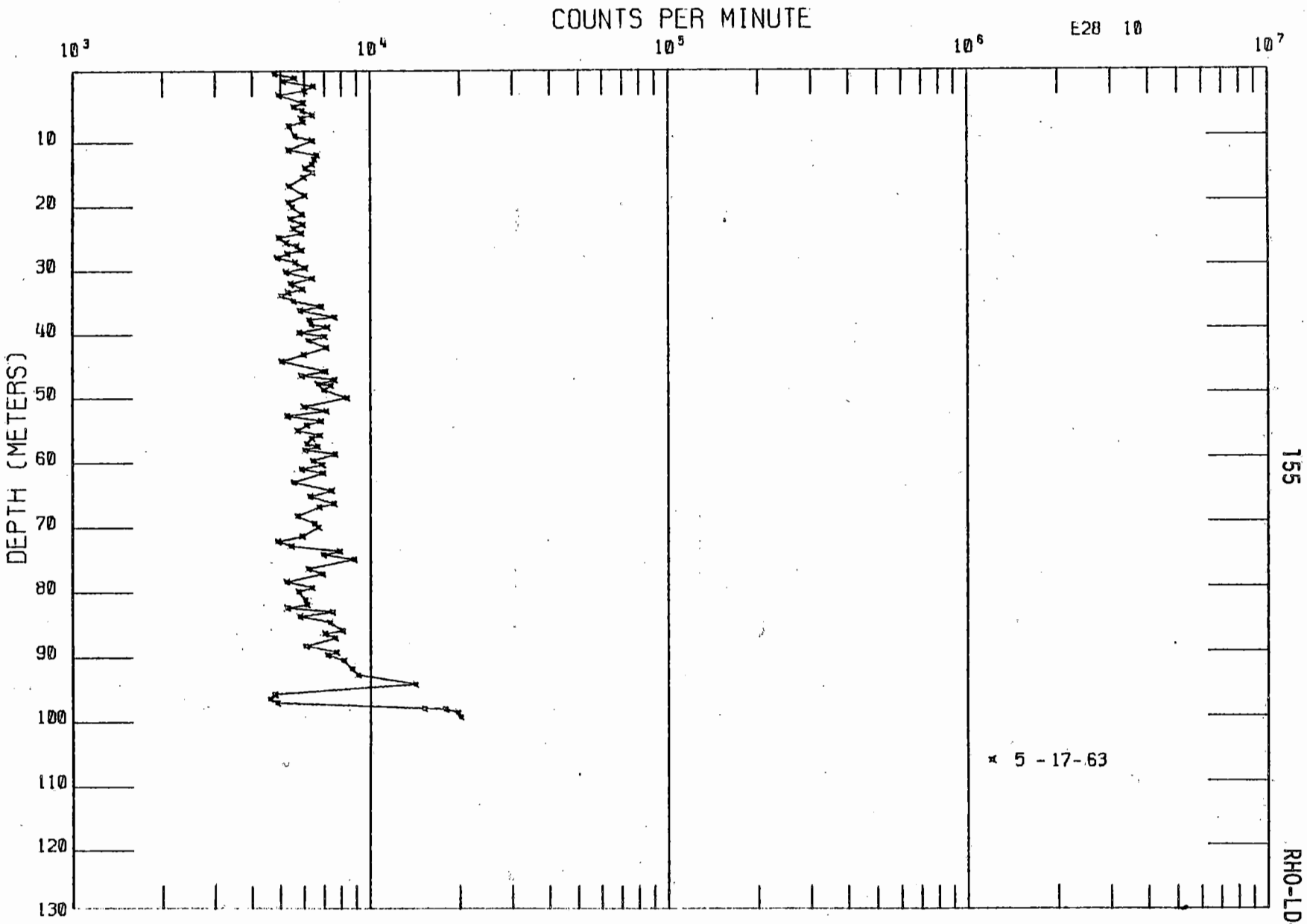
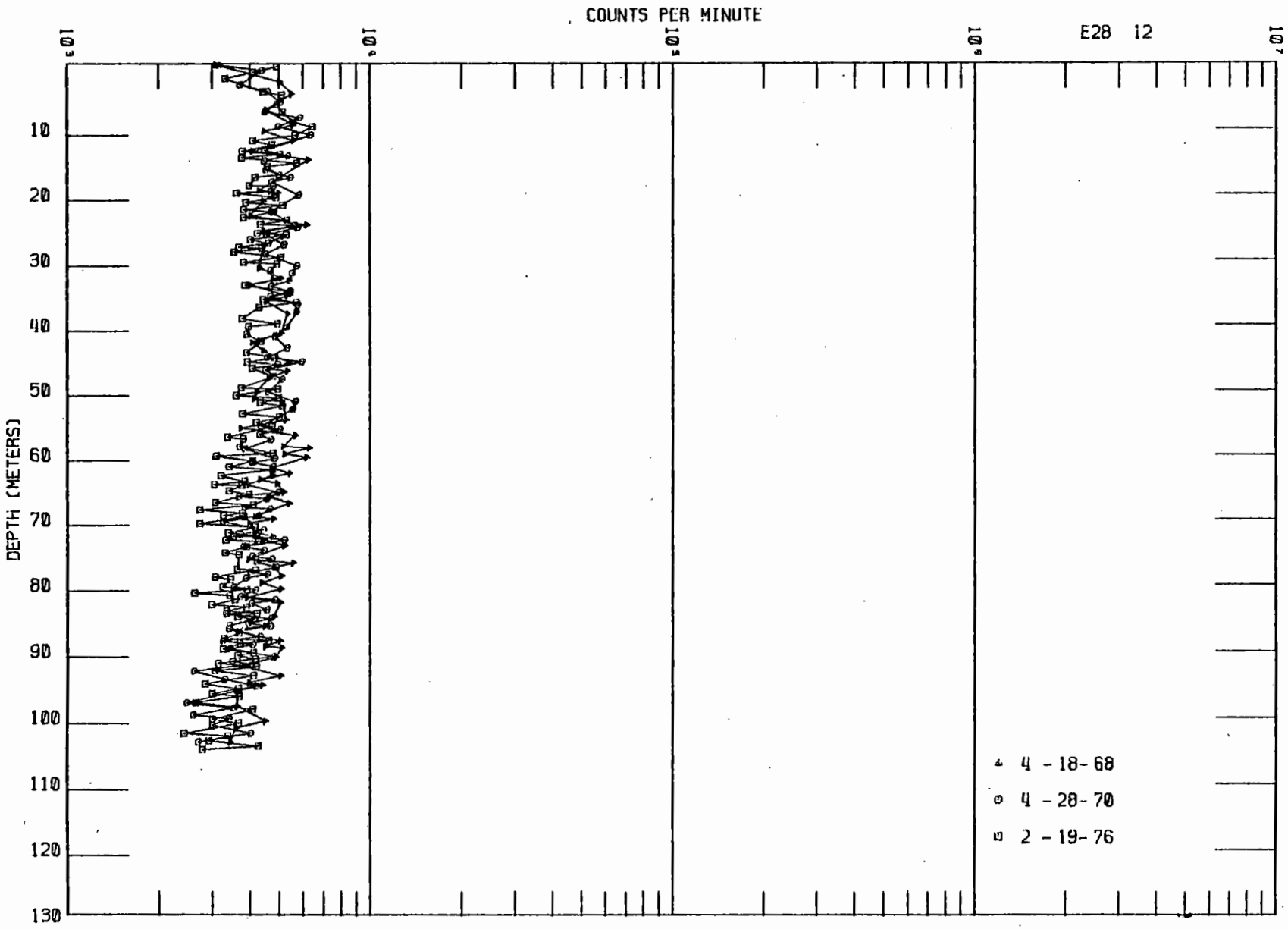

COUNTS PER MINUTE
10^3
10^4
10^5
10^6
E28 7
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
5 - 4 - 76

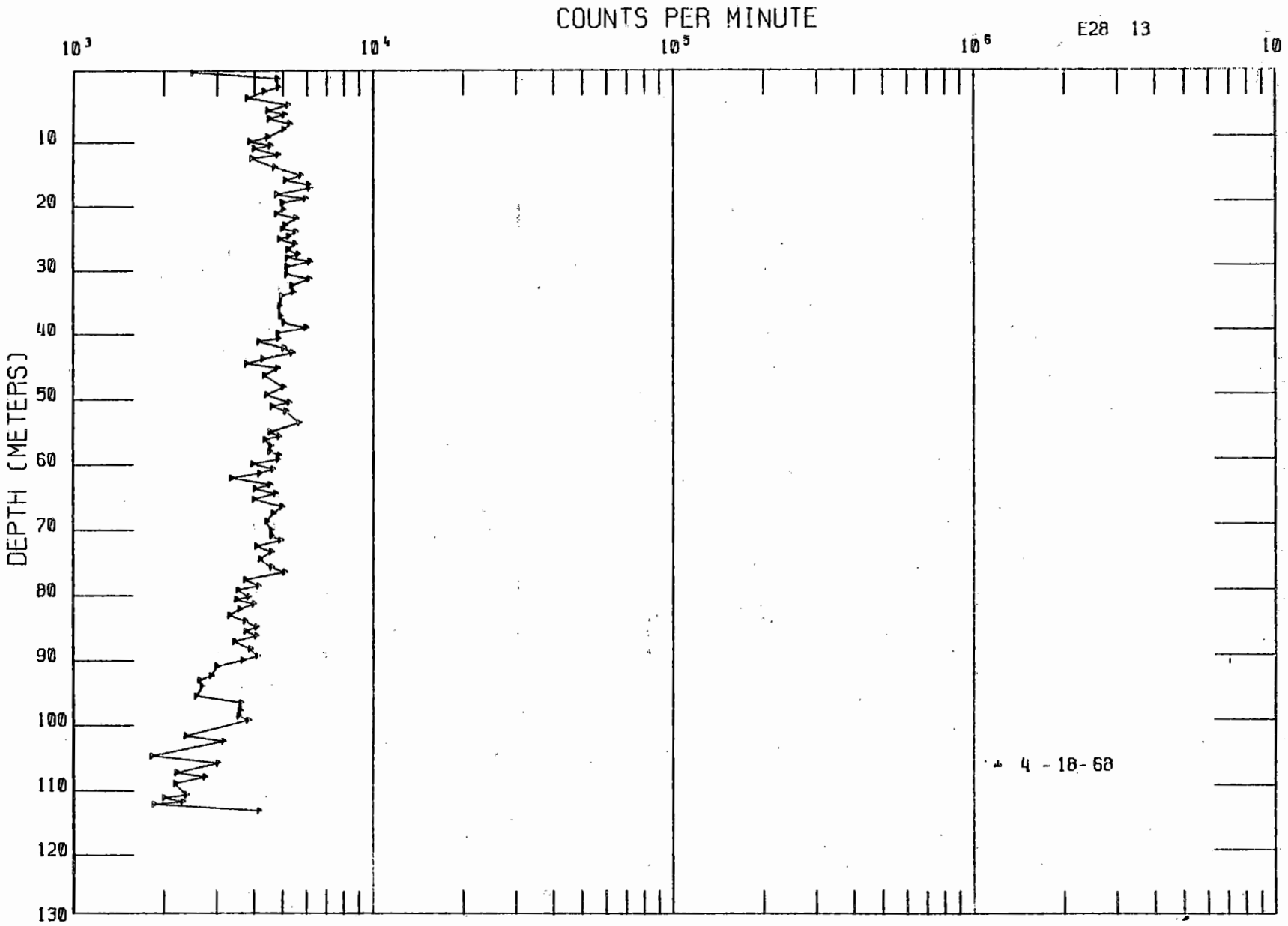

CO NTS PER MINUTE
E28 8
10³
10⁴
.0⁵
10⁶
.0⁷
DEPTH (ME ERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 17-63

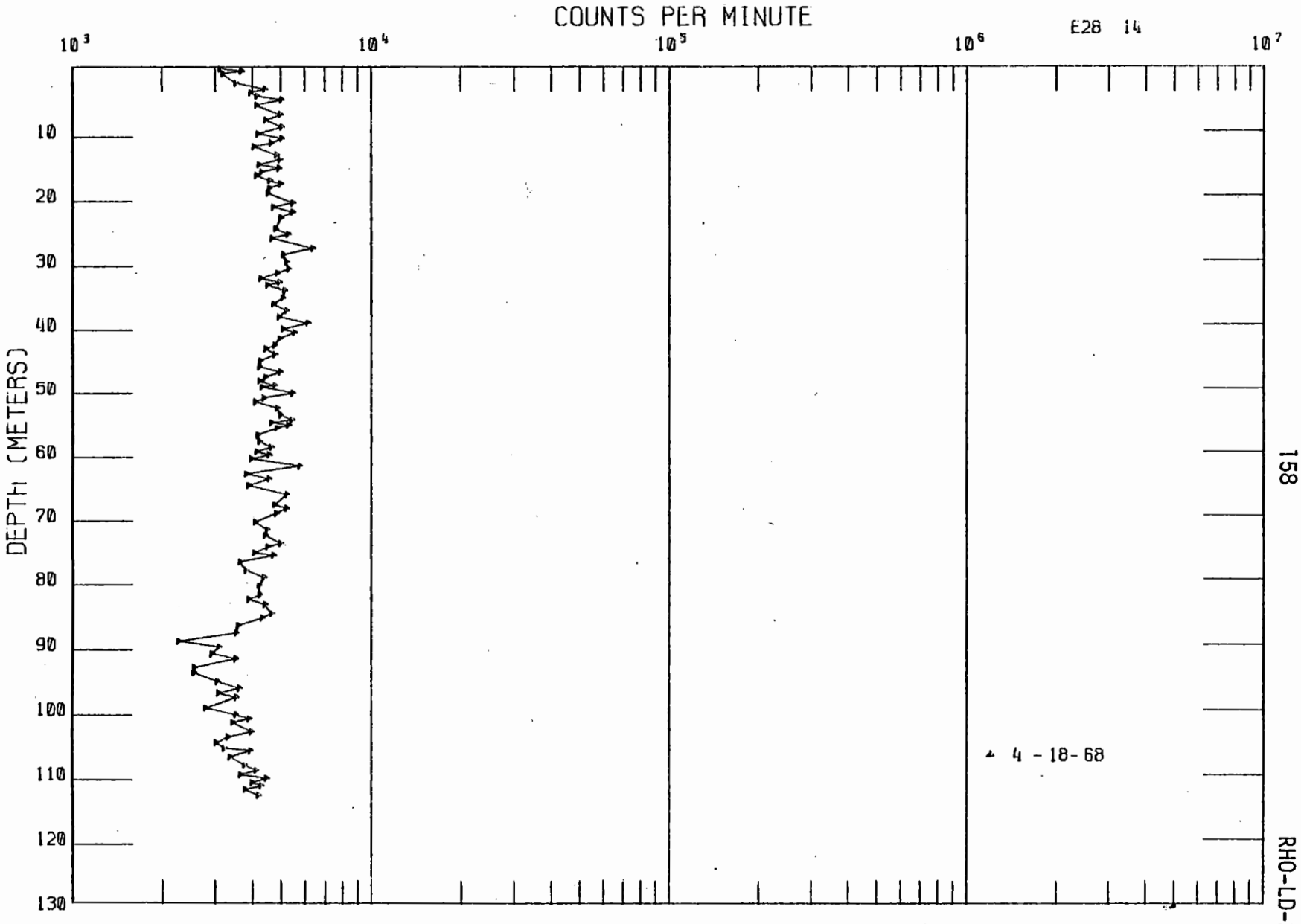

COUNTS PER MINUTE
E28 9
10³
10⁴
10⁵
10⁶
10⁷
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 .5-63
⊙ 4 -28 70


COUNTS PER MINUTE
10³
10⁴
10⁵
10⁶
10⁷
E28 9
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
5 - 5 - 76

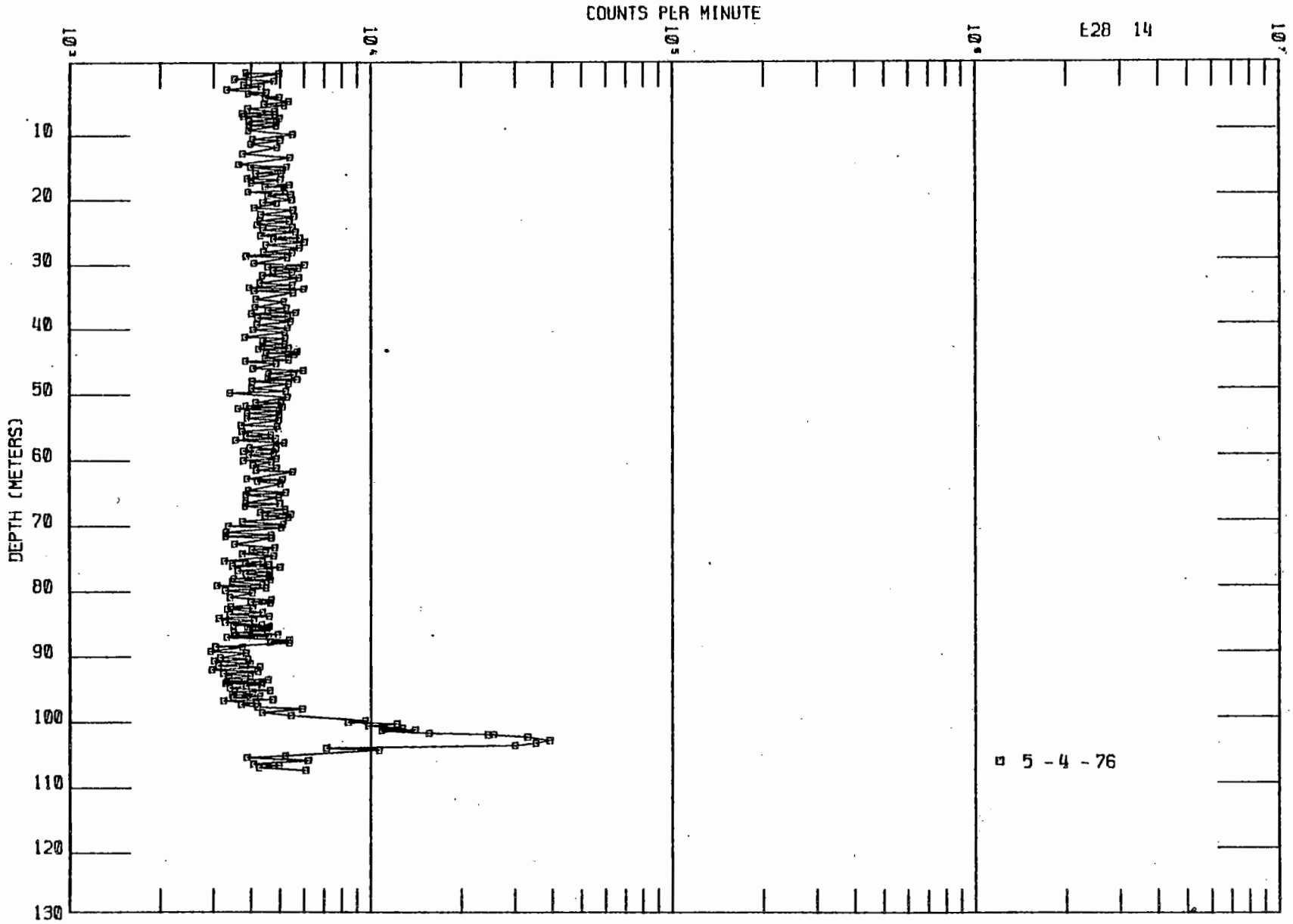

COUNTS PER MINUTE
E28 10
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 17-63


COUNTS PER MINUTE
E28 12
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
4 - 18- 68
4 - 28- 70
2 - 19- 76


COUNTS PER MINUTE
E28 13
10^3
10^4
10^5
10^6
10
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
4 - 18 - 68


COUNTS PER MINUTE
E28 14
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
4 - 18 - 68

9 2 1 2 4 6 6 0 7 5 2



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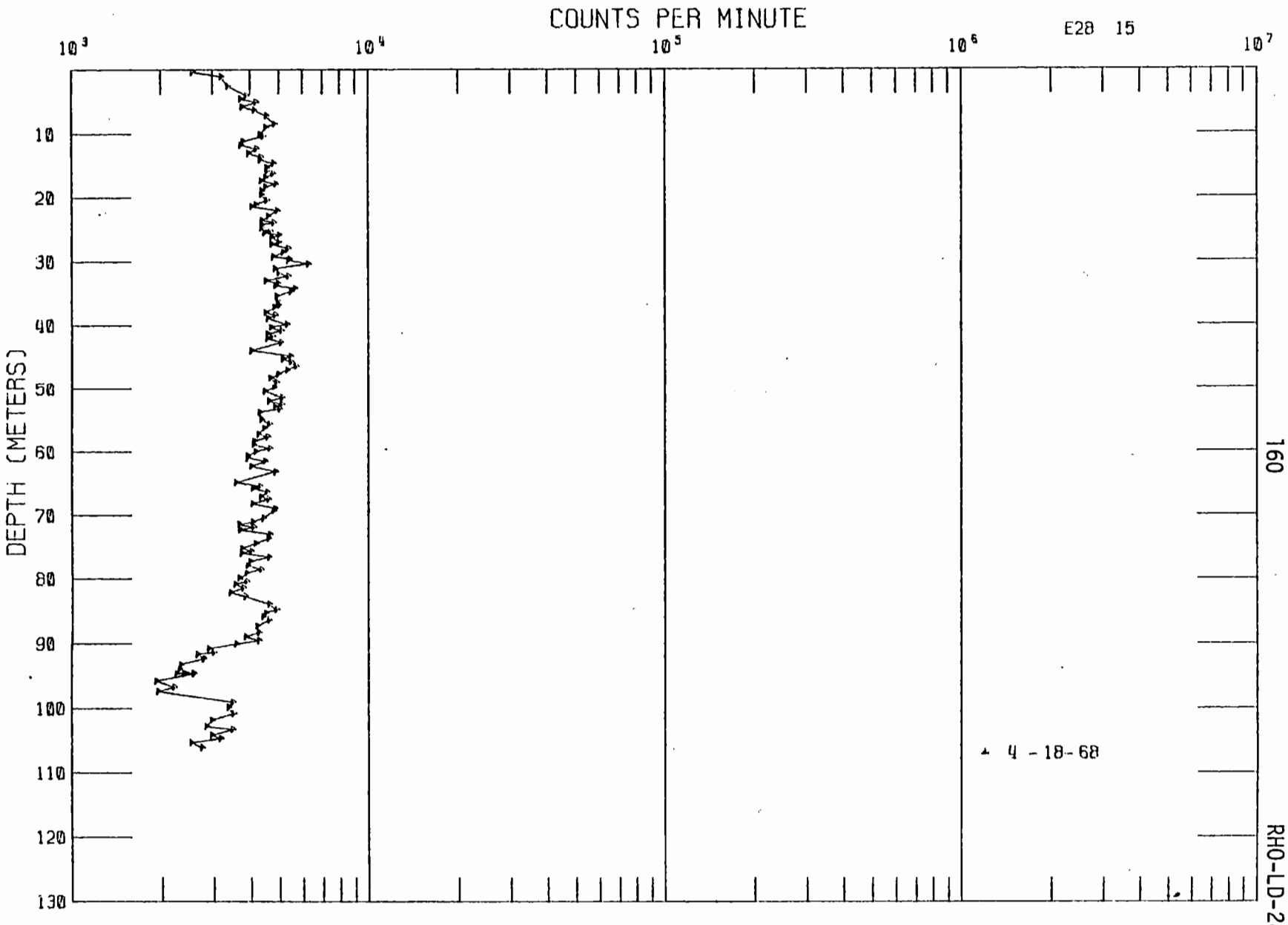
9 2 1 2 4 6 6 0 7 5 3



160

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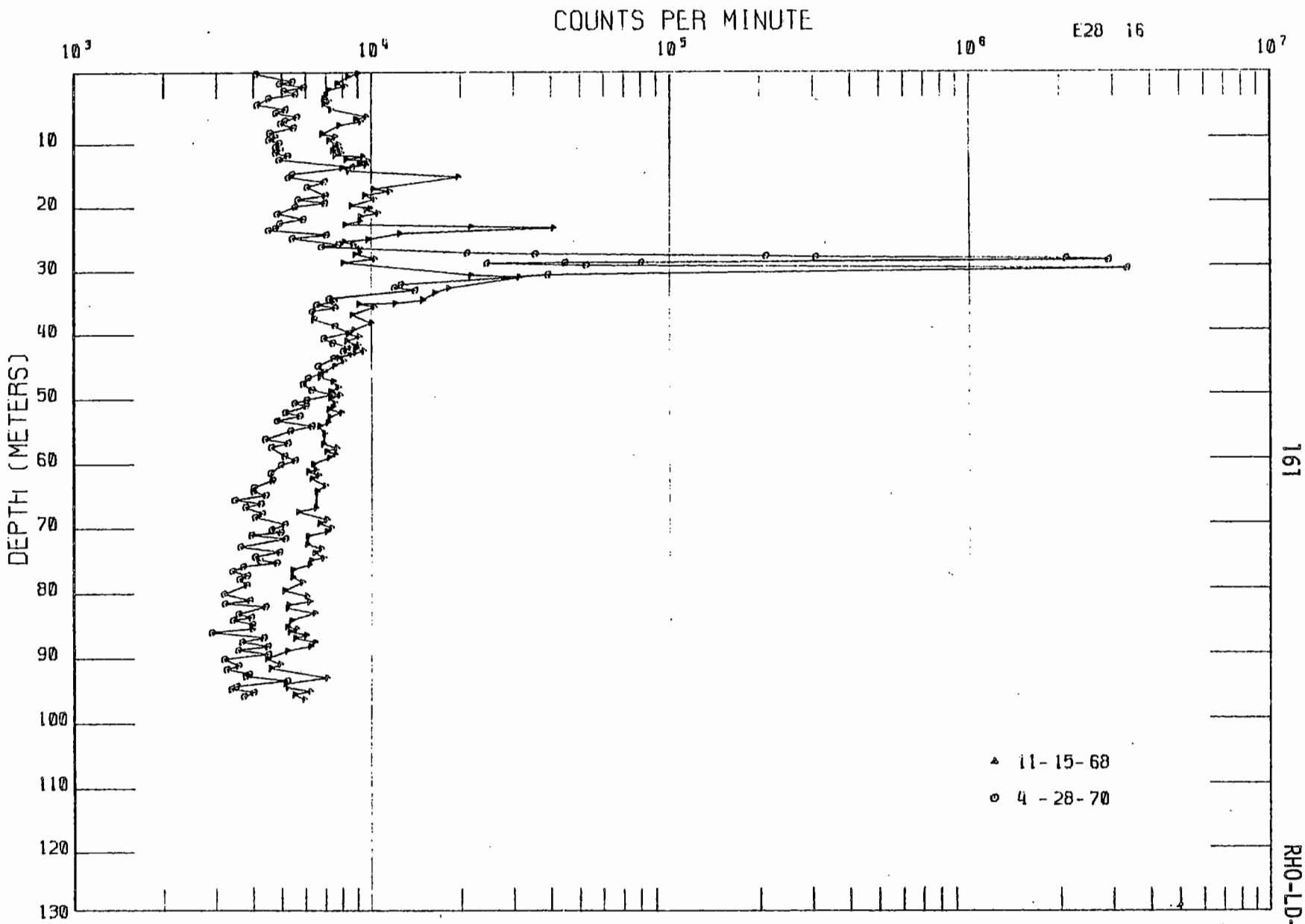
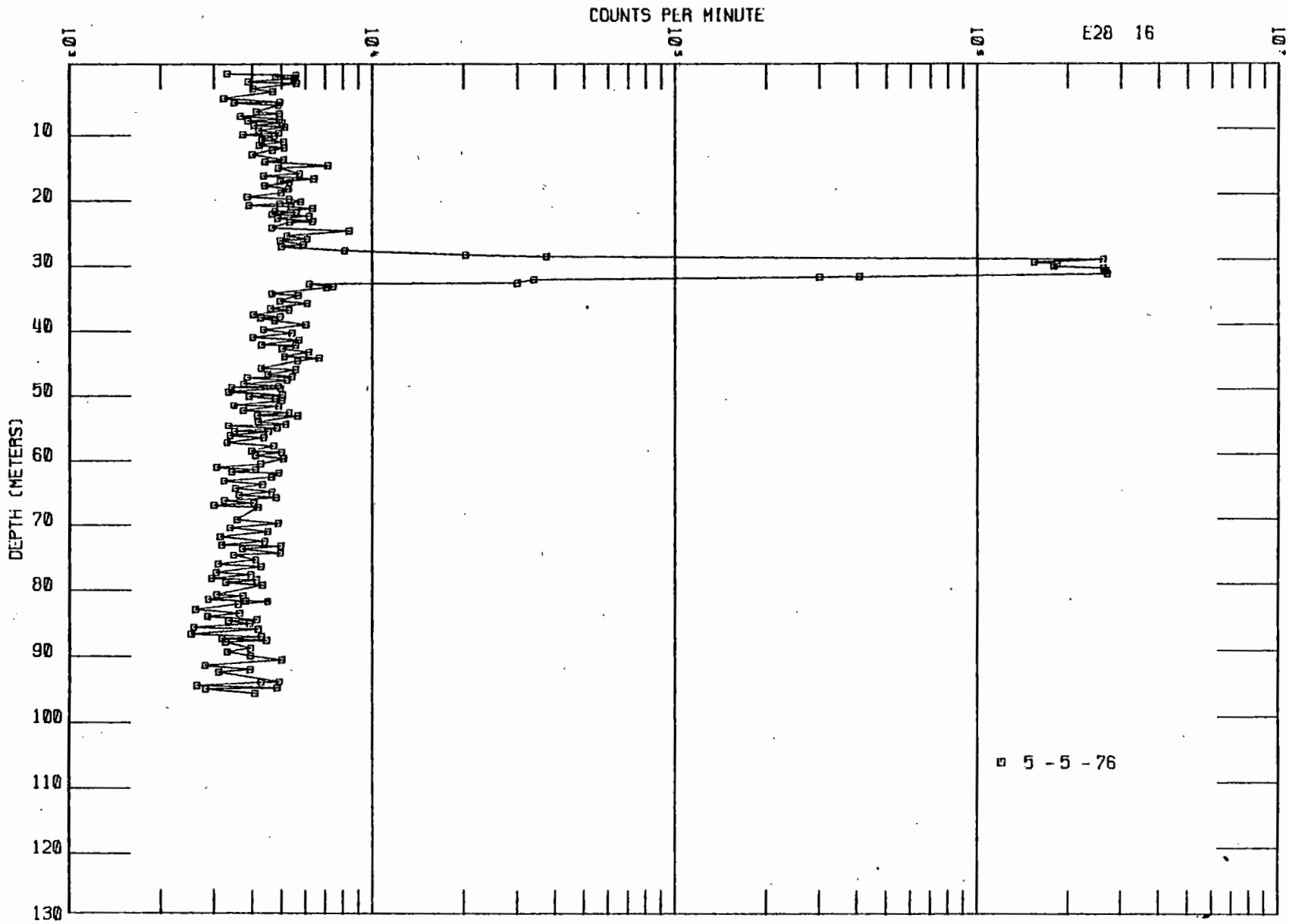
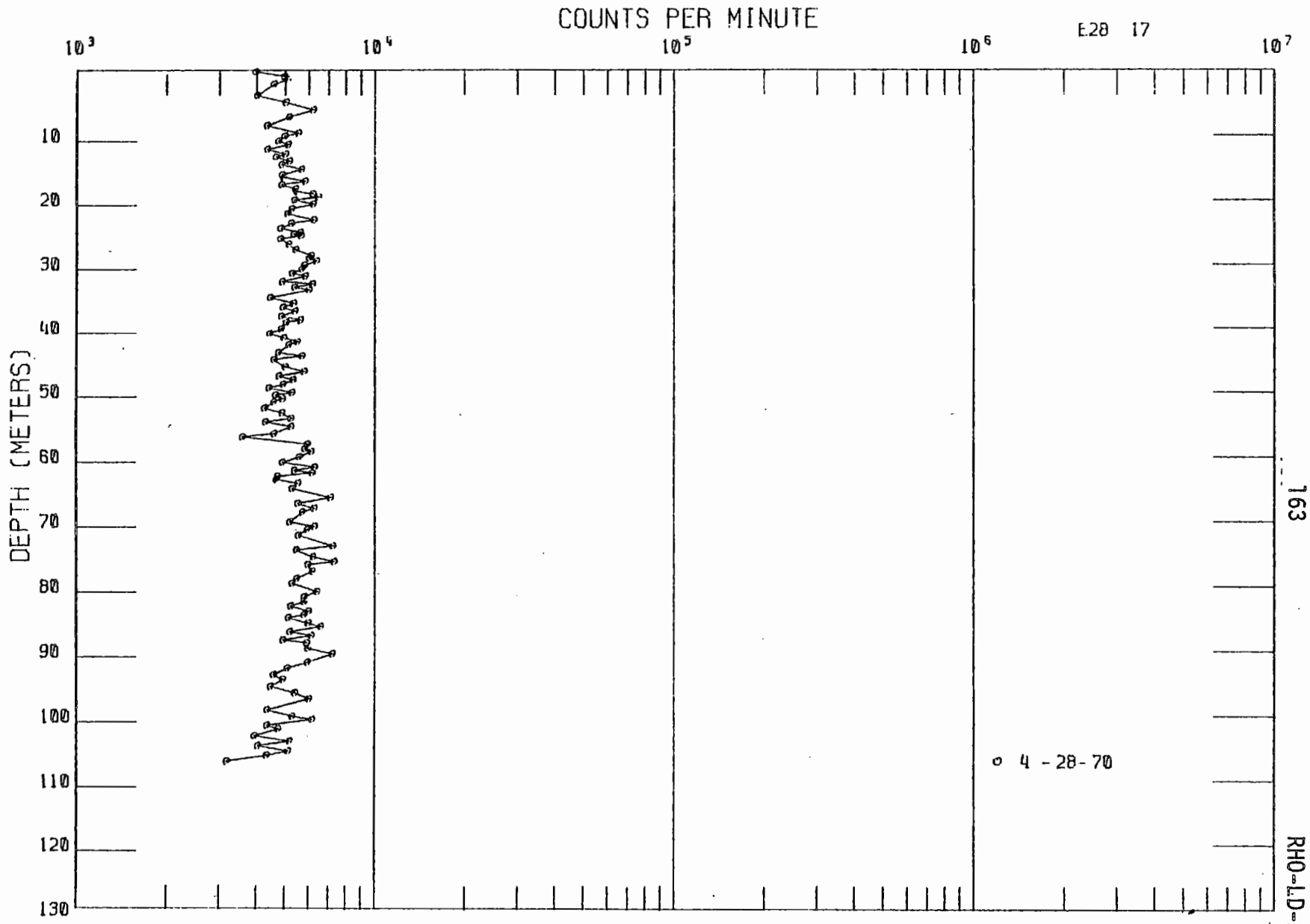

COUNTS PER MINUTE
E28 16
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
11-15-68
4-28-70


COUNTS PER MINUTE
E28 16
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
5 - 5 - 76


COUNTS PER MINUTE
E28 17
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
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60
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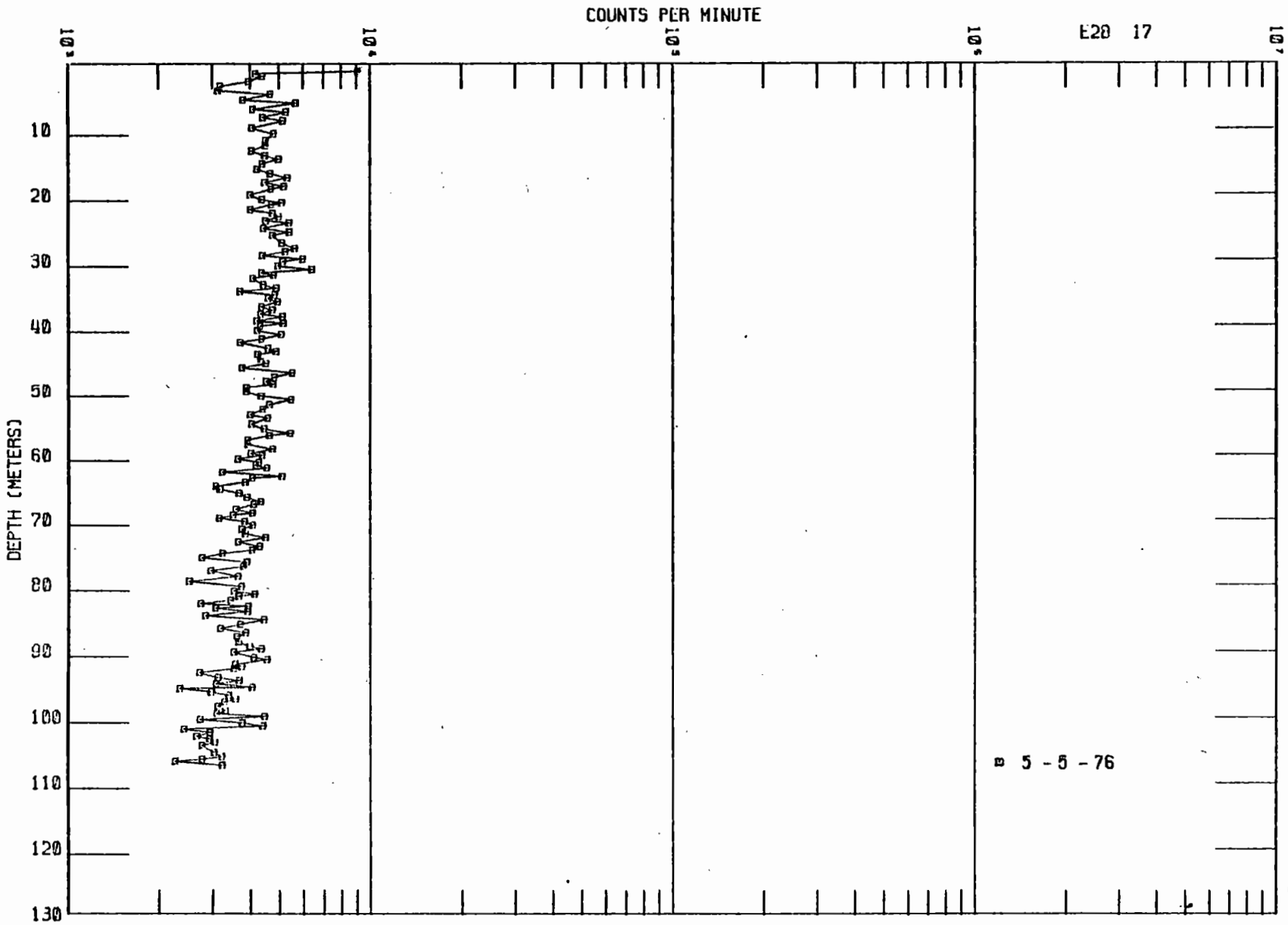
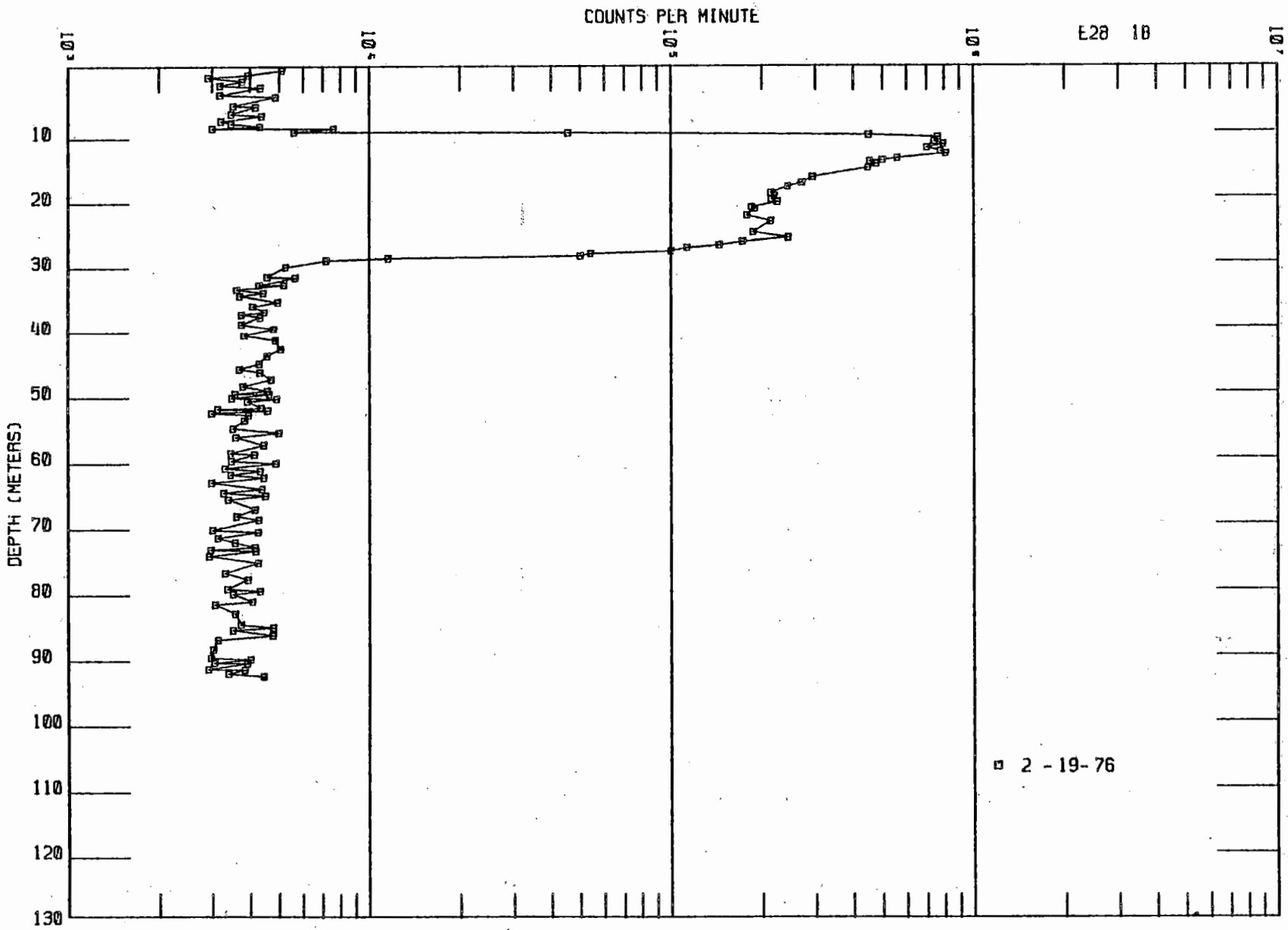
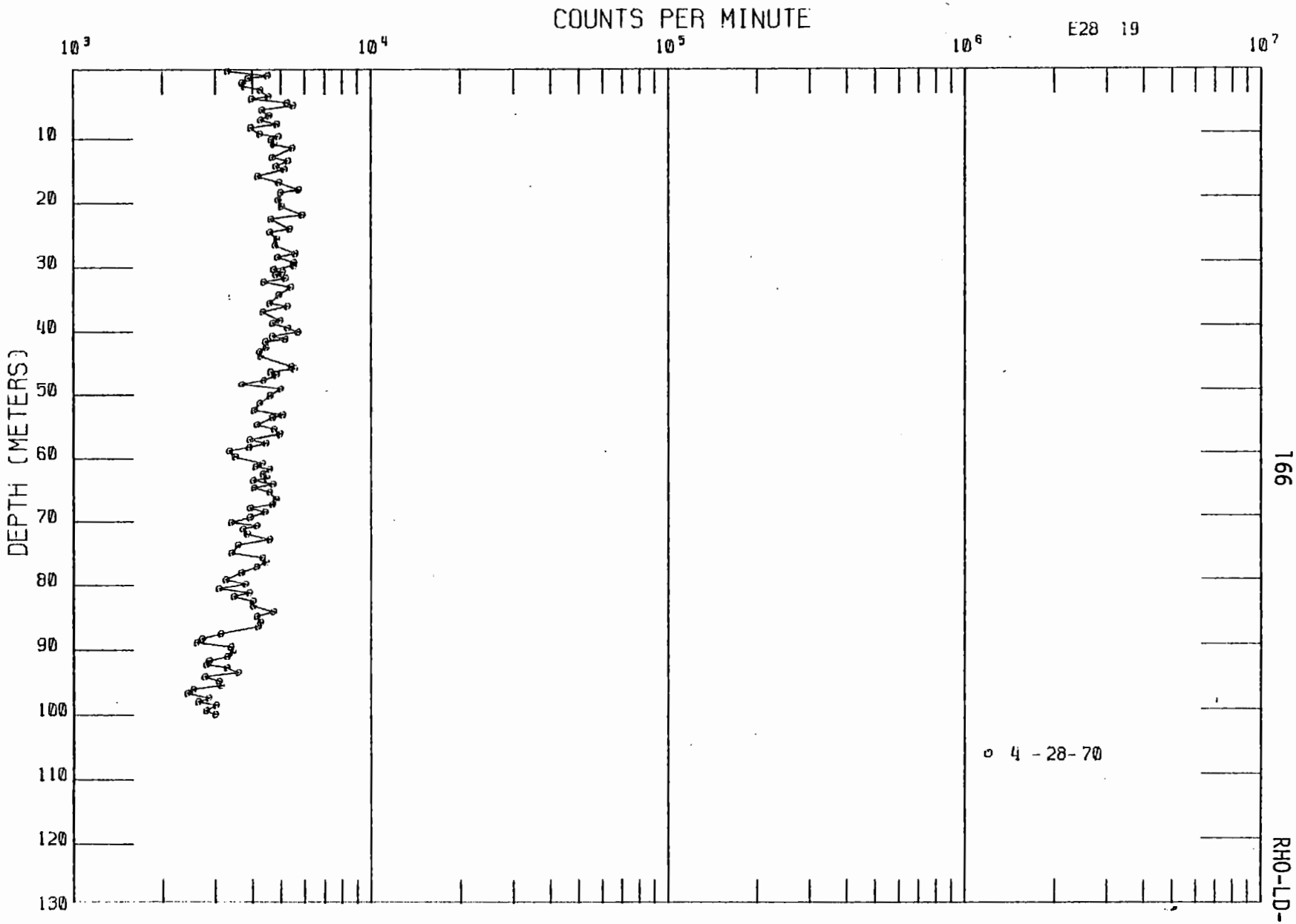
80
90
100
110
120
130
o 4 - 28 - 70


COUNTS PER MINUTE
E20 17
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
5 - 5 - 76

