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ADDRESSEE: ~~Robert Fuller~~	ORGANIZATION: ~~DOE~~
AUTHOR: ~~J. L. Daniels, et al~~ ~~Michael Smith~~	ORGANIZATION: ~~ORAU~~ ORNL
SUBJECT: Draft Report, Results of Radiological Survey at Former Ore Storage Site, Palmerton, Pennsylvania	
SITES/PROJECTS: Palmerton Ore Buying Site	
KEYWORDS: Draft Survey Report	

ACTION ASSIGNMENT					YES ☒ NO ☐
DATE RECD.	TASK – WBS #	PRIORITY	RESP	SUPPORT	DATE DUE
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ACTION DESCRIPTION:
Review draft radiological survey report for Palmerton, site and provide comments.

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To: Doug Tonkay, OTS

December 19, 1989

From: MIchele Landis, ORAU

Subject: Draft report, Results of the Radiological Survey at the Former Ore Storage Site, Palmerton, Pennsylvania

Attached is one copy of the draft report. Please review and provide your comments to me by January 16, 1990.

Thank-you,

Michele

Michele Landis

reversed FIGURE ~~Table~~ Headings

PA.33-6

ORNL/TM-11218

Results of the Radiological Survey at the Former Ore Storage Site, Palmerton, Pennsylvania (PP001)

J. L. Quillen
J. W. Crutcher
W. D. Cottrell

DRAFT

ORNL/TM-11218

HEALTH AND SAFETY RESEARCH DIVISION

Waste Management Research and Development Programs
(Activity No. AH 10 05 00 0; NEAH001)

RESULTS OF THE RADIOLOGICAL SURVEY AT THE FORMER ORE STORAGE SITE, PALMERTON, PENNSYLVANIA (PP001)

J. L. Quillen, J. W. Crutcher, and W. D. Cottrell

Manuscript Completed — December 1989

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CONTENTS

TABLES

FIGURES

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ABSTRACT

As part of the Formerly Utilized Sites Remedial Action Program (FUSRAP), the U.S. Department of Energy (DOE) is implementing a radiological survey program to determine the radiological conditions at sites that were formerly used by the department's predecessor agencies. The radiological survey discussed in this report for the former ore storage site in Palmerton, Pennsylvania, is part of the FUSRAP effort and was conducted at the request of DOE by members of the Measurement Applications and Development group of Oak Ridge National Laboratory (ORNL) in 1988.

In 1953 and 1954 the Atomic Energy Commission (AEC) established an ore stockpile on the property of the New Jersey Zinc Corporation in Palmerton, Pennsylvania. Approximately 57 truckloads of ore (about 360 tons) were stored at this site and remained there until 1973, when the AEC initiated a clean-up program. The 1988 ORNL radiological survey included gamma measurements at the surface and at 1 m, a gamma scan at the surface, gamma logging of 80 auger holes, and collection of 161 surface and subsurface soil samples. Of these 161 soil samples, 98% were below DOE guidelines for ^{226}Ra concentration in soil. Interpretation of the data suggests small, isolated spots of residual ore. The data indicate that it is highly unlikely that an individual living or working on this site could receive a radiation dose approaching the 100 mrem annual limit. However, it is suggested that DOE evaluate potential exposures at this site to ensure compliance with their policy that all exposures to radiation are reduced to levels that are as low as reasonably achievable.

RESULTS OF THE RADIOLOGICAL SURVEY AT THE FORMER ORE STORAGE SITE, PALMERTON, PENNSYLVANIA (PP001)*

INTRODUCTION

During the early 1950s the Atomic Energy Commission (AEC) implemented a program to identify potential sources of domestic uranium. Several sites in eastern Pennsylvania underwent exploratory mining. To support the development of eastern uranium mines and to meet the AEC's goals for procurement and stockpiling of uranium ore, in 1953 and 1954 the AEC established an ore stockpile on the property of the New Jersey Zinc Corporation in Palmerton, Pennsylvania. Approximately 57 truckloads of ore (about 360 tons), with an average uranium oxide content of 0.21%, were stored at this site. The ore remained there until 1973 when, as an indirect result of the Grand Junction mill tailings legislation, the AEC initiated a program to evaluate and clean up its ore storage or stockpile locations.[1]

The AEC cleanup plan for the Palmerton site called for the removal of the ore and the first 15 cm (6 in.) of soil. The ore and soil were transported to the AEC Feed Materials Center in Fernald, Ohio, for disposal in the plant's raffinate pits. During removal operations, some chunks of ore were inadvertently buried, necessitating additional soil excavation. The area at the east end of the stockpile was excavated an additional 61 to 76 cm (2 to 2.5 ft) to ensure removal of all the ore, and this material was disposed of in the New Jersey Zinc slag dump.[1]

The AEC arbitrarily set the maximum acceptable residual radioactivity level at 20 μR/h above background. The post-removal survey, completed in July 1973, found all areas to be within acceptable limits. One air sample taken prior to backfilling contained a radon concentration of 6.4 pCi/L, or 20 times background, which was in excess of the initial radon guideline (2 times background). Additional samples and measurements were taken later in the year (September 1973) at both background locations and the ore storage site. Radon samples indicated that levels at the site (0.5 pCi/L) were actually lower than those at background locations (1.6 pCi/L). External gamma measurements in the areas excavated and backfilled and around the railroad tracks averaged 8 μR/h, with a maximum measurement of 11 μR/h. Based on this second set of measurements, and because all the gamma measurements were within applicable guidelines, the site was considered acceptable and was released to the owner.[1]

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*The survey was performed by members of the Measurement Applications and Development group of the Health and Safety Research Division at Oak Ridge National Laboratory under DOE contract DE-AC05-84OR21400.

As part of the Formerly Utilized Sites Remedial Action Program (FUSRAP), the U.S. Department of Energy (DOE) is implementing a radiological survey program to determine the radiological conditions at sites that were used by the department's predecessor agencies. Although the final Palmerton site report indicated that the site met the criteria as defined at the time of cleanup, DOE determined that supporting radiological data were not sufficient to demonstrate that contemporary standards were met everywhere on the site. Subsequent radiological criteria and guidelines have become more stringent for the release of such sites for unrestricted use. Thus, the data were insufficient to demonstrate that current FUSRAP standards are met.

A preliminary radiological scoping survey was conducted at the request of DOE by members of the Measurement Applications and Development group of Oak Ridge National Laboratory (ORNL) on May 10, 1988, at the Palmerton site. The results of this survey indicated the possibility of residual contamination. In order to determine the extent of contamination, a comprehensive survey was performed by ORNL in July and August of 1988.

SURVEY METHODS

The radiological survey included (1) a gamma scan at the surface and measurement of gamma radiation levels at the surface and at 1 m, throughout the site, (2) collection of surface and subsurface soil samples, and (3) gamma logging of auger holes. The radiological survey followed a plan developed at ORNL for this site.[2] For convenience and in order to arrive at meaningful estimates of the average concentration levels, the area to be surveyed was divided into a grid of 15-m (50-ft) squares (Fig. 1). Photographs characterizing the site at the time of the survey (August 1988) are shown in Figs. 2–6.

To define the extent of possible subsurface soil contamination, auger holes were drilled to varying depths. A plastic pipe was placed in each hole, and a NaI scintillation probe was lowered inside the pipe. The probe was encased in a lead shield with a horizontal row of collimating slits on the side. This collimation allows measurements of contamination-induced gamma radiation intensities to be taken within small increments of the hole depth. Measurements were made at 15-to-46-cm (6-to-18-in.) intervals. If the gamma readings in the hole were elevated, a soil sample was scraped from the wall of the auger hole at the point showing the highest gamma radiation level. The auger hole loggings were used to select locations where further soil sampling would be useful. A split-spoon sampler was used to collect subsurface samples at known depths. In some auger holes, a combination of split-spoon sampling and side-wall scraping was used to collect samples. These survey methods followed the plan outlined in Reference 2. A comprehensive description of the survey methods and instrumentation has been presented in another report.[3]

SURVEY RESULTS

Applicable federal guidelines are summarized in Table 1. Normal background radiation levels for the Palmerton, Pennsylvania, area are presented in Table 2. These data are provided for comparison with survey results presented in this section. All direct measurement results presented in this report are gross readings; background radiation levels have not been subtracted. Similarly, background concentrations have not been subtracted from radionuclide concentrations measured in soil samples.

Gamma Radiation Levels

Gamma radiation levels measured during a scan of the surface, at 1 m from the surface, and the range of gamma exposure rates during the scan of the grid block are given in Table 3. Gamma exposure rates over the major portion of the site ranged from 5 to 25 μR/h and are shown in Fig. 7. Small areas of elevated gamma measurements (hot spots) were noted during the scan of the grid blocks and are shown in Table 3. Areas ≥25 μR/h occurred in seven grid blocks: 4+50, BL; 5+00, BL; 4+50, 50R; 5+00, 50R; 5+50, 50R; 3+00, 100R; and 3+50, 100R.