9 2 1 2 4 6 6 0 7 5 8




COUNTS PER MINUTE
E28 19
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
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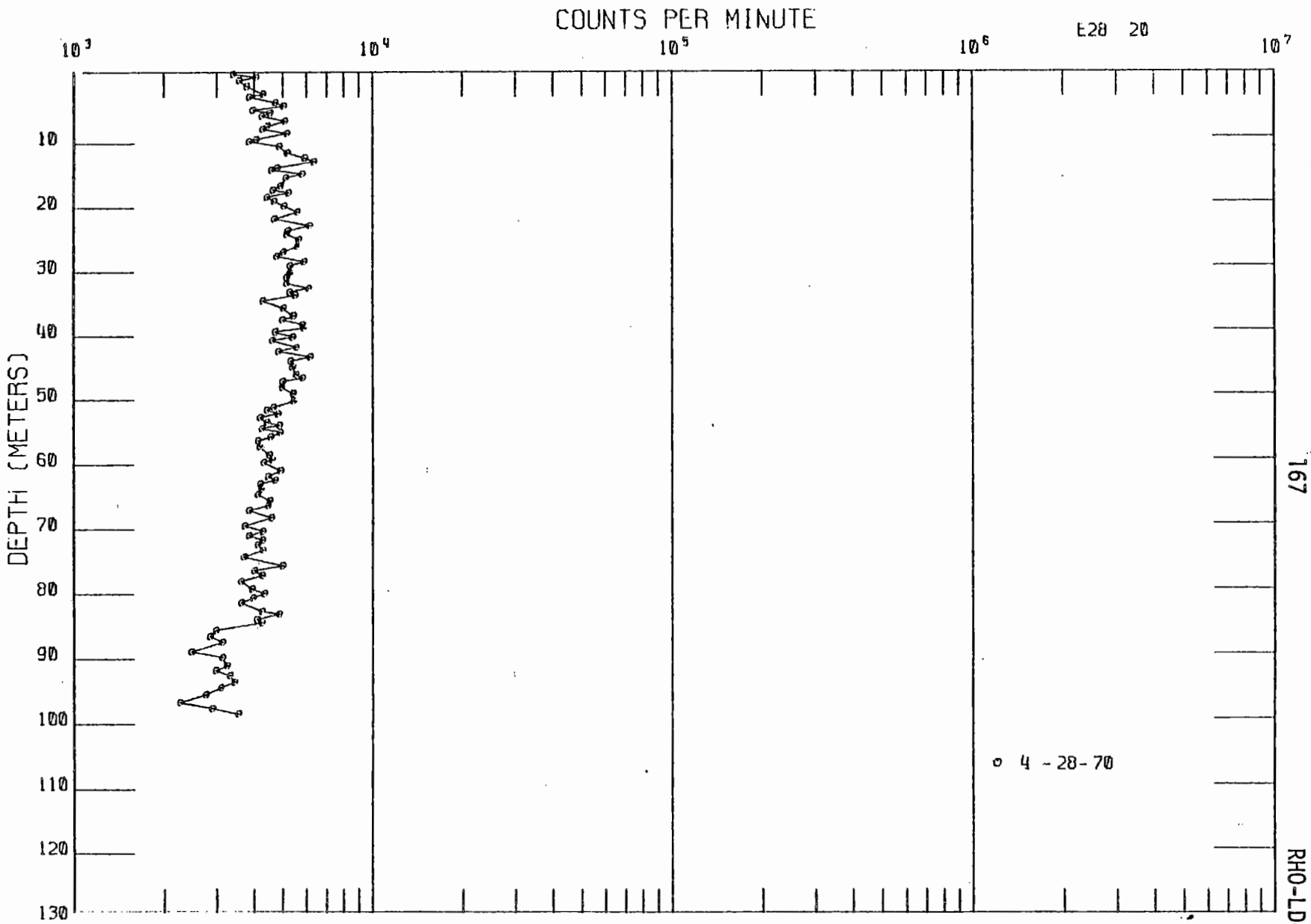
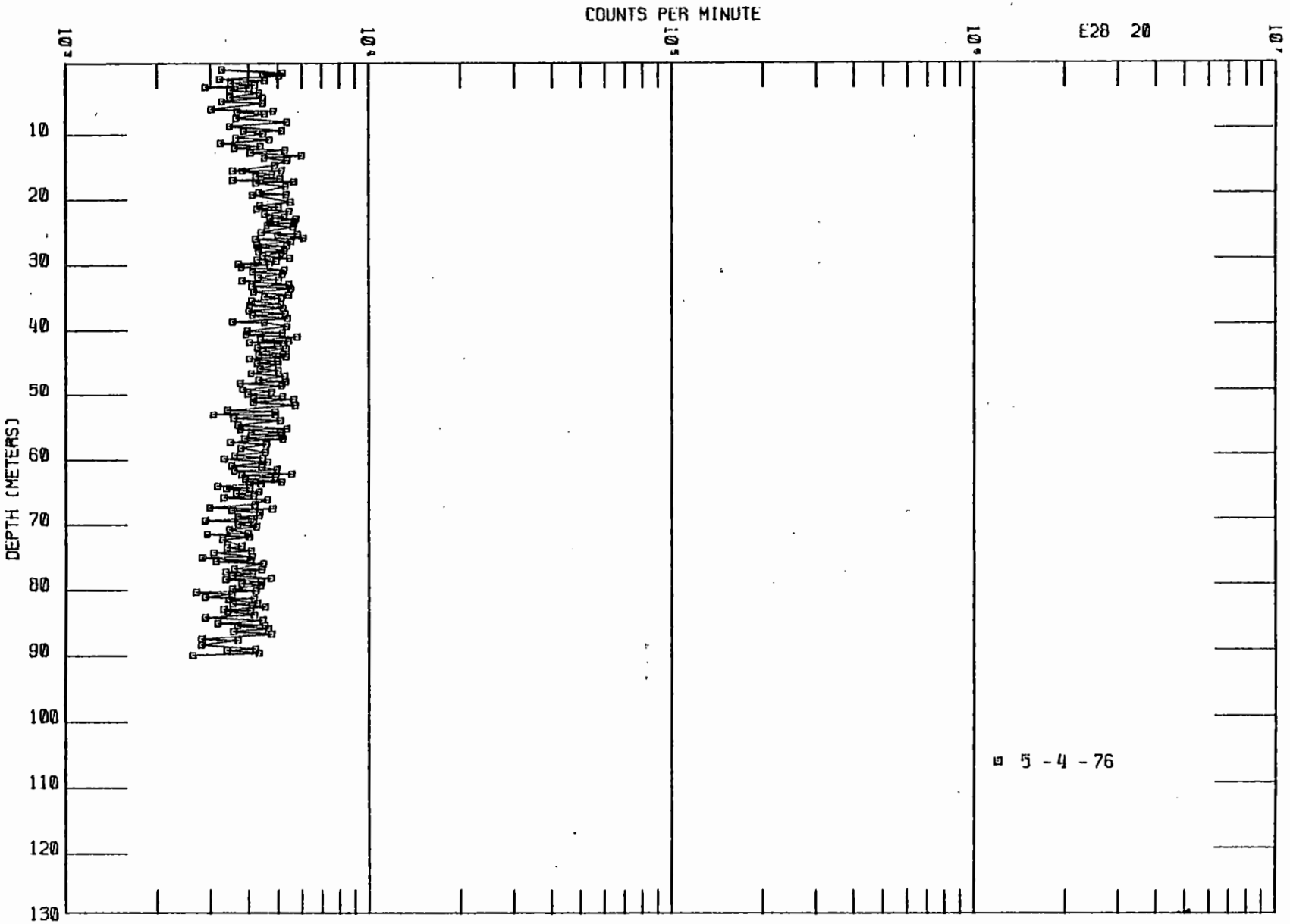
60
70
80
90
100
110
120
130
o 4 -28-70


COUNTS PER MINUTE
E28 20
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
o 4 - 28 - 70

9 2 1 2 4 6 6 0 7 6 1



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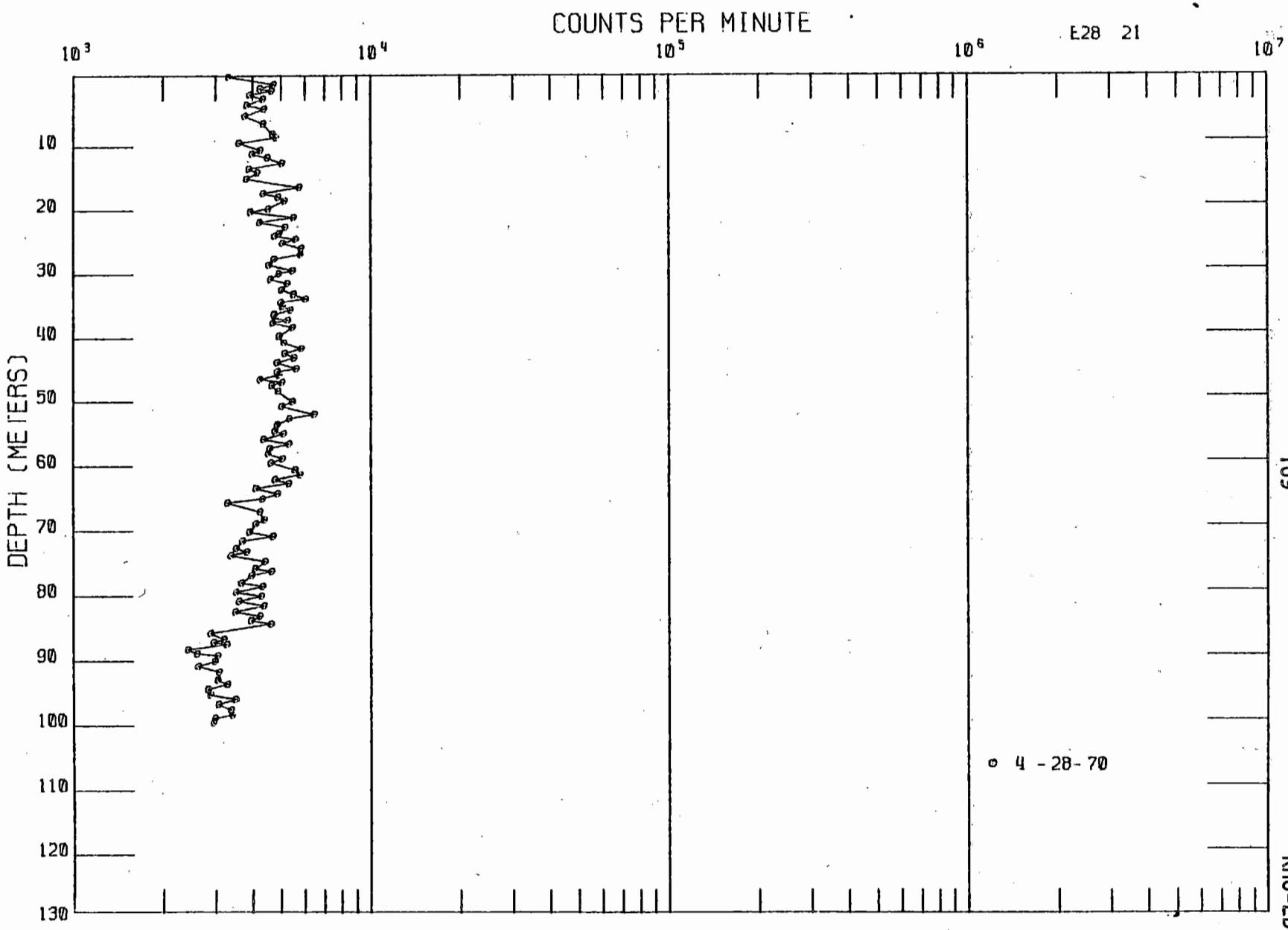
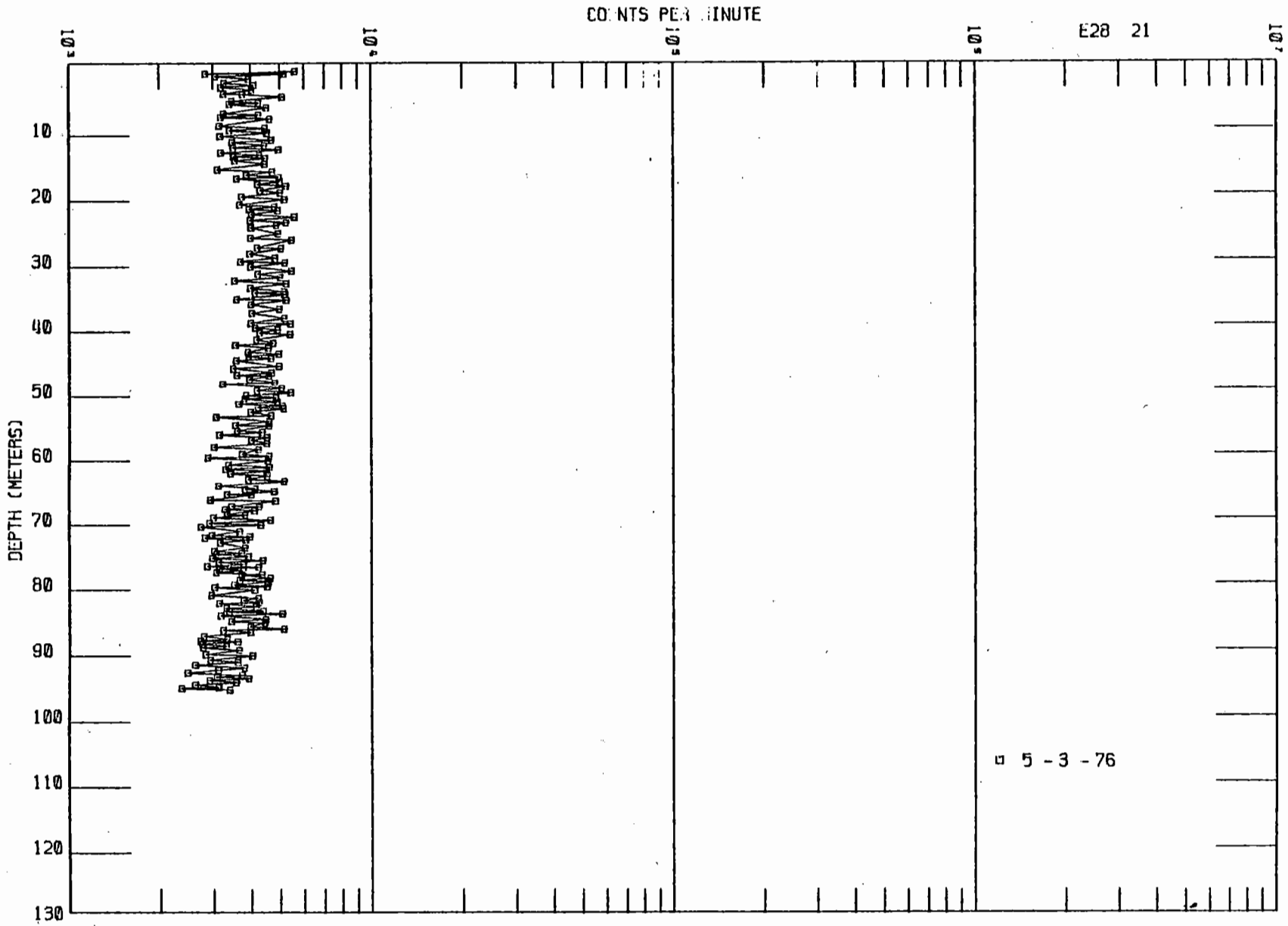

COUNTS PER MINUTE
E28 21
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
o 4 - 28 - 70

9 2 1 2 4 6 6 0 7 6 3



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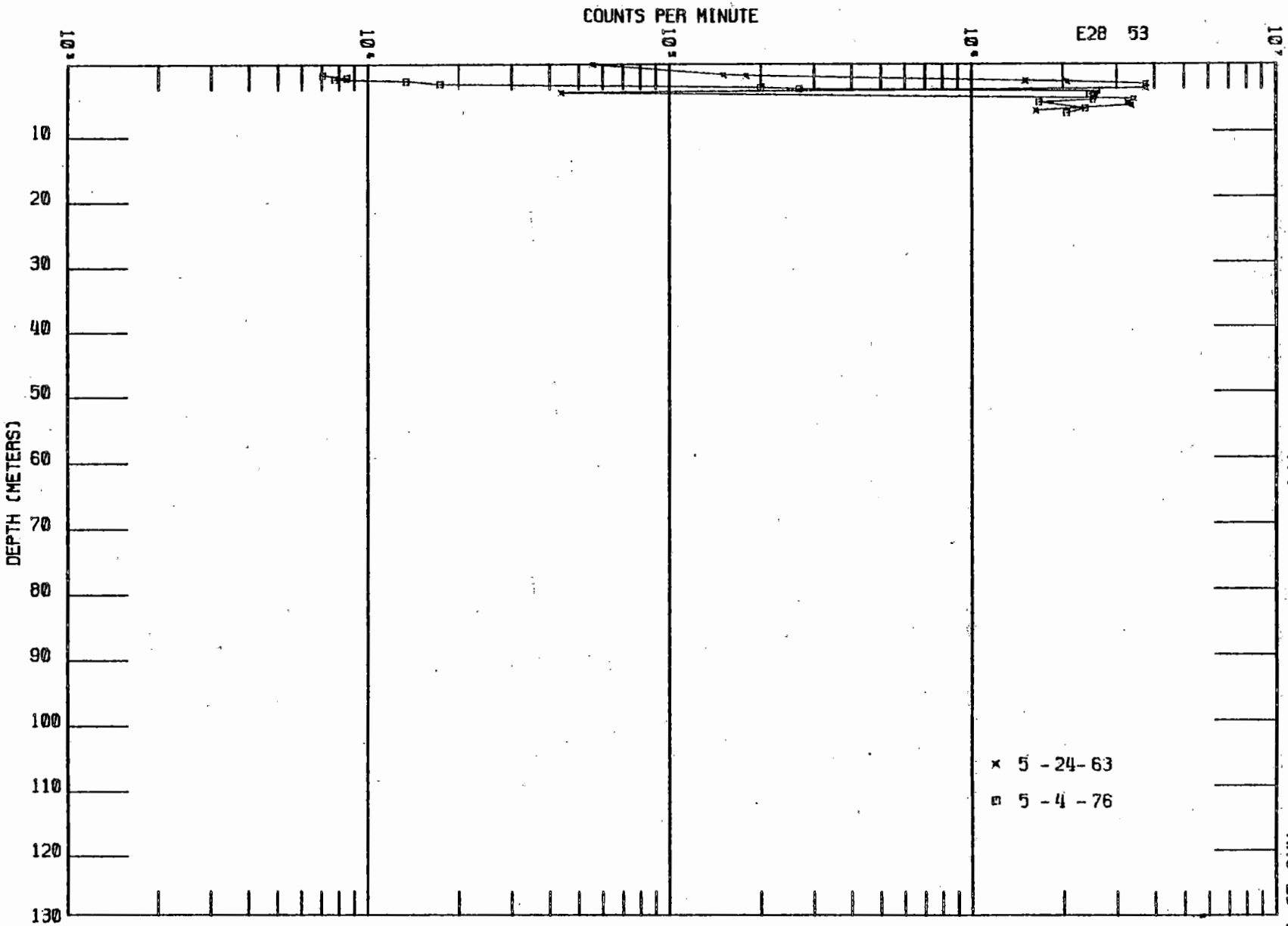
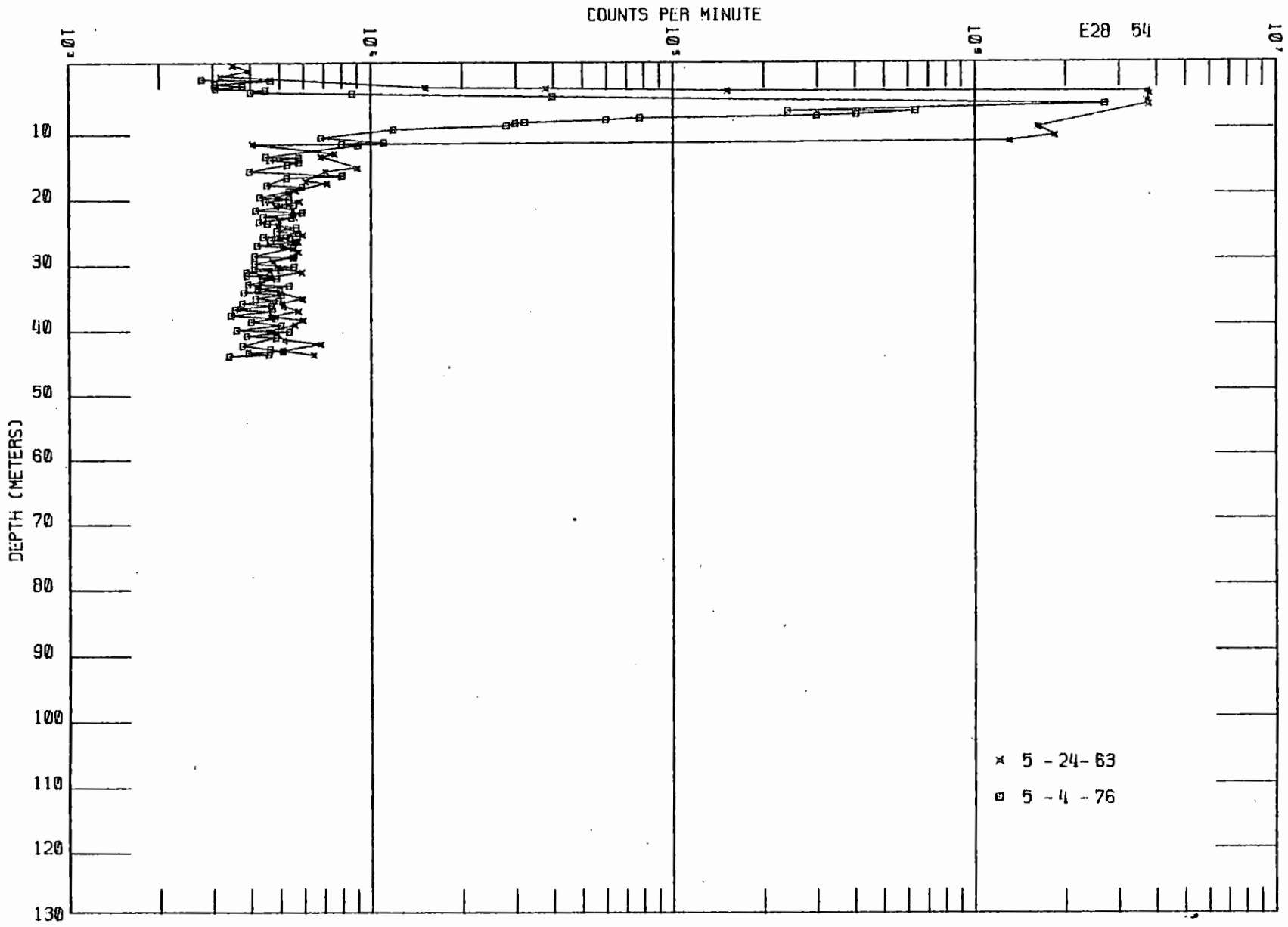
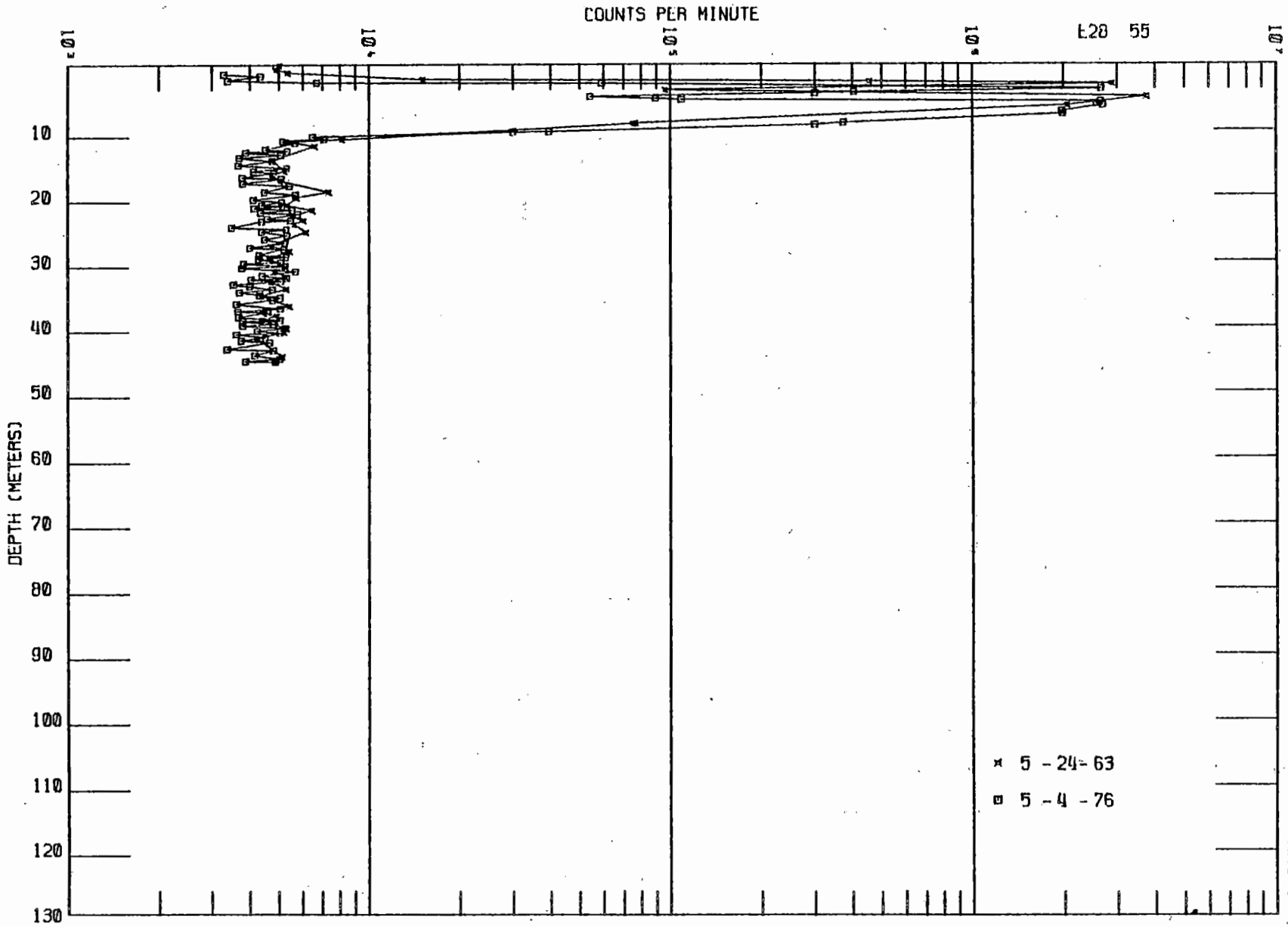
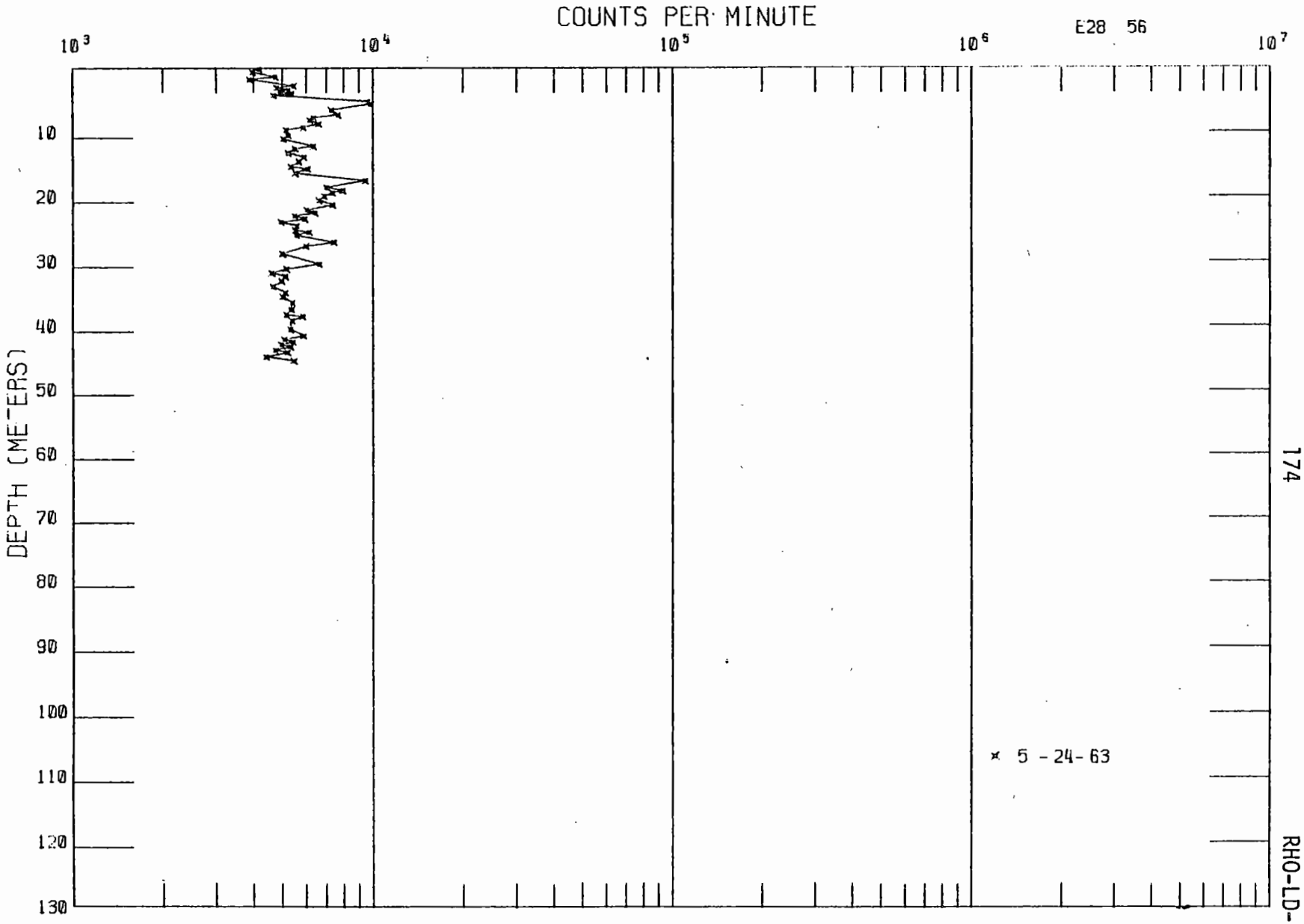
RHO-LD-28

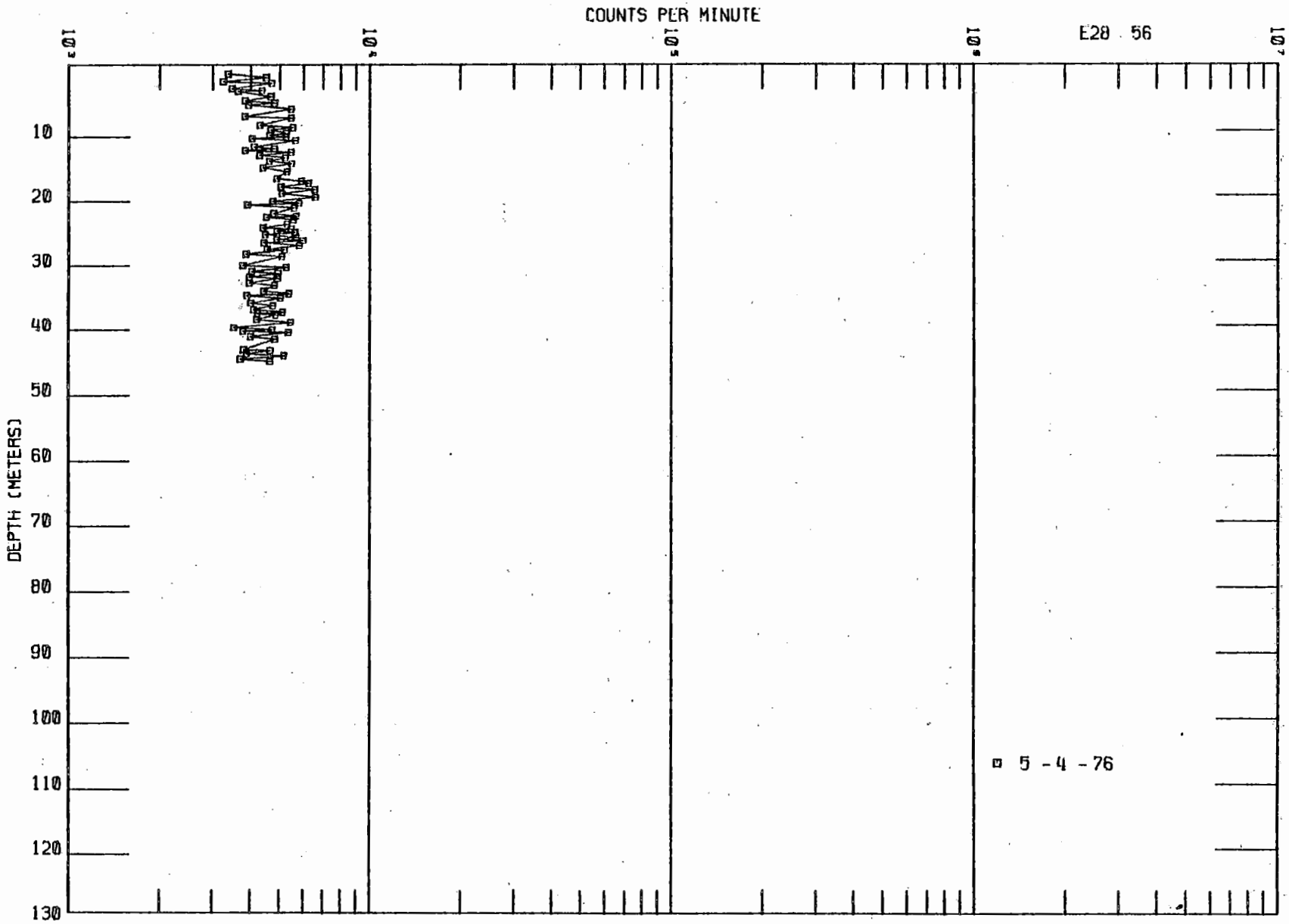

COUNTS PER MINUTE
E28 53
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 -24-63
▫ 5 -4 -76


COUNTS PER MINUTE
E28 54
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
5 - 24- 63
5 - 4 - 76


COUNTS PER MINUTE
10³
10⁴
10⁵
10⁶
10⁷
E28 55
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 24- 63
▫ 5 - 4 - 76


COUNTS PER MINUTE
E28 56
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 24- 63

9 2 1 2 4 6 6 0 7 6 8



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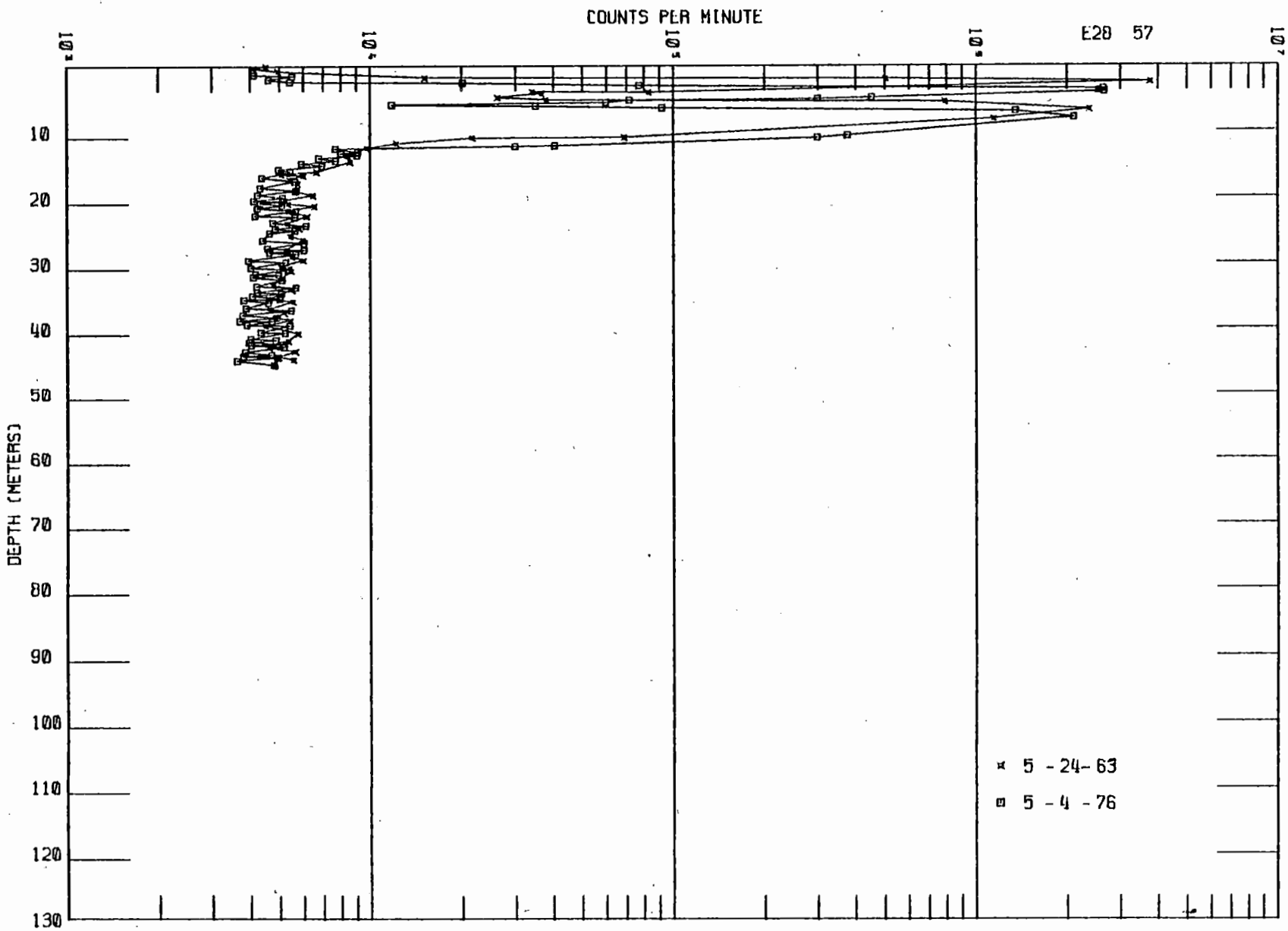
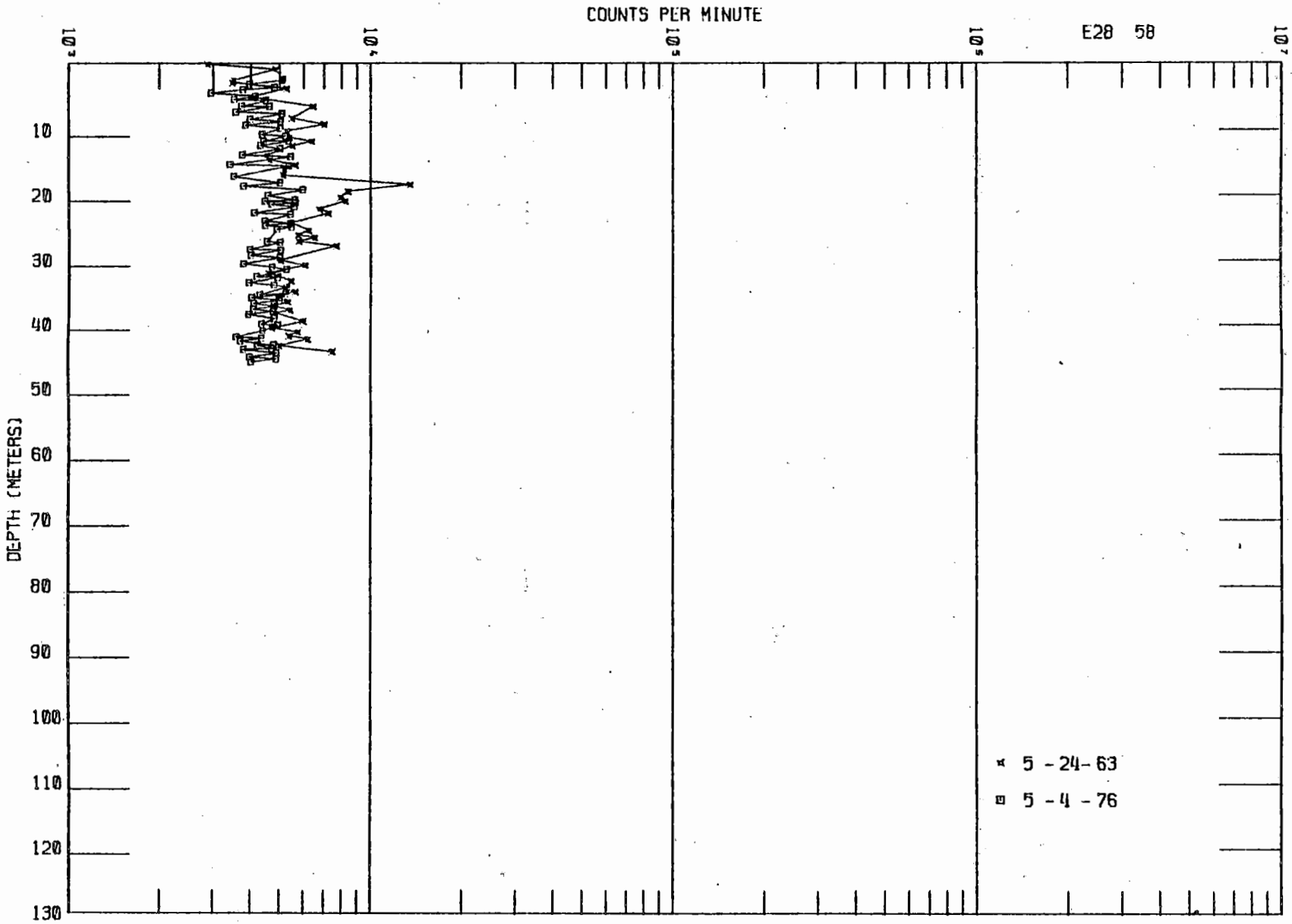

COUNTS PER MINUTE
E28 57
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
5 - 24- 63
5 - 4 - 76

9 2 1 2 4 6 6 0 7 7 0



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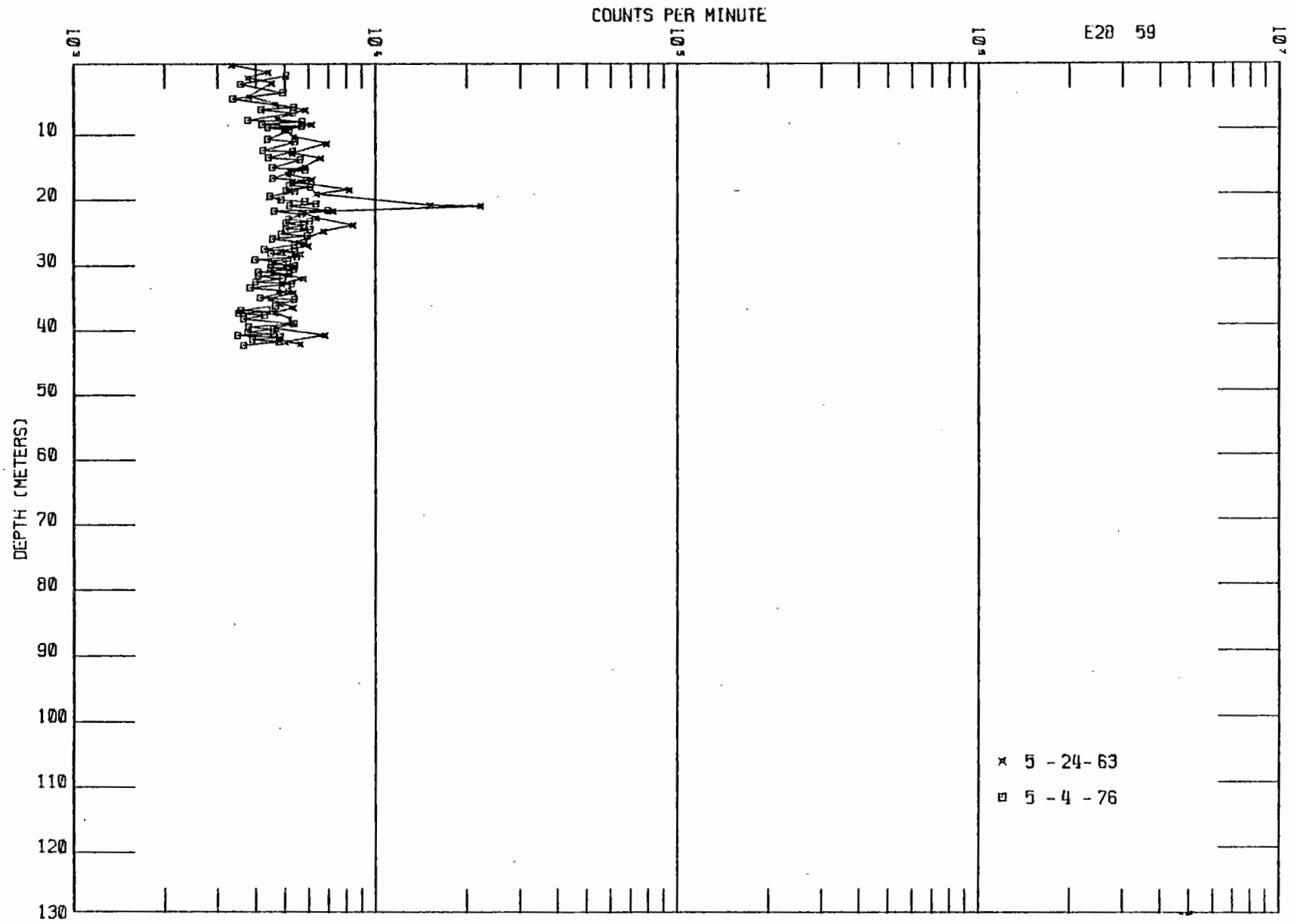
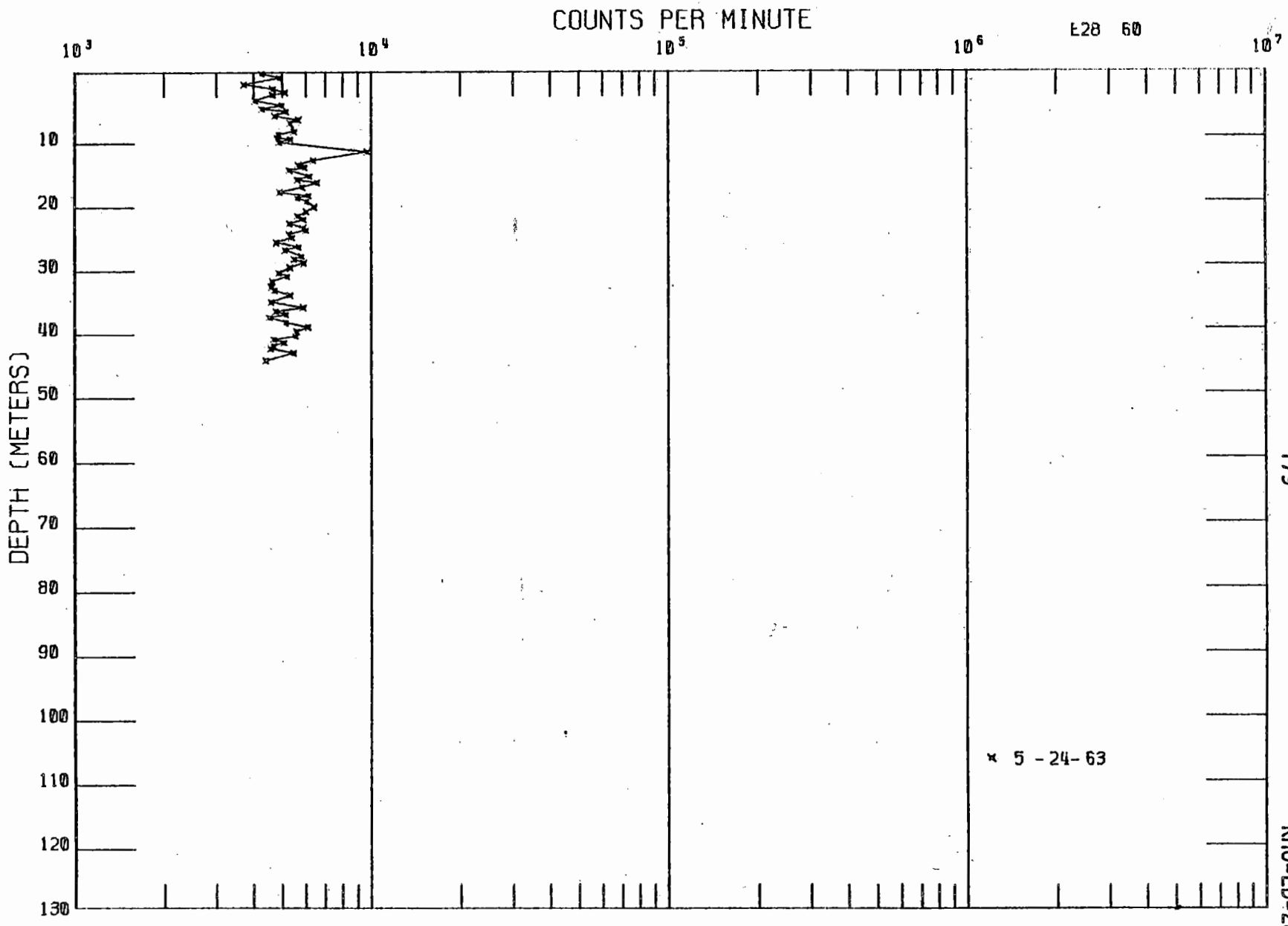
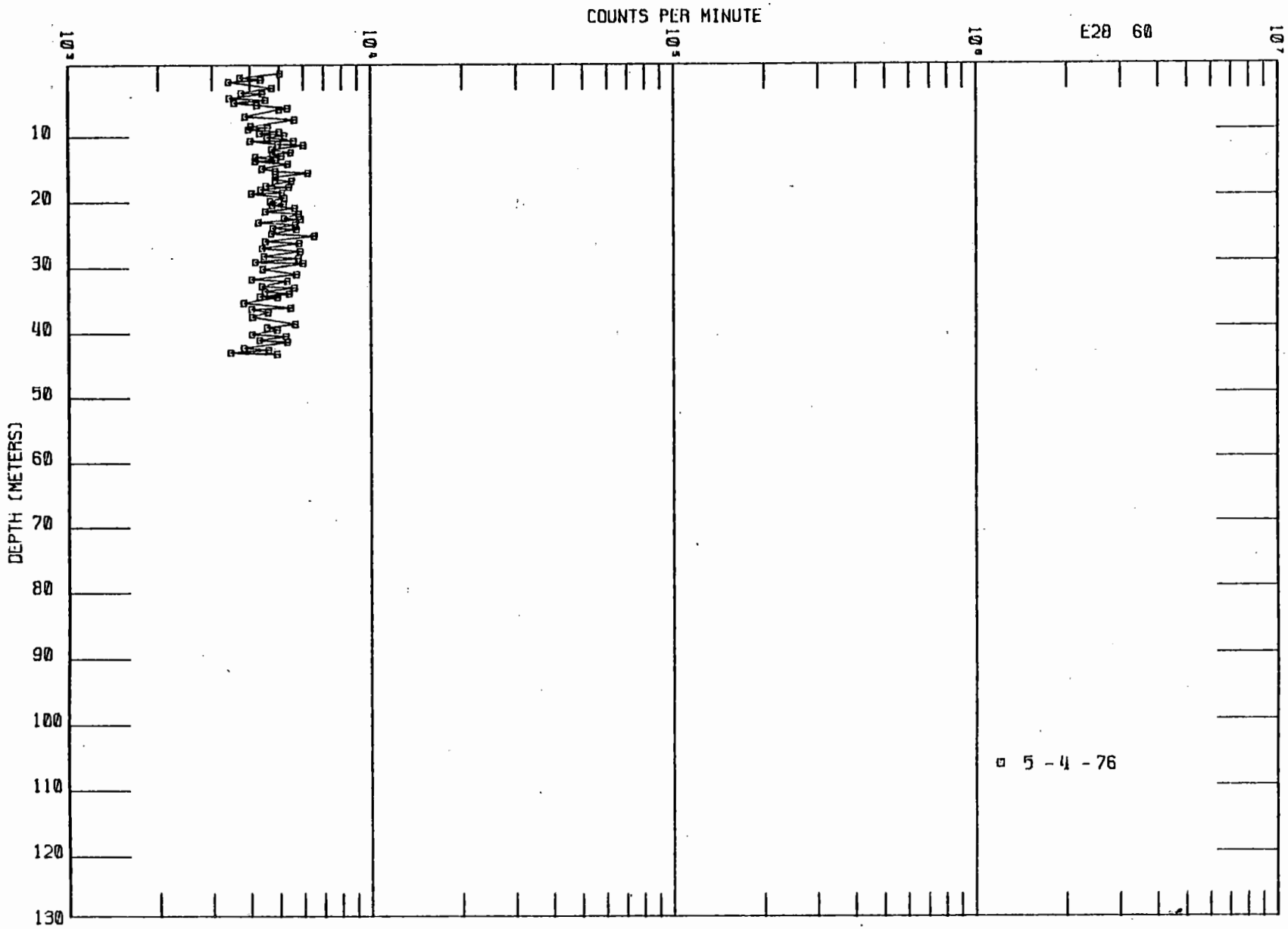
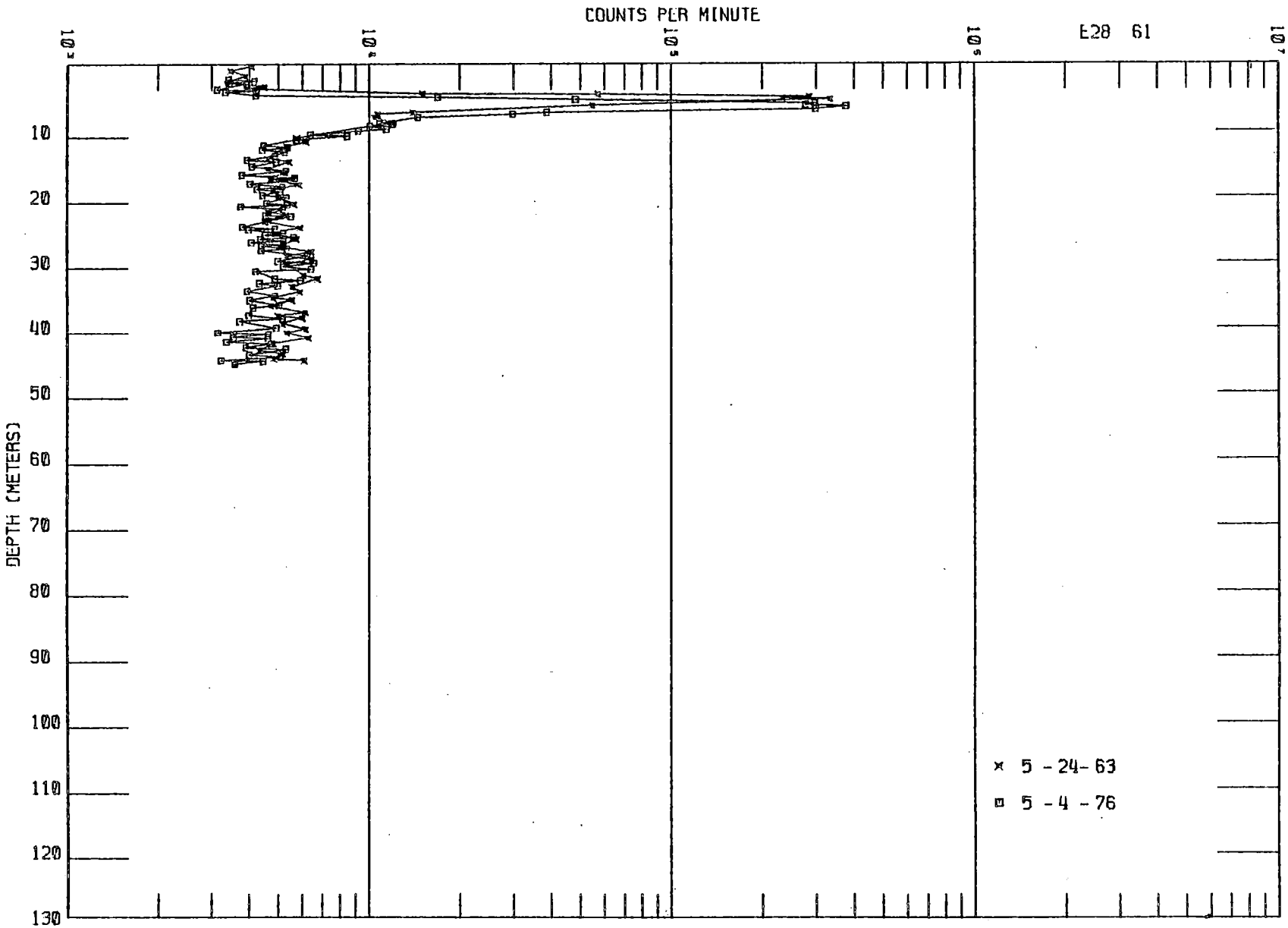

COUNTS PER MINUTE
E20 59
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
5 - 24- 63
5 - 4 - 76

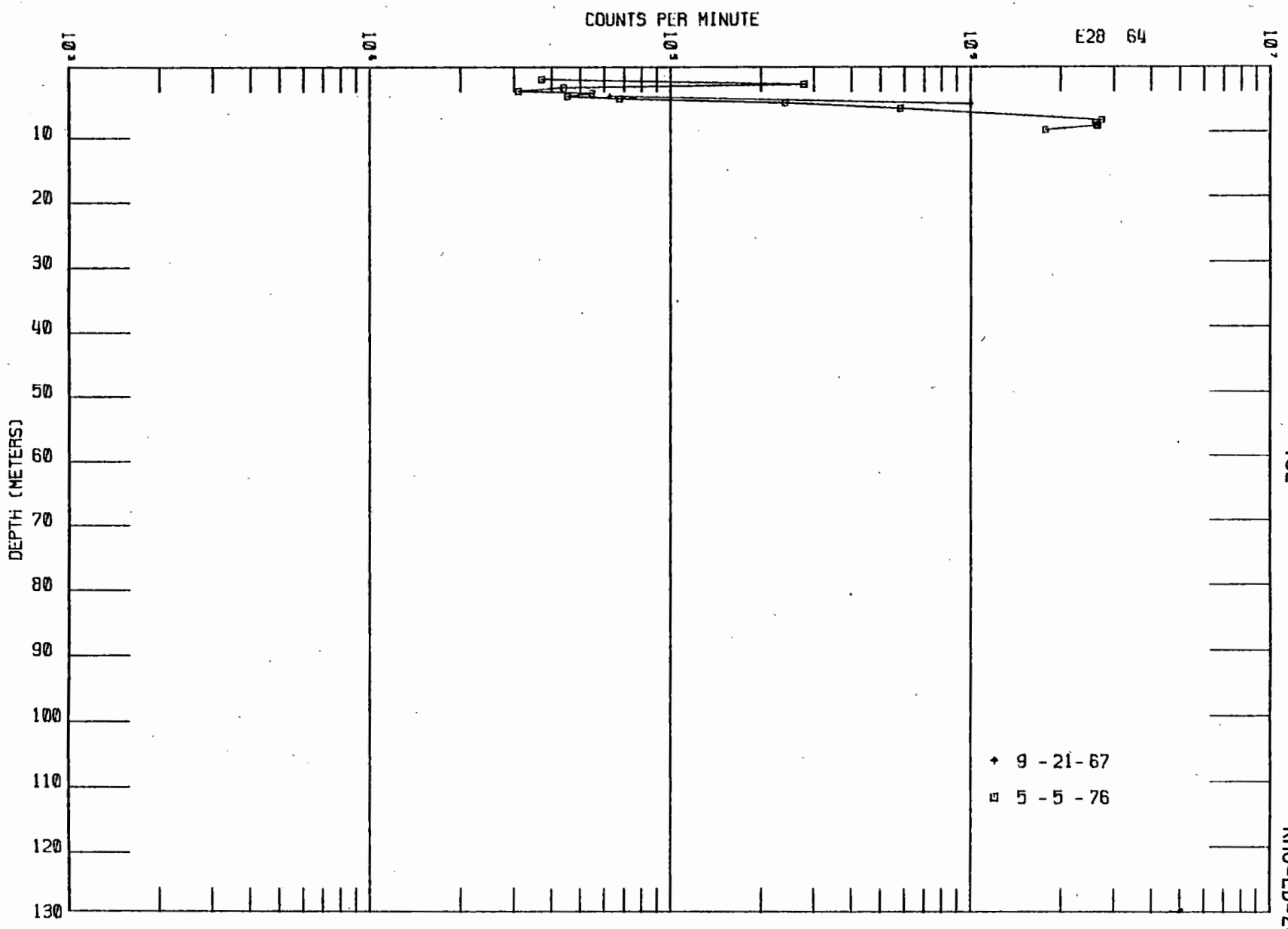
9 2 1 2 4 6 6 0 7 7 2




COUNTS PER MINUTE
E20 60
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
5 - 4 - 76


COUNTS PER MINUTE
E28 61
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 24- 63
▫ 5 - 4 - 76

9 2 1 2 4 6 6 0 7 7 5



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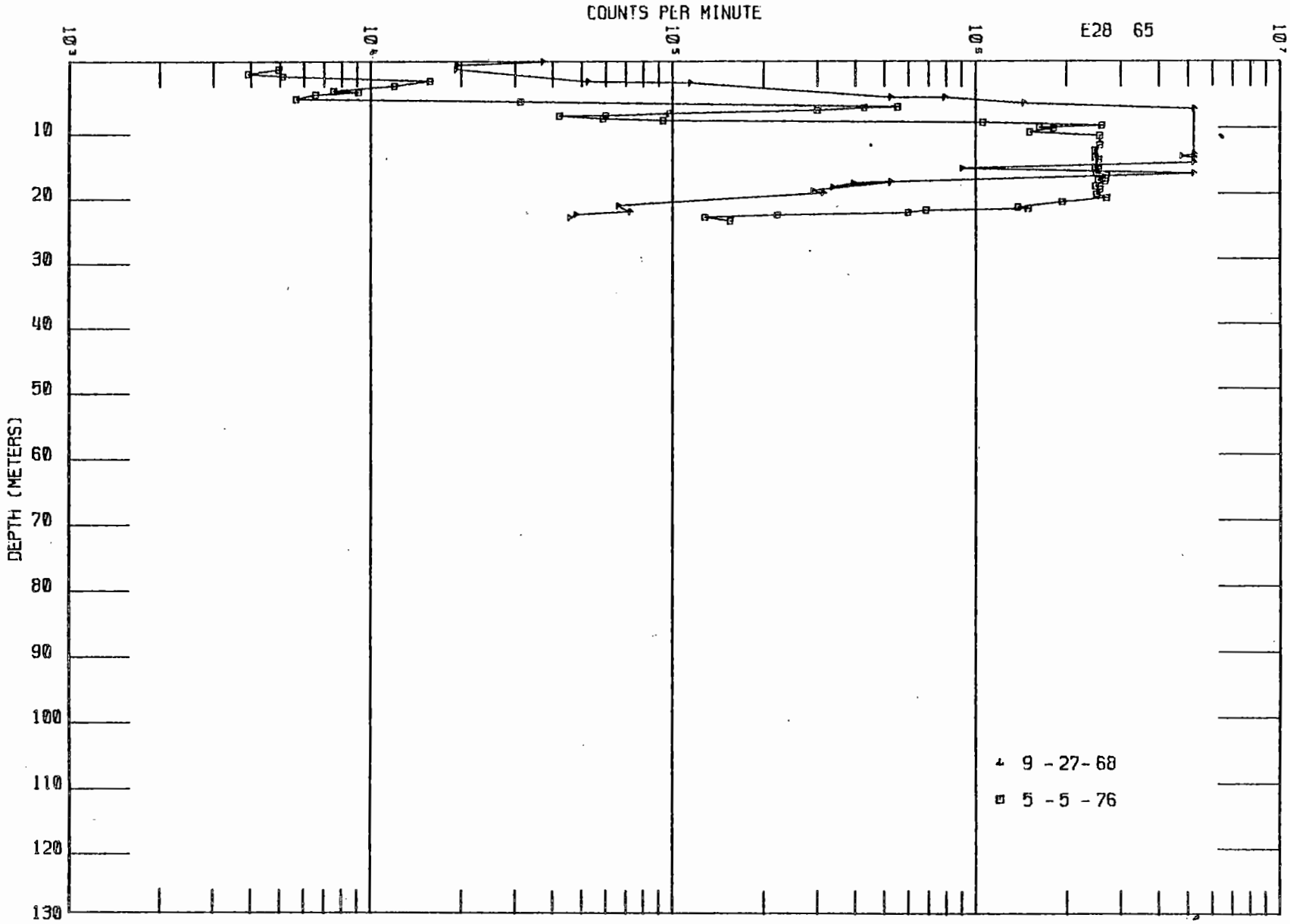
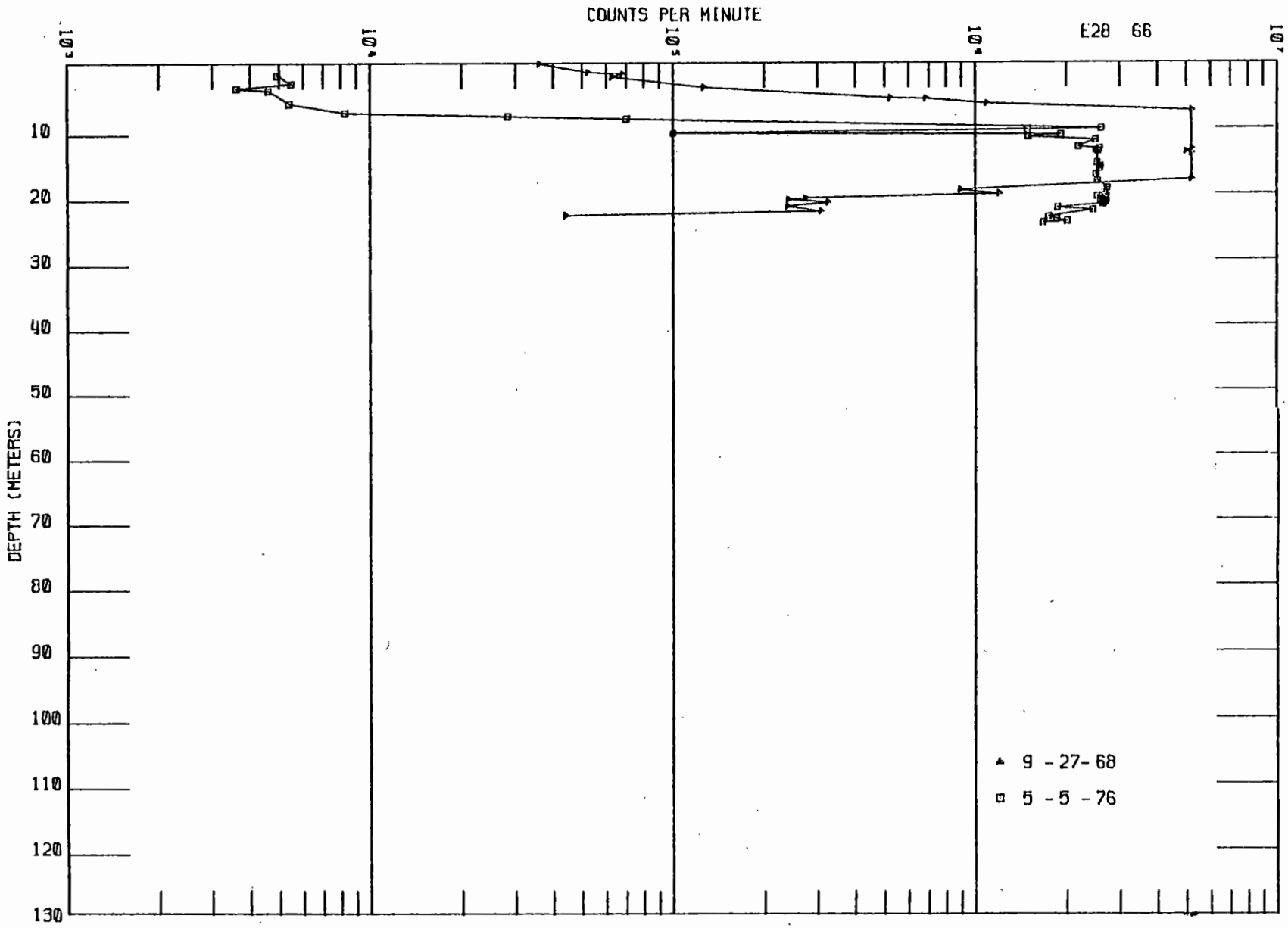
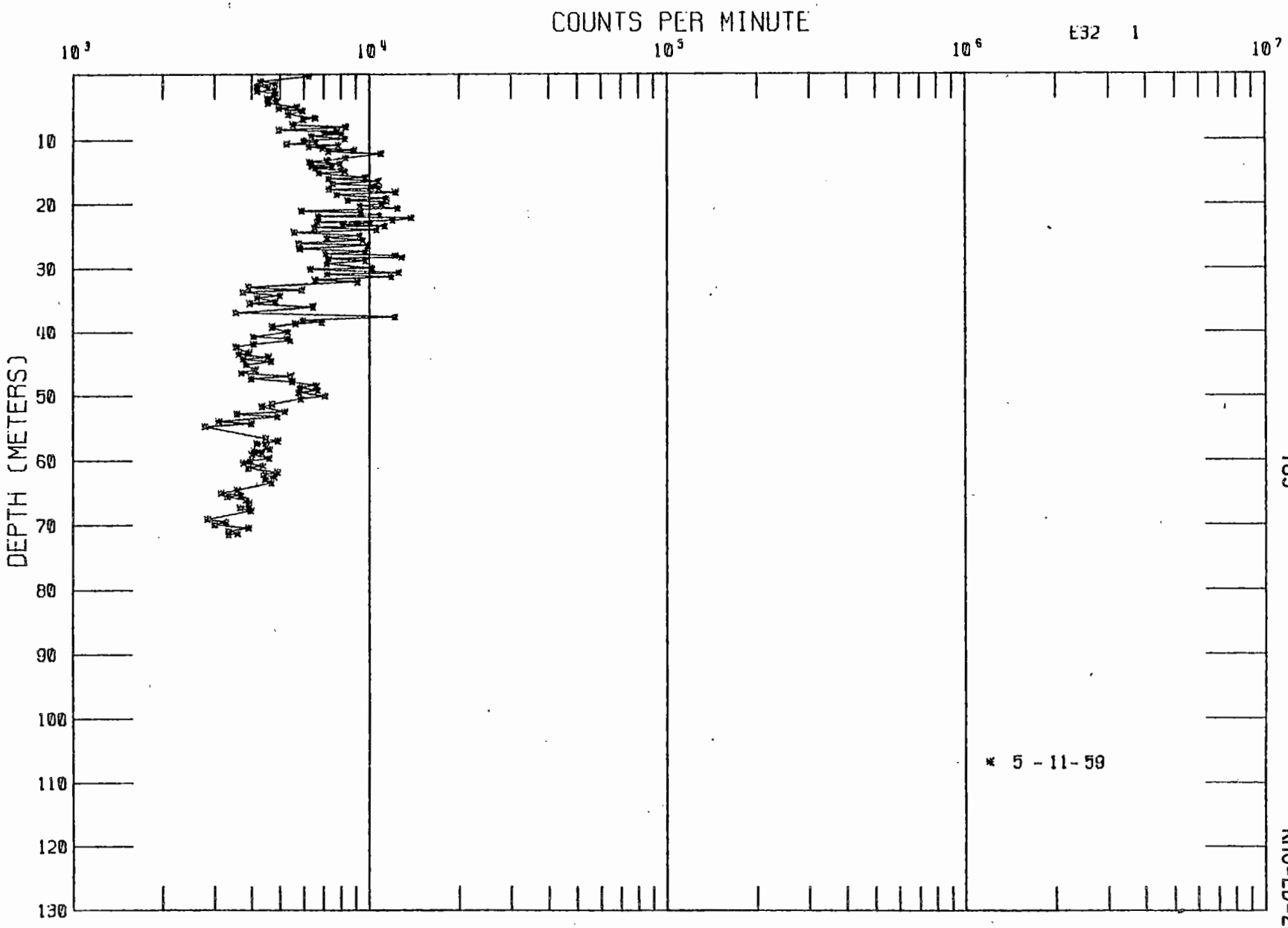
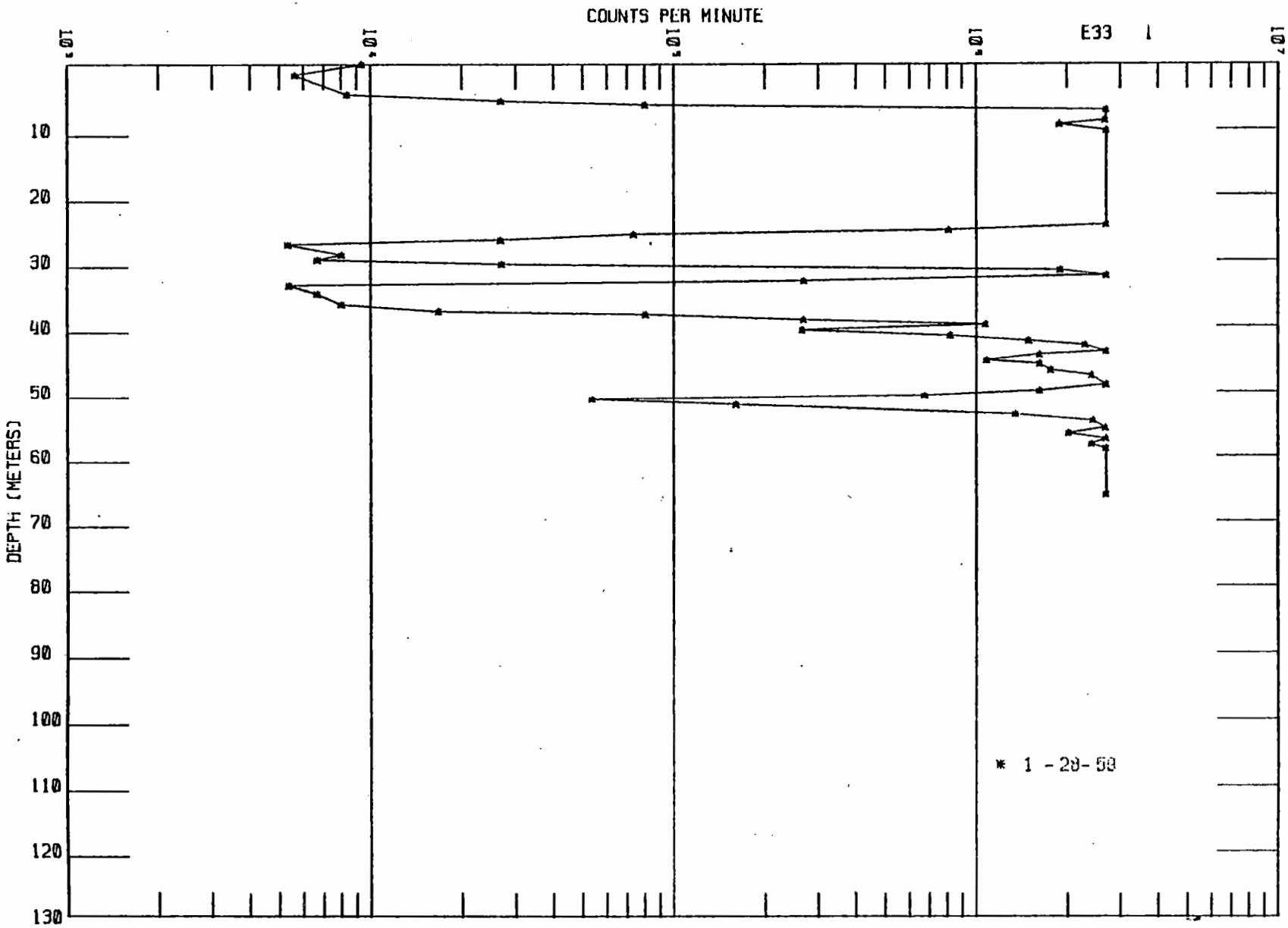
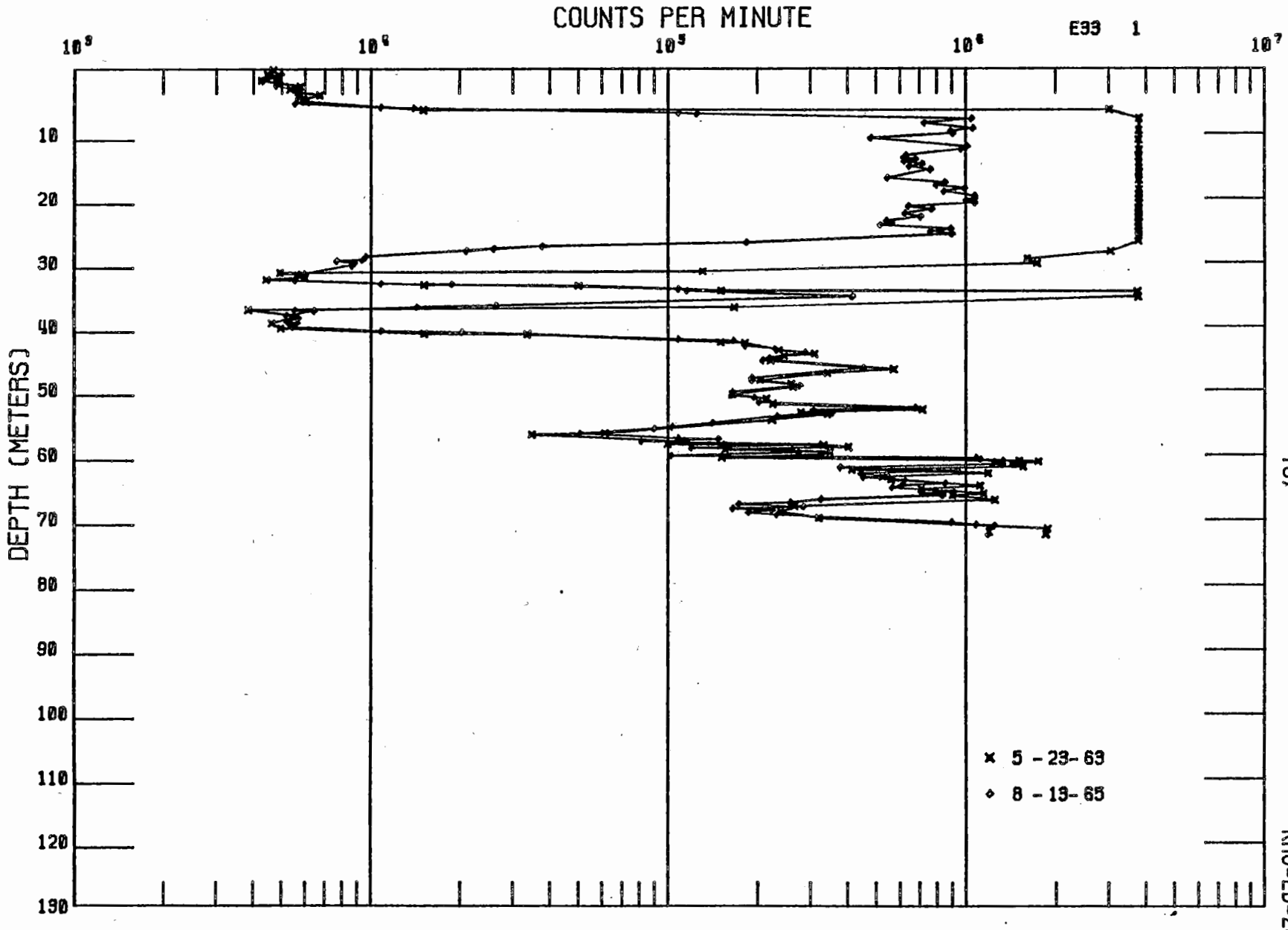

COUNTS PER MINUTE
E28 65
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
9 -27-68
5 -5 -76


COUNTS PER MINUTE
E28 66
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
9 - 27- 68
5 - 5 - 76


COUNTS PER MINUTE
E32 1
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
* 5 - 11 - 59


COUNTS PER MINUTE
E33 1
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
* 1 -20-50


COUNTS PER MINUTE
E33 1
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
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40
50
60
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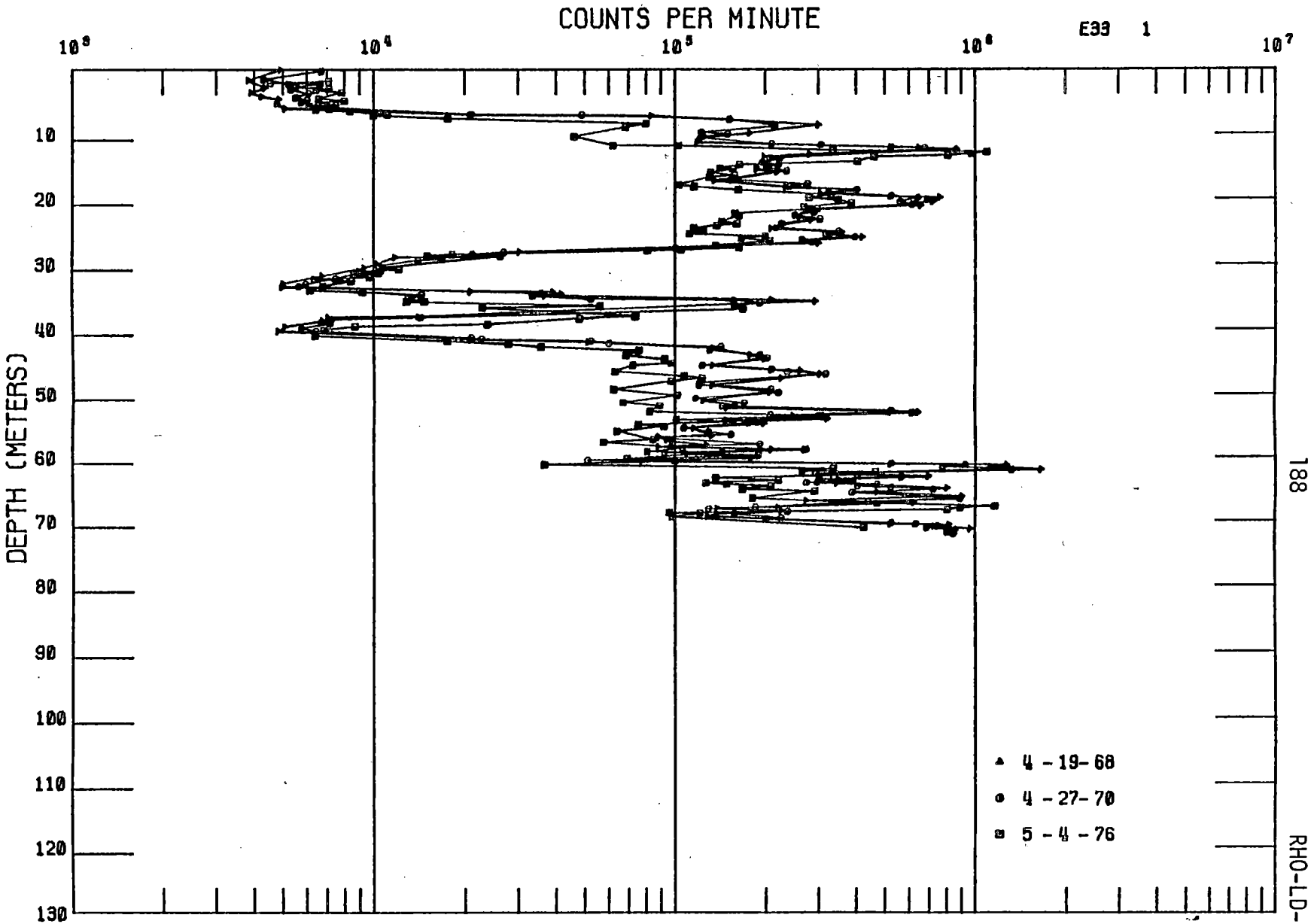
80
90
100
110
120
130
× 5 - 23- 63
◇ 8 - 13- 65


COUNTS PER MINUTE
E33 1
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
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50
60
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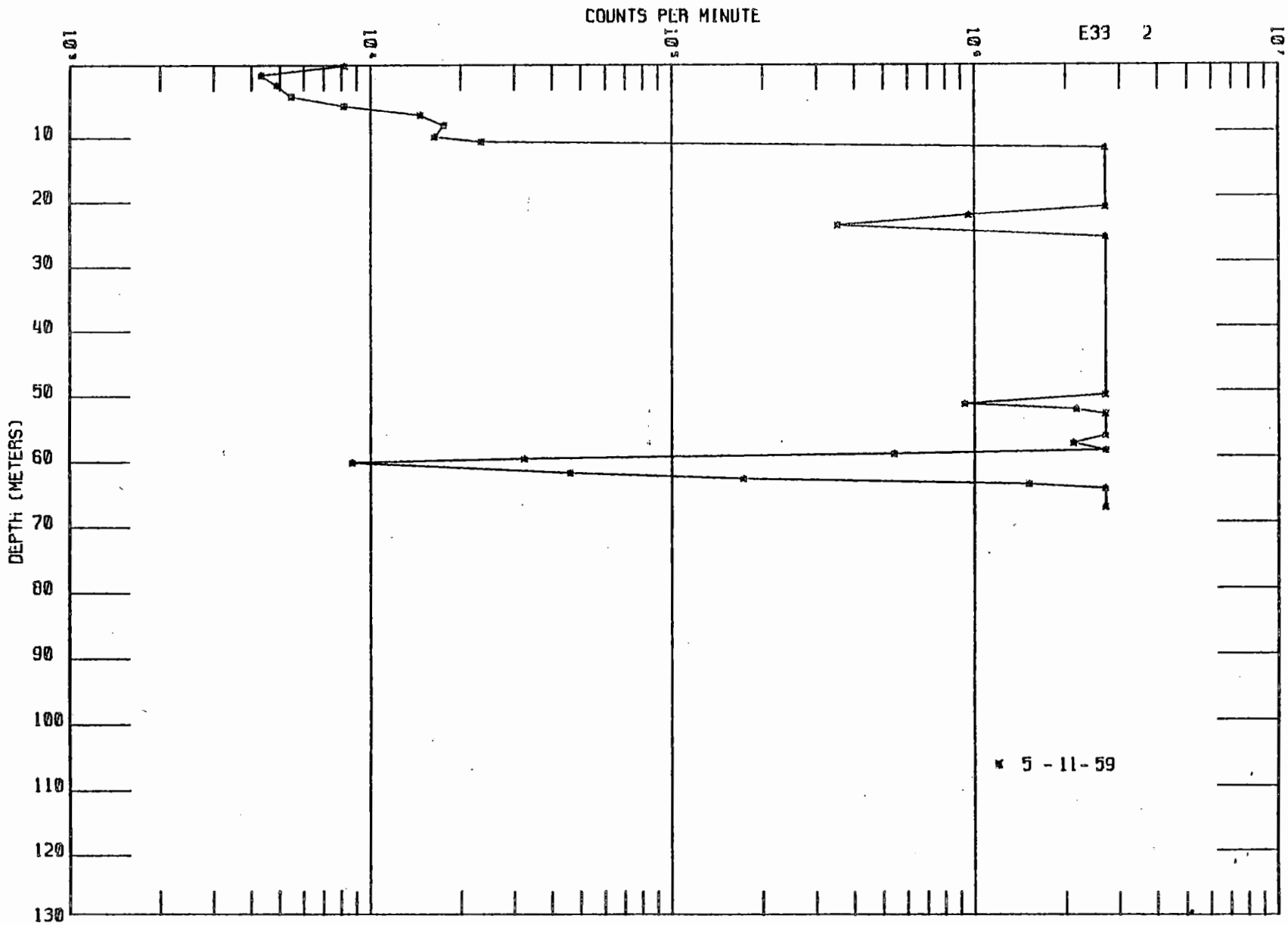
100
110
120
130
4 - 19- 68
4 - 27- 70
5 - 4 - 76


COUNTS PER MINUTE
E33 2
DEPTH (METERS)
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20
30
40
50
60
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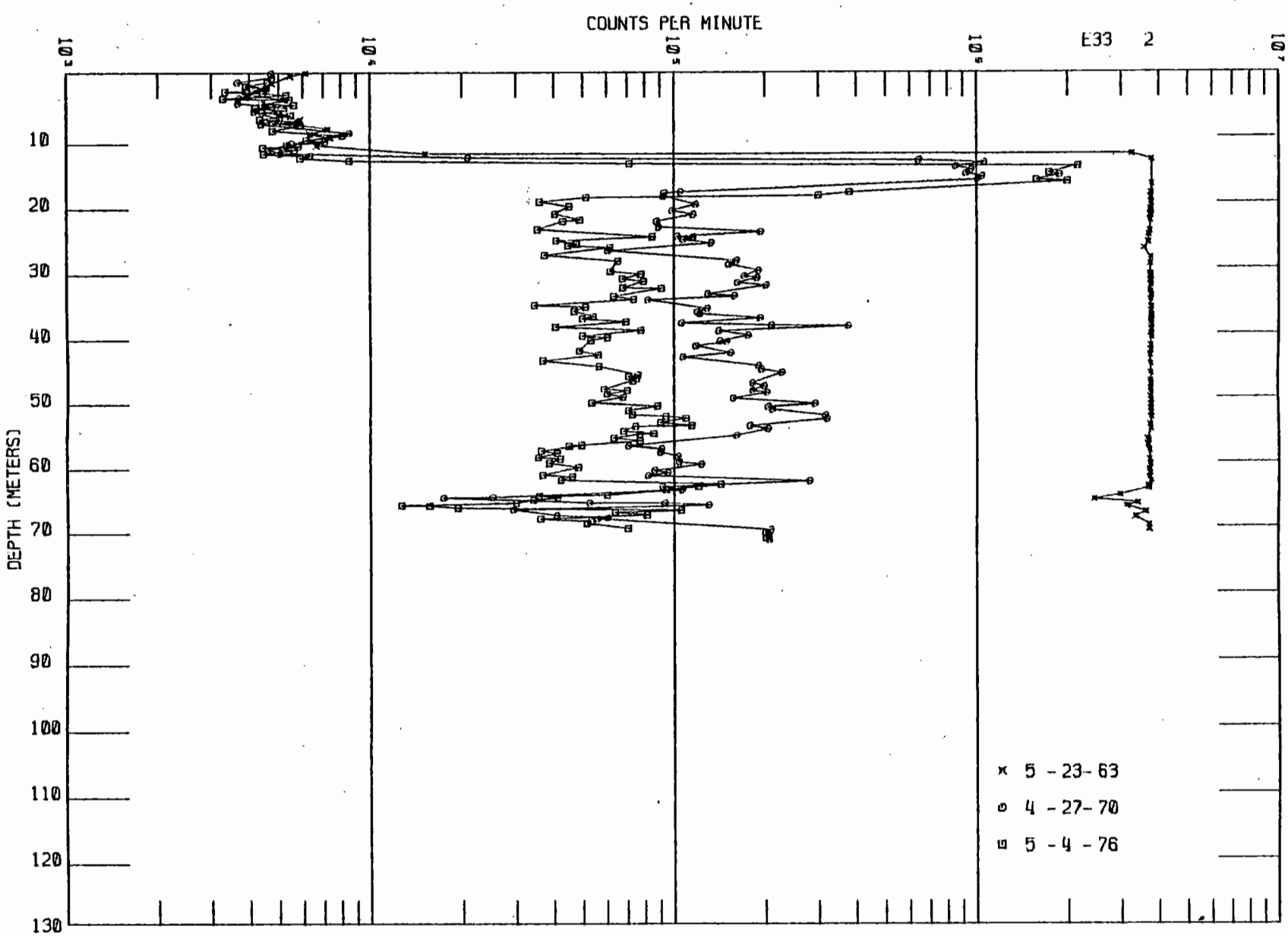
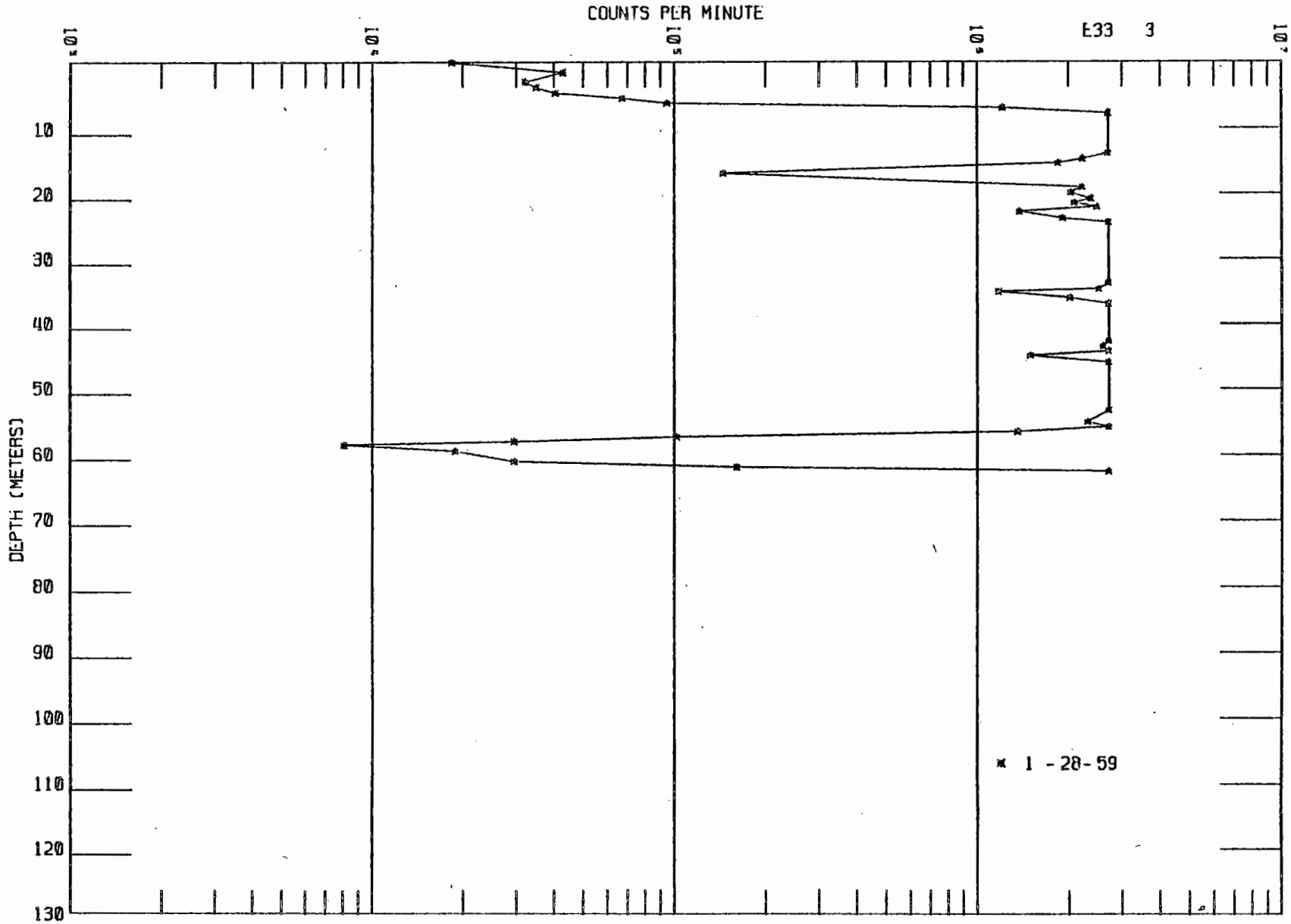
80
90
100
110
120
130
5 - 11 - 59