Systematic and Biased Soil Samples

Thirteen systematic soil samples were taken from seven locations, and eight biased soil samples were taken from three locations. These samples were taken at varying depths and were analyzed for radionuclide concentrations. The results of analysis for ^{226}Ra, ^{232}Th, and ^{238}U are shown in Table 4. Locations of the systematic (S) and biased (B) samples are shown in Fig. 7. Concentrations of ^{226}Ra, ^{232}Th, and ^{238}U in the systematic soil samples ranged from 0.85 to 1.9 pCi/g, 0.34 to 2.3 pCi/g, and 0.82 to 1.7 pCi/g, respectively. In the biased soil samples, concentrations of ^{226}Ra, ^{232}Th, and ^{238}U ranged from 1.3 to 750 pCi/g, 1.2 to 1.9 pCi/g, and <3.0 to 670, respectively.

Because of past usage of this site for uranium ore storage, it seemed likely that if any elevated radiation levels existed, they would result from natural uranium. Therefore, a comparison was made of the ^{226}Ra and ^{238}U concentrations listed in Table 4. This comparison verified that, generally, the two radionuclides are in secular equilibrium, which supports the case for the presence of uranium ore. The applicable DOE guidelines for sites containing uranium ore residuals in soil are the ^{226}Ra guidelines for surface and subsurface soils given in Table 1. All the systematic soil samples are well within these guidelines. DOE guidelines for ^{226}Ra are exceeded in three biased soil samples: B2, B3A, and B3B. The high concentrations of ^{226}Ra and ^{238}U in these samples (maximum concentrations occurring in sample B2: 750 pCi/g of ^{226}Ra and 670 pCi/g of ^{238}U) appear to result from small, residual chunks of ore that were buried during the 1973 soil excavation or from "fines" (i.e., small particles of ore) that have become mixed with soil.

Auger Hole Soil Samples and Gamma Logging

To determine if subsurface contamination existed and, if so, to define its extent, 140 soil samples were taken from 80 auger holes drilled to varying depths on the site. Varying thicknesses of subsurface soil were sampled from depths of 0 to 198 cm (0 to 6.5 ft) in auger holes (A) drilled at locations indicated in Fig. 8. The results of analyses of these samples are given in Table 4. Concentrations of ^{226}Ra, ^{232}Th, and ^{238}U ranged from 0.46 to 260 pCi/g, 0.26 to 2.4 pCi/g, and 0.70 to 280 pCi/g, respectively. The maximum concentrations of ^{226}Ra (260 pCi/g) and ^{238}U (280 pCi/g) were found in soil sample A58C at a depth of 15 to 31 cm. The 139 other soil samples were slightly elevated above background concentrations of radionuclides but below DOE guidelines.

Gamma logging was performed in each of the auger holes to characterize and further define the extent of possible contamination. The logging technique used here is not radionuclide specific. However, logging data, in conjunction with soil sample analyses data, may be used to estimate regions of elevated radionuclide concentration in auger holes when compared with background levels for the area. Following a comparison of these data, it appears that any shielded scintillator readings of 1000 counts per minute (cpm) or greater generally indicate the presence of elevated concentrations of ^{226}Ra and/or ^{232}Th. Data from the gamma profiles of the logged auger holes are graphically represented in Figs. 9–88. Readings between the surface and 2.1 m (0 to 7 ft) were >1000 in 21 of the 80 auger holes, with the maximum reading occurring in auger hole A58 at a depth of 30 cm (1 ft). The location of the maximum gamma reading corresponds to the location of the soil sample with the maximum concentrations of radionuclides (Table 4). In auger hole A56 a large chunk of ore was removed after gamma logging. Following removal of the ore, the hole was relogged. Gamma readings and radionuclide concentrations were near background levels (Fig. 64 and Table 4). Other soil samples revealed slight elevation above background radionuclide concentrations but were within DOE guidelines.

135
8B
140A

SIGNIFICANCE OF FINDINGS

Gamma exposure rates and concentrations of radionuclides in soil samples from the former ore storage site in Palmerton, Pennsylvania, indicate small, isolated areas of residual radioactive material. To further define the contamination, extensive gamma measurements were taken, and 161 soil samples were analyzed for radionuclide concentrations. Comparison of the ^{226}Ra and ^{238}U concentrations in these soil samples verified that the two radionuclides are, generally, in secular equilibrium, which supports the case for the presence of uranium ore. Thus, DOE guidelines for concentrations of ^{226}Ra in surface and subsurface soil are applicable. These ^{226}Ra guidelines were exceeded in four soil samples taken at three soil sample locations: B2 (750 pCi/g), B3 (33 pCi/g in sample B3A and 30 pCi/g in sample B3B), and A58 (260 pCi/g in sample A58C).

Mention that B3 would not exceed hot spot limits

Of the 161 soil samples taken, 157 (98%) were below DOE guidelines for ^{226}Ra concentrations in soil. Interpretation of the data suggests small, isolated spots of residual ore or small areas of soil that has become mixed with particles of uranium ore. The data

A58 does not exceed 30×guideline
30×15 = 450

What does the logging tell us?

indicate that it is highly unlikely that an individual living or working on this site could receive an exposure approaching the 100-mrem annual limit. However, it is suggested that DOE evaluate potential exposures on this site to ensure that all exposures to radiation have been reduced to levels as low as reasonably achievable (ALARA).

REFERENCES

1. "Summary and Preliminary Analysis for the Ore Storage Site in Palmerton, Pennsylvania," report by Aerospace for U.S. DOE Office of Nuclear Energy, September 1985.

2. W. D. Cottrell, Oak Ridge National Laboratory, correspondence to A. Wallo III, U.S. Department of Energy, Headquarters, "Radiological Survey Plan for the Former Ore Storage Site in Palmerton, Pennsylvania, July 20, 1988.

3. T. E. Myrick, B. A. Berven, W. D. Cottrell, and W. A. Goldsmith, *Procedures Manual for the ORNL Radiological Survey Activities (RASA) Program*, ORNL/TM-8600, Oak Ridge National Laboratory, Oak Ridge, Tenn., April 1987.

4. *Guidelines for Residual Radioactivity at Formerly Utilized Sites, Remedial Action Program and Remote Surplus Facilities Management Program Sites*, Rev. 2, U.S. Department of Energy, March 1987.

Table 1. Applicable guidelines for protection against radiation

Mode of exposure	Exposure conditions	Guideline value
Radionuclide concentrations in soil	Maximum permissible concentration of the following radionuclides in soil above background levels, averaged over a 100 m^2 area	5 pCi/g averaged over the first 15 cm of soil below the surface; 15 pCi/g when averaged over 15-cm-thick soil layers more than 15 cm below the surface
	^{226}Ra	
	^{232}Th	
	^{238}U	Derived (site specific)
Guidelines for nonhomogeneous contamination (used in addition to the 100 m^2 guideline)[a]	Applicable to locations meeting the above criterion but averaged over a ≤25 m^2 area with significantly elevated concentrations of radionuclides	Multiplication factor for application to "hot spots" varying in size as follows:
		(m^2) (Factor)[b]
		<1 10
		1–<3 6
		3–<10 3
		10–25 2

[a]DOE guidelines specify that every reasonable effort shall be made to identify and to remove any source which has a concentration exceeding 30 times the guideline value, irrespective of area.

[b]Multiple of guideline value for radionuclide concentrations averaged over a 100-m^2 area. These multipliation factors are applicable to surface areas <25 m^2.

Source: Adapted from *Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites,* Rev. 2, U.S. Department of Energy, March 1987.

Table 2. Background radiation levels for the Palmerton, Pennsylvania, area

Type of radiation measurement or sample	Radionuclide level or radionuclide concentration
Gamma exposure rate at 1 m (μR/h)[a]	9.3
Concentration of radionuclides in soil (pCi/g)[b]	
^{226}Ra	0.81
^{232}Th	0.69
^{238}U	0.63

[a]Exposure rate determined from pressurized ionization chamber measurements taken at eight locations near the former Palmerton ore storage site.

[b]*Source:* T. E. Myrick, B. A. Berven, and F. F. Haywood, *State Background Radiation Levels: Results of Measurments Taken During 1975–1979,* Oak Ridge National Laboratory, ORNL/TM-7343 (November 1981).