COUNTS PER MINUTE
E33 2
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 23- 63
⊙ 4 - 27- 70
⊡ 5 - 4 - 76


COUNTS PER MINUTE
E33 3
DEPTH (METERS)
10
20
30
40
50
60
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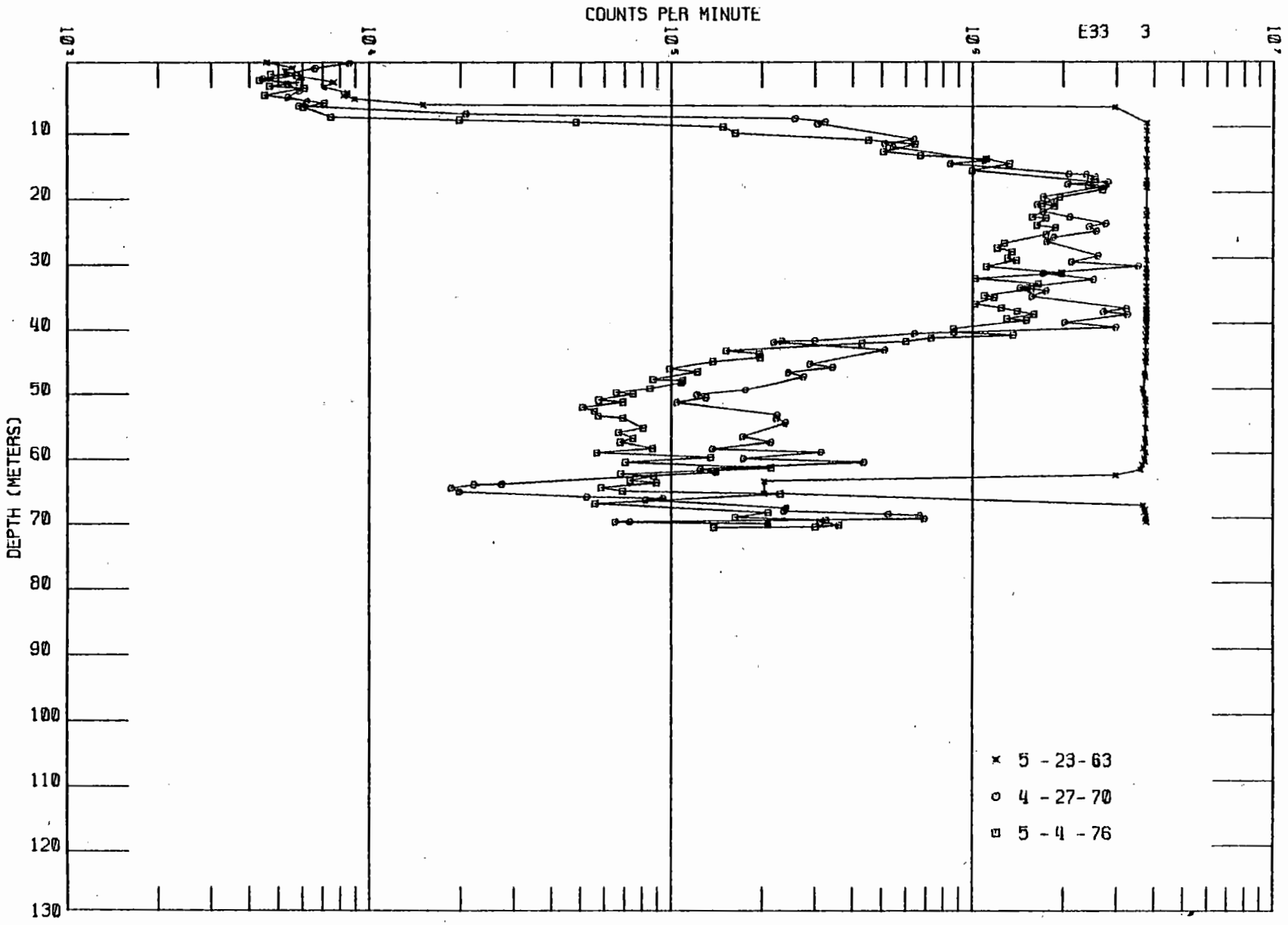
100
110
120
130
1 - 28 - 59


COUNTS PER MINUTE
E33 3
DEPTH (METERS)
10
20
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60
70
80
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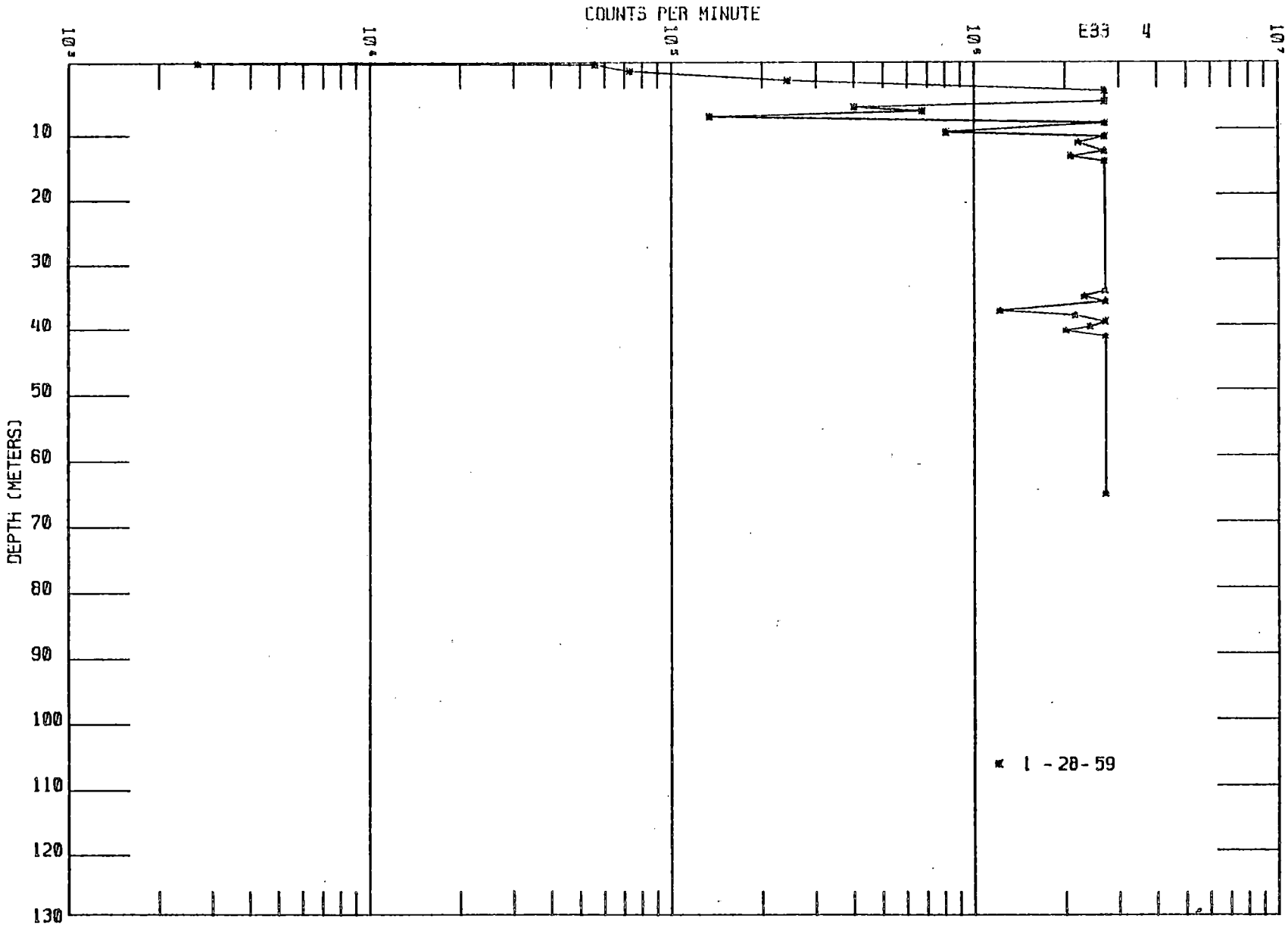
100
110
120
130
× 5 - 23 - 63
○ 4 - 27 - 70
□ 5 - 4 - 76


COUNTS PER MINUTE
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DEPTH (METERS)
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50
60
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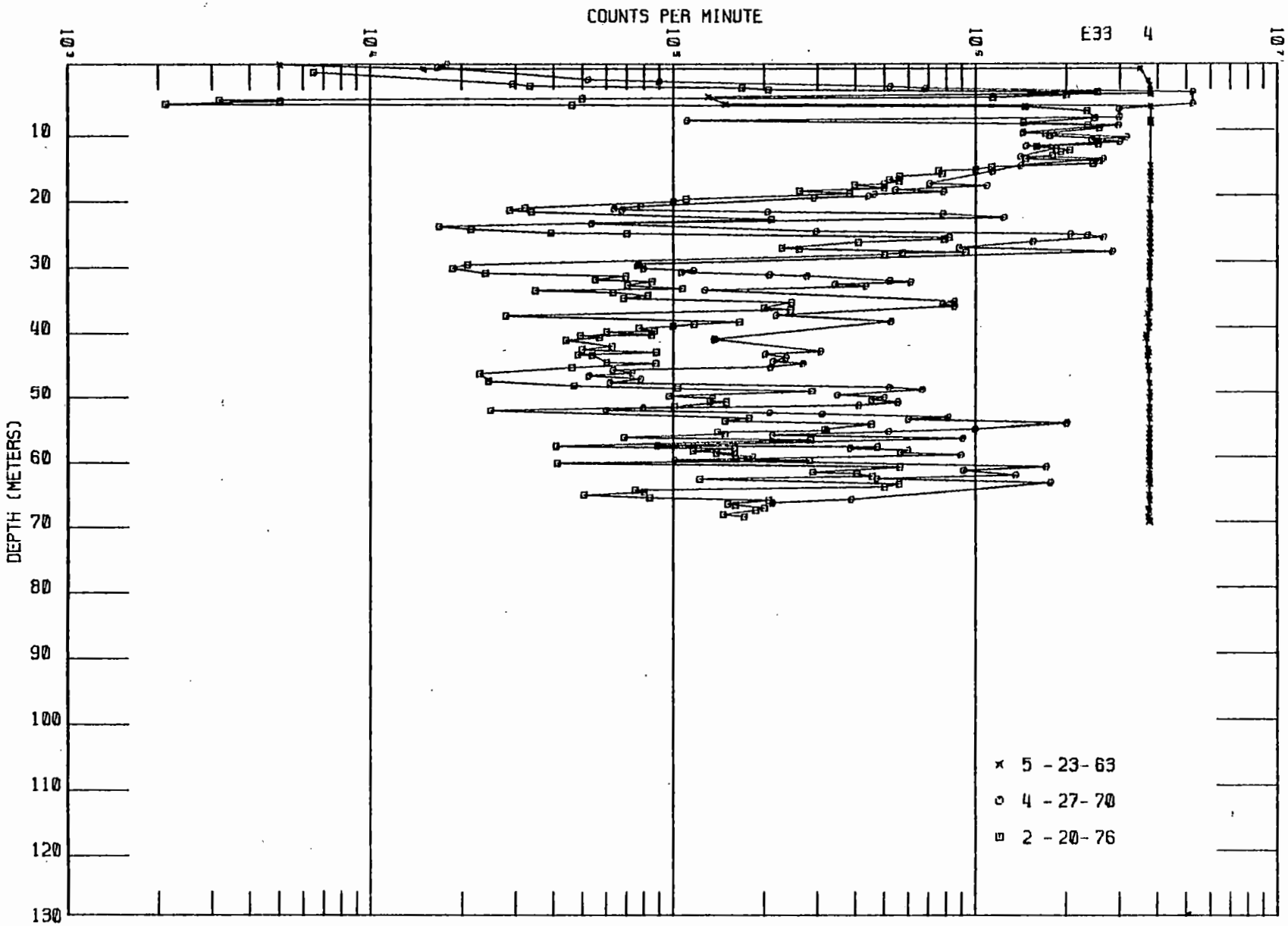
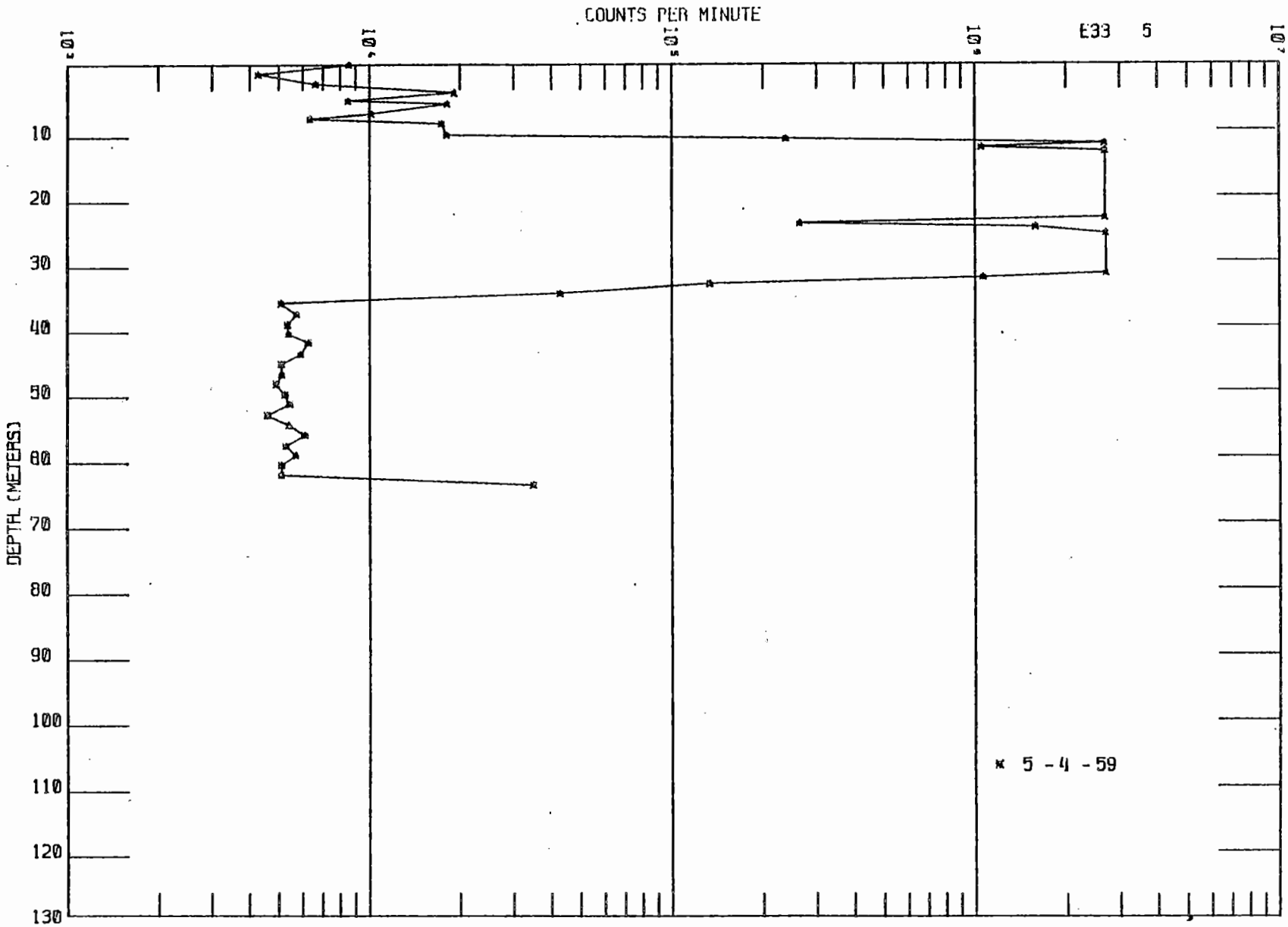
110
120
130
1 - 28 - 59


COUNTS PER MINUTE
10^3
10^4
10^5
10^6
E33 4
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 23- 63
○ 4 - 27- 70
□ 2 - 20- 76


COUNTS PER MINUTE
E33 5
DEPTH (METERS)
10
20
30
40
50
60
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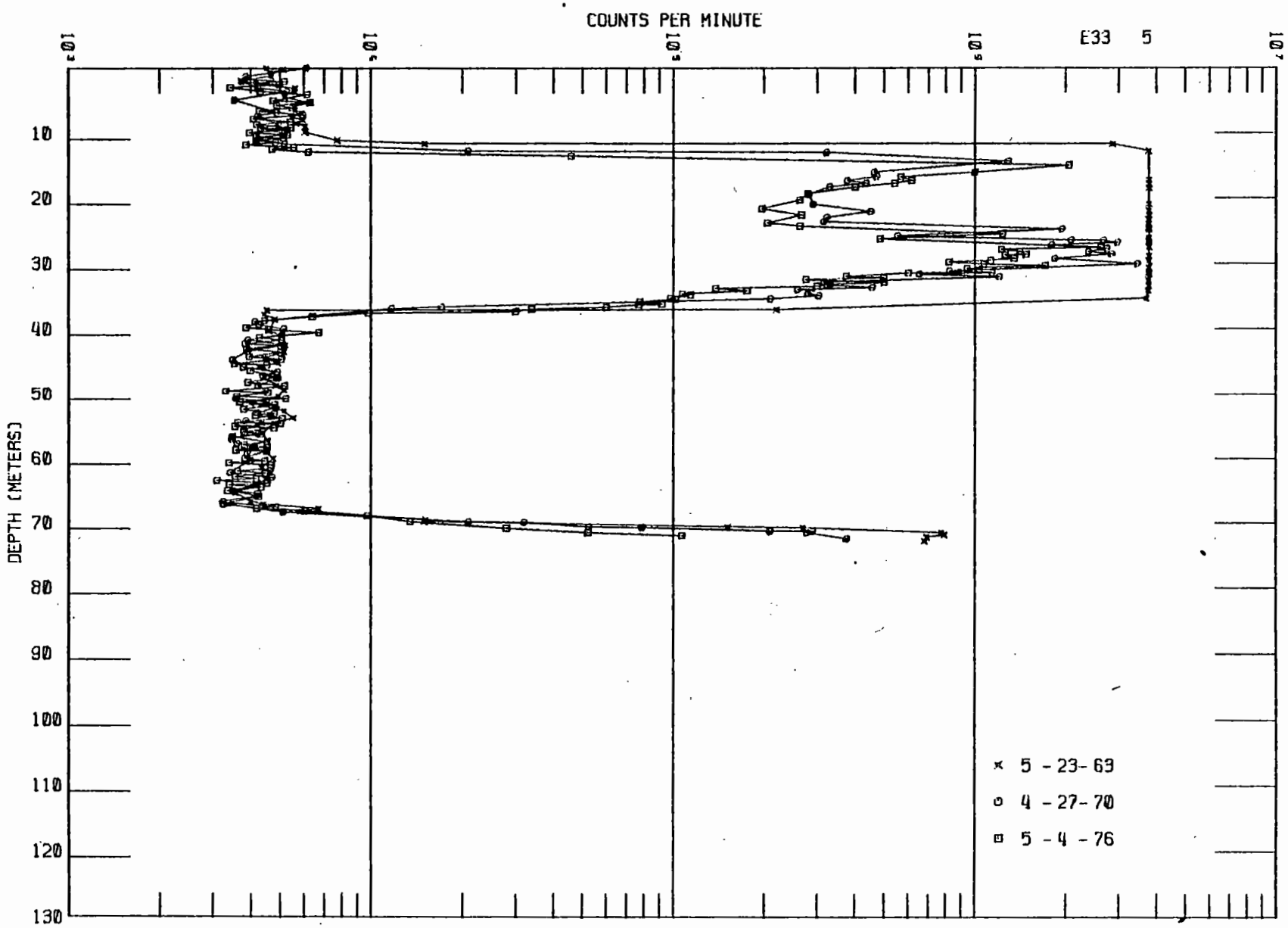
80
90
100
110
120
130
× 5 -4 -59


COUNTS PER MINUTE
E33 5
DEPTH (METERS)
10
20
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60
70
80
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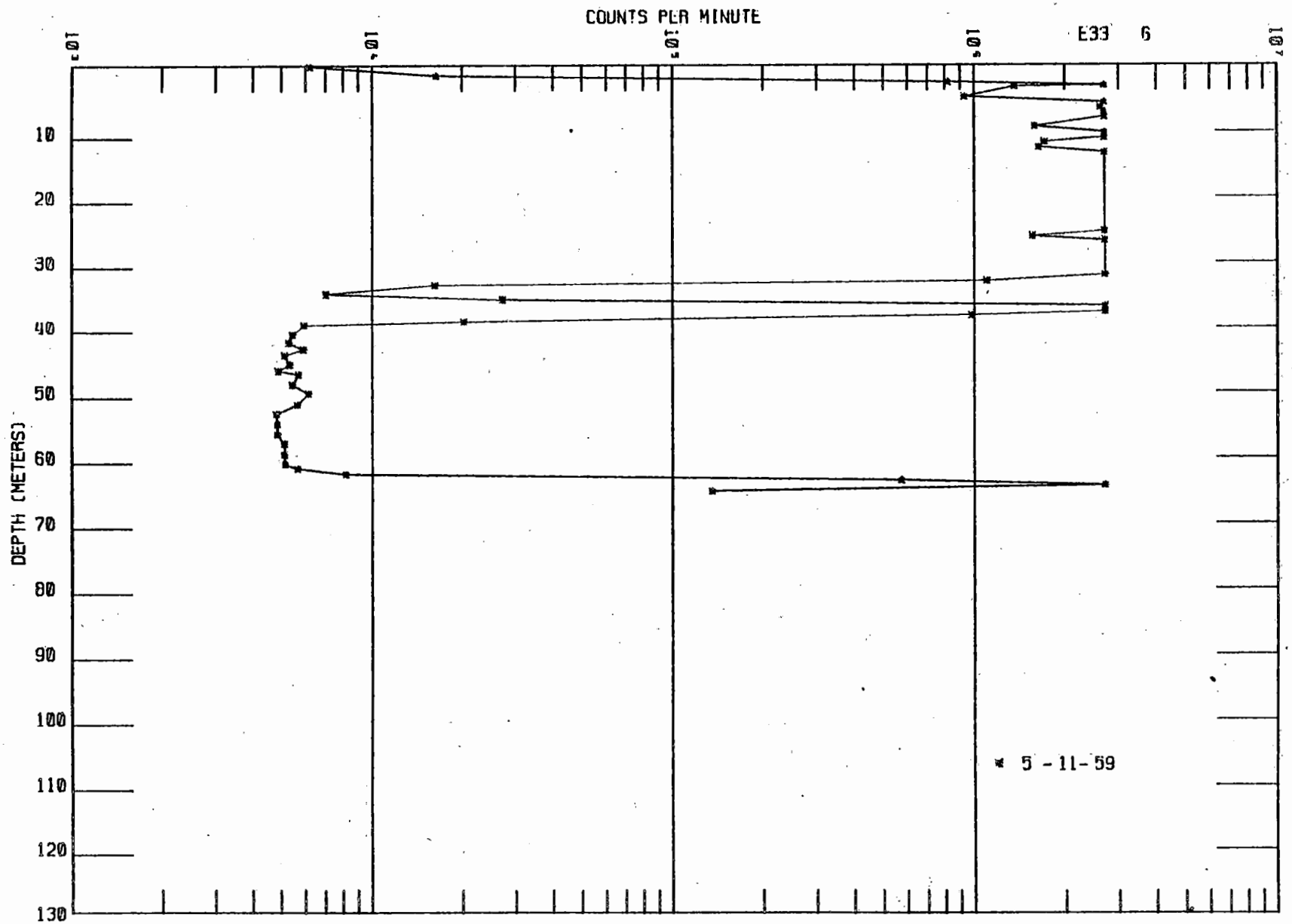
100
110
120
130
× 5 - 23- 63
○ 4 - 27- 70
□ 5 - 4 - 76


COUNTS PER MINUTE
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DEPTH (METERS)
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20
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50
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80
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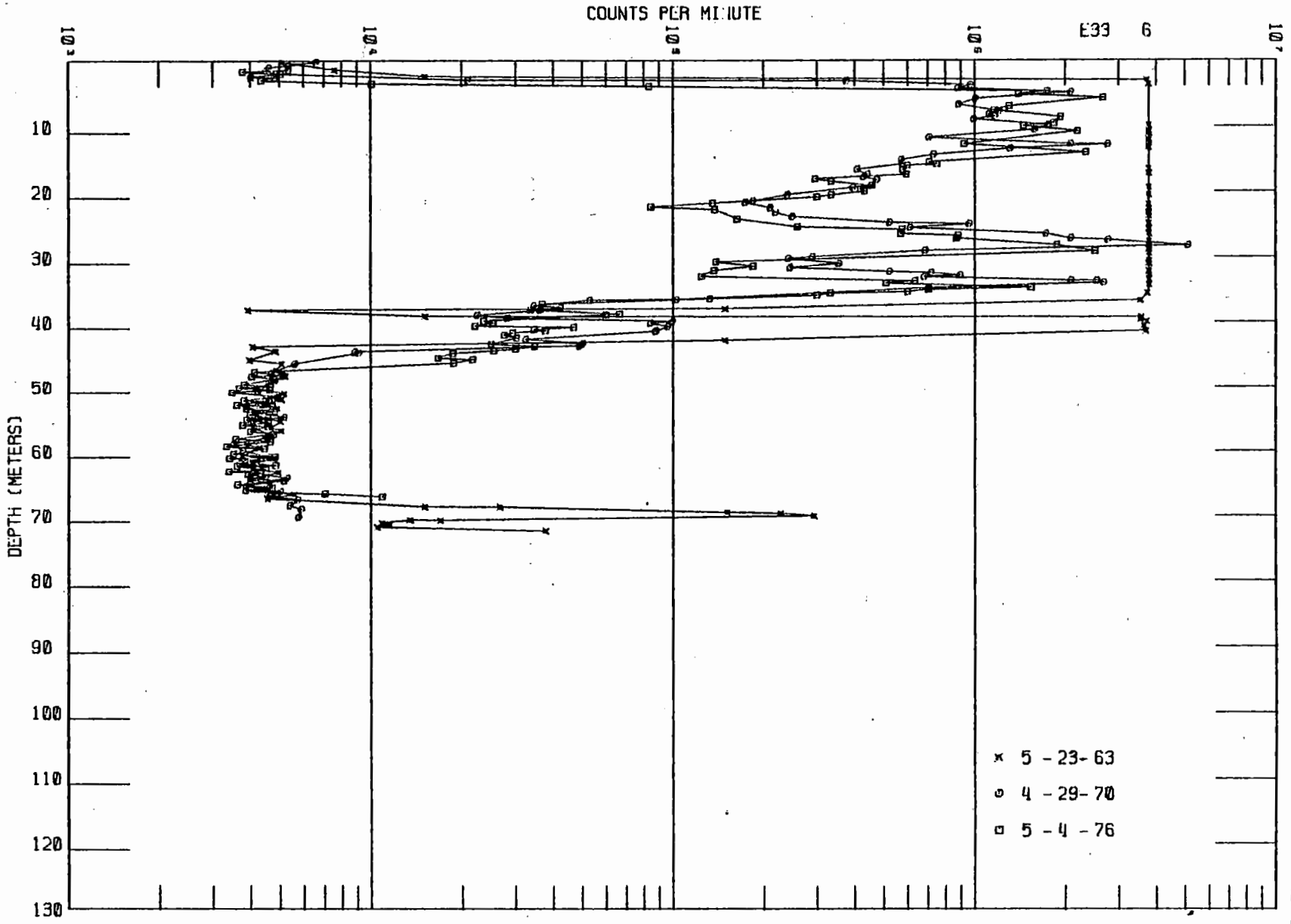
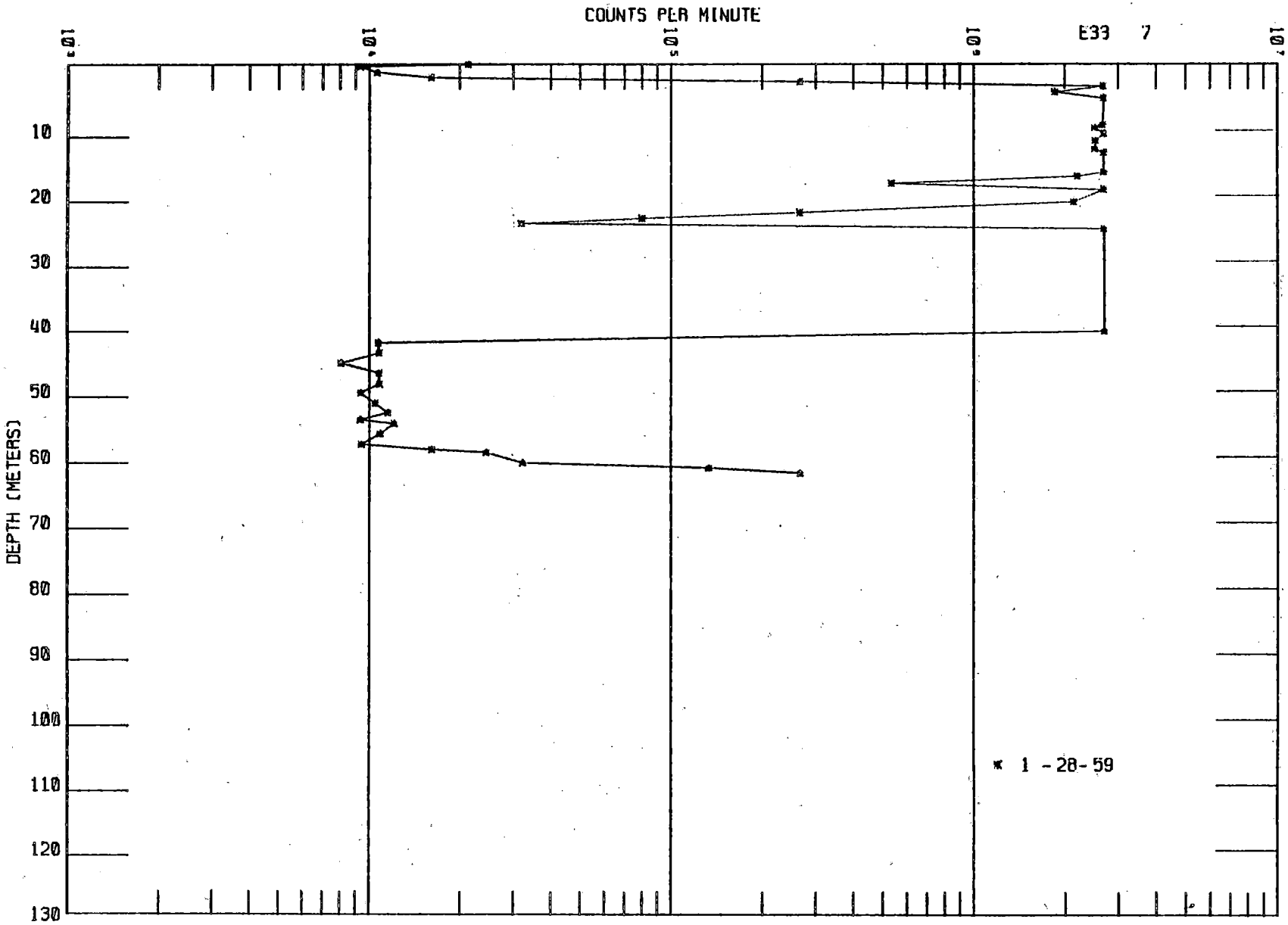
100
110
120
130
5 - 11 - 59


COUNTS PER MINUTE
E33 6
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 23- 63
○ 4 - 29- 70
□ 5 - 4 - 76

9 2 1 2 4 6 6 0 7 9 2



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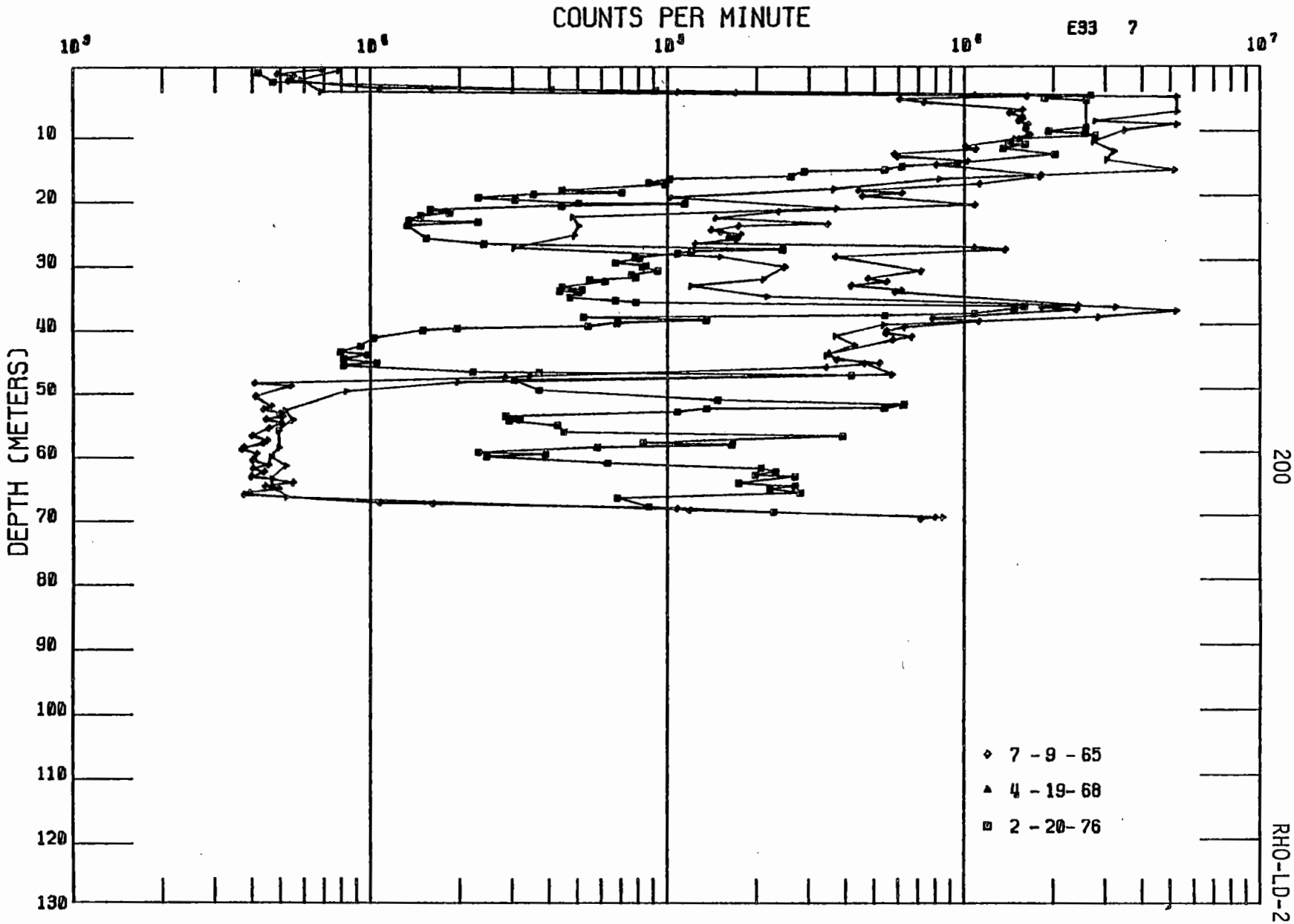
COUNTS PER MINUTE
E33 7
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
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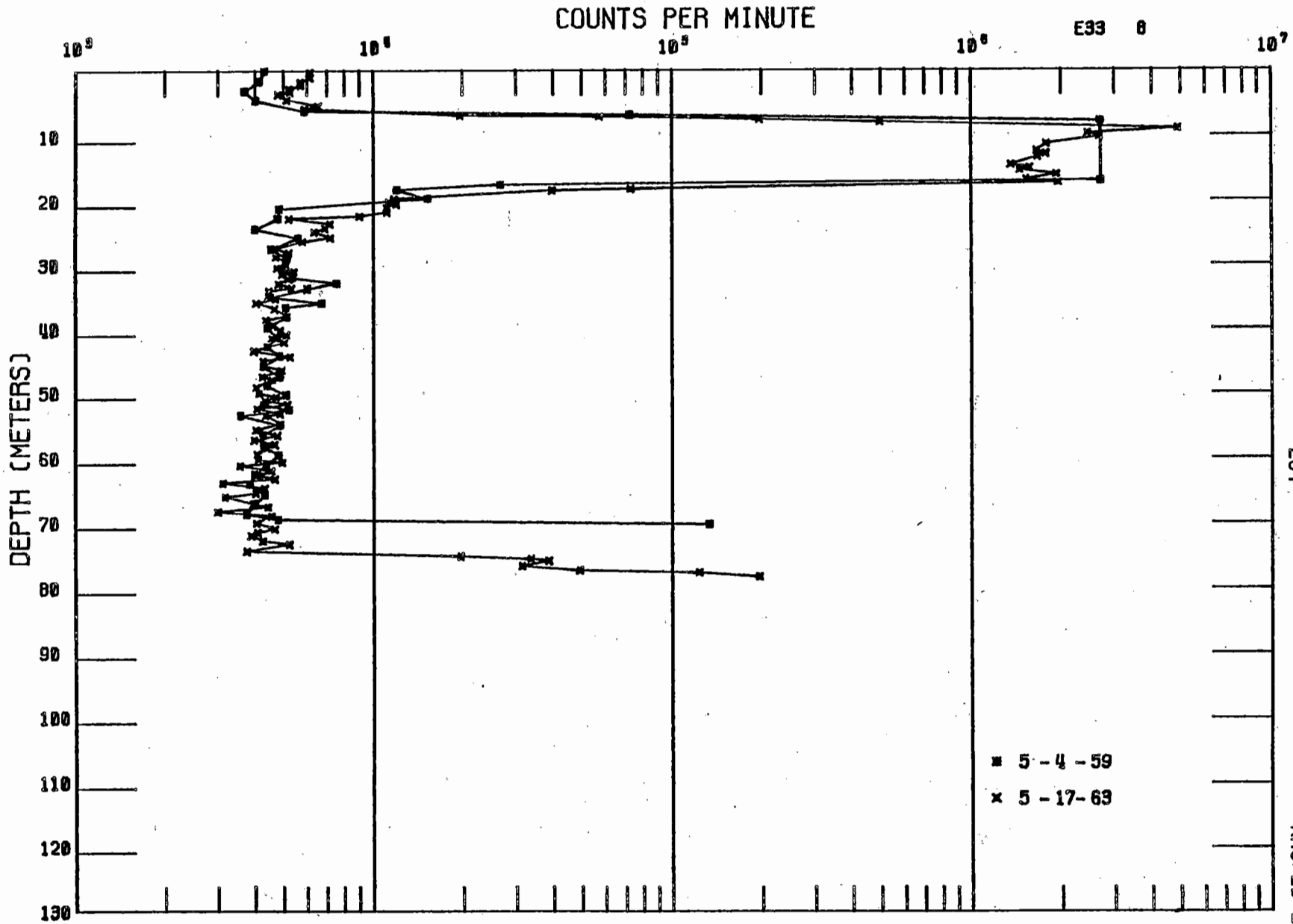
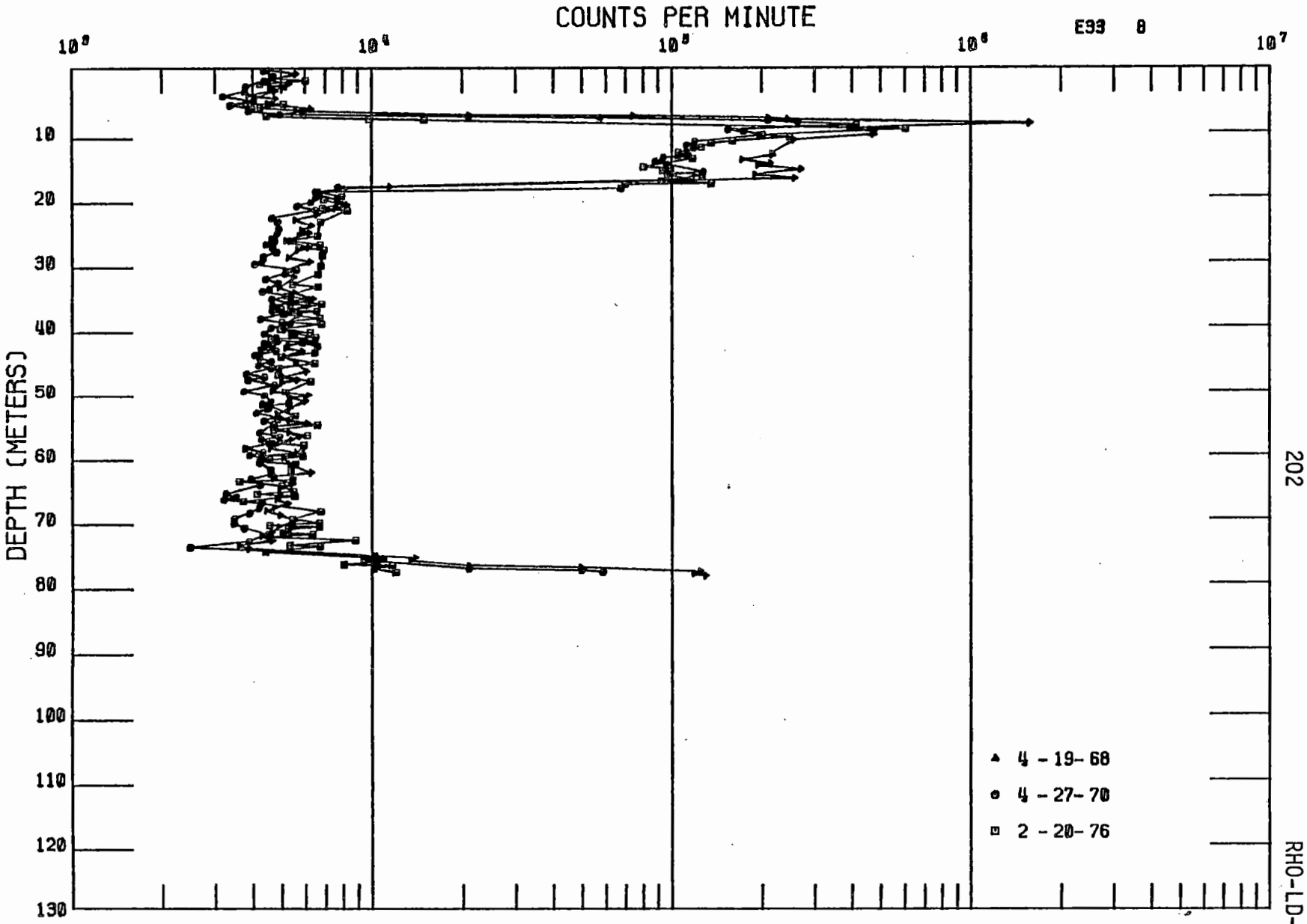
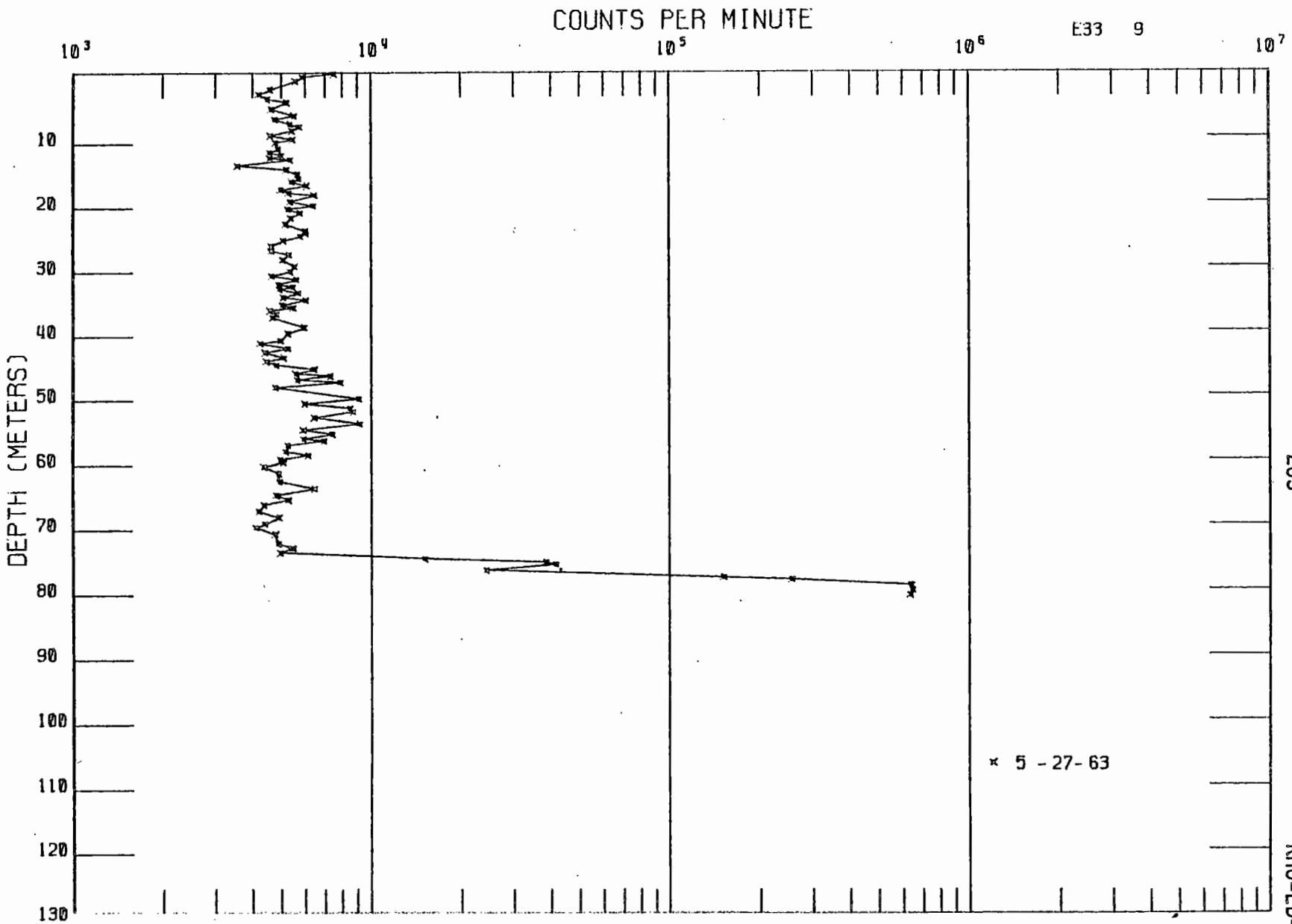
120
130
7 - 9 - 65
4 - 19- 68
2 - 20- 76