Table 3. Gamma exposure rate measurements at the former ore storage site, Palmerton, Pennsylvania (PP001)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rates during scan of grid block[c] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface	
0+00, BL	7.5	7.5	5–10
0+50, BL	6.3	5.8	4.5–8
1+00, BL	7.5	8.3	5–13
1+50, BL	7	7.5	5–7.5
2+00, BL	6.8	6.8	5–8.8
2+50, BL	6.3	6.8	3.8–7.5
3+00, BL	7.5	7	5–8.8
3+50, BL	7.5	7	5–10
4+00, BL	7.5	7	5–10
4+50, BL	7.5	7	5–25
5+00, BL	8	8	5–75
5+50, BL	8	7	5–10
6+00, BL	7.5	7.5	5–10
6+50, BL	8	8.8	5.8–9.5
7+00, BL	9.3	9.3	5–11
7+50, BL	8.8	9.3	5–8.8
8+00, BL	8.8	8.8	5–8
8+32, BL	8	8	–
0+00, 50R	6.5	5.8	3.8–6.3
0+50, 50R	7.5	8.8	4.5–8.8
1+00, 50R	7.3	6.5	5–11
1+50, 50R	9.3	10	3.8–7.5
2+00, 50R	6.8	6.8	4.5–6.3
2+50, 50R	6.3	6.3	5–7.5
3+00, 50R	6.3	5.8	3.8–6.3
3+50, 50R	5.8	5.8	4.5–6.3

Table 3 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rates during scan of grid block[c] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface	
4+00, 50R	6.5	6.5	5–7.5
4+50, 50R	6.3	6.8	6.3–125
5+00, 50R	6.3	6.3	5–150
5+50, 50R	6.3	6.3	7–100
6+00, 50R	7.5	7	3.8–6.3
0+00, 100R	6.3	6.3	4.8–5.8
0+50, 100R	5.5	5.5	3.8–6.3
1+00, 100R	4.5	4.3	3.8–5
1+50, 100R	5.8	5.8	3.8–6.3
2+00, 100R	5.8	5.8	3.8–5.5
2+50, 100R	6.3	6.8	3.8–7.5
3+00, 100R	6.8	6.8	3.8–25
3+50, 100R	6.8	6.3	5–25
4+00, 100R	5.8	6.3	4.5–8.8
4+50, 100R	7	5.5	–
0+00, 150R	5.5	5.5	5–7.5
0+50, 150R	3.8	4.3	5–7.5
1+00, 150R	5	4.5	3.8–6.3
1+50, 150R	4.5	4.5	5–7.5
2+00, 150R	4.5	5	3.8–7
2+50, 150R	5	5	3.8–6.3
3+00, 150R	5	4.5	–
3+50, 150R	6.3	5.5	–
0+00, 200R	5.5	5.5	3.8–7.5
0+50, 200R	4.5	4	3.8–5
1+00, 200R	3.8	3.8	3.8–6.3
1+50, 200R	3.8	3.8	–

Table 3 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rates during scan of grid block[c] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface	
0+00, 225R	5.8	6.3	–
0+50, 225R	3.8	3.8	–

[a]Grid locations are shown on Fig. 1.

[b]Grid point measurements are discrete measurements taken at grid points.

[c]Grid block measurements are obtained from a gamma scan of the entire grid block.

Table 4. Concentration of radionuclides in soil samples taken from the former ore storage site, Palmerton, Pennsylvania (PP001)

Sample No.[a]	Depth (cm)	Radionuclide concentration (pCi/g)[b]		
		^{226}Ra	^{232}Th	^{238}U
		Systematic samples[c]		
S1A	0–15	1.5 ± 0.04	1.5 ± 0.06	<2.7
S1B	15–31	1.7 ± 0.1	1.8 ± 0.1	<6.5
S1C	46–61	1.9 ± 0.1	2.3 ± 0.2	<8.2
S1D	76–84	1.2 ± 0.04	1.4 ± 0.08	<4.2
S2A	0–15	1.0 ± 0.02	0.34 ± 0.04	0.82 ± 0.4
S2B	15–25	1.1 ± 0.06	0.42 ± 0.8	<3.4
S2C	25–31	1.0 ± 0.06	0.44 ± 0.08	<3.9
S3A	0–15	0.85 ± 0.04	0.76 ± 0.06	<3.5
S3B	15–31	1.3 ± 0.06	1.2 ± 0.09	<1.7
S3C	46–61	1.2 ± 0.1	1.4 ± 0.2	<8.9
S6	76–81	1.3 ± 0.04	1.3 ± 0.06	1.7 ± 0.8
S7A	31–46	1.5 ± 0.04	1.2 ± 0.04	1.7 ± 0.6
S7B	76–84	1.2 ± 0.04	1.4 ± 0.06	<2.9
		Biased samples[d]		
B1A	0–15	5.0 ± 0.1	1.6 ± 0.1	<7.5
B1B	15–31	2.0 ± 0.08	1.9 ± 0.08	<3.5
B1C	31–46	2.1 ± 0.04	1.9 ± 0.08	3.5 ± 1
B1D	61–76	1.3 ± 0.04	1.4 ± 0.06	<3.0
B1E	91–107	1.4 ± 0.08	1.3 ± 0.1	<5.3
B2	25–28	750 ± 5	<1.6	670 ± 60
B3A	0–3	33 ± 0.3	1.4 ± 0.3	43 ± 10
B3B	3–15	30 ± 0.3	1.2 ± 0.3	73 ± 10
		Auger samples[e]		
A1	122–137	0.98 ± 0.01	1.1 ± 0.01	1.4 ± 0.2
A2	76–91	1.2 ± 0.01	1.2 ± 0.03	1.2 ± 0.5
A3	76–91	1.3 ± 0.03	1.4 ± 0.05	<4.7

Table 4 (continued)

Sample No.[a]	Depth (cm)	Radionuclide concentration (pCi/g)[b]		
		^{226}Ra	^{232}Th	^{238}U
		Auger samples[e]		
A4	76–91	1.2 ± 0.01	1.3 ± 0.02	1.3 ± 0.4
A5	137–152	1.1 ± 0.01	1.2 ± 0.02	1.6 ± 0.2
A6	46–61	1.3 ± 0.03	1.4 ± 0.05	1.5 ± 0.7
A7	61–76	1.3 ± 0.01	1.1 ± 0.02	<1.3
A8	76–91	1.1 ± 0.02	1.1 ± 0.04	1.3 ± 0.6
A9	46–61	1.0 ± 0.01	1.2 ± 0.02	1.2 ± 0.3
A10	46–61	1.1 ± 0.01	1.1 ± 0.02	1.3 ± 0.2
A11	46–61	1.1 ± 0.02	1.1 ± 0.03	<2.6
A12	15–31	2.2 ± 0.04	1.2 ± 0.05	8.9 ± 0.8
A13A	0–5	1.2 ± 0.02	0.46 ± 0.02	<0.71
A13B	31–46	1.5 ± 0.01	1.3 ± 0.02	1.8 ± 0.4
A14	76–91	1.1 ± 0.01	1.2 ± 0.02	<1.4
A15A	0–5	1.3 ± 0.01	0.48 ± 0.01	1.4 ± 0.3
A15B	46–61	1.3 ± 0.03	1.4 ± 0.05	<4.2
A16	31–46	1.2 ± 0.02	1.2 ± 0.04	3.1 ± 0.8
A17	0–0	1.5 ± 0.01	1.3 ± 0.02	2.6 ± 0.5
A18A	0–5	1.1 ± 0.02	0.32 ± 0.02	1.4 ± 0.4
A18B	76–91	1.3 ± 0.01	1.4 ± 0.02	2.3 ± 0.4
A19	91–107	1.1 ± 0.01	1.2 ± 0.02	1.6 ± 0.2
A20A	0–5	1.9 ± 0.02	1.0 ± 0.03	<2.9
A20B	76–91	1.2 ± 0.02	1.4 ± 0.04	<3.3
A21	76–91	1.2 ± 0.02	1.4 ± 0.05	<1.5
A22A	0–5	1.2 ± 0.01	0.97 ± 0.02	1.7 ± 0.3
A22B	31–46	1.2 ± 0.03	1.4 ± 0.05	<4.1
A23	76–91	1.3 ± 0.01	1.4 ± 0.02	1.8 ± 0.2
A24A	0–5	0.61 ± 0.01	0.31 ± 0.02	<1.9
A24B	61–76	1.1 ± 0.03	1.2 ± 0.05	<1.7

Table 4 (continued)