COUNTS PER MINUTE
E33 6
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
5 - 4 - 59
5 - 17- 63

9 2 1 2 4 6 6 0 7 9 5




COUNTS PER MINUTE
E33 9
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
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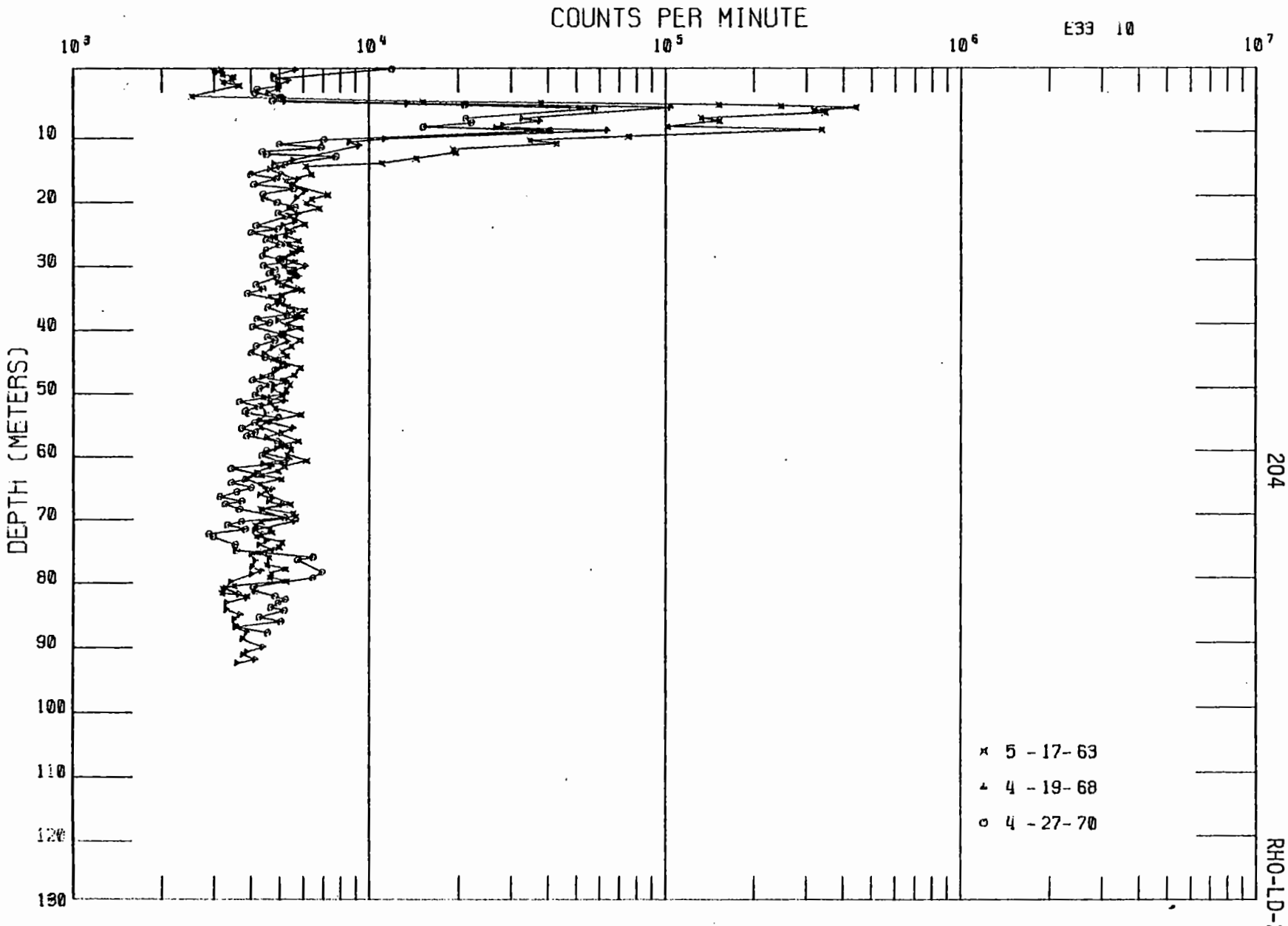
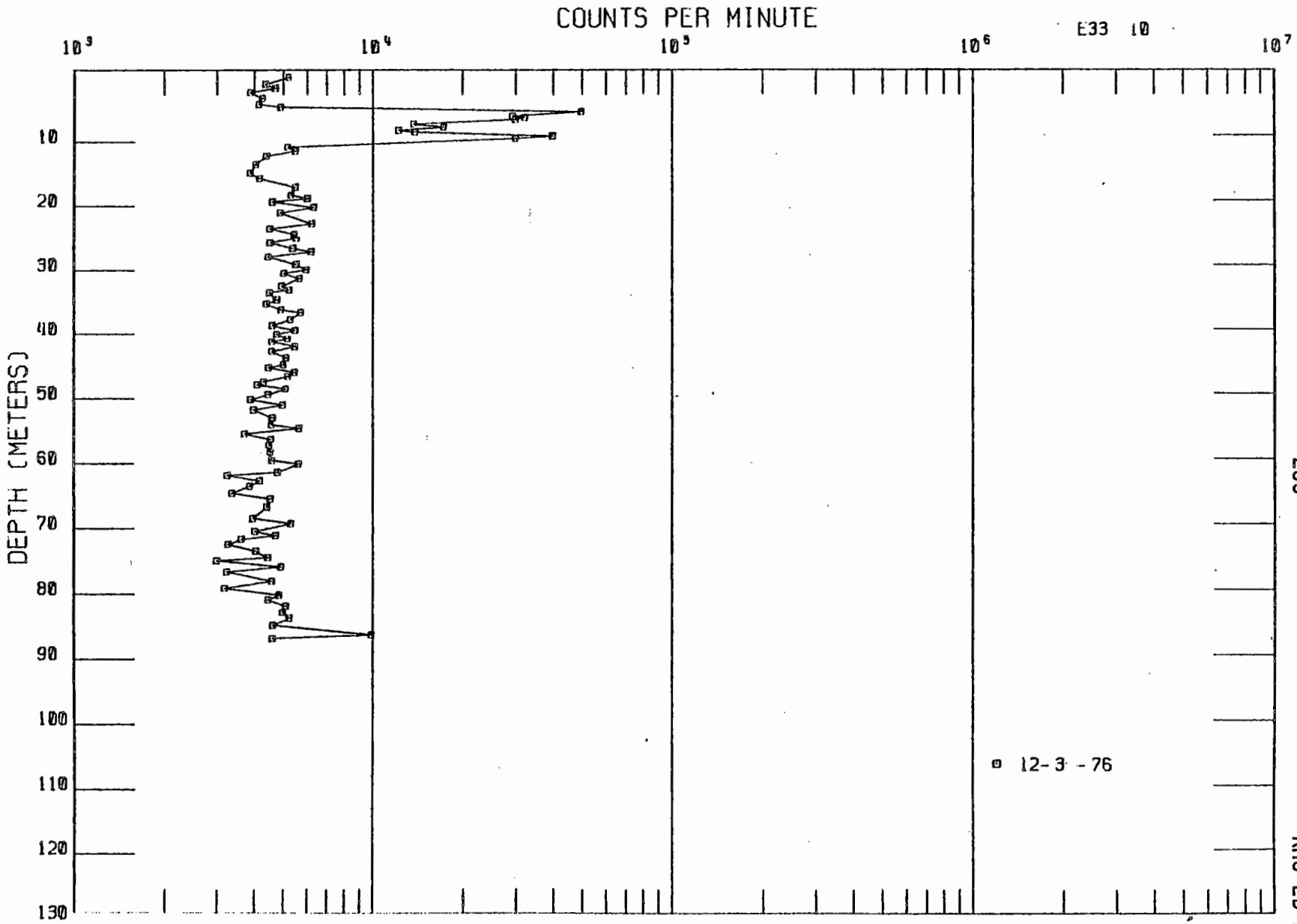
100
110
120
130
× 5 - 27- 63


COUNTS PER MINUTE
E33 10
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 17- 63
▲ 4 - 19- 68
○ 4 - 27- 70


COUNTS PER MINUTE
E33 10
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
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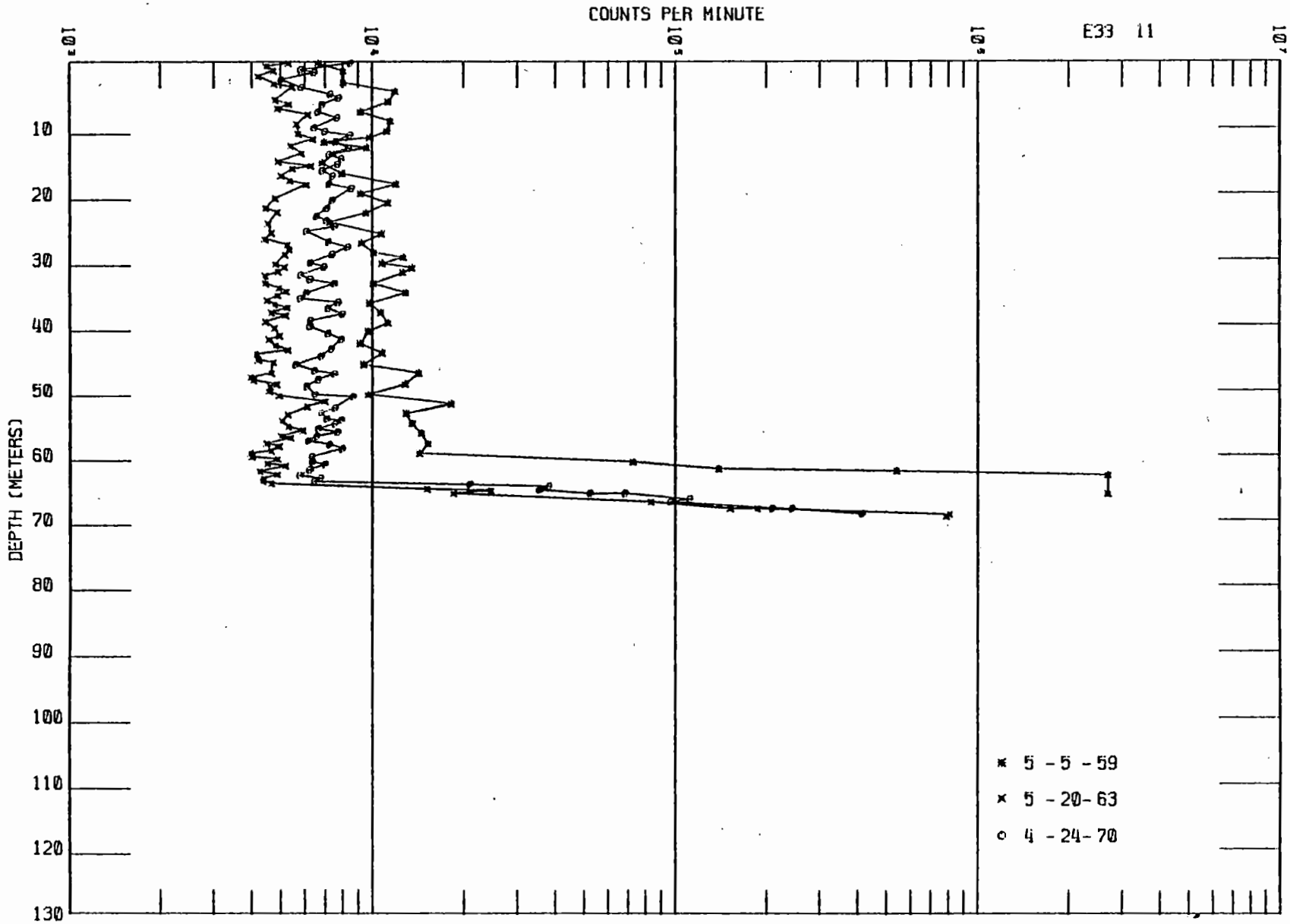
12-3-76


COUNTS PER MINUTE
E33 11
DEPTH (METERS)
10
20
30
40
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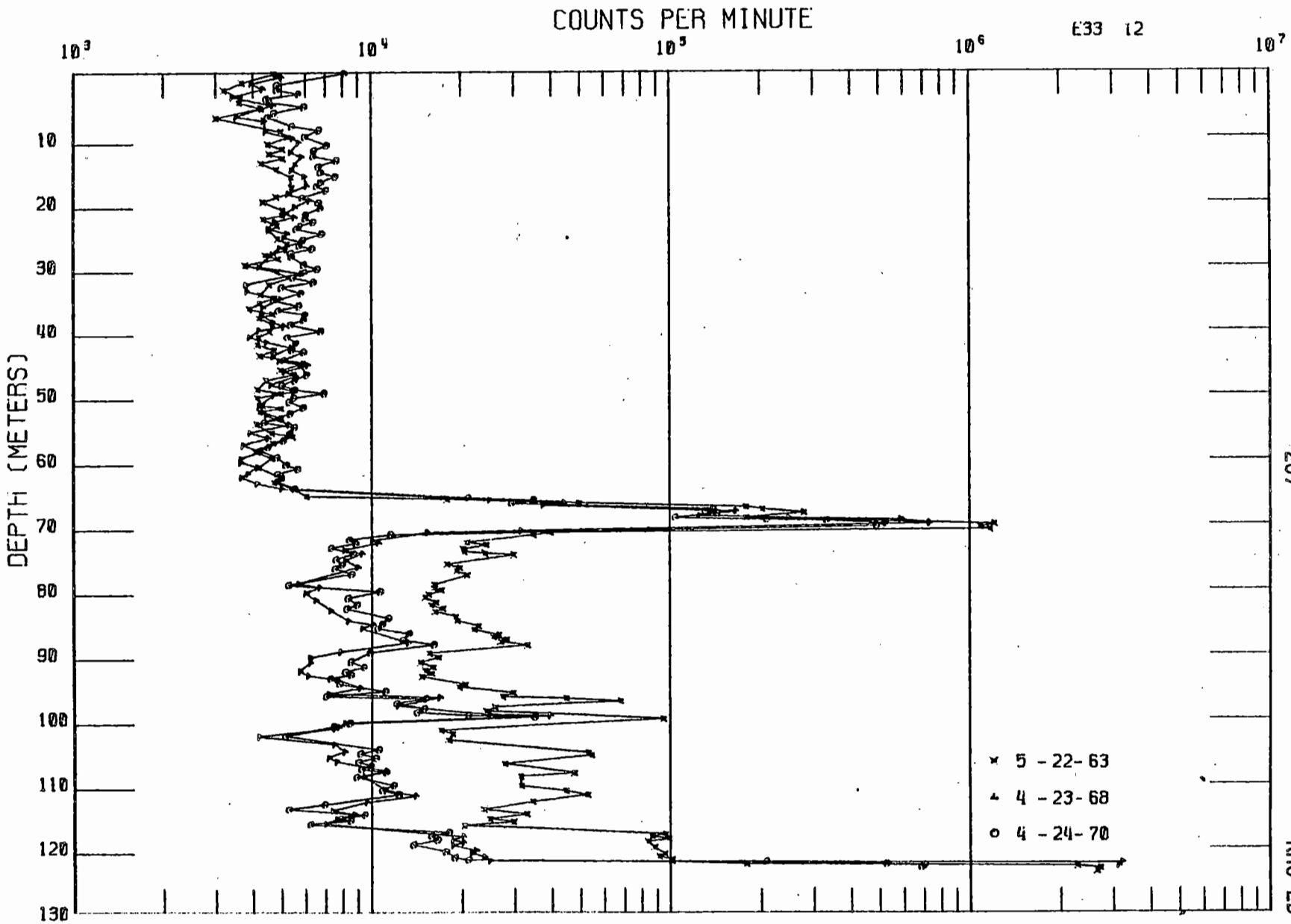
90
100
110
120
130
5 - 5 - 59
5 - 20- 63
4 - 24- 70

9 2 1 2 4 6 6 0 8 0 0



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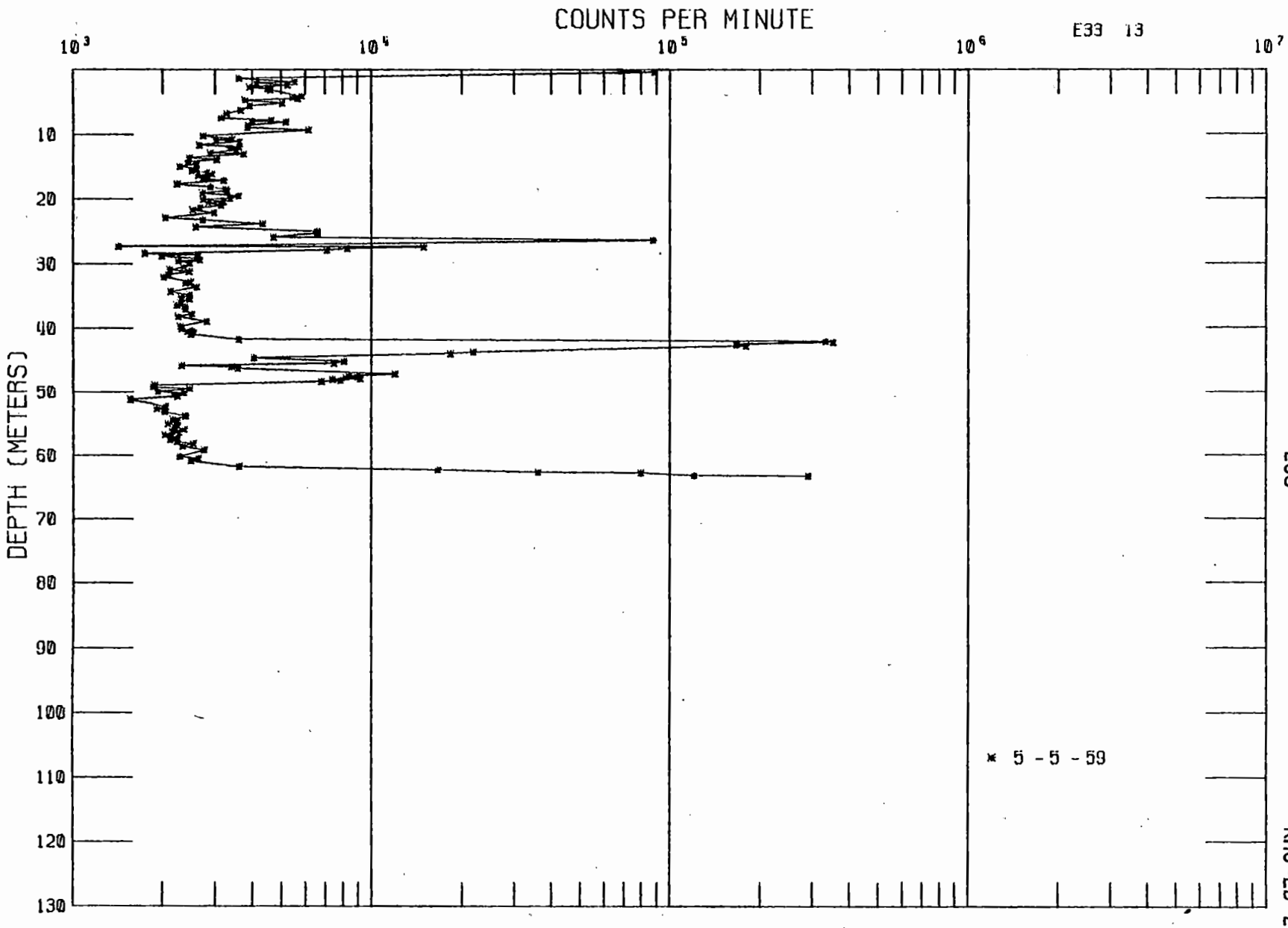
COUNTS PER MINUTE
E33 13
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
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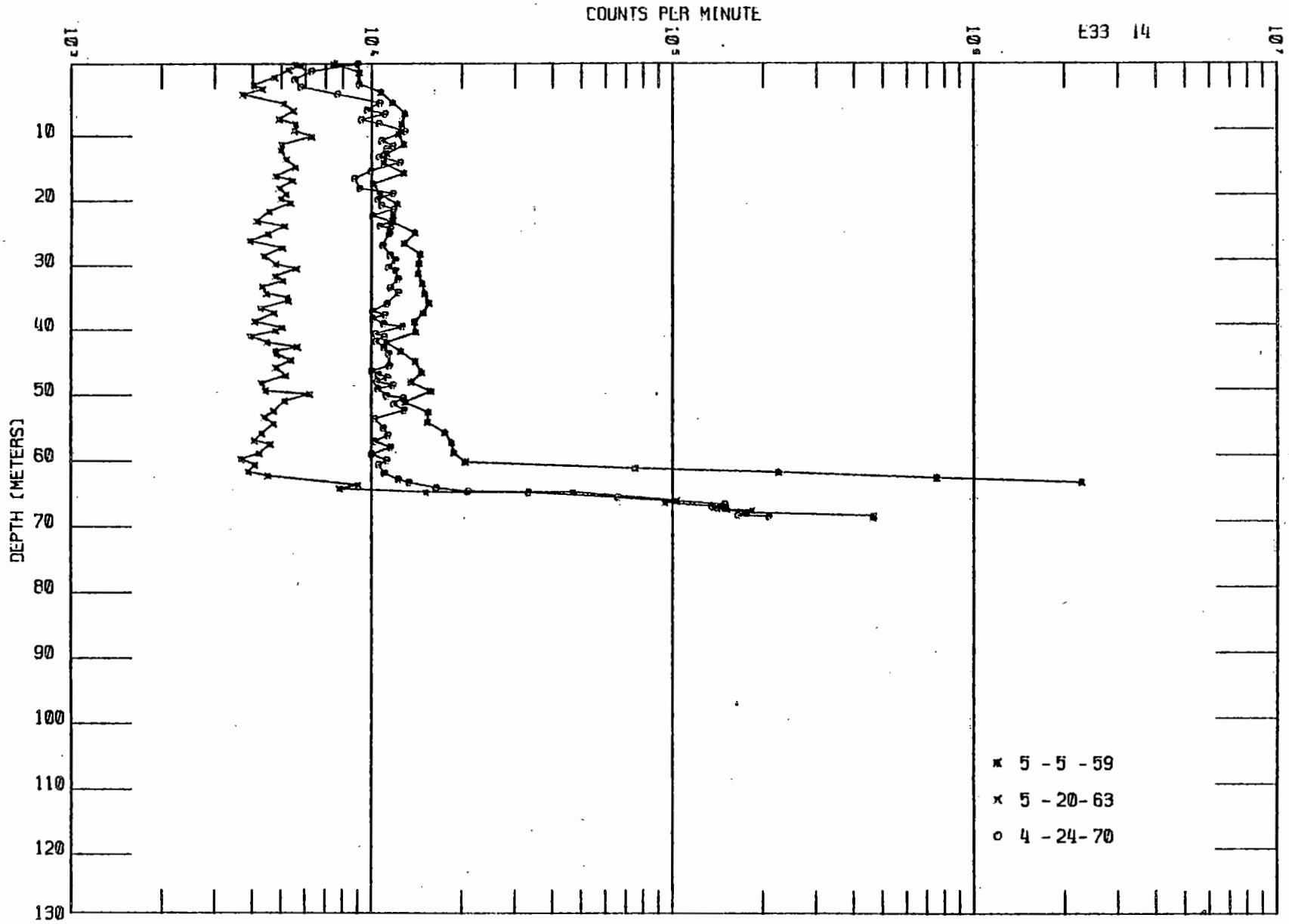
100
110
120
130
* 5 - 5 - 59


COUNTS PER MINUTE
E33 14
DEPTH (METERS)
10
20
30
40
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70
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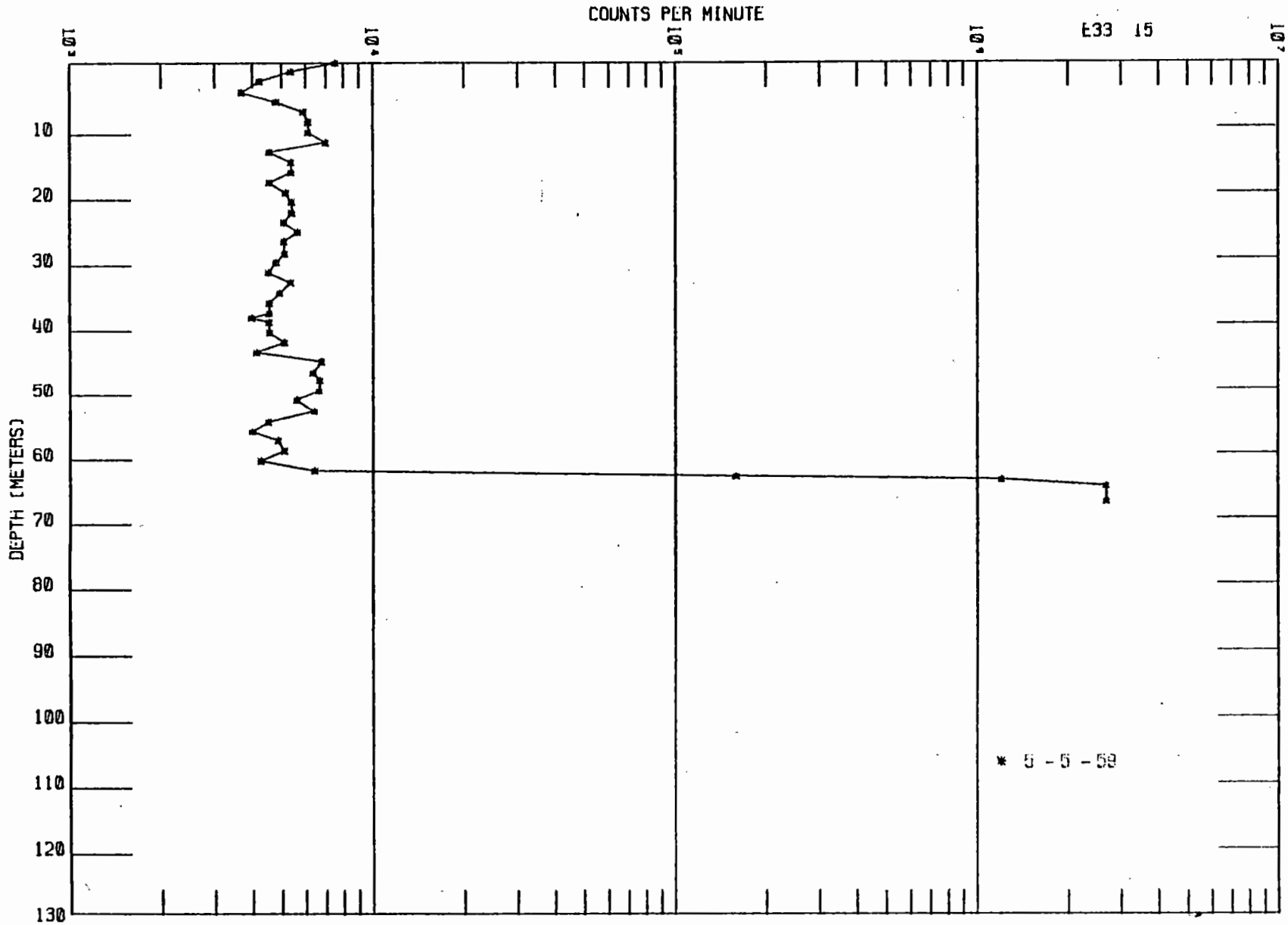
90
100
110
120
130
5 - 5 - 59
5 - 20 - 63
4 - 24 - 70

9 2 1 2 4 5 6 0 8 0 3



210

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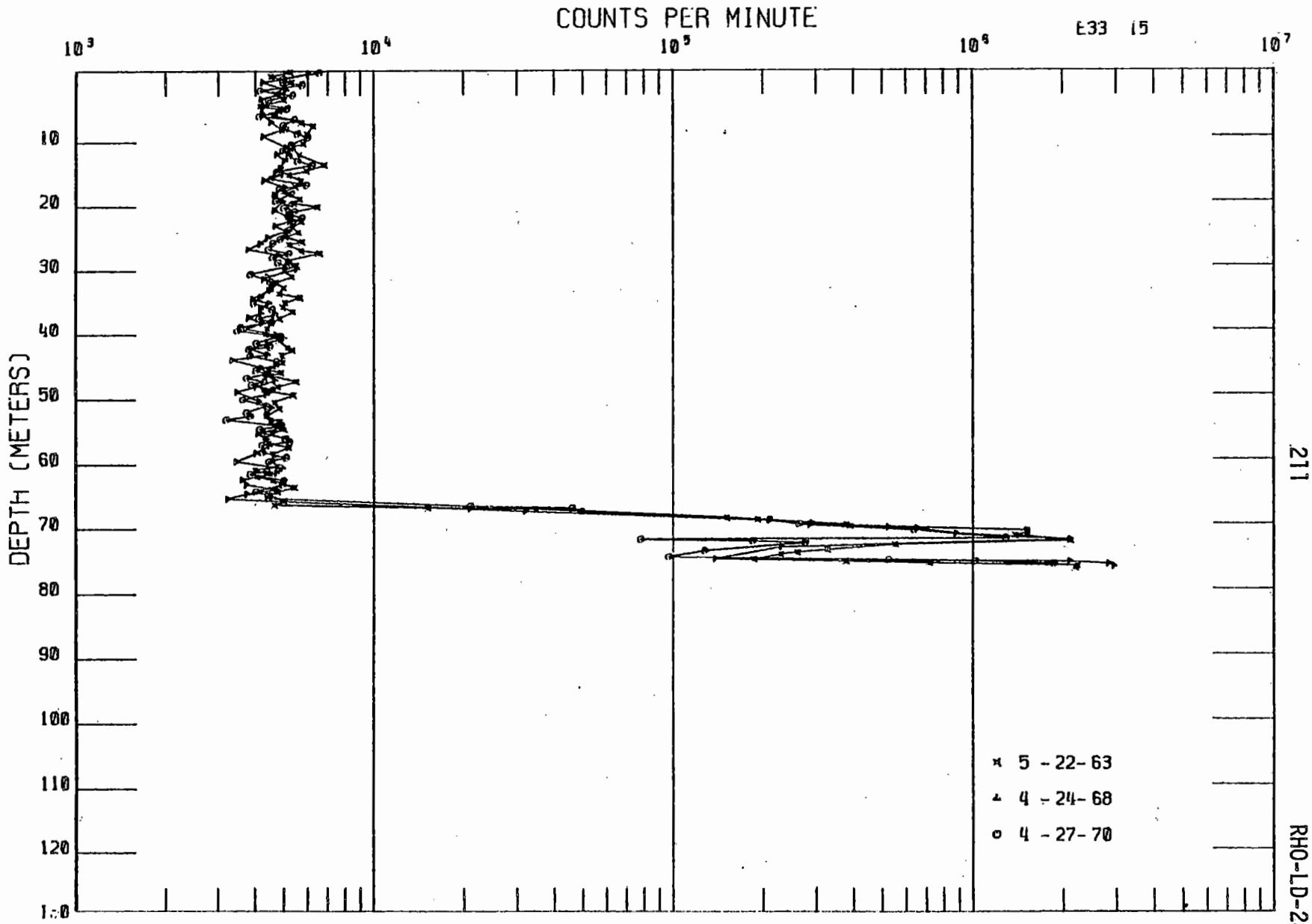
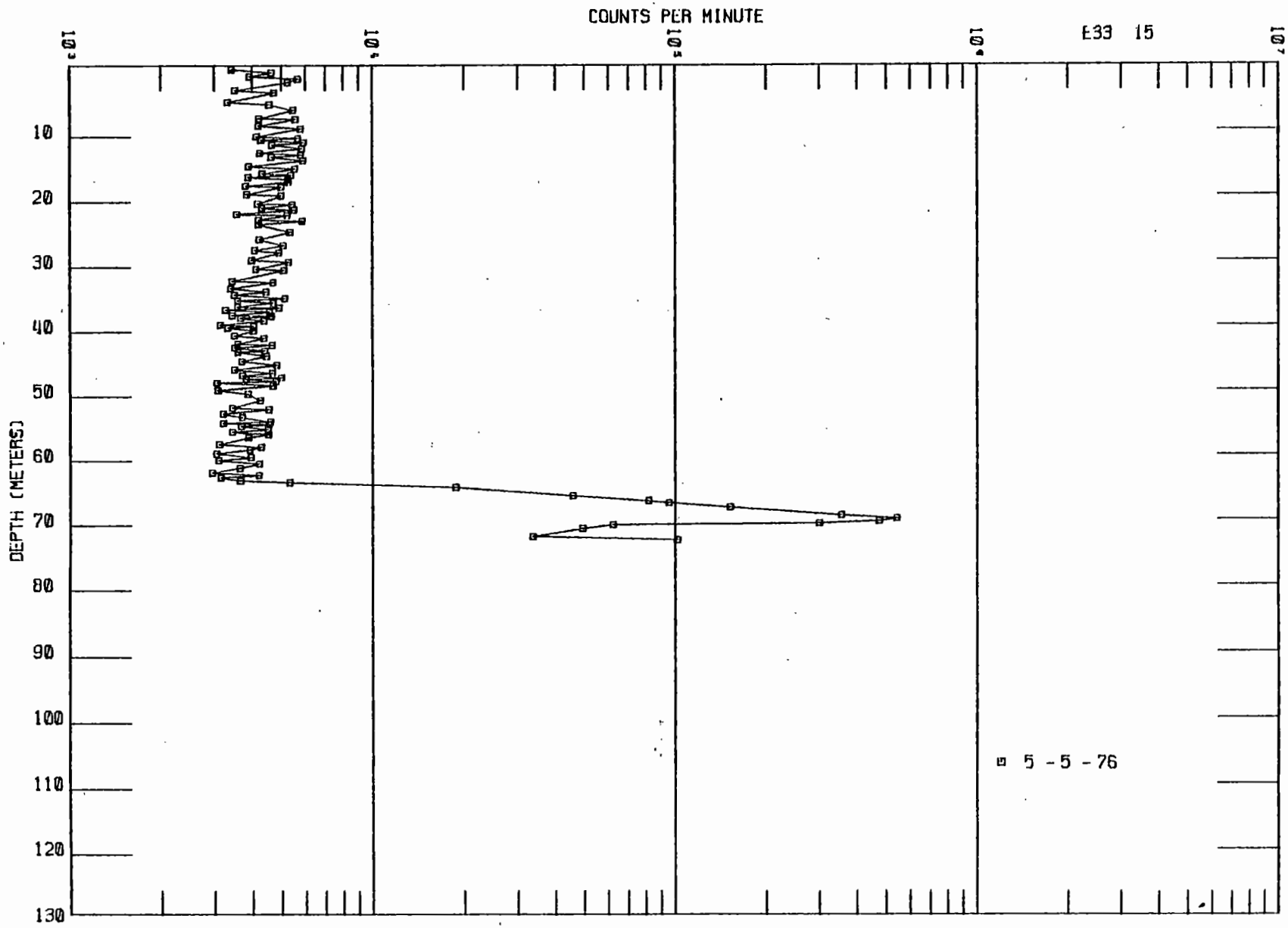

COUNTS PER MINUTE
E33 15
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 22- 63
▲ 4 - 24- 68
o 4 - 27- 70


COUNTS PER MINUTE
E33 15
DEPTH (METERS)
10
20
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50
60
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80
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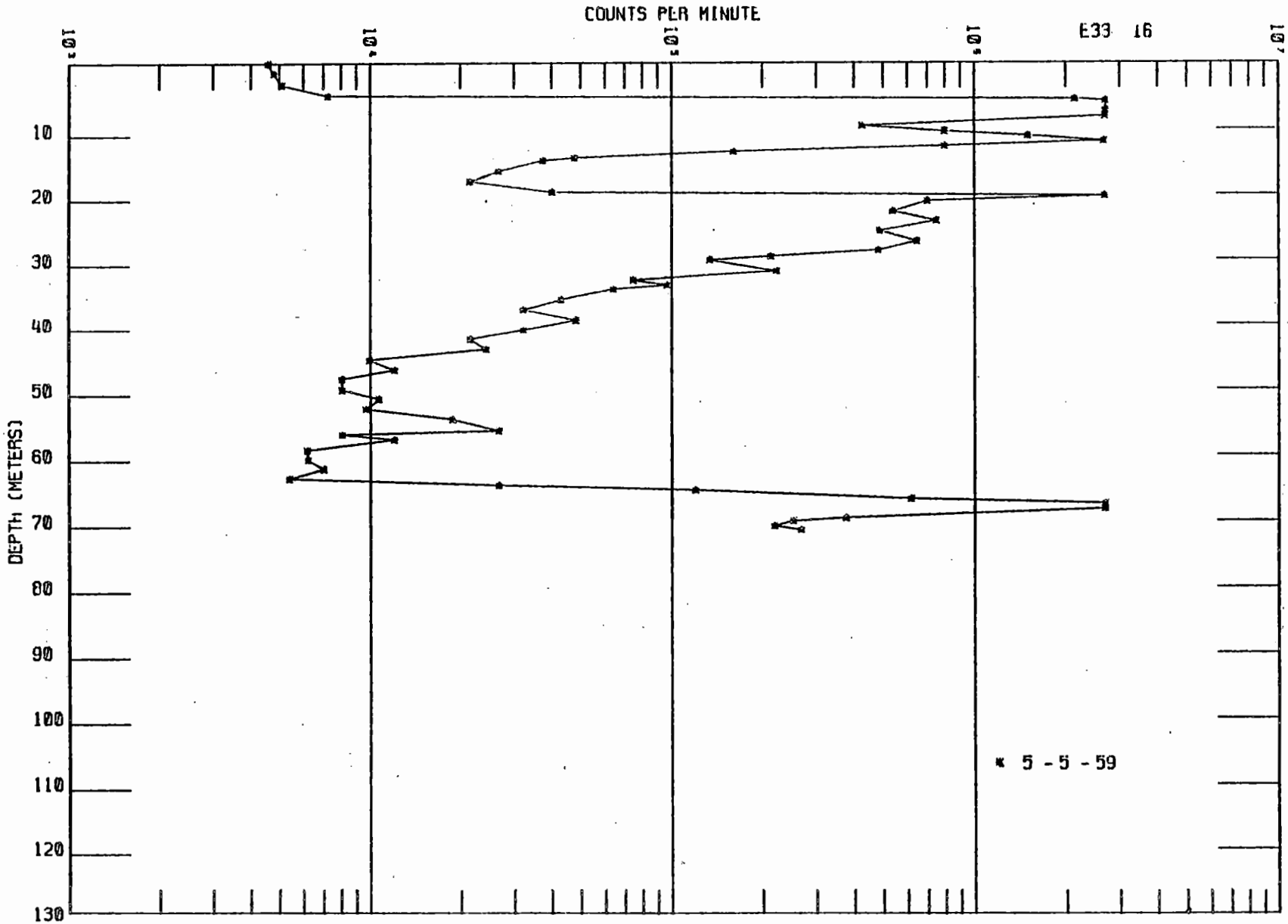
100
110
120
130
5 - 5 - 76