Sample No.[a]	Depth (cm)	Radionuclide concentration (pCi/g)[b]		
		^{226}Ra	^{232}Th	^{238}U
		Auger samples[e]		
A25	46–61	1.1 ± 0.01	0.42 ± 0.01	0.97 ± 0.2
A26A	0–5	1.4 ± 0.02	0.87 ± 0.02	<2.5
A26B	31–46	1.6 ± 0.02	1.1 ± 0.04	<3.2
A27	15–31	1.7 ± 0.02	1.2 ± 0.03	<2.4
A28A	0–5	1.2 ± 0.02	0.45 ± 0.02	<2.3
A28B	61–76	1.7 ± 0.02	0.97 ± 0.03	<3.0
A29	61–76	1.3 ± 0.03	1.4 ± 0.04	2.6 ± 0.8
A30A	0–5	0.86 ± 0.01	0.50 ± 0.01	<0.90
A30B	46–61	1.3 ± 0.01	1.3 ± 0.04	1.2 ± 0.2
A31	91–107	1.2 ± 0.02	1.4 ± 0.04	<3.1
A32A	0–5	0.90 ± 0.01	0.64 ± 0.01	1.0 ± 0.3
A32B	152–168	1.2 ± 0.02	1.3 ± 0.05	<1.6
A33	107–122	1.4 ± 0.03	1.5 ± 0.05	3.5 ± 0.8
A34A	0–5	1.0 ± 0.01	0.44 ± 0.01	0.81 ± 0.2
A34B	107–122	1.1 ± 0.03	1.3 ± 0.04	4.6 ± 1
A35	91–107	1.2 ± 0.02	1.3 ± 0.05	<4.0
A36A	0–5	1.7 ± 0.04	1.3 ± 0.05	<4.5
A36B	46–61	1.4 ± 0.01	1.3 ± 0.03	<2.2
A37	61–76	1.4 ± 0.01	1.1 ± 0.01	1.6 ± 0.3
A38A	0–5	0.86 ± 0.01	0.66 ± 0.01	0.80 ± 0.1
A38B	61–76	1.2 ± 0.02	1.3 ± 0.04	<3.4
A39	46–61	2.2 ± 0.05	2.4 ± 0.1	2.9 ± 2
A40A	0–5	0.56 ± 0.01	0.50 ± 0.02	1.2 ± 0.3
A40B	91–107	1.1 ± 0.02	1.1 ± 0.03	2.3 ± 0.6
A41	91–107	1.1 ± 0.01	1.3 ± 0.02	1.2 ± 0.2
A42A	0–5	0.46 ± 0.01	0.41 ± 0.02	<1.3
A42B	61–76	1.2 ± 0.01	1.4 ± 0.02	1.3 ± 0.3

Table 4 (continued)

Sample No.[a]	Depth (cm)	Radionuclide concentration (pCi/g)[b]		
		^{226}Ra	^{232}Th	^{238}U
		Auger samples[e]		
A43	137–152	1.2 ± 0.01	1.2 ± 0.04	1.5 ± 0.2
A44A	0–5	0.76 ± 0.01	0.26 ± 0.01	0.70 ± 0.1
A44B	46–61	1.7 ± 0.04	1.8 ± 0.07	<2.4
A45	91–107	1.1 ± 0.01	1.3 ± 0.01	1.7 ± 0.2
A46A	0–5	0.48 ± 0.01	0.40 ± 0.02	<1.8
A46B	91–107	1.2 ± 0.01	1.2 ± 0.02	1.3 ± 0.2
A47A	0–15	2.0 ± 0.04	2.2 ± 0.07	<5.9
A47B	31–61	1.3 ± 0.01	1.4 ± 0.02	<1.5
A47C	61–91	1.2 ± 0.02	1.4 ± 0.04	<2.9
A47D	91–107	1.1 ± 0.02	1.2 ± 0.03	1.0 ± 0.4
A48A	0–15	1.2 ± 0.02	0.56 ± 0.02	1.1 ± 0.4
A48B	46–61	1.3 ± 0.02	1.3 ± 0.04	2.5 ± 0.6
A48C	61–76	1.3 ± 0.01	1.3 ± 0.02	2.2 ± 0.3
A48D	76–91	1.2 ± 0.01	1.5 ± 0.02	2.1 ± 0.2
A48E	91–107	1.4 ± 0.01	1.6 ± 0.02	<1.6
A48F	107–122	1.3 ± 0.02	1.6 ± 0.04	<3.7
A48G	122–137	1.3 ± 0.01	1.5 ± 0.02	1.8 ± 0.4
A48H	137–168	1.0 ± 0.02	1.2 ± 0.04	1.3 ± 0.5
A49A	0–15	1.1 ± 0.01	0.56 ± 0.01	1.1 ± 0.2
A49B	31–61	1.4 ± 0.02	1.4 ± 0.03	<2.7
A49C	61–76	1.3 ± 0.03	1.3 ± 0.04	2.6 ± 0.5
A49D	76–91	1.3 ± 0.01	1.4 ± 0.02	1.9 ± 0.5
A50A	31–46	1.9 ± 0.01	1.3 ± 0.02	1.8 ± 0.3
A50B	46–61	2.7 ± 0.02	1.5 ± 0.04	3.0 ± 0.6
A50C	61–91	2.4 ± 0.02	1.5 ± 0.03	2.5 ± 0.4
A50D	122–152	1.4 ± 0.03	1.3 ± 0.05	<1.6
A50E	152–168	1.3 ± 0.01	1.4 ± 0.02	1.8 ± 0.4

Table 4 (continued)

Sample No.[a]	Depth (cm)	Radionuclide concentration (pCi/g)[b]		
		^{226}Ra	^{232}Th	^{238}U
		Auger samples[e]		
A51A	76–91	1.7 ± 0.02	1.2 ± 0.04	<3.3
A51B	91–107	1.4 ± 0.01	1.4 ± 0.02	1.7 ± 0.4
A52A	46–76	1.3 ± 0.01	1.4 ± 0.02	1.1 ± 0.3
A53A	76–107	1.4 ± 0.03	1.4 ± 0.05	<3.9
A54A	31–46	1.4 ± 0.03	1.4 ± 0.05	<5.2
A54B	46–61	1.4 ± 0.02	1.4 ± 0.04	<3.1
A54C	61–76	4.4 ± 0.05	1.5 ± 0.06	<6.6
A54D	76–91	1.5 ± 0.01	1.4 ± 0.02	1.4 ± 0.4
A54E	91–107	3.2 ± 0.03	1.3 ± 0.04	2.9 ± 0.6
A54F	107–122	1.4 ± 0.02	1.3 ± 0.04	2.1 ± 0.6
A54G	122–152	1.7 ± 0.01	1.3 ± 0.02	2.0 ± 0.3
A54H	152–167	1.1 ± 0.01	1.1 ± 0.02	1.9 ± 0.3
A55A	61–76	1.3 ± 0.01	0.81 ± 0.01	1.3 ± 0.2
A55B	76–91	1.2 ± 0.03	1.3 ± 0.05	<1.6
A56A	0–15	1.2 ± 0.02	0.37 ± 0.02	1.1 ± 0.4
A56B	31–61	0.99 ± 0.01	1.1 ± 0.02	1.6 ± 0.4
A57A	31–46	1.3 ± 0.01	1.4 ± 0.02	1.5 ± 0.3
A57B	46–61	1.3 ± 0.02	1.4 ± 0.03	<2.9
A57C	61–76	1.4 ± 0.03	1.5 ± 0.06	<4.7
A57D	76–91	1.4 ± 0.02	1.3 ± 0.04	2.0 ± 0.6
A57E	91–107	1.3 ± 0.01	0.93 ± 0.02	1.6 ± 0.3
A58A	31–61	2.0 ± 0.03	1.5 ± 0.05	<4.7
A58B	61–76	4.6 ± 0.05	1.4 ± 0.07	7.6 ± 2
A58C	15–31	260 ± 0.9	<2.0	280 ± 30
A59A	31–46	1.4 ± 0.03	1.5 ± 0.05	3.6 ± 2
A59B	46–61	1.2 ± 0.02	1.4 ± 0.04	<3.2
A59C	61–76	1.3 ± 0.01	1.4 ± 0.02	1.9 ± 0.4

Table 4 (continued)

Sample No.[a]	Depth (cm)	Radionuclide concentration (pCi/g)[b]		
		^{226}Ra	^{232}Th	^{238}U
		Auger samples[e]		
A59D	76–91	1.3 ± 0.03	1.5 ± 0.05	<4.6
A59E	107–122	1.3 ± 0.01	1.4 ± 0.05	1.6 ± 0.2
A59F	122–137	1.4 ± 0.03	1.5 ± 0.05	<4.1
A59G	137–152	1.4 ± 0.01	1.5 ± 0.02	2.1 ± 0.5
A59H	152–168	1.3 ± 0.01	1.5 ± 0.02	1.9 ± 0.2
A59I	168–183	1.2 ± 0.02	1.4 ± 0.05	2.4 ± 0.7
A59J	183–198	1.1 ± 0.01	1.3 ± 0.02	1.5 ± 0.3
A60	31–46	1.6 ± 0.03	1.3 ± 0.05	2.3 ± 0.8
A61	31–46	2.1 ± 0.03	1.2 ± 0.04	3.2 ± 0.6
A62	15–31	2.1 ± 0.02	1.2 ± 0.04	2.9 ± 0.7
A63	31–46	2.3 ± 0.03	1.1 ± 0.03	1.9 ± 0.6
A64	15–31	2.6 ± 0.01	1.4 ± 0.02	2.2 ± 0.5
A65A	31–46	3.0 ± 0.04	1.4 ± 0.05	9.9 ± 1
A65B	61–76	6.3 ± 0.04	1.5 ± 0.06	22 ± 2
A65C	91–107	1.3 ± 0.02	1.4 ± 0.05	3.0 ± 0.8
A66	76–91	1.3 ± 0.01	1.5 ± 0.02	1.8 ± 0.4
A67	0–15	5.2 ± 0.03	1.8 ± 0.04	8.2 ± 1
A68	76–91	1.3 ± 0.03	1.5 ± 0.05	<4.1
A69	31–46	4.6 ± 0.05	1.2 ± 0.06	11 ± 2
A70	46–61	1.2 ± 0.01	1.2 ± 0.02	1.7 ± 0.2
A71	46–61	1.3 ± 0.01	1.3 ± 0.02	1.8 ± 0.2
A72	46–61	1.4 ± 0.01	1.5 ± 0.02	2.0 ± 0.8
A73	31–46	1.5 ± 0.03	1.5 ± 0.05	<4.0
A74	31–46	1.2 ± 0.03	1.2 ± 0.05	<4.1
A75	46–61	1.1 ± 0.02	1.2 ± 0.04	1.3 ± 0.7
A76	31–46	1.1 ± 0.01	1.3 ± 0.02	<1.5
A78	91–107	1.2 ± 0.02	1.4 ± 0.04	1.7 ± 0.6

Table 4 (continued)

Sample No.[a]	Depth (cm)	Radionuclide concentration (pCi/g)[b]		
		^{226}Ra	^{232}Th	^{238}U
		Auger samples[e]		
A79	61–76	1.4 ± 0.03	1.4 ± 0.05	<4.1
A80	46–61	1.7 ± 0.03	1.5 ± 0.04	4.8 ± 2

[a]Locations of soil samples are shown on Fig. 7.
[b]Indicated counting error is at the 95% confidence level (± 1σ).
[c]Systematic samples are taken at grid locations irrespective of gamma exposure.
[d]Biased samples are taken from areas shown to have elevated gamma exposure rates.
[e]Auger samples are taken from holes drilled to further define the depth and extent of radioactive material. Holes are drilled where the surface may or may not be contaminated.

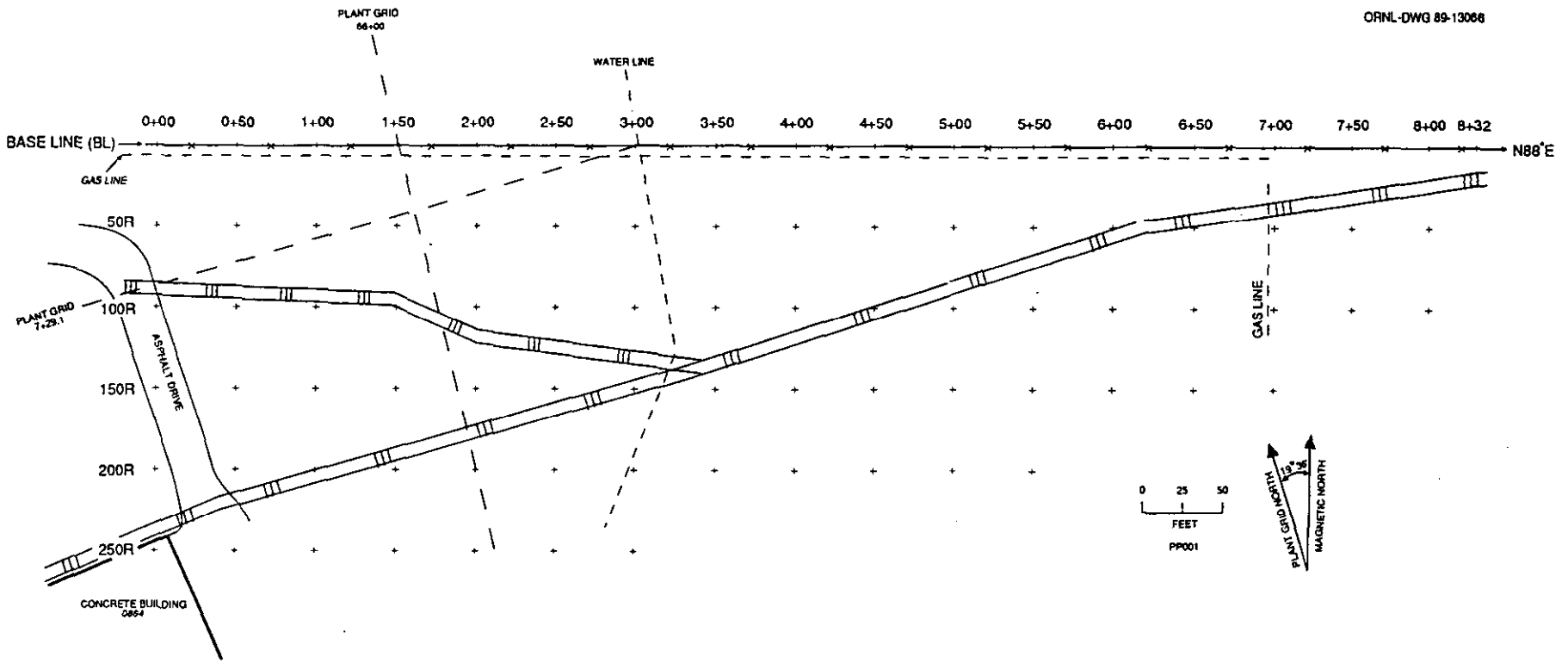

Fig. 1. Diagram showing the grid system used in the survey at the former ore storage site, Palmerton, Pennsylvania (PP001).

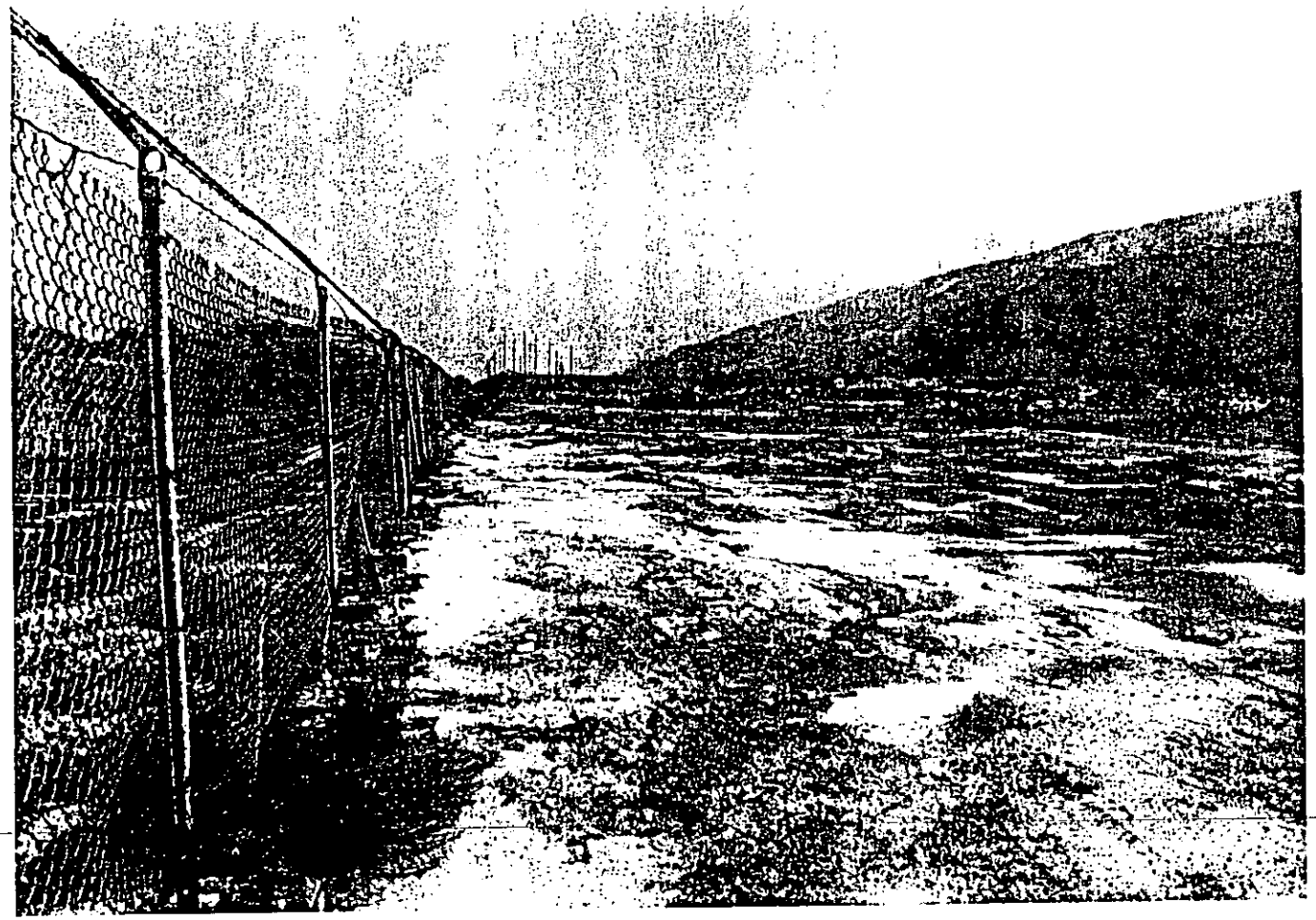

Fig. 2. The former ore storage site, Palmerton, Pennsylvania (PP001), looking east (August 1988). The fence at the left forms the baseline for the grid system (Fig. 1).