COUNTS PER MINUTE
E33 16
DEPTH (METERS)
10
20
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40
50
60
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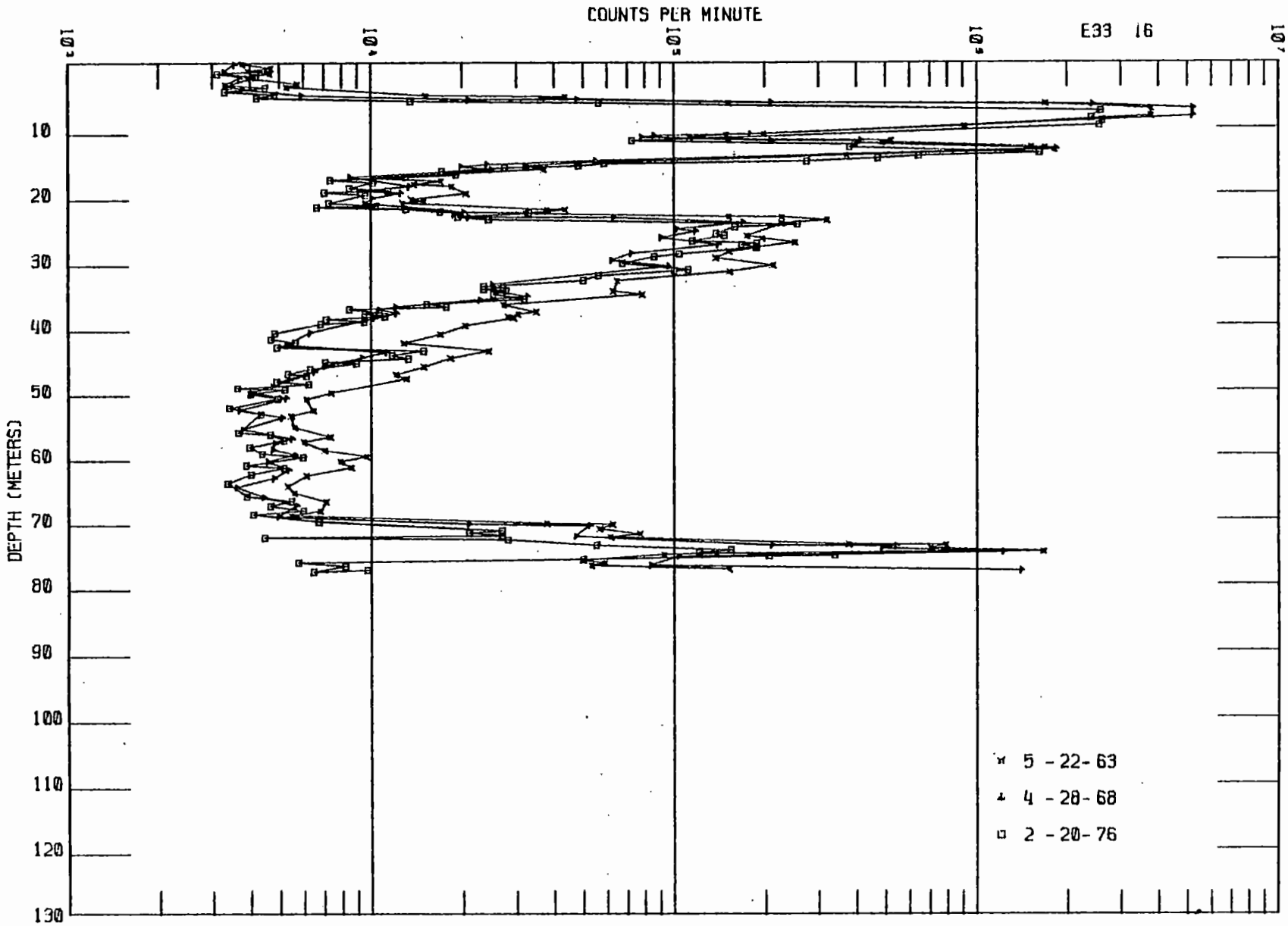
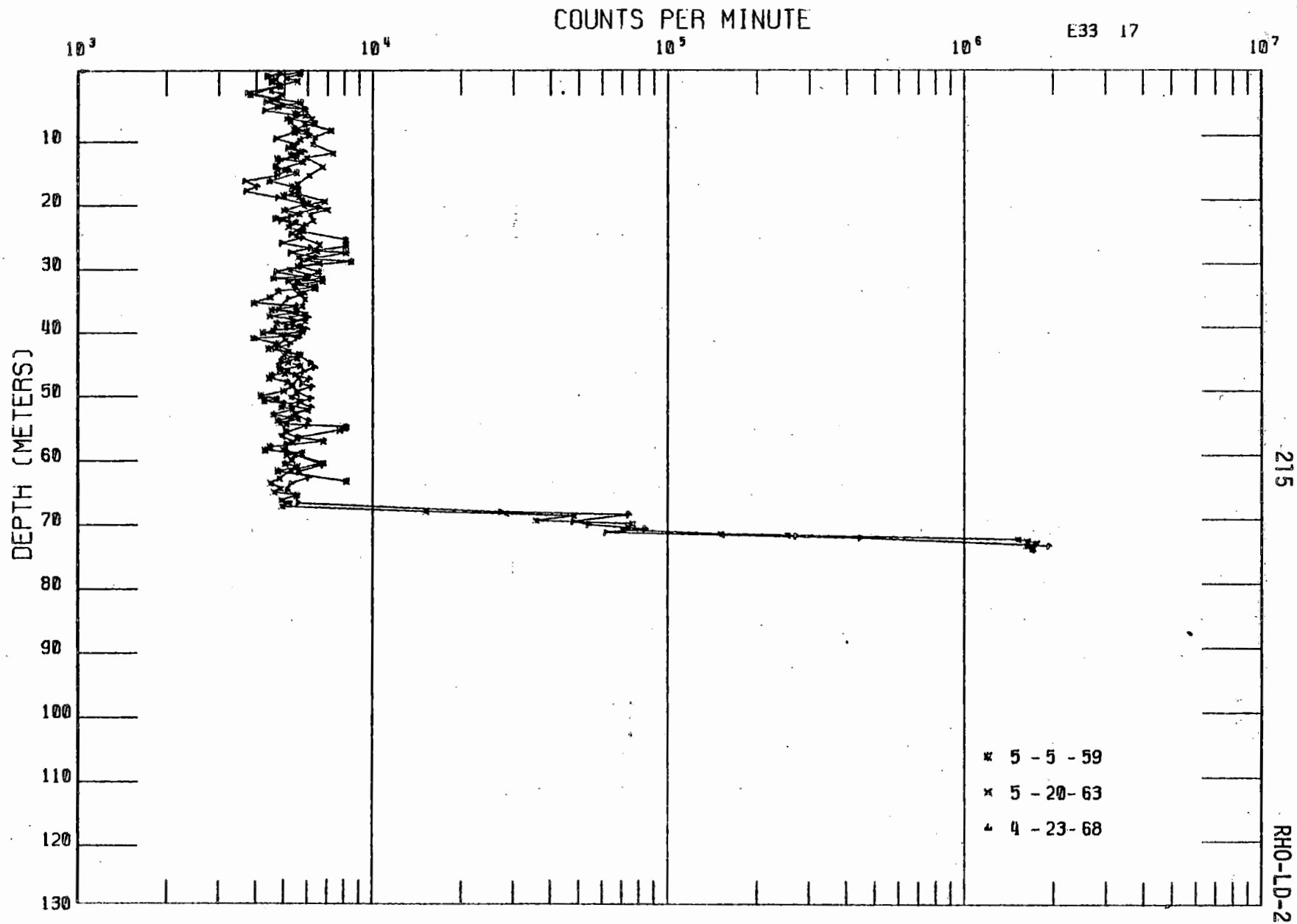
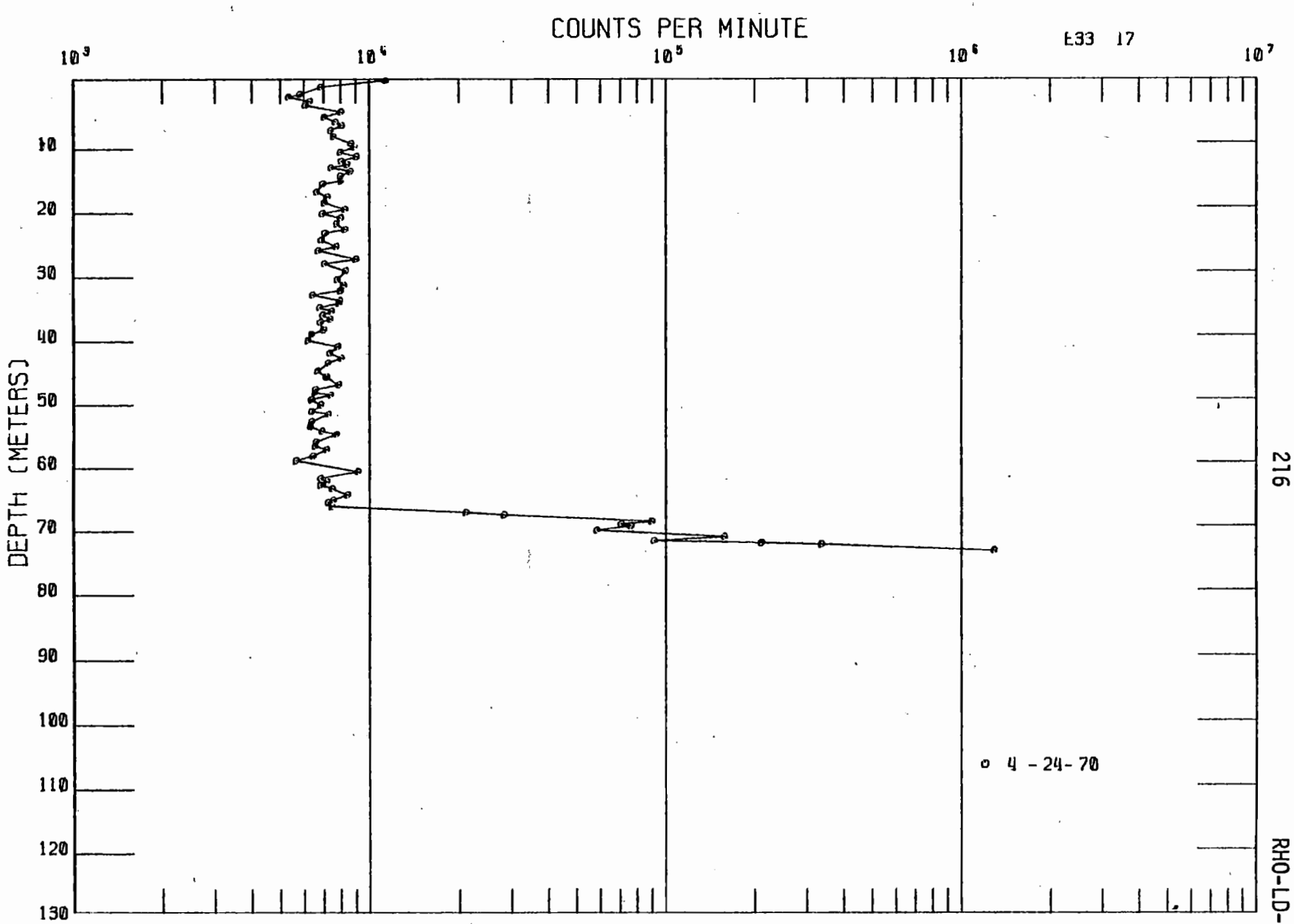
90
100
110
120
130
* 5 - 5 - 59


COUNTS PER MINUTE
E33 16
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
5 - 22- 63
4 - 28- 68
2 - 20- 76


COUNTS PER MINUTE
E33 17
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 5 - 59
× 5 - 20- 63
4 - 23- 68


COUNTS PER MINUTE
E33 17
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
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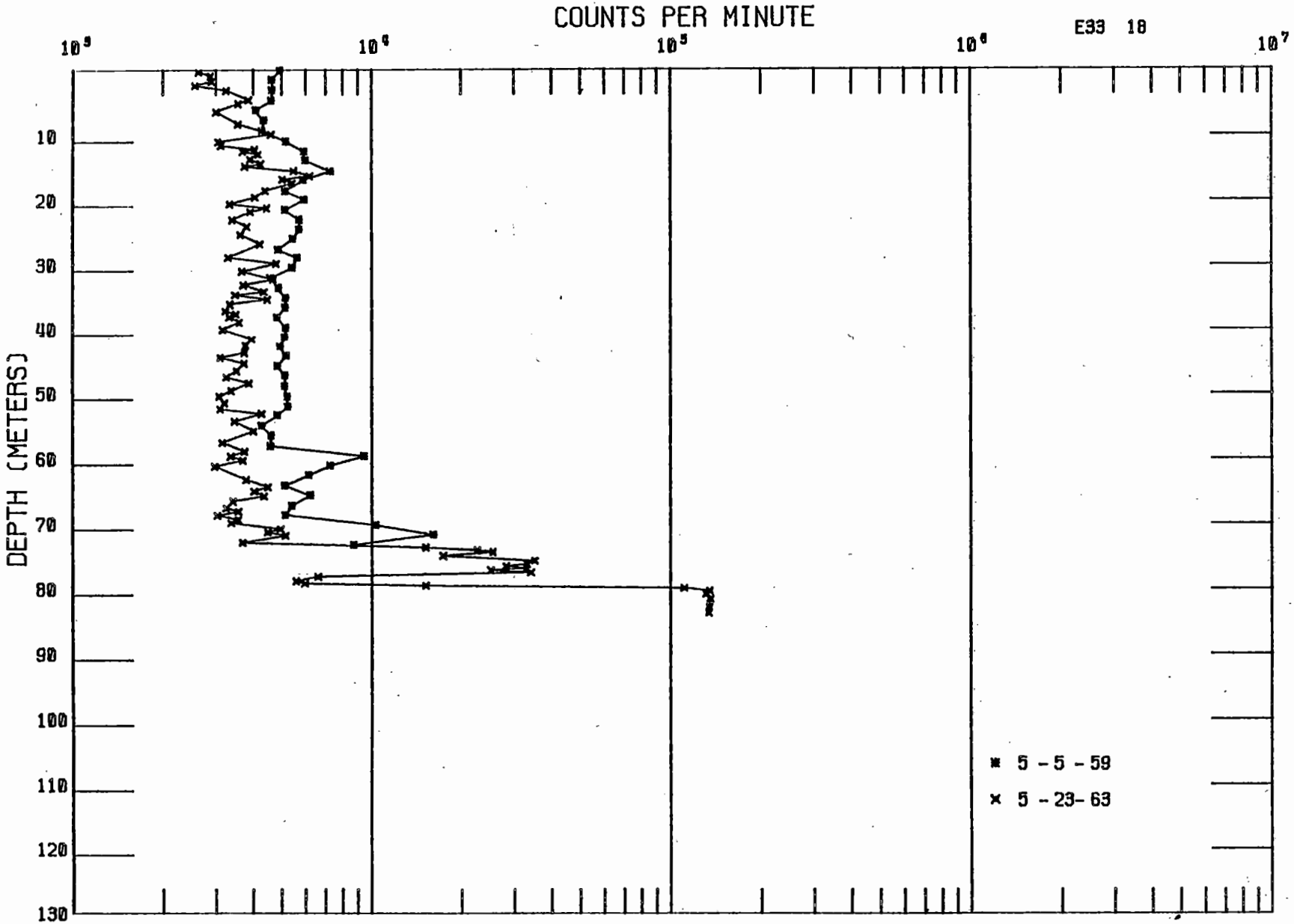
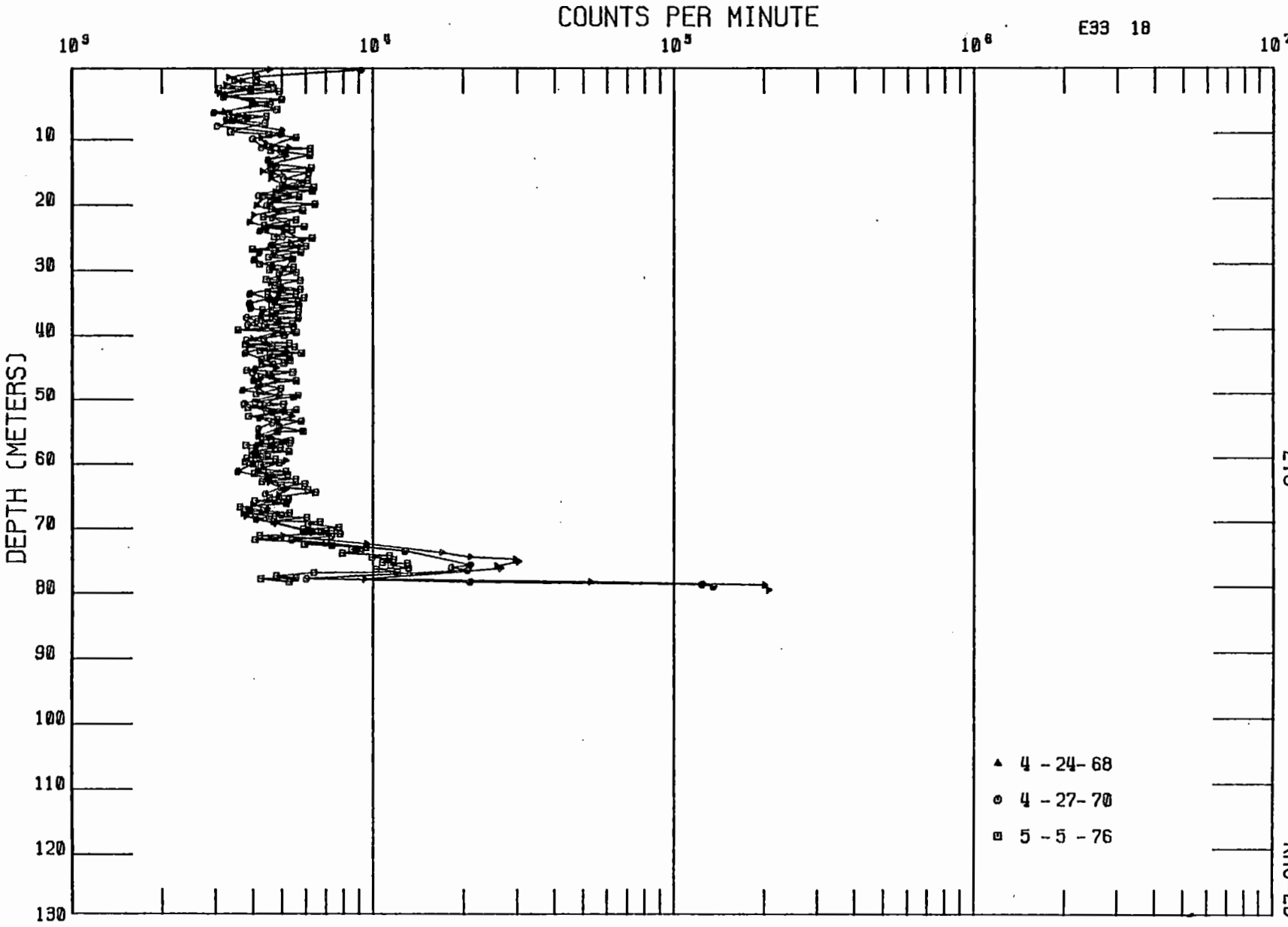
100
110
120
130
o 4 - 24 - 70


COUNTS PER MINUTE
E33 18
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
* 5 - 5 - 59
× 5 - 23- 63


COUNTS PER MINUTE
E33 18
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
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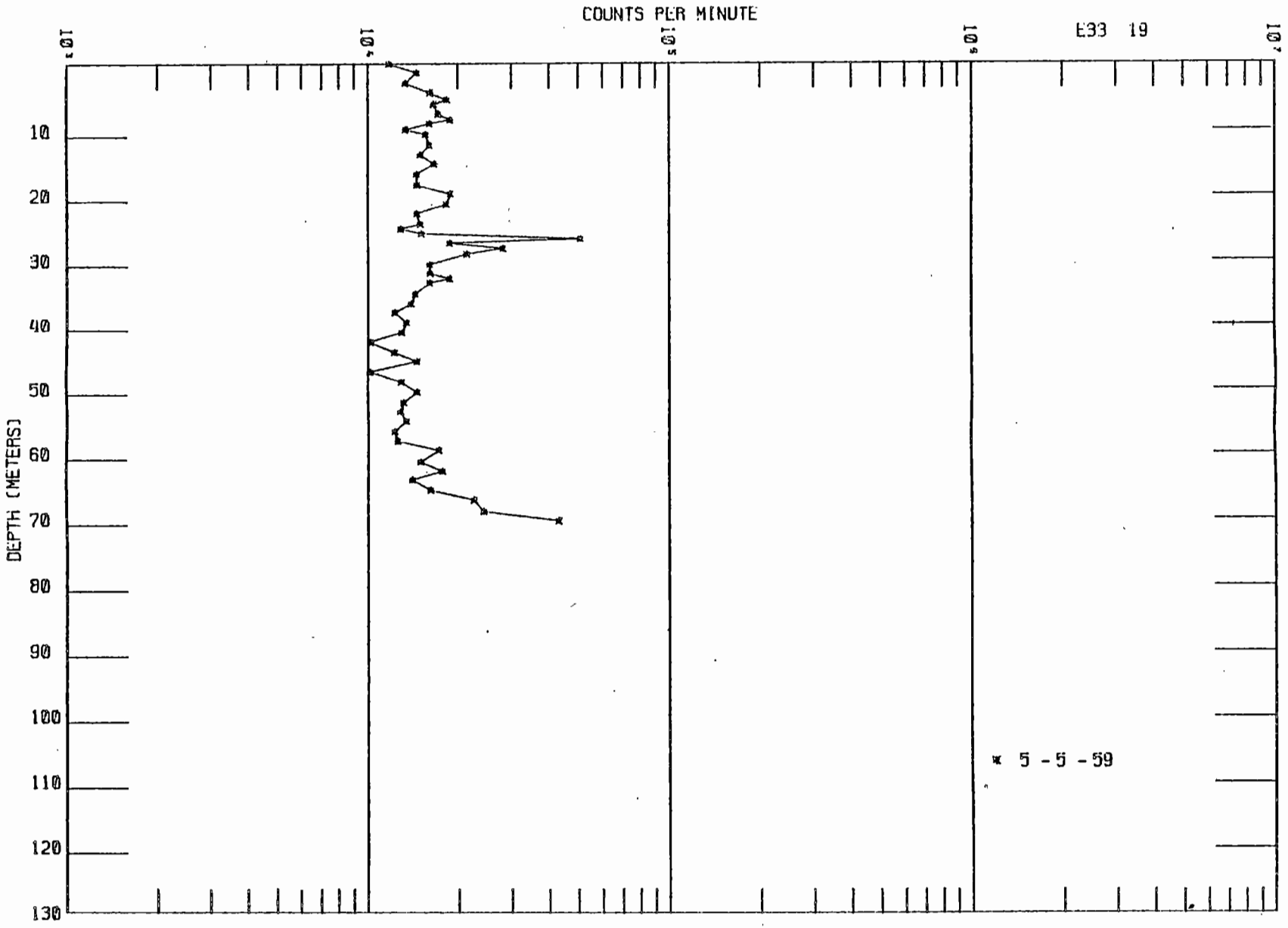
120
130
4 - 24- 68
4 - 27- 70
5 - 5 - 76


COUNTS PER MINUTE
E33 19
10³
10⁴
10⁵
10⁶
10⁷
DEPTH (METERS)
10
20
30
40
50
60
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80
90
100
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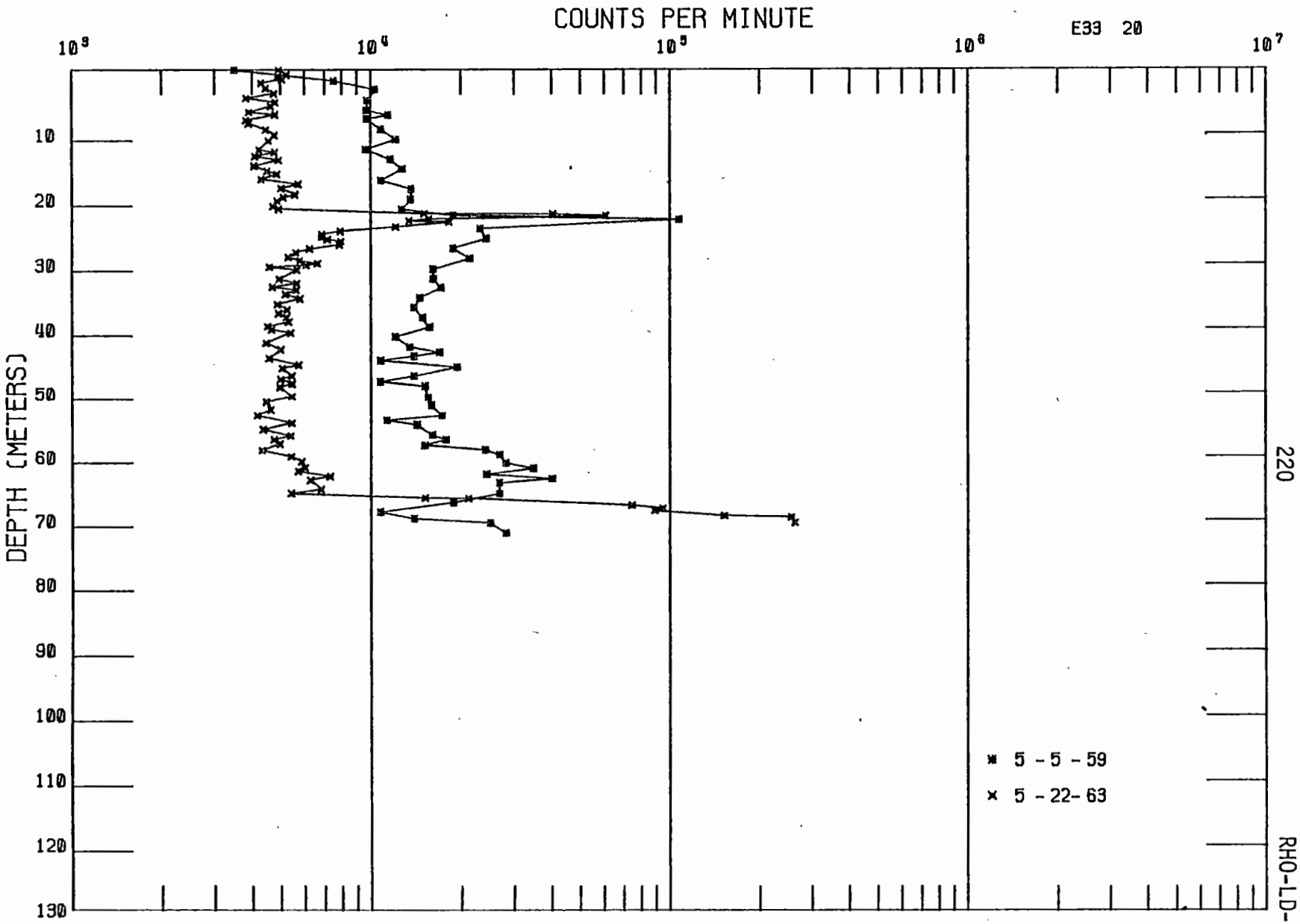
120
130
* 5 - 5 - 59


COUNTS PER MINUTE
E33 20
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
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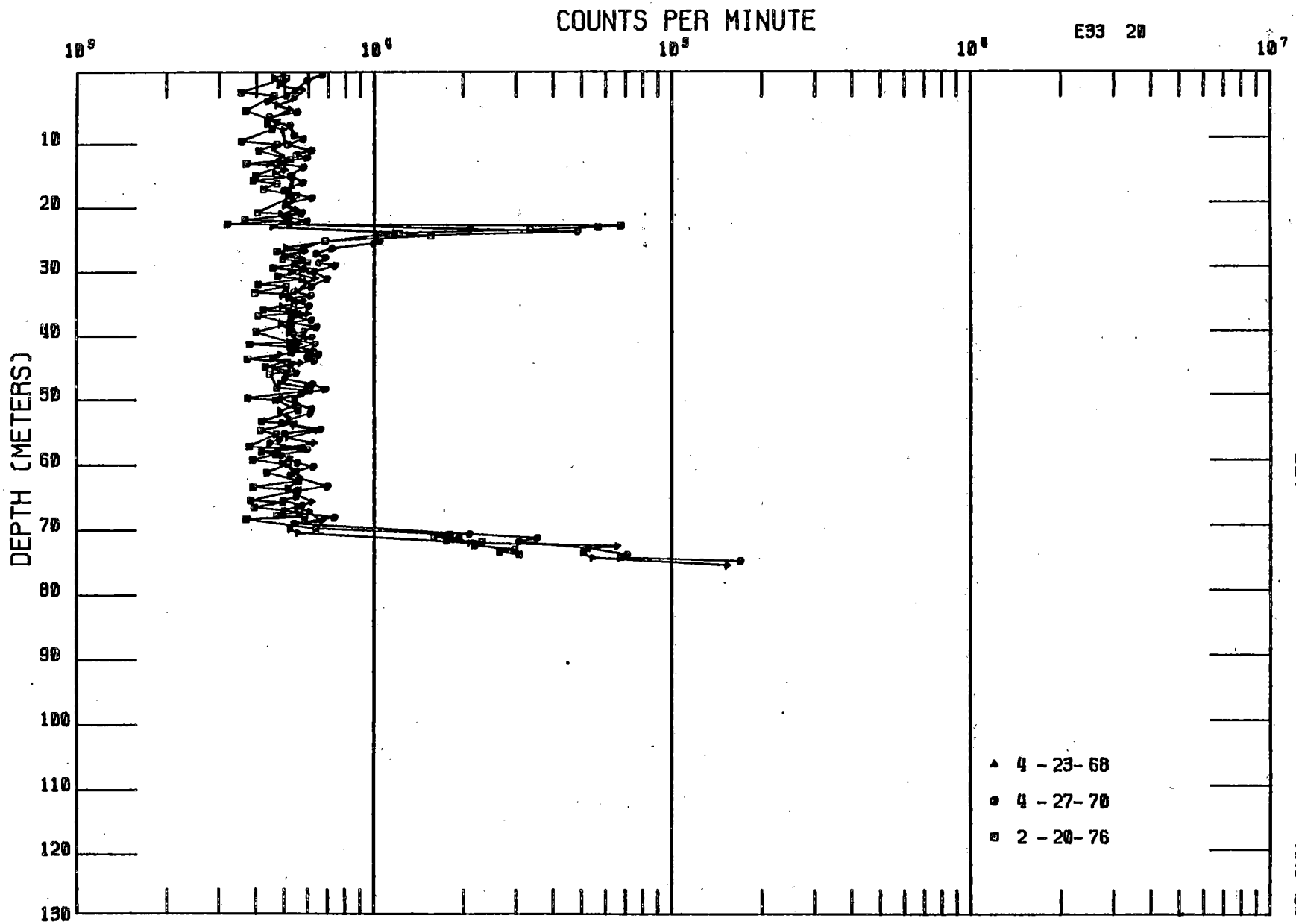
20
30
40
50
60
70
80
90
100
110
120
130
* 5 - 5 - 59
× 5 - 22- 63


COUNTS PER MINUTE
E33 20
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
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50
60
70
80
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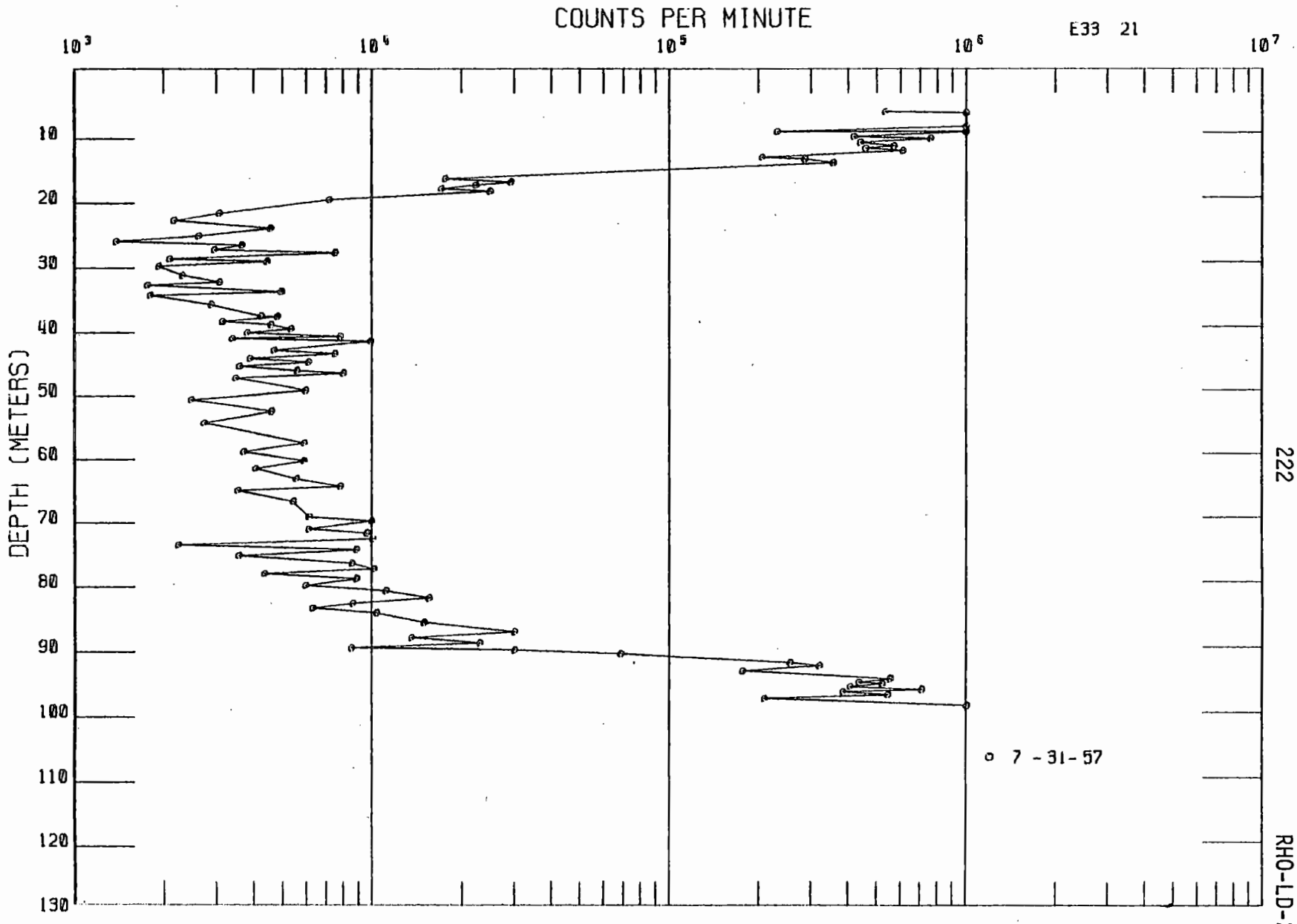
100
110
120
130
4 - 23- 68
4 - 27- 70
2 - 20- 76


COUNTS PER MINUTE
E33 21
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
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60
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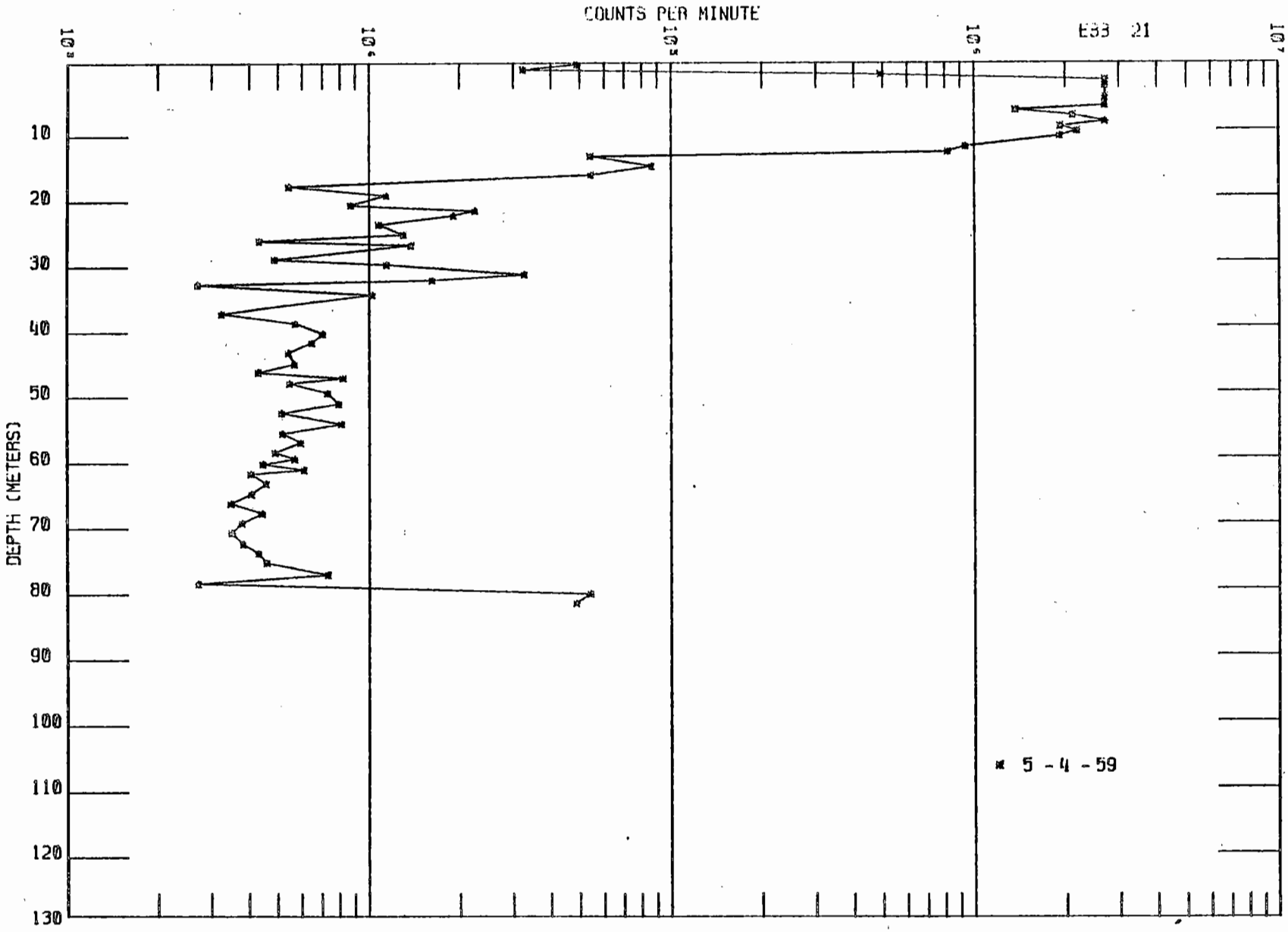
100
110
120
130
o 7-31-57


COUNTS PER MINUTE
E33 21
DEPTH (METERS)
10
20
30
40
50
60
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80
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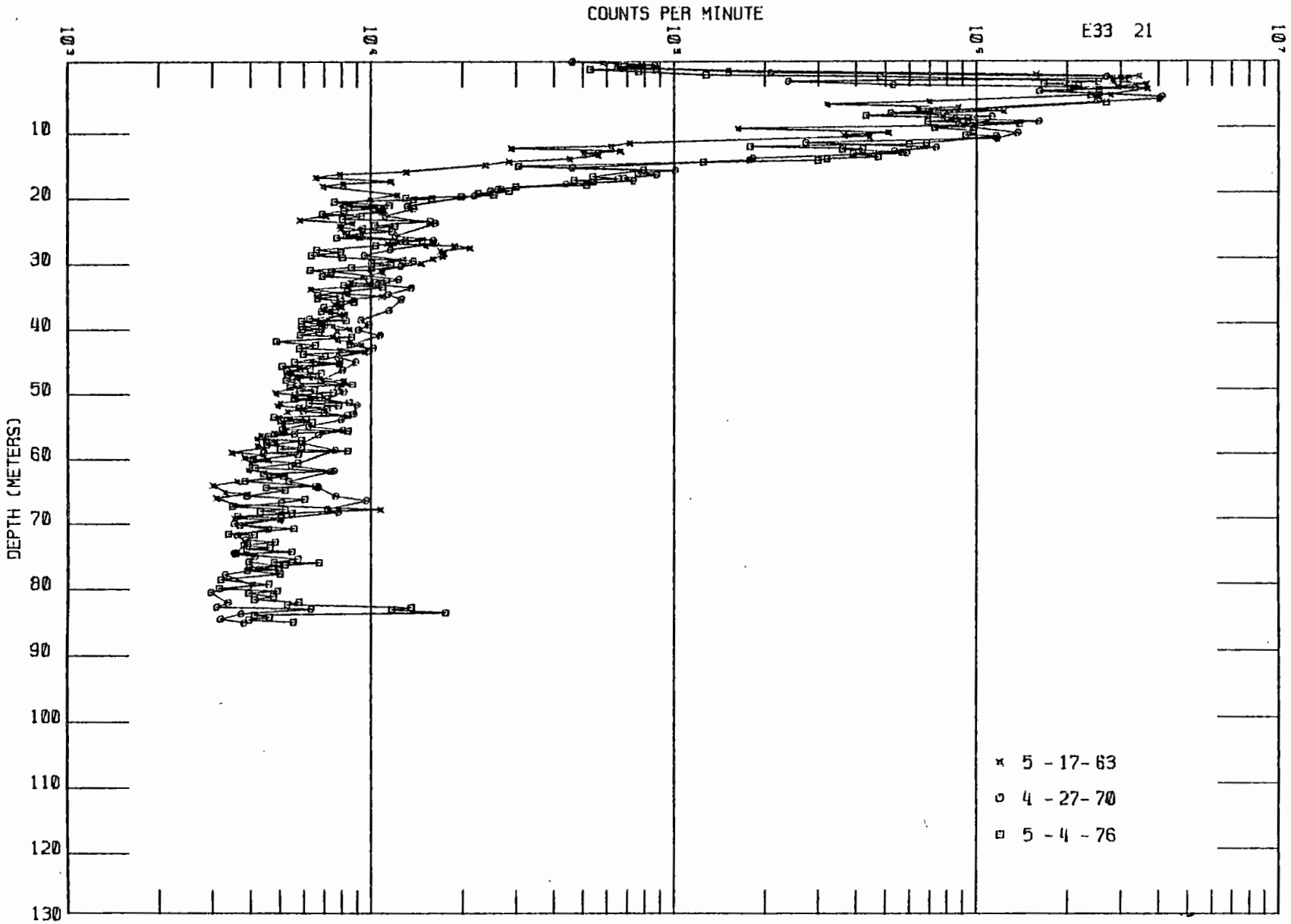
100
110
120
130
5 - 4 - 59