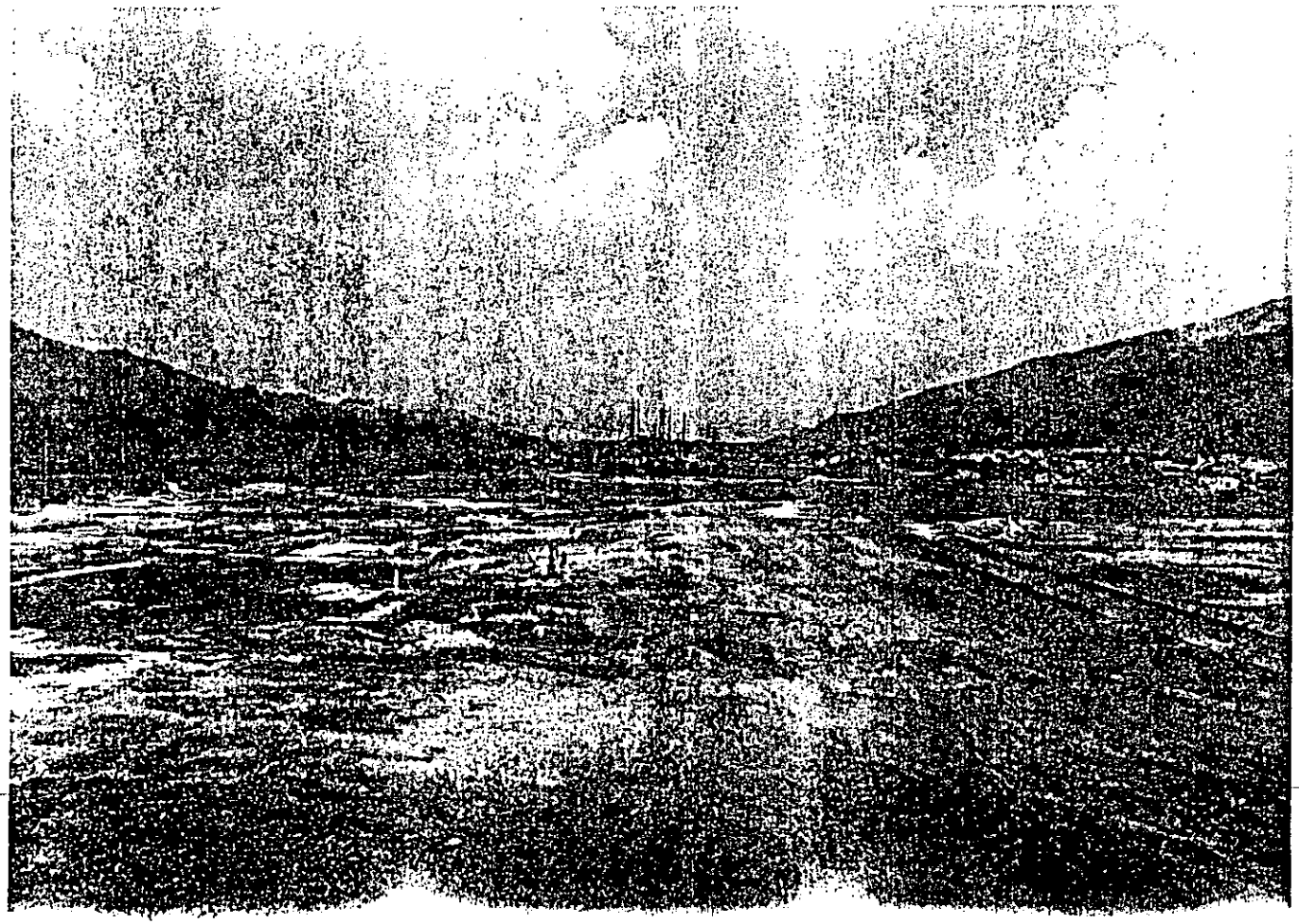

Fig. 3. The former ore storage site, Palmerton, Pennsylvania (PP001), looking east (August 1988).

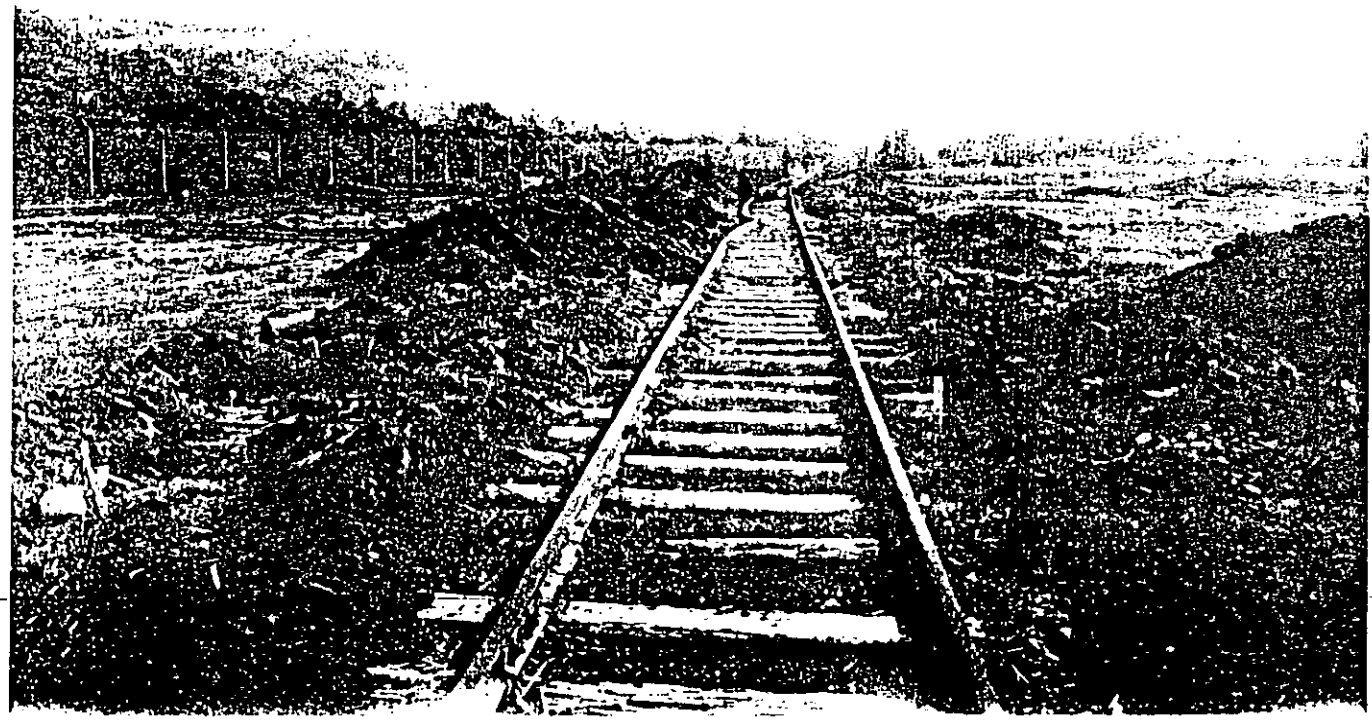

Fig. 4. Railroad tracks at the former ore storage site in Palmerton, Pennsylvania (PP001), looking east (August 1988). Piles of soil and debris were moved to allow access to the area around the tracks.