COUNTS PER MINUTE
E33 21
DEPTH (METERS)
10
20
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40
50
60
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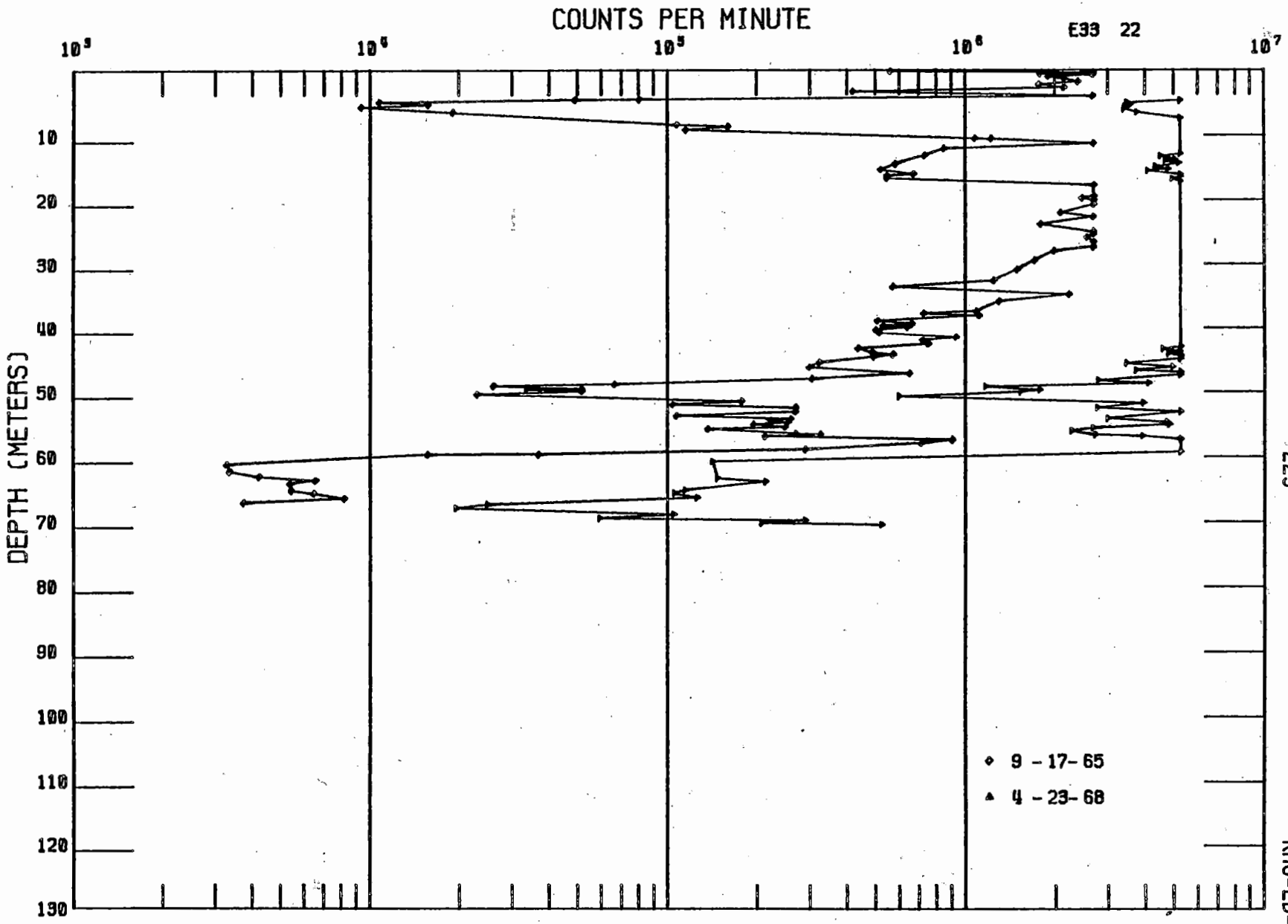
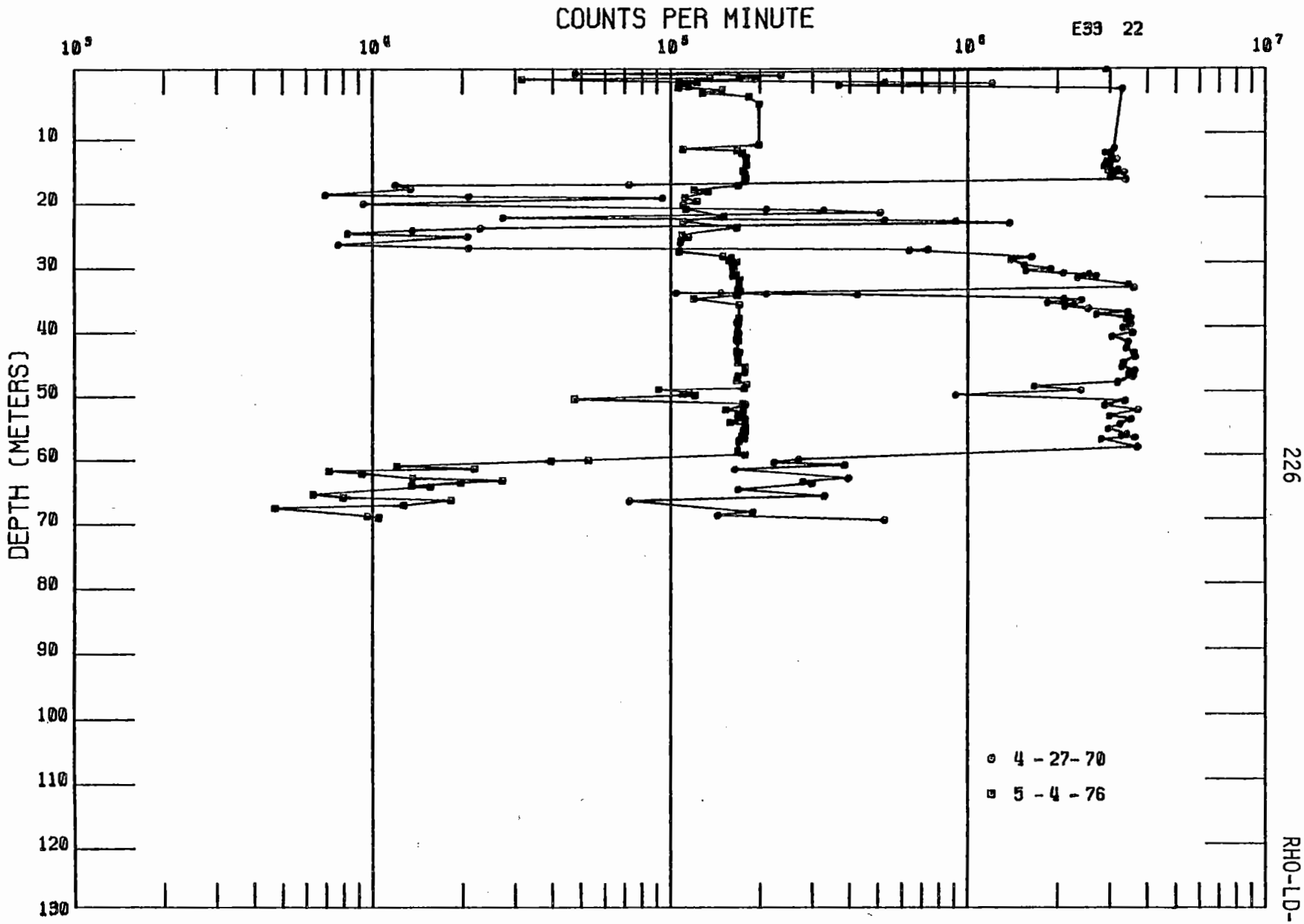
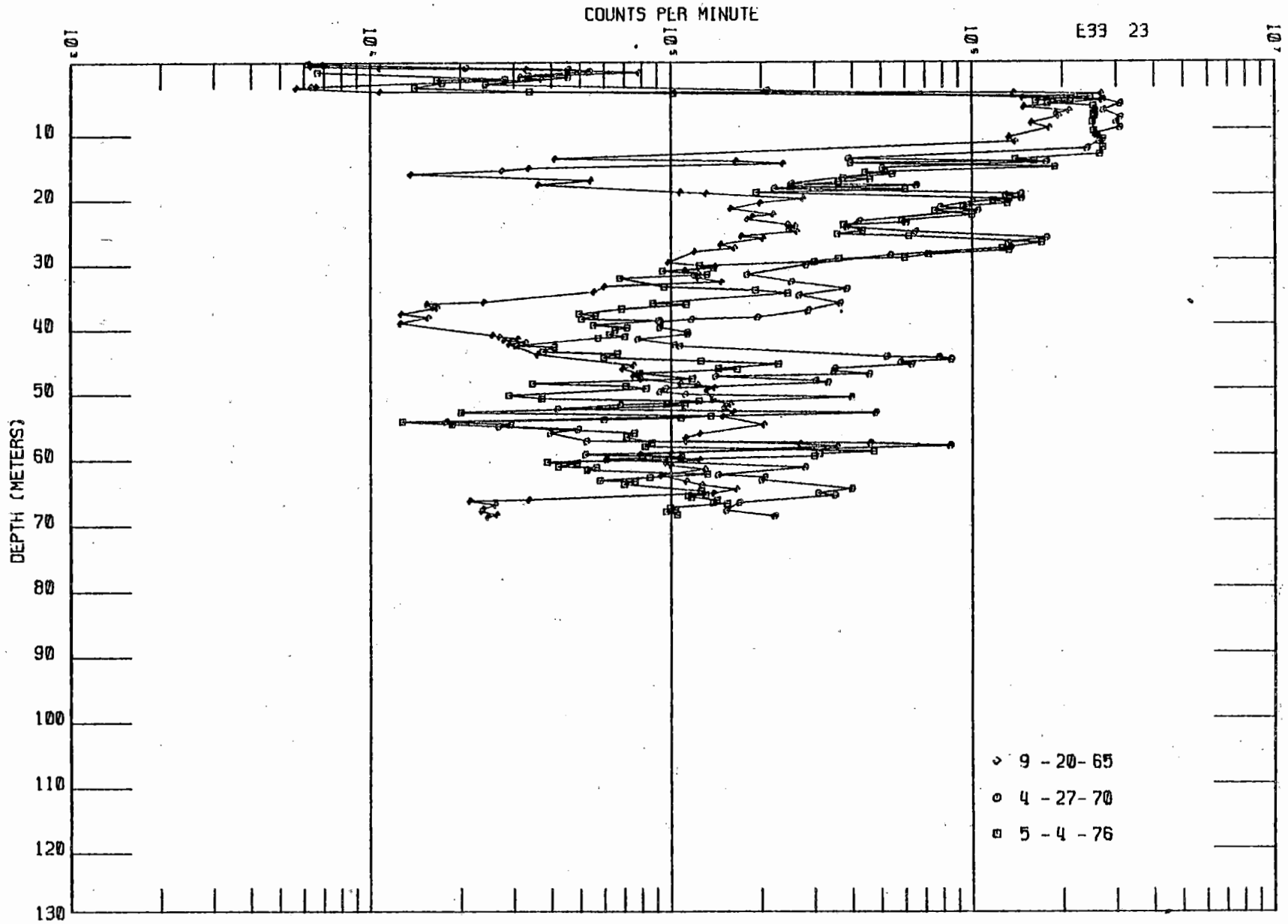
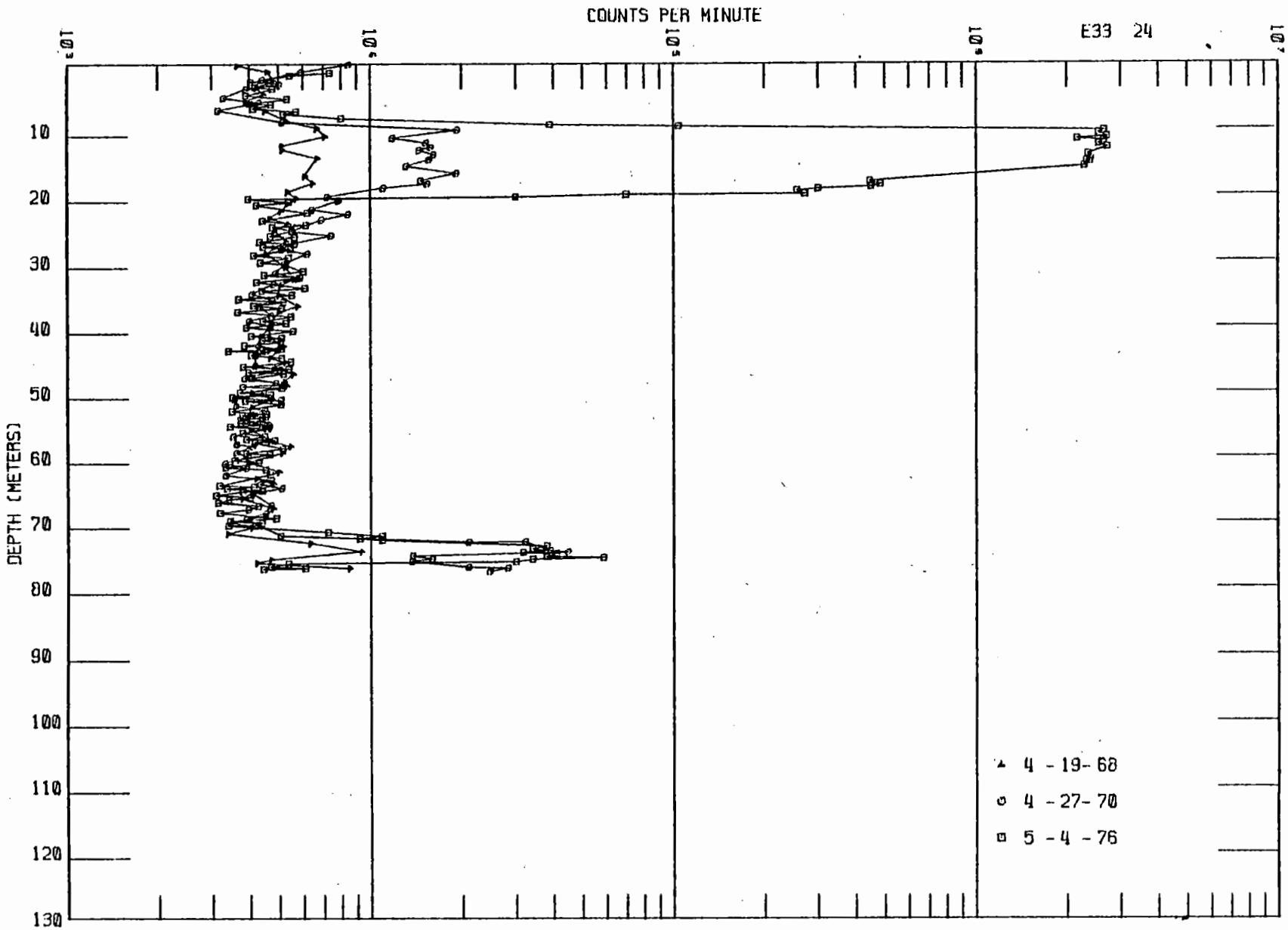
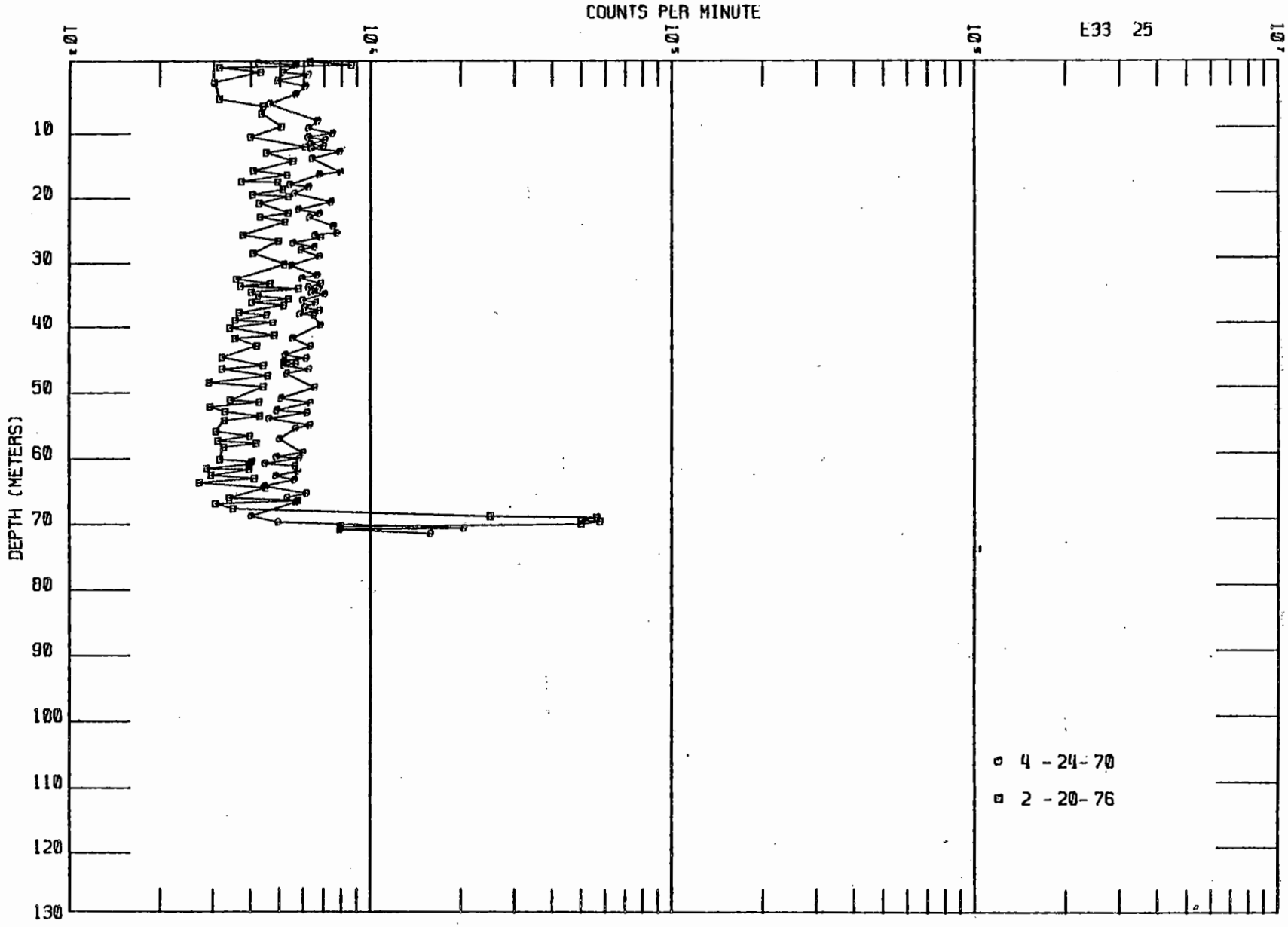
80
90
100
110
120
130
5 - 17- 63
4 - 27- 70
5 - 4 - 76


COUNTS PER MINUTE
E33 22
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
◇ 9 - 17- 65
▲ 4 - 23- 68


COUNTS PER MINUTE
E33 22
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
4 - 27- 70
5 - 4 - 76


COUNTS PER MINUTE
E33 23
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
9 - 20- 65
4 - 27- 70
5 - 4 - 76


COUNTS PER MINUTE
E33 24
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
4 - 19- 68
4 - 27- 70
5 - 4 - 76


COUNTS PER MINUTE
E33 25
DEPTH (METERS)
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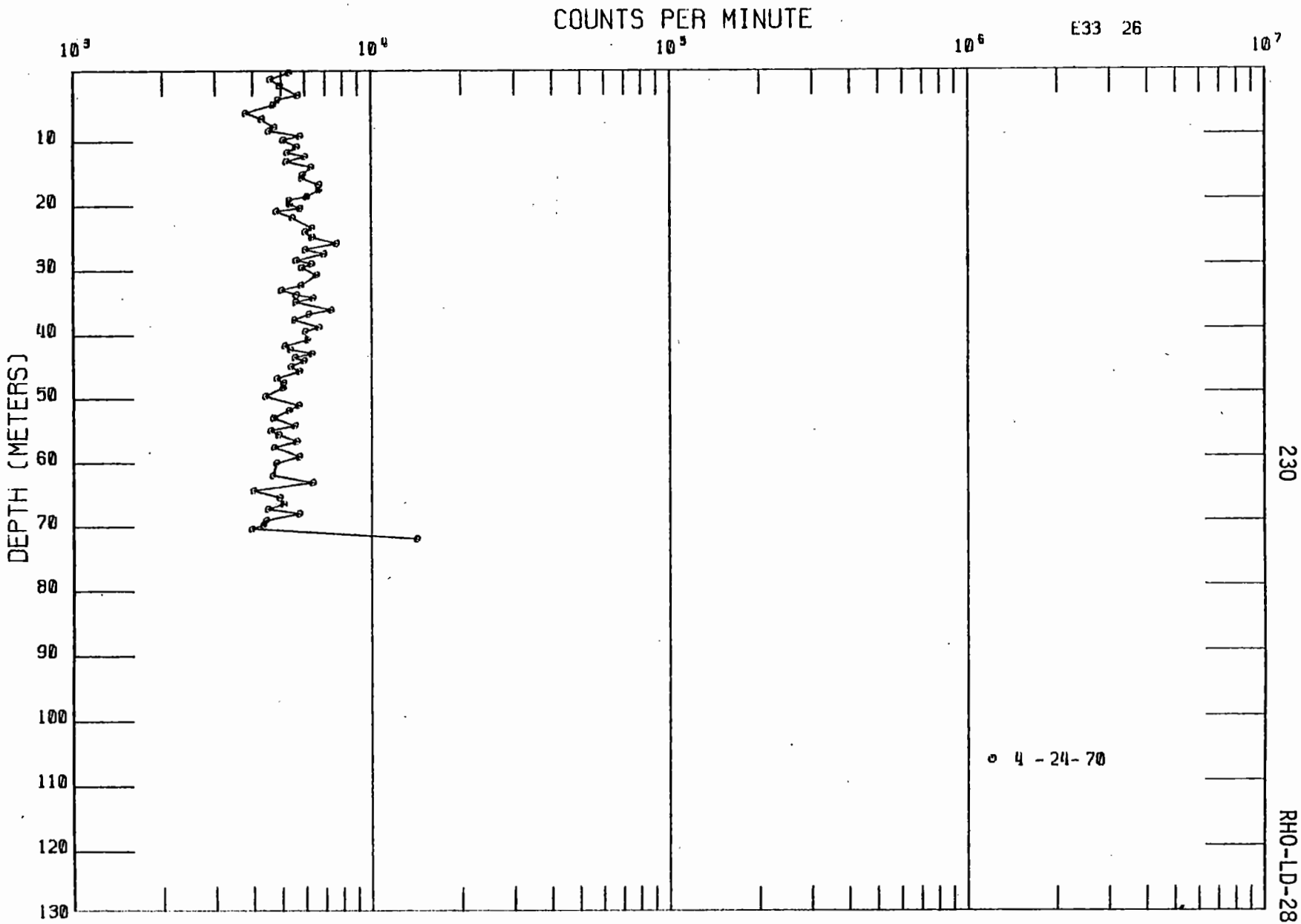
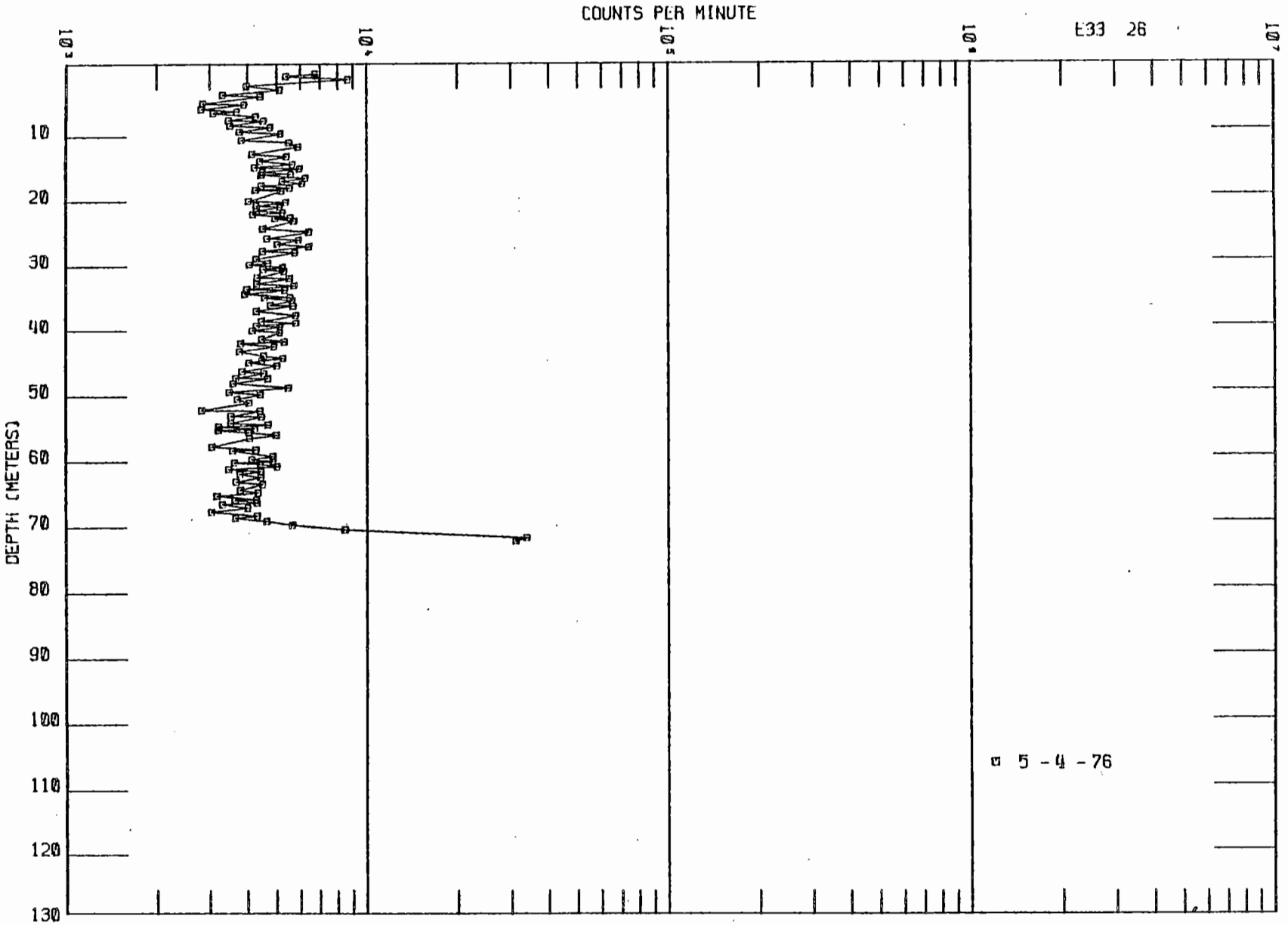
20
30
40
50
60
70
80
90
100
110
120
130
4 - 24- 70
2 - 20- 76


COUNTS PER MINUTE
E33 26
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
o 4 - 24- 70

9 2 1 2 4 6 6 0 3 2 4



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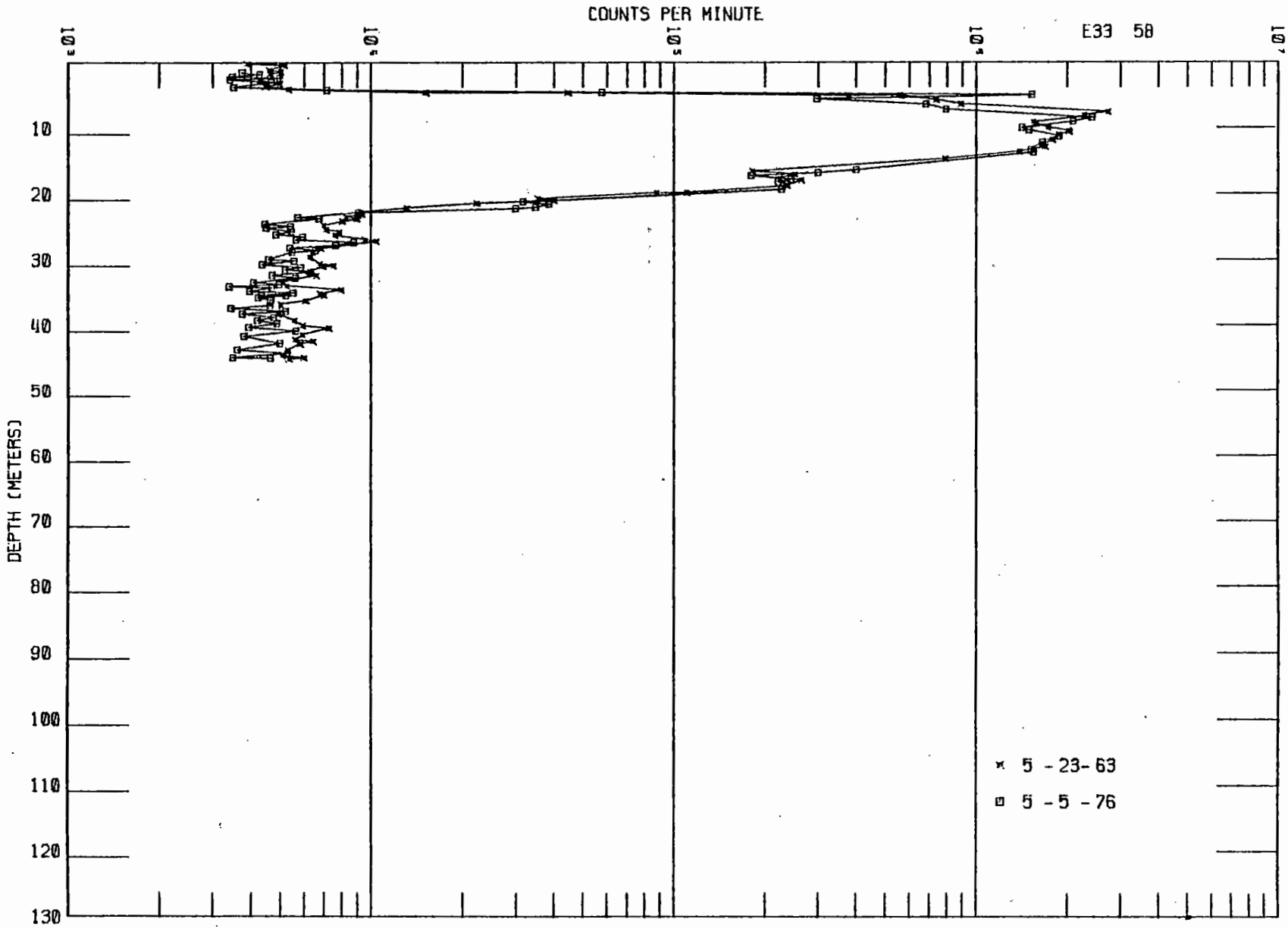
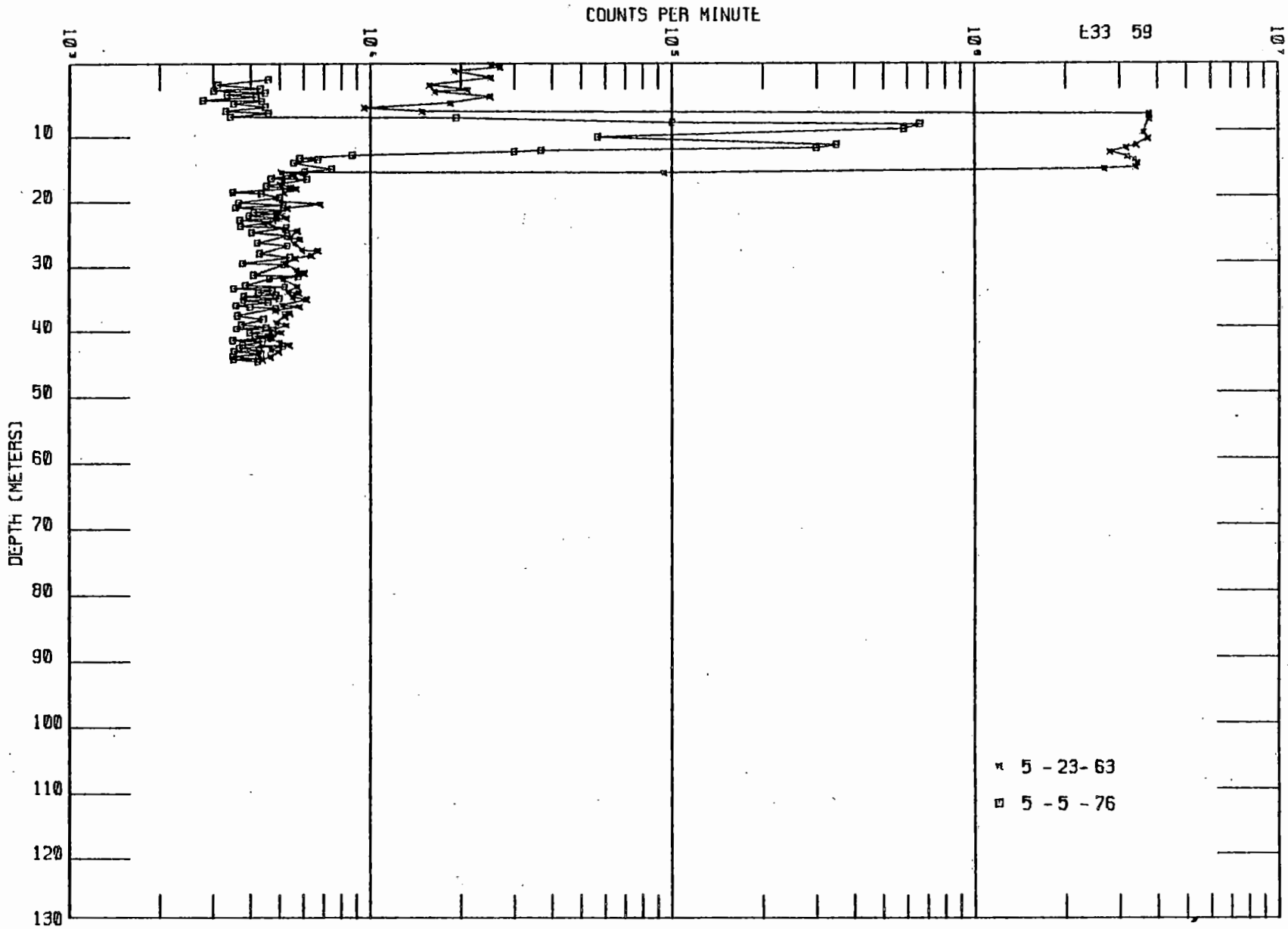

COUNTS PER MINUTE
E33 58
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
5 - 23- 63
5 - 5 - 76

9 2 1 2 4 6 6 0 8 2 6



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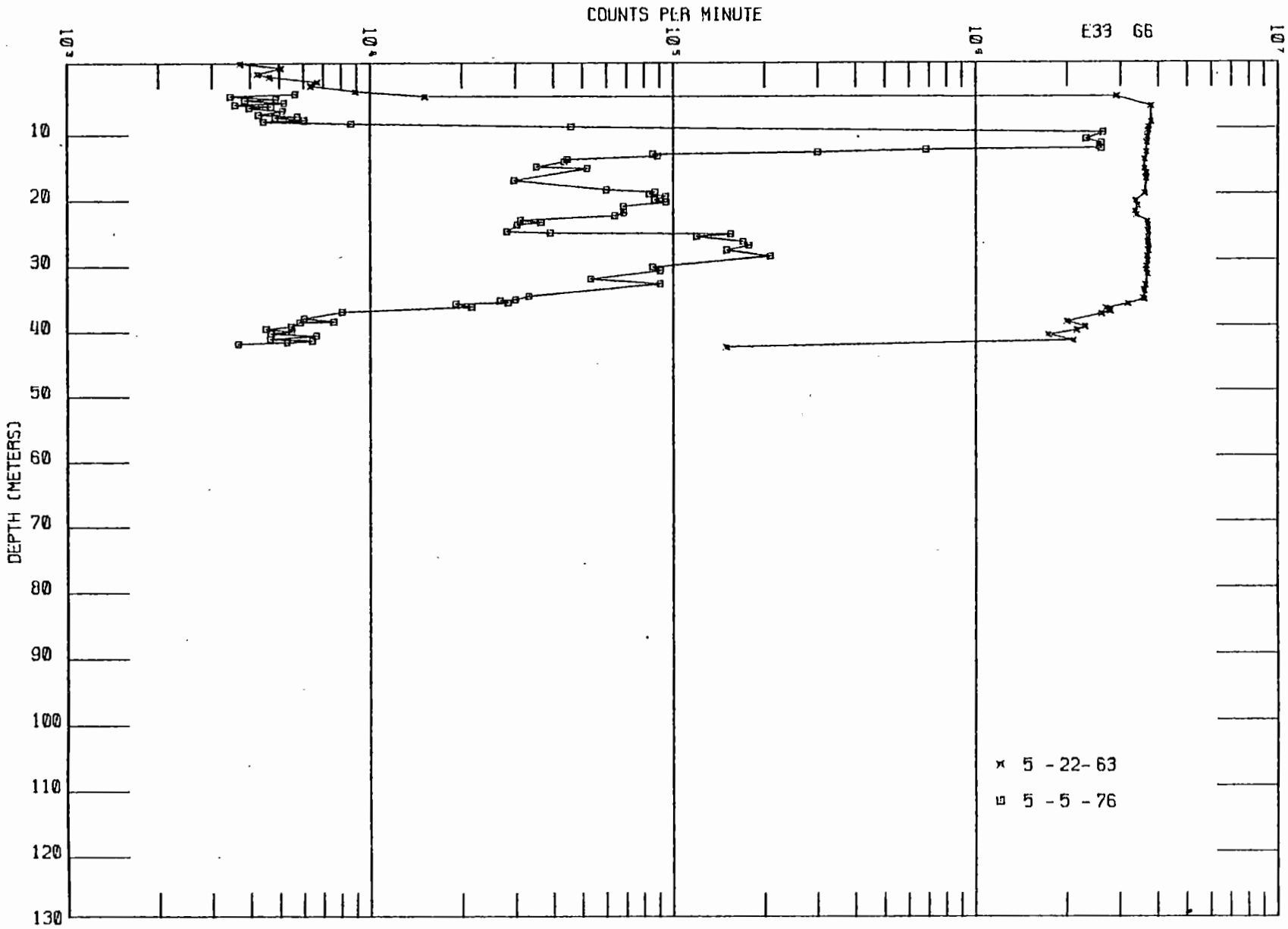
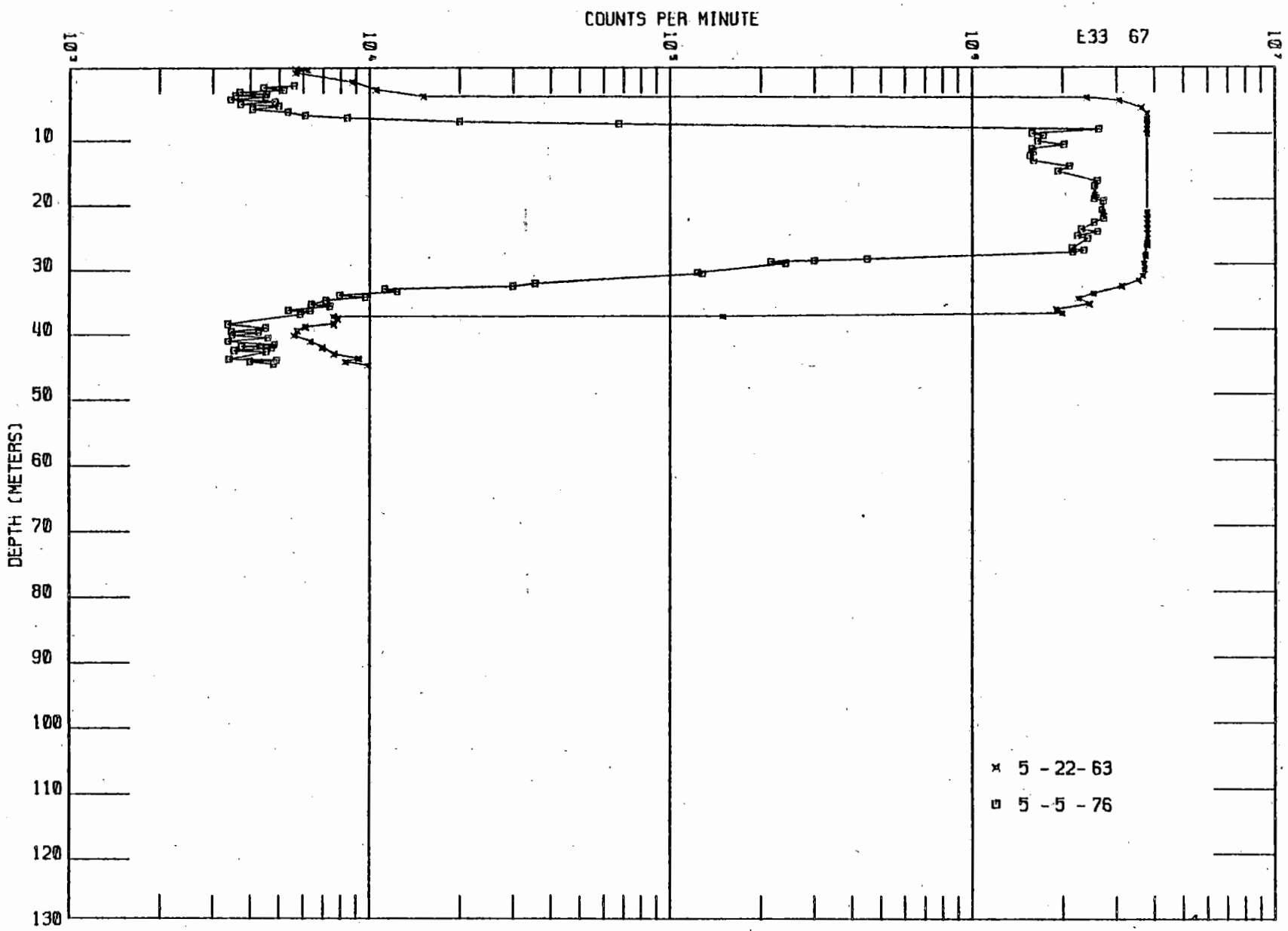
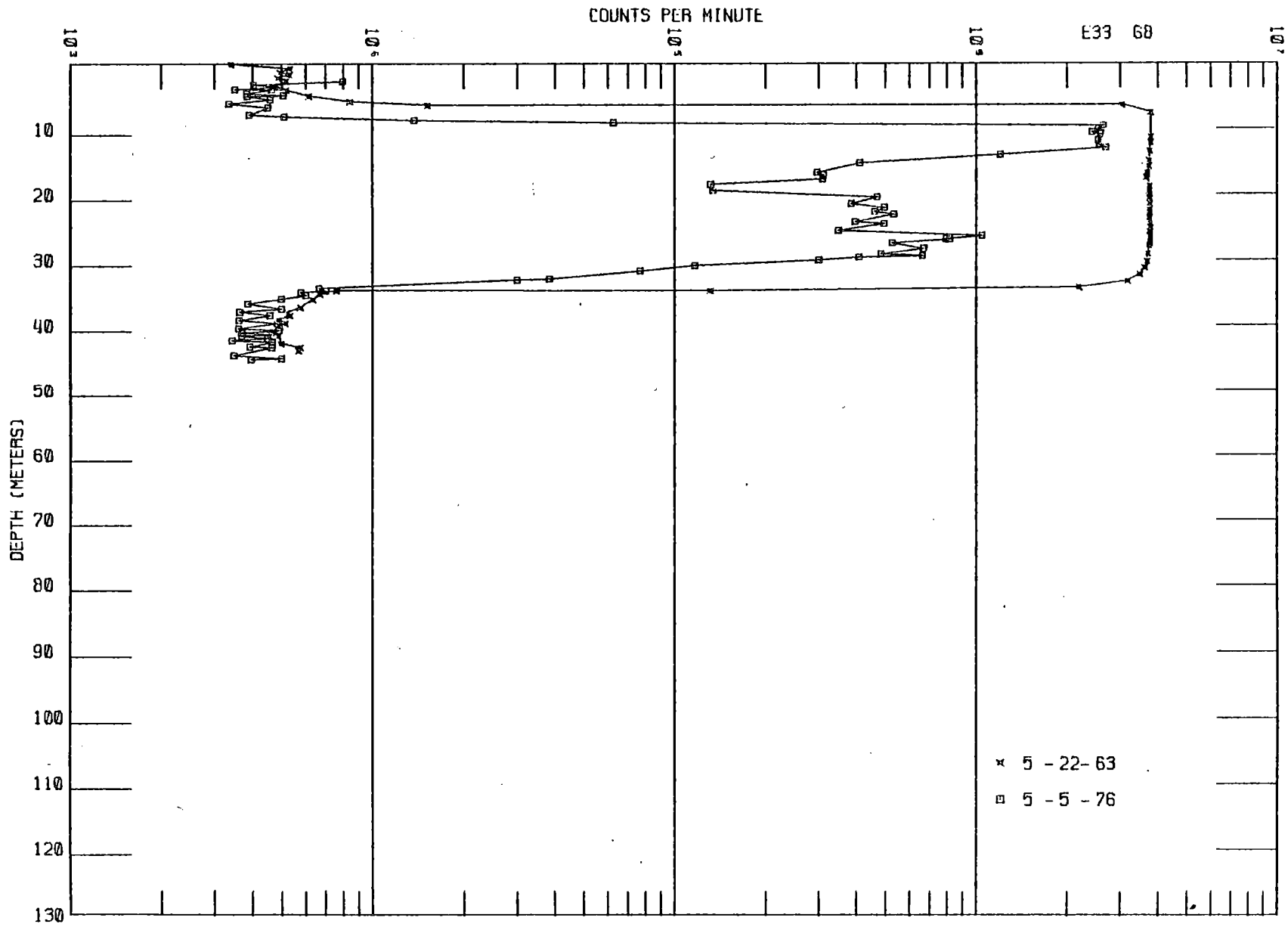

COUNTS PER MINUTE
10^3
10^4
10^5
10^6
10^7
E33 G6
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 -22-63
□ 5 -5 -76


COUNTS PER MINUTE
E33 67
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 22- 63
□ 5 - 5 - 76

9 2 1 2 4 6 6 0 8 2 9



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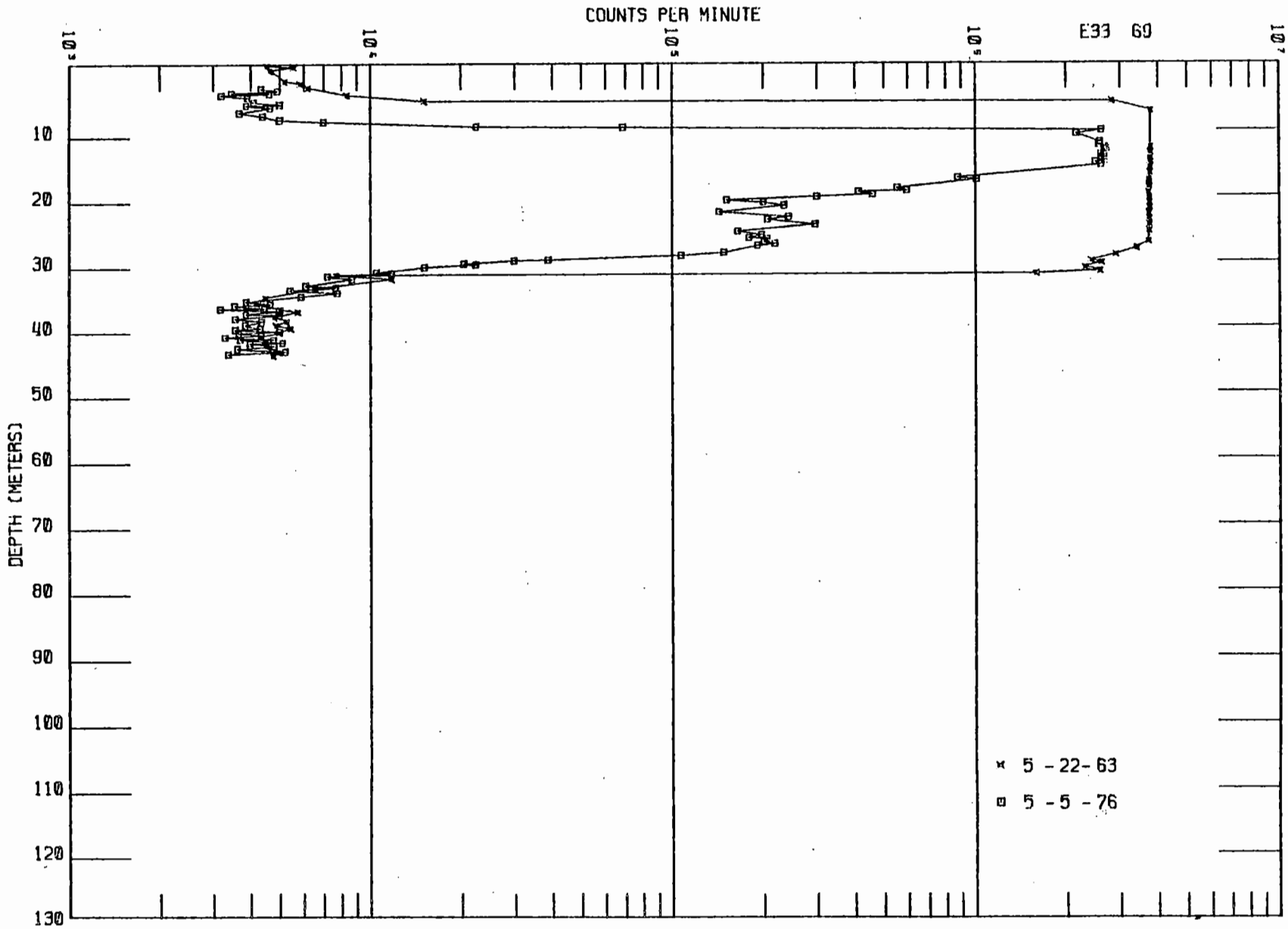
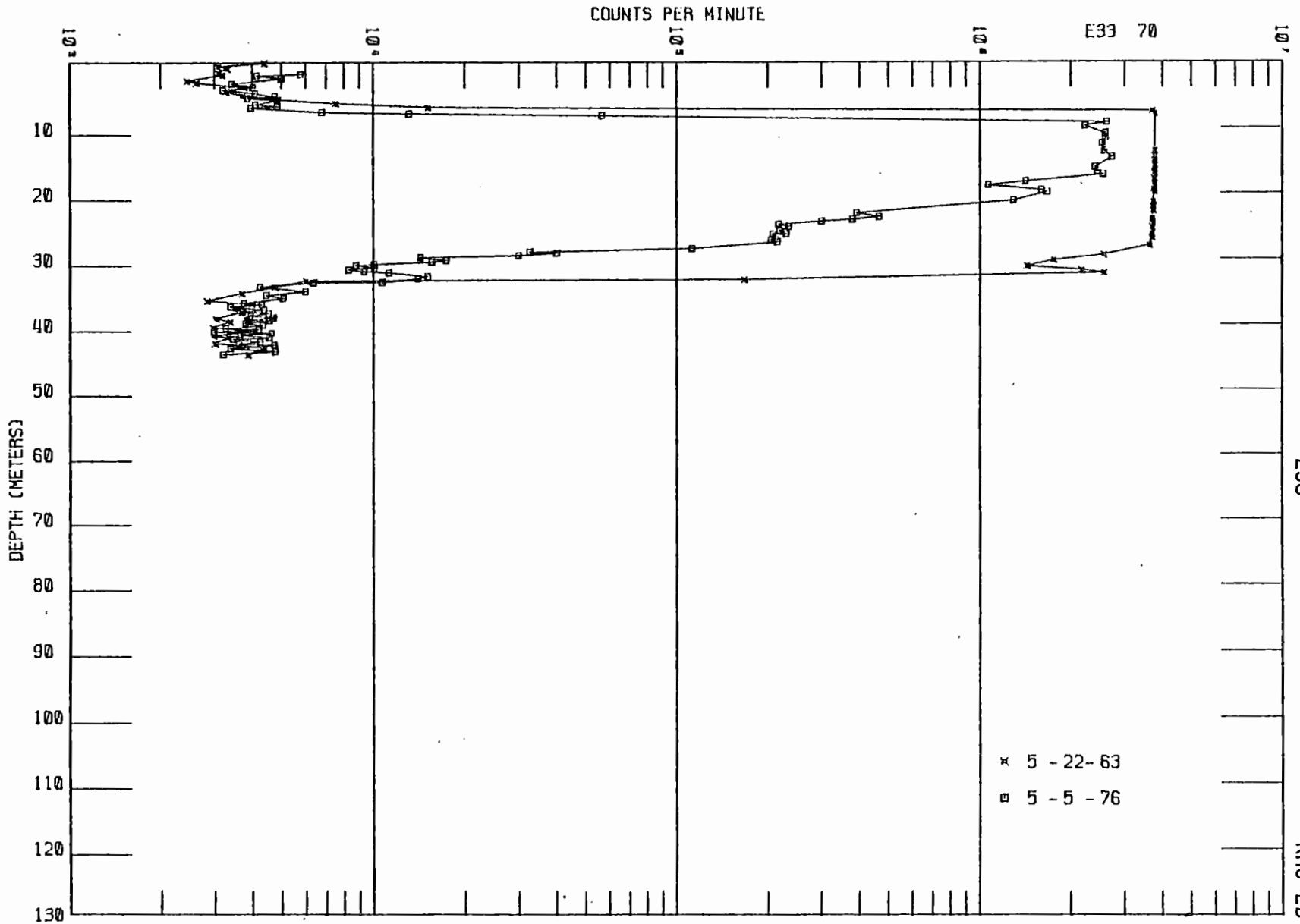

COUNTS PER MINUTE
10³
10⁴
10⁵
10⁶
10⁷
E33 60
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 22- 63
▫ 5 - 5 - 76


COUNTS PER MINUTE
E33 70
DEPTH (METERS)
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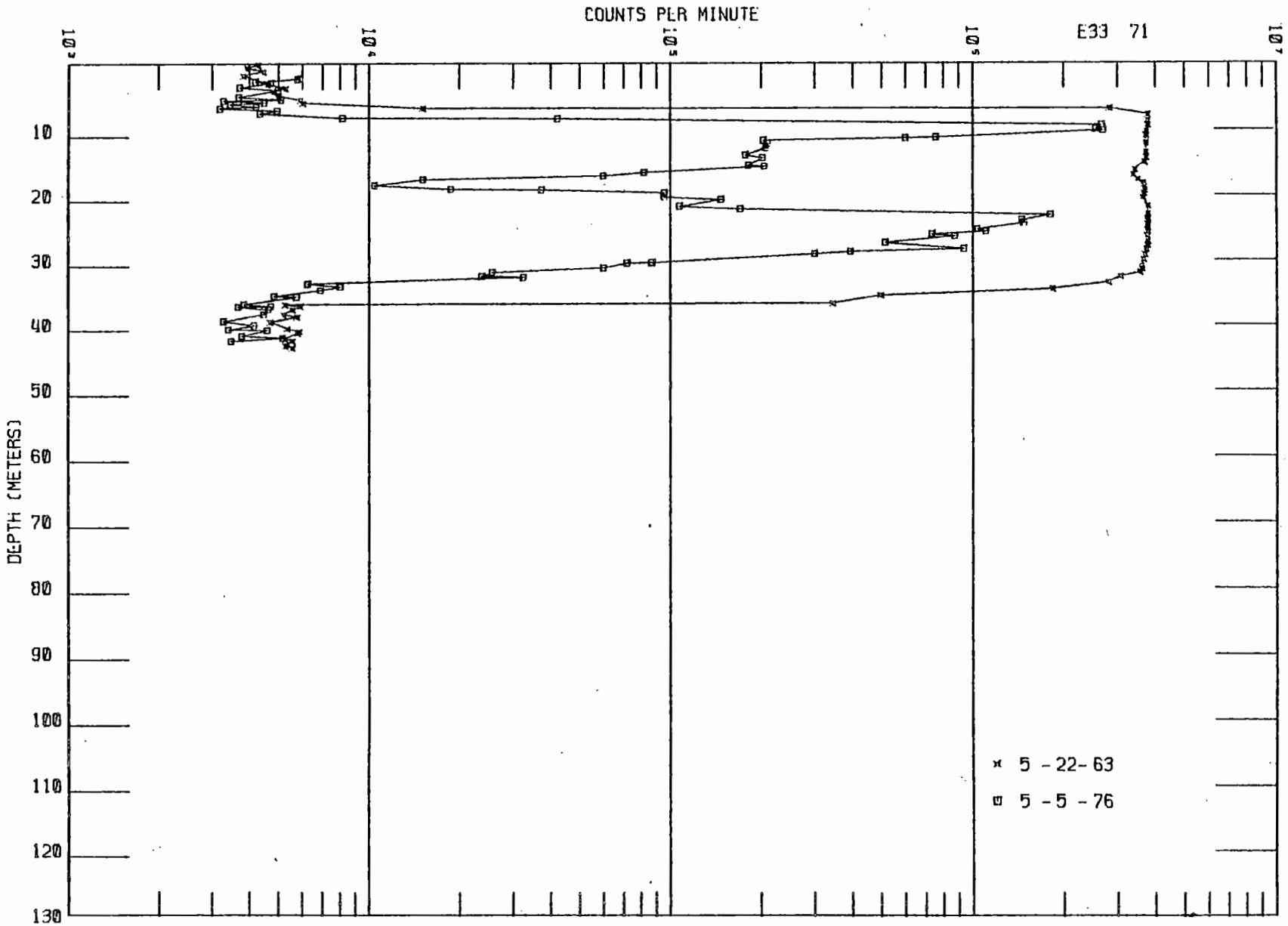
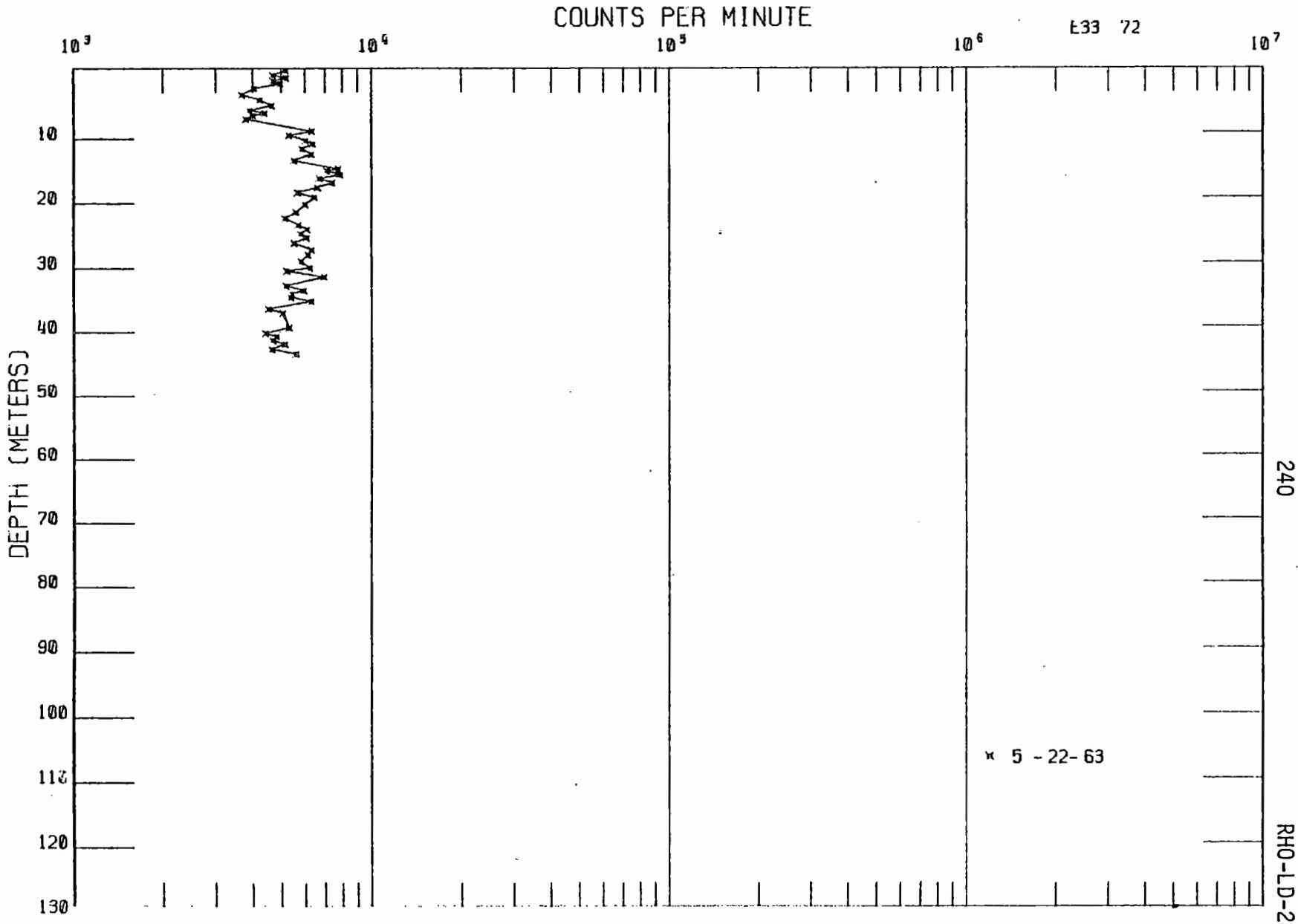
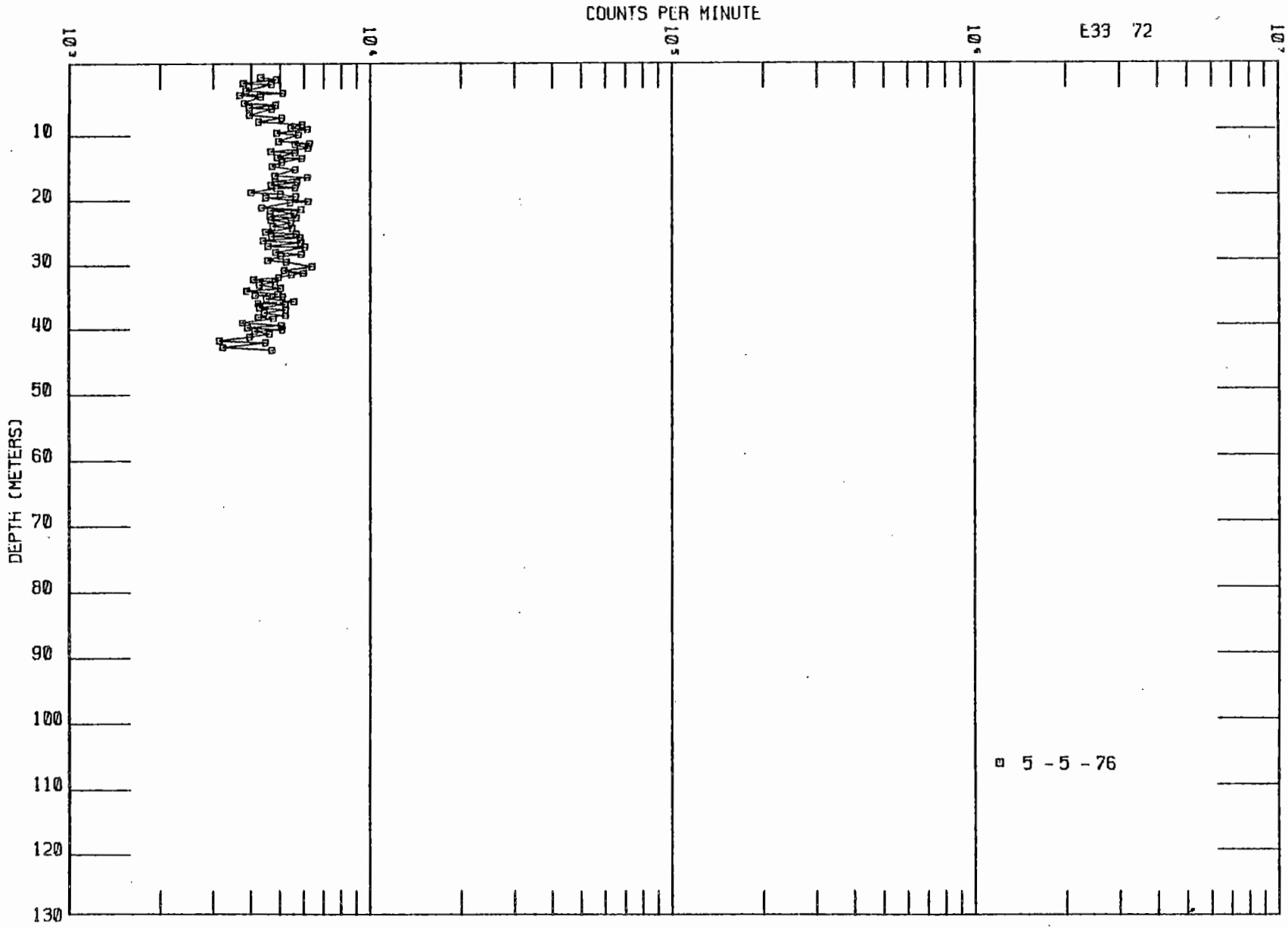
20
30
40
50
60
70
80
90
100
110
120
130
5 - 22- 63
5 - 5 - 76


COUNTS PER MINUTE
E33 71
10³
10⁴
10⁵
10⁶
10⁷
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 -22-63
▫ 5 -5 -76


COUNTS PER MINUTE
E33 72
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
112
120
130
x 5 - 22- 63

9 2 1 2 4 6 6 0 8 3 4



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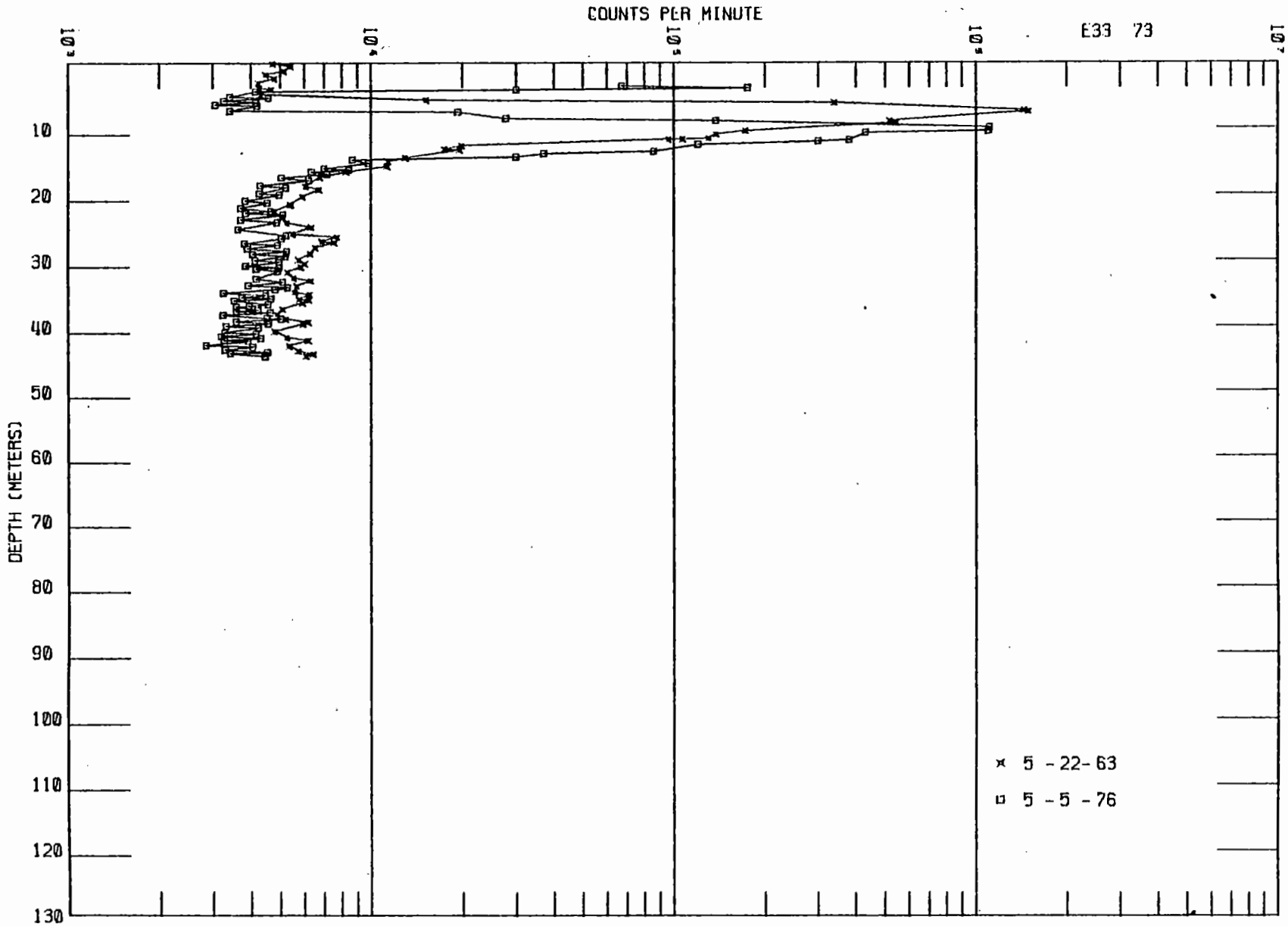
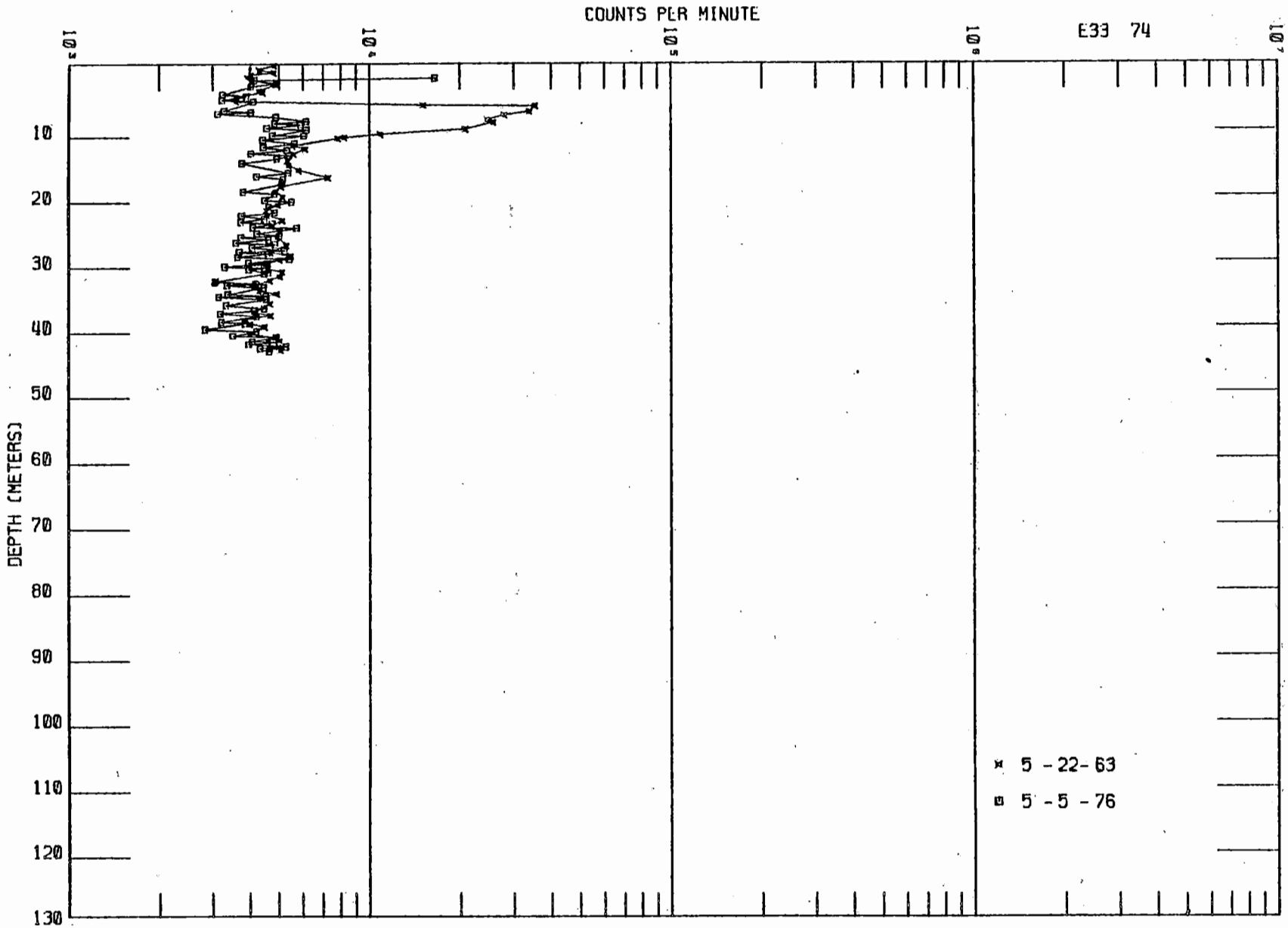

COUNTS PER MINUTE
E33 73
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
5 -22-63
5 -5 -76

9 2 1 2 4 6 6 0 8 3 6



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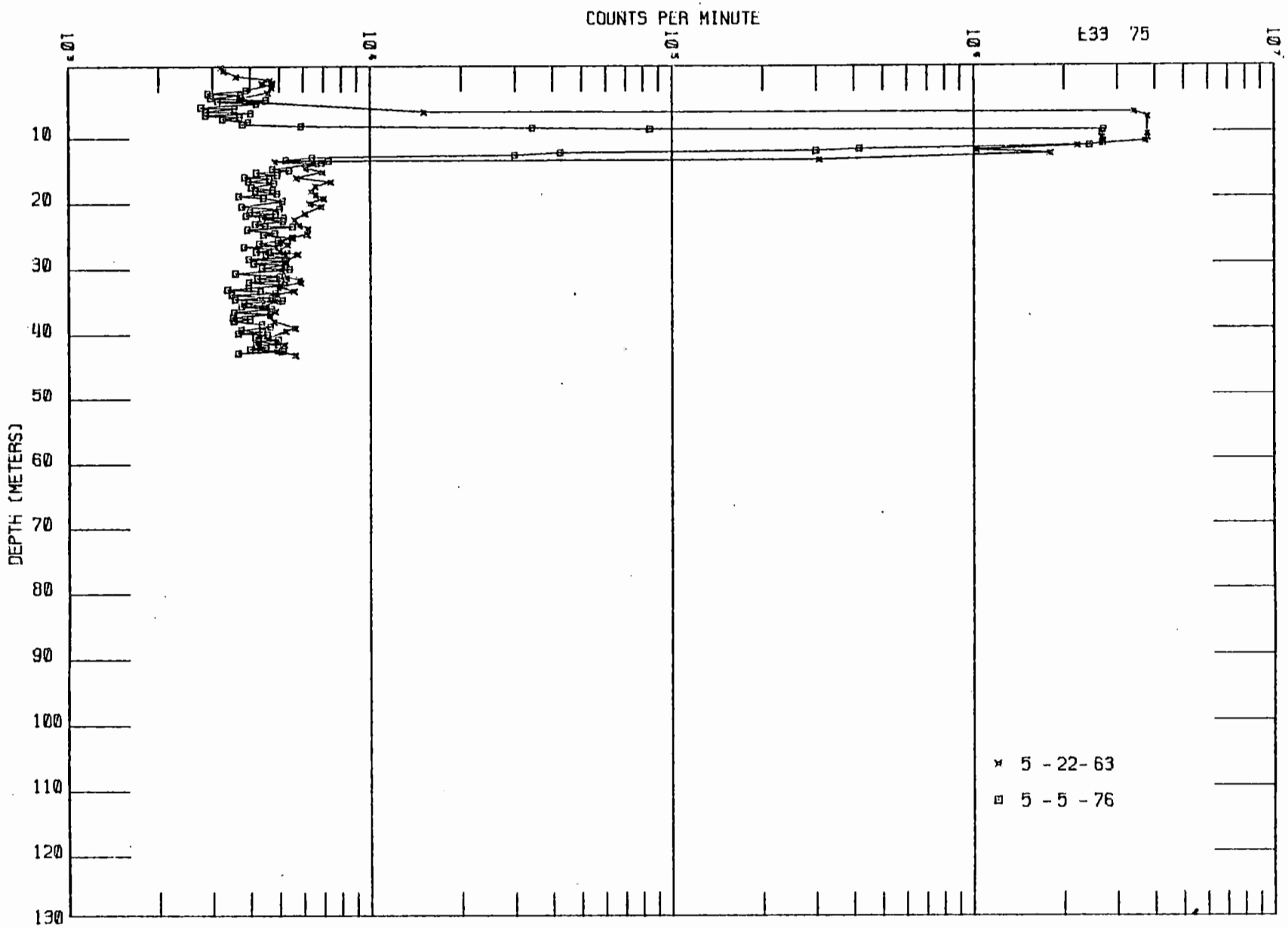
RHO-LD-28


COUNTS PER MINUTE
E33 75
DEPTH (METERS)
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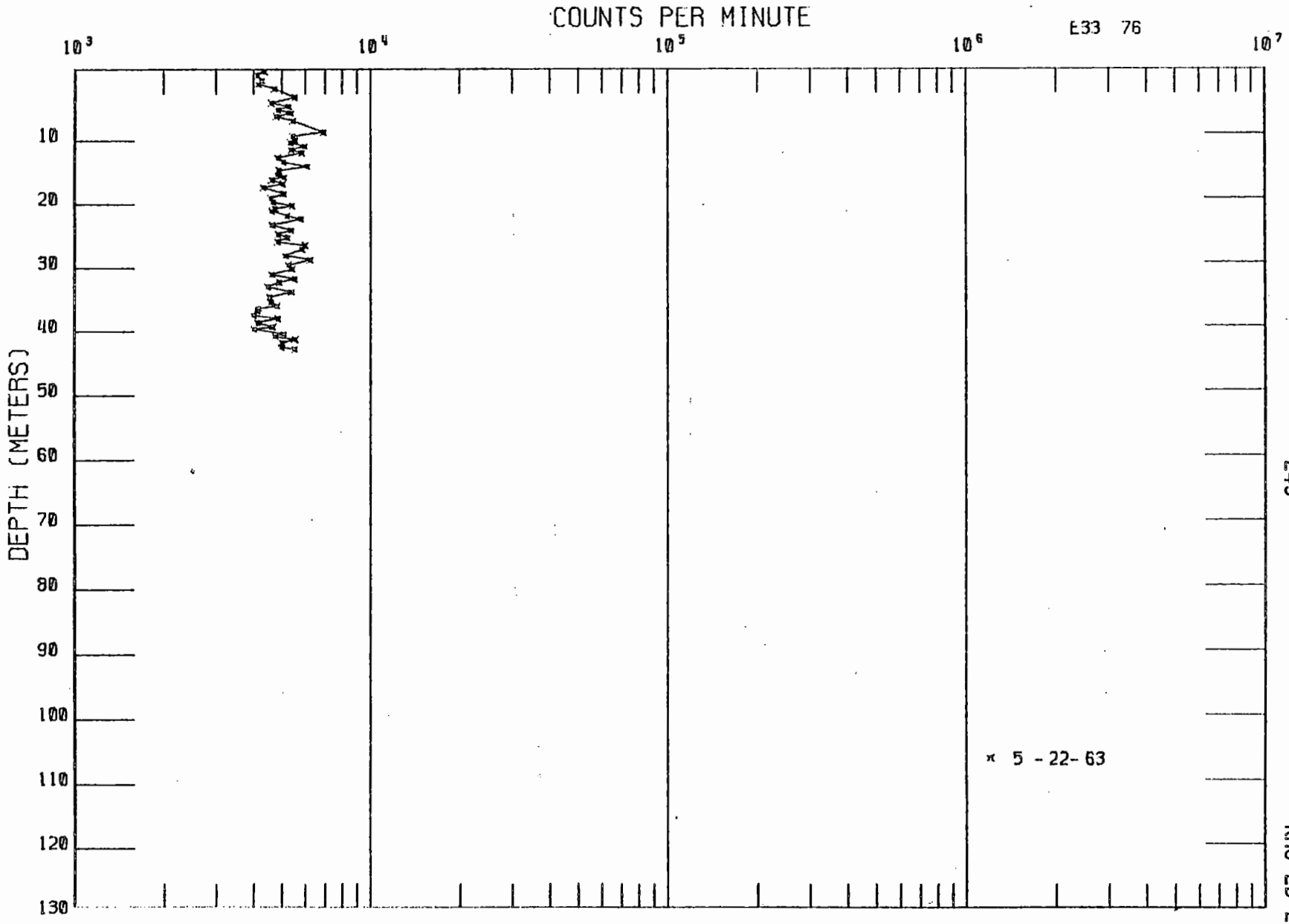
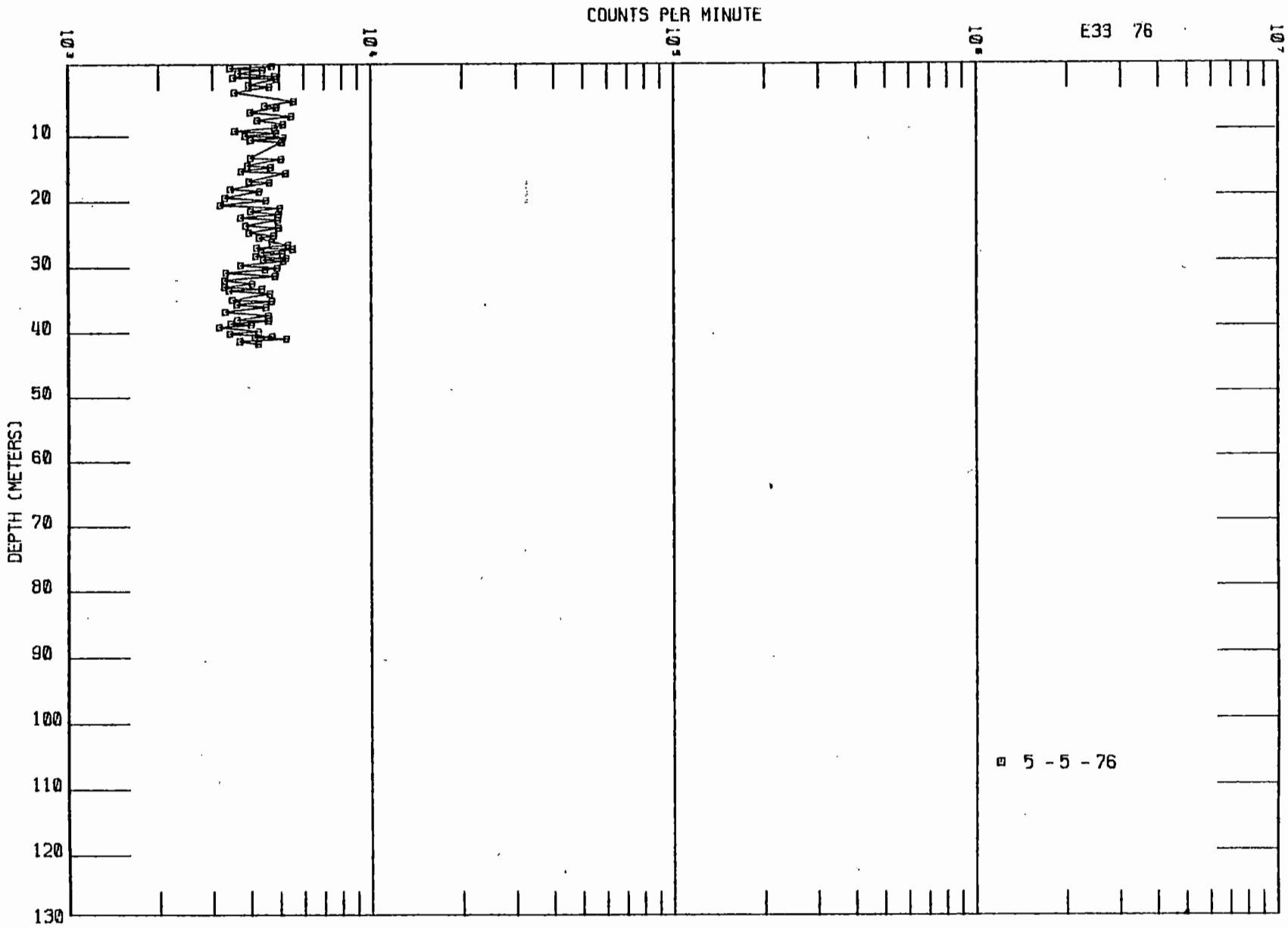
20
30
40
50
60
70
80
90
100
110
120
130
5 - 22- 63
5 - 5 - 76


COUNTS PER MINUTE
E33 76
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 22- 63

9 2 1 2 4 6 6 0 8 3 9



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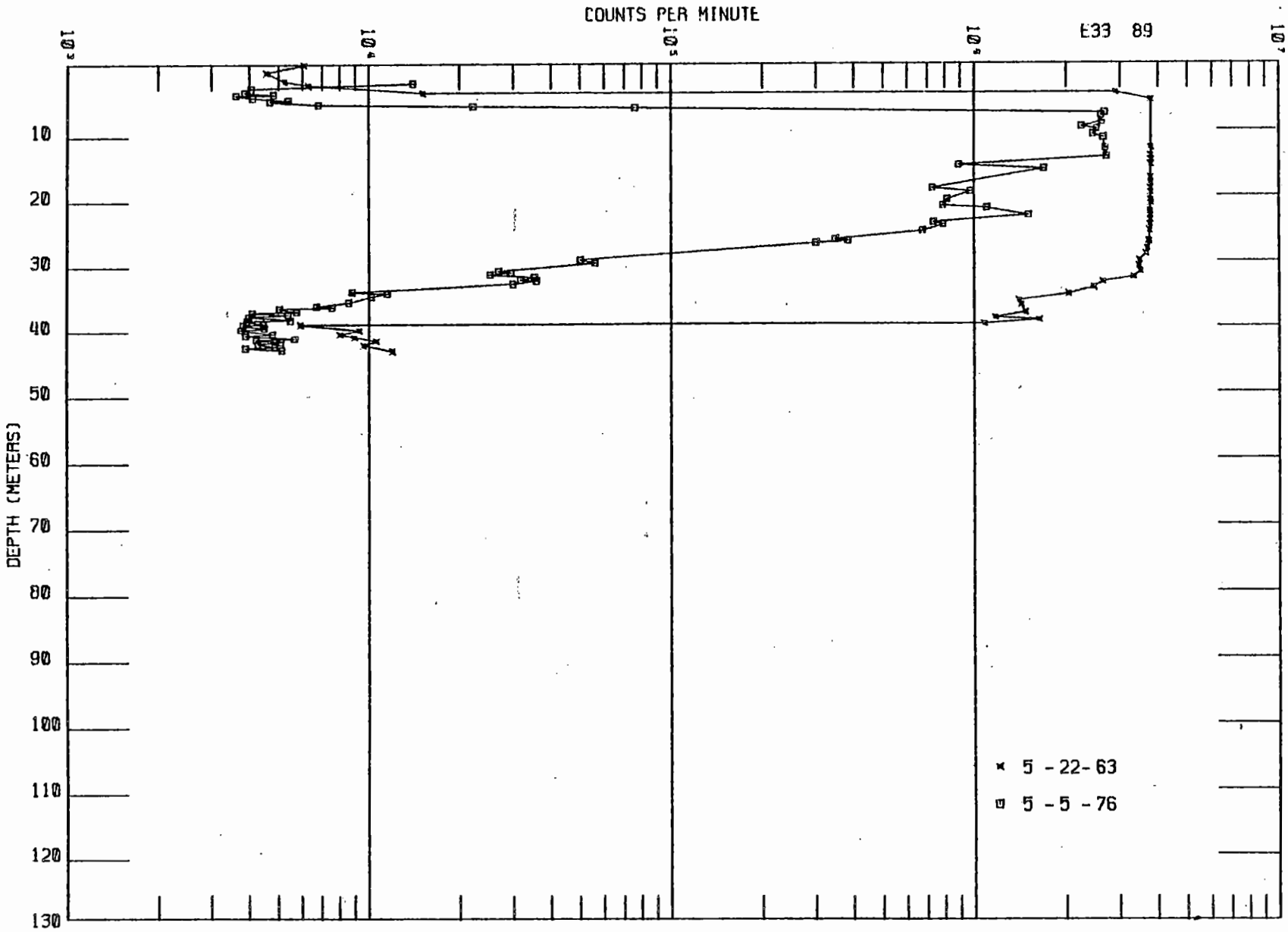
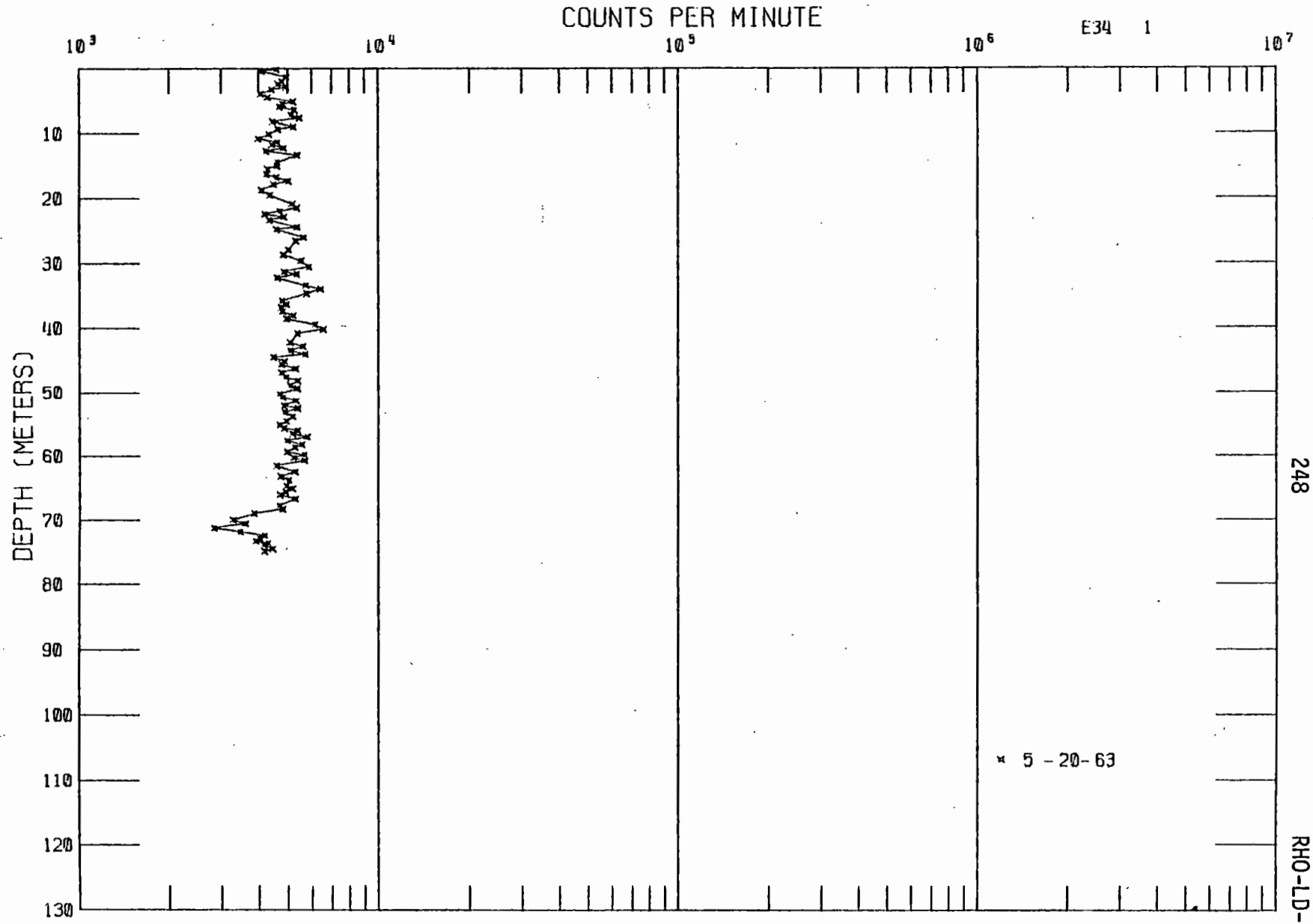
RHO-LD-28


COUNTS PER MINUTE
10^3
10^4
10^5
10^6
10^7
E33 89
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 22- 63
▫ 5 - 5 - 76


COUNTS PER MINUTE
E34 1
10^3
10^4
10^5
10^6
10^7
DEPTH (METERS)
10
20
30
40
50
60
70
80
90
100
110
120
130
× 5 - 20- 63

ACKNOWLEDGEMENTS

We wish to thank Mr. J. R. Raymond and Ms. V. L. Coburn of Pacific-Northwest Laboratories for providing the computer-generated profiles.

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9. Instruction Manual - *Pulse Logging Systems,* Gearhart-Owen Industries, Inc., Fort Worth, Texas.

10. J. W. Crosby III, E. P. Jackson, and L. M. Moe, *Techniques of Geophysical Logging of the Hanford Reservation,* Washington State University, June 29, 1976.

9 2 1 2 4 6 0 8 4 2

APPENDIX A

Listed below are the well numbers of 200 East Area crib monitoring wells and the designation of the associated *crib facility* monitored.

Well Number*	*Crib Facility* Designation	Page Number
E13-1	216-B-14	13, 14
E13-2	216-B-15	15, 16
E13-3	216-B-16	17, 18
E13-4	216-B-17	19, 20
E13-5	216-B-18	21, 22
E13-6	216-B-19	23, 24
E13-7	216-B-20	25, 26
E13-8	216-B-21	27, 28, 29
E13-9	216-B-22	30, 31, 32
E13-10	216-B-34	33, 34, 35
E13-11	216-B-24	36
E13-12	216-B-26	37
E13-13	216-B-28	38
E13-14	216-B-29	39, 40
E13-15	216-B-31	41, 42
E13-16	216-B-31	43, 44
E13-17	216-B-34	45
E13-18	216-B-34	46, 47
E13-19	216-B-28	48, 49
E13-21	216-B-16	50
E16-2	216-A-30	51
E17-1	216-A-10	52, 53
E17-2	216-A-27	54
E17-3	216-A-27	55, 56

*Well number prefixed by 299- (3)

9 2 1 2 4 6 6 0 8 4 3

Well Number	*Crib Facility* Designation	Page Number
E17-4	216-A-36A	57
E17-5	216-A-36B	58, 59
E17-6	216-A-36B	60
E17-7	216-A-36B	61
E17-8	216-A-38	62
E17-9	216-A-36A	63, 64
E17-10	216-A-36A	65, 66
E19-1	---	67
E23-1	---	68
E23-2	---	69
E24-1	216-A-5	70, 71, 72
E24-2	216-A-10	73, 74
E24-3	216-A-9	75, 76
E24-4	216-A-9	77, 78
E24-5	216-A-9	79, 80
E24-7	---	81
E24-8	216-C-5	82
E24-9	216-A-31	83
E24-10	216-A-5	84, 85
E24-11	216-A-38	86
E24-12	216-A-21	87, 88
E24-53	216-A-2	89
E24-54	216-A-4	90
E24-56	216-A-5	91
E24-57	216-A-5	92
E24-58	216-A-5	93
E24-59	216-A-10	94, 95
E24-60	216-A-10	96, 97
E24-63	216-A-9	98, 99
E25-2	216-A-1	100, 101

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Well Number	*Crib Facility Designation*	Page Number
E25-3	216-A-6	102, 103, 104
E25-4	216-A-8	105, 106
E25-5	216-A-8	107, 108
E25-6	216-A-8	109, 110, 111
E25-7	216-A-8	112, 113, 114
E25-8	216-A-8	115, 116
E25-9	216-A-8	117, 118, 119
E25-10	216-A-18	120
E25-11	216-A-30	121
E25-12	216-A-30	122
E25-14	216-A-8	123
E25-17	216-A-37	124
E25-18	216-A-37	125
E25-19	216-A-37	126
E25-20	216-A-37	127
E25-53	216-A-6	128
E25-54	216-A-7	129
E26-1	---	130
E26-2	216-A-24	131, 132
E26-3	216-A-24	133, 134
E26-4	216-A-24	135, 136
E26-5	216-A-24	137, 138, 139
E26-7	216-A-24	140
E27-1	---	141
E27-3	216-A-40	142
E27-5	216-C-10	143
E28-1	---	144
E28-2	---	145
E28-3	---	146
E28-4	---	147
E28-5	---	148
E28-6	---	149

9 2 1 2 4 6 6 0 9 4 5

Well Number	*Crib Facility* Designation	Page Number
E28-7	216-B-5	150, 151
E28-8	---	152
E28-9	216-B-12	153, 154
E28-10	---	155
E28-12	216-B-55	156
E28-13	216-B-55	157
E28-14	216-B-56	158, 159
E28-15	---	160
E28-16	216-B-12	161, 162
E28-17	216-B-10A, 216-B-10B	163, 164
E28-18	216-B-62	165
E28-19	---	166
E28-20	216-B-62	167, 168
E28-21	216-B-62	169, 170
E28-53	216-B-9	171
E28-54	216-B-9	172
E28-55	216-B-9	173
E28-56	216-B-9	174, 175
E28-57	216-B-9	176
E28-58	216-B-9	177
E28-59	216-B-9	178
E28-60	216-B-9	179, 180
E28-61	216-B-9	181
E28-64	216-B-12	182
E28-65	216-B-12	183
E28-66	216-B-12	184
E32-1	---	185
E33-1	216-B-43	186, 187, 188
E33-2	216-B-44	189, 190
E33-3	216-B-45	191, 192
E33-4	216-B-46	193, 194
E33-5	216-B-47	195, 196

9 2 1 2 4 5 6 0 8 4 6

Well Number	*Crib Facility* Designation	Page Number
E33-6	216-B-48	197, 198
E33-7	216-B-50	199, 200
E33-8	216-B-41	201, 202
E33-9	---	203
E33-10	216-B-42	204, 205
E33-11	216-B-51	206
E33-12	---	207
E33-13	---	208
E33-14	216-B-51	209
E33-15	216-B-8	210, 211, 212
E33-16	216-B-8	213, 214
E33-17	---	215, 216
E33-18	216-B-7A, 216-B-7B	217, 218
E33-19	216-B-11B	219
E33-20	216-B-11A	220, 221
E33-21	216-B-36	222, 223, 224
E33-22	216-B-45	225, 226
E33-23	216-B-46	227
E33-24	216-B-57	228
E33-25	216-B-61	229
E33-26	216-B-61	230, 231
E33-58	216-B-7A, 216-B-7B	232
E33-59	216-B-7A, 216-B-7B	233
E33-66	216-B-8	234
E33-67	216-B-8	235
E33-68	216-B-8	236
E33-69	216-B-8	237
E33-70	216-B-8	238
E33-71	216-B-8	239
E33-72	216-B-8	240, 241
E33-73	216-B-8	242
E33-74	216-B-8	243

9 2 1 2 4 5 6 0 8 4 7

Well Number	*Crib Facility* Designation	Page Number
E33-75	216-B-7A, 216-B-7B	244
E33-76	216-B-8	245, 246
E33-89	216-B-8	247
E34-1	---	248

9 2 1 2 4 6 6 0 8 4 8

APPENDIX B

Listed below are the designations of 200 East Area crib facilities and the well numbers of associated monitoring wells.

Crib Facility Designation	Well Number*	Page Number
216-A-1	E25-2	100, 101
216-A-2	E24-53	89
216-A-4	E24-54	90
216-A-5	E24-1	70, 71, 72
	E24-10	84, 85
	E24-56	91
	E24-57	92
	E24-58	93
216-A-6	E25-3	102, 103, 104
	E25-53	128
216-A-7	E25-54	129
216-A-8	E25-4	105, 106
	E25-5	107, 108
	E25-6	109, 110, 111
	E25-7	112, 113, 114
	E25-8	115, 116
	E25-9	117, 118, 119
	E25-14	123
216-A-9	E24-3	75, 76
	E24-4	77, 78
	E24-5	79, 80
	E24-63	98, 99

*Well number prefixed by 299- (3)

9 2 1 2 4 5 6 0 3 4 9

Crib Facility Designation	Well Number	Page Number
216-A-10	E17-1	52, 53
	E24-2	73, 74
	E24-59	94, 95
	E24-60	96, 97
216-A-18	E25-10	120
216-A-21	E24-12	87, 88
216-A-24	E26-2	131, 132
	E26-3	133, 134
	E26-4	135, 136
	E26-5	137, 138, 139
	E26-7	140
216-A-27	E17-2	54
	E17-3	55, 56
216-A-30	E16-2	51
	E25-11	121
	E25-12	122
216-A-31	E24-9	83
216-A-36A	E17-4	57
	E17-9	63, 64
	E17-10	65, 66
216-A-36B	E17-5	58, 59
	E17-6	60
	E17-7	61
216-A-37	E25-17	124
	E25-18	125
	E25-19	126
	E25-20	127
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