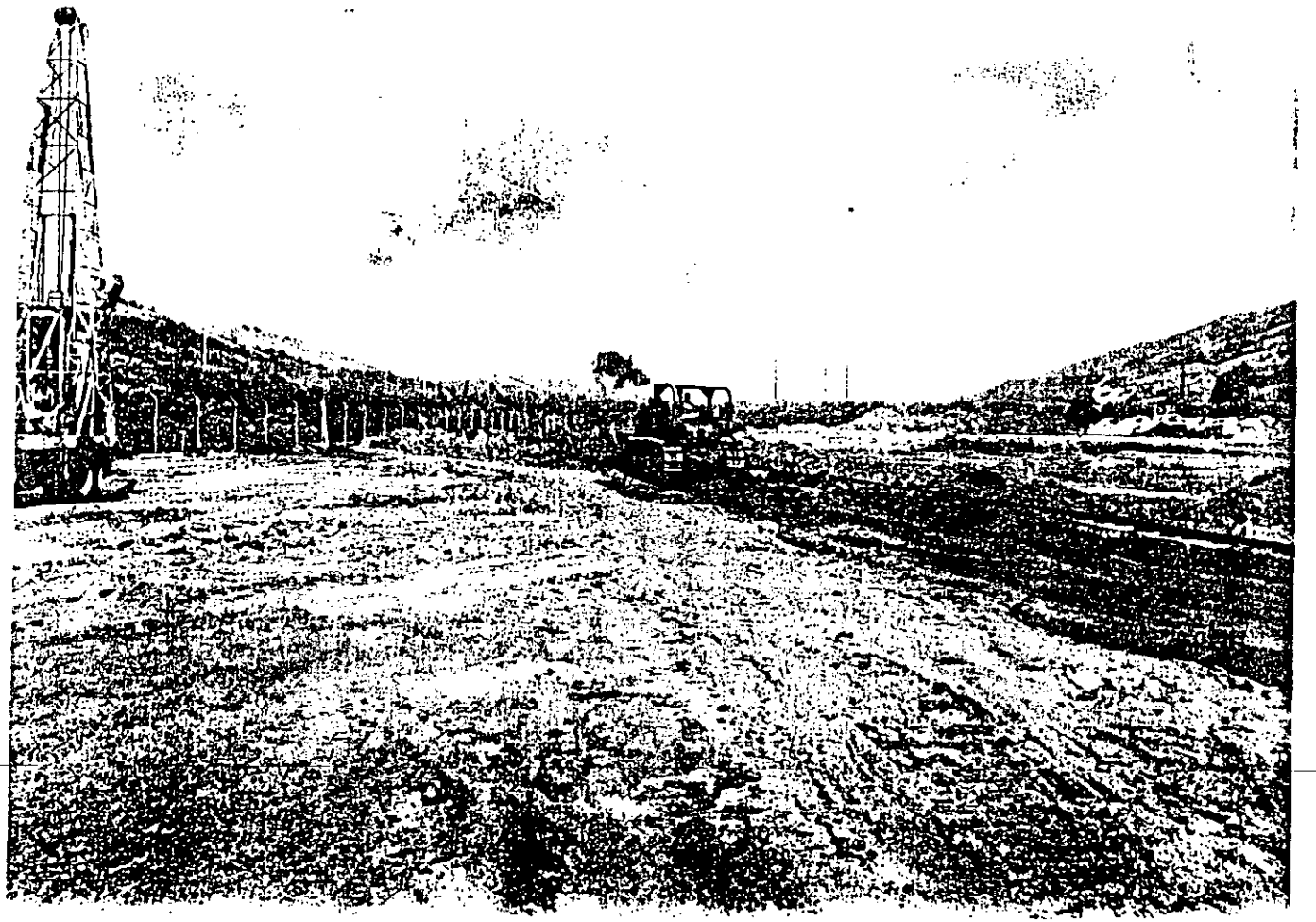

Fig. 5. Movement of soil and debris to allow access to the area around the railroad tracks (Fig. 6) at the former ore storage site, Palmerton, Pennsylvania (PP001), looking northeast (August 1988).

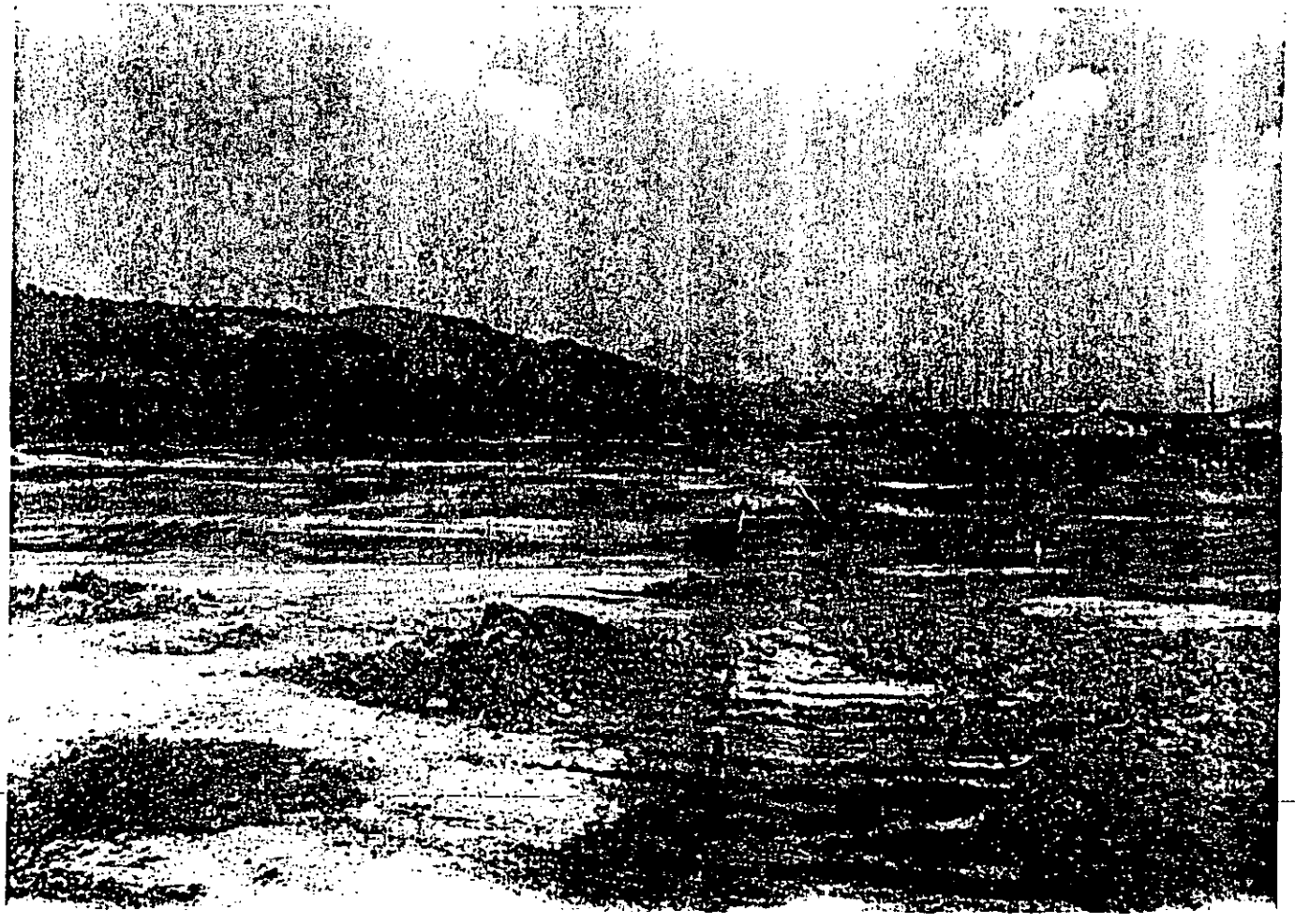

Fig. 6. Railroad tracks following movement of soil and debris (Fig. 5), former ore storage site, Palmerton, Pennsylvania (PP001), looking east (August 1988).

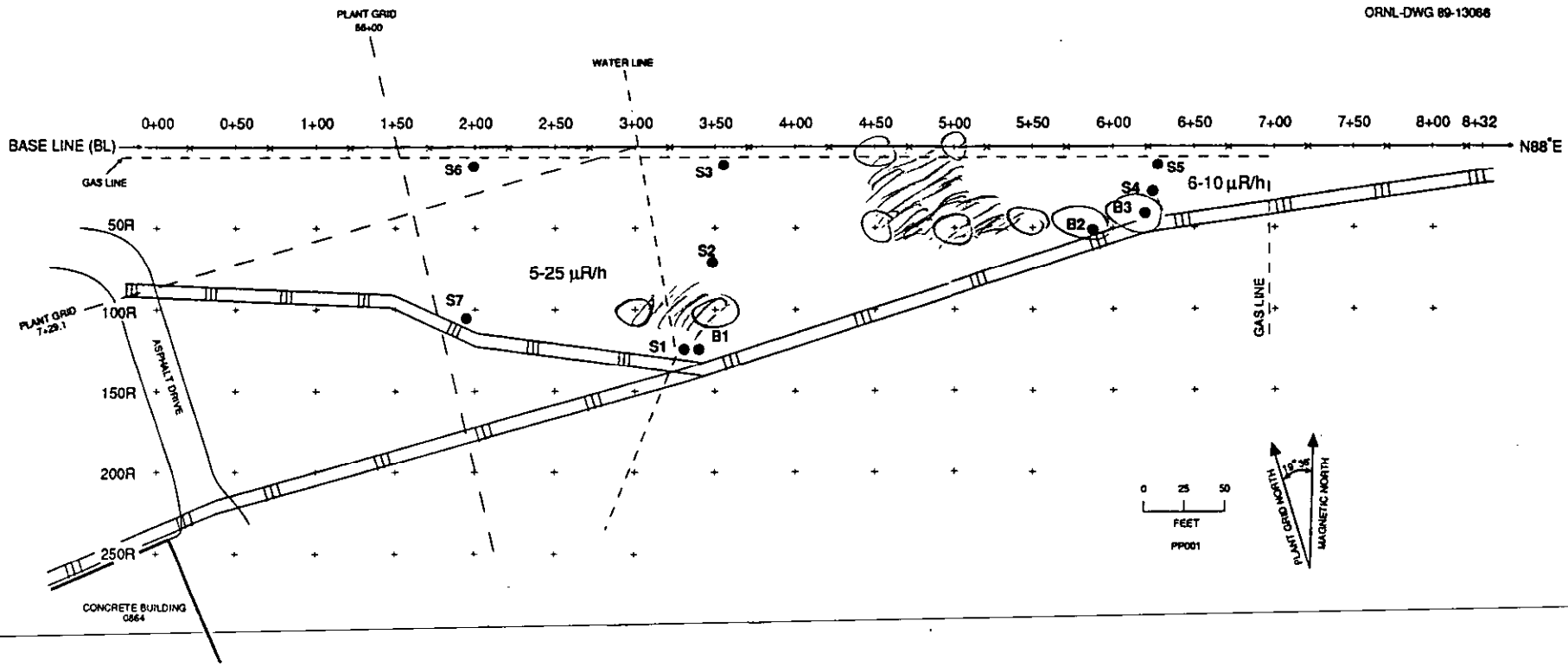

Fig. 8. Diagram showing auger hole locations at the former ore storage site, Palmerton, Pennsylvania (PP001).

Should be Fig 7 caption

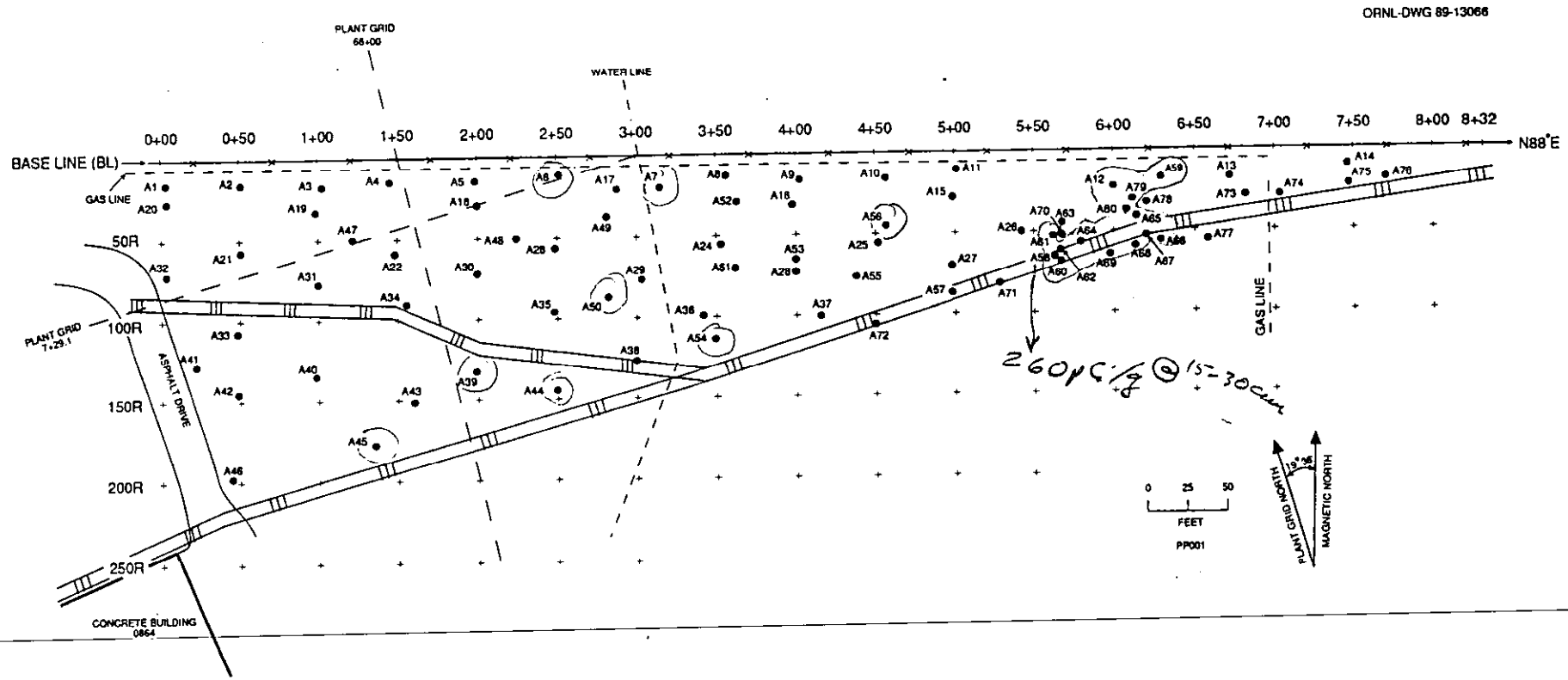

Fig. 7. Gamma radiation levels (μR/h) and systematic (S) and biased (B) soil sample locations at the former ore storage site, Palmerton, Pennsylvania (PP001).

Should be Figure 8 caption

A60 - A70

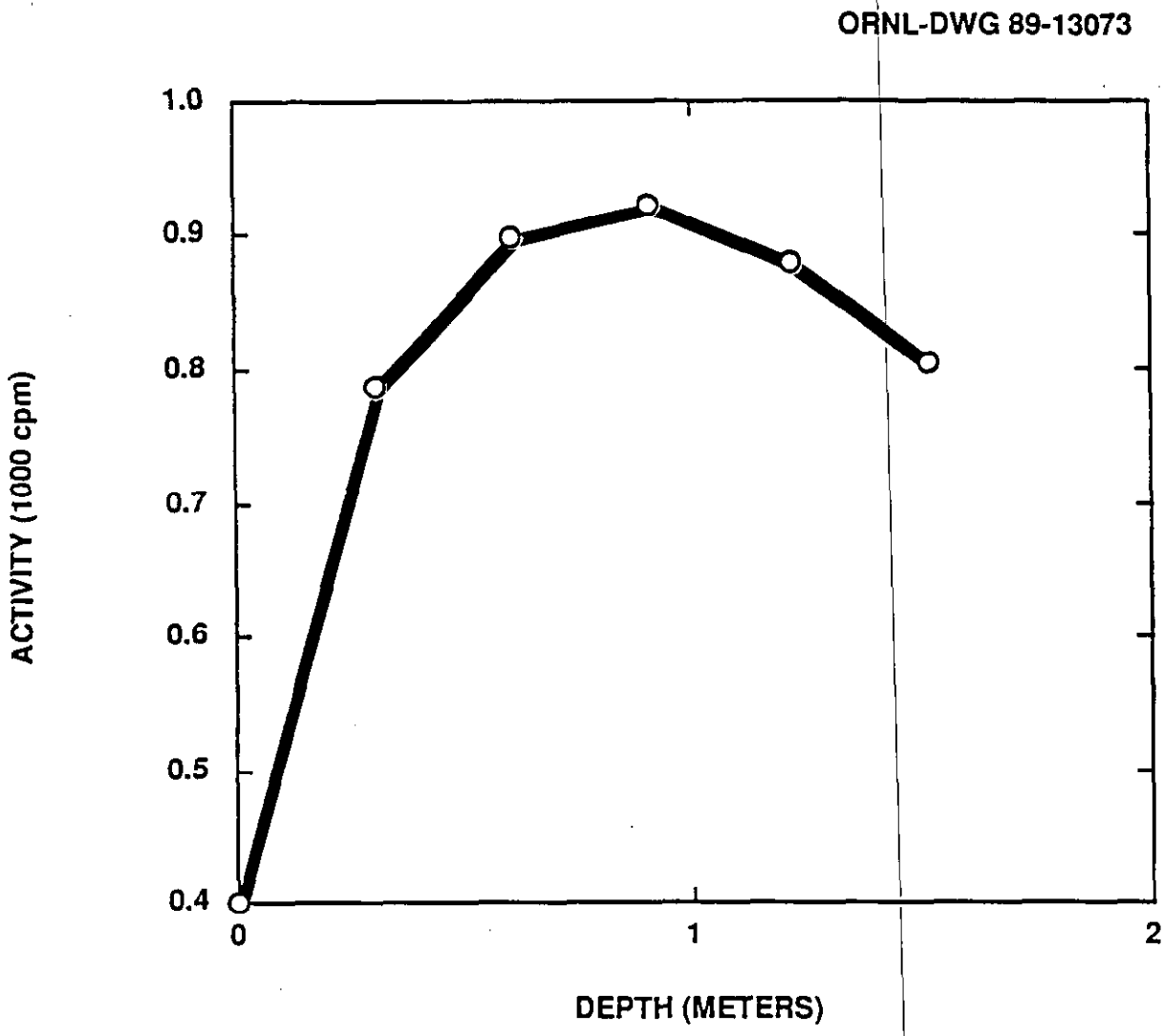

Fig. 9. Gamma profile for auger hole 1 (A1) at the former ore storage site, Palmerton, Pennsylvania (PP001).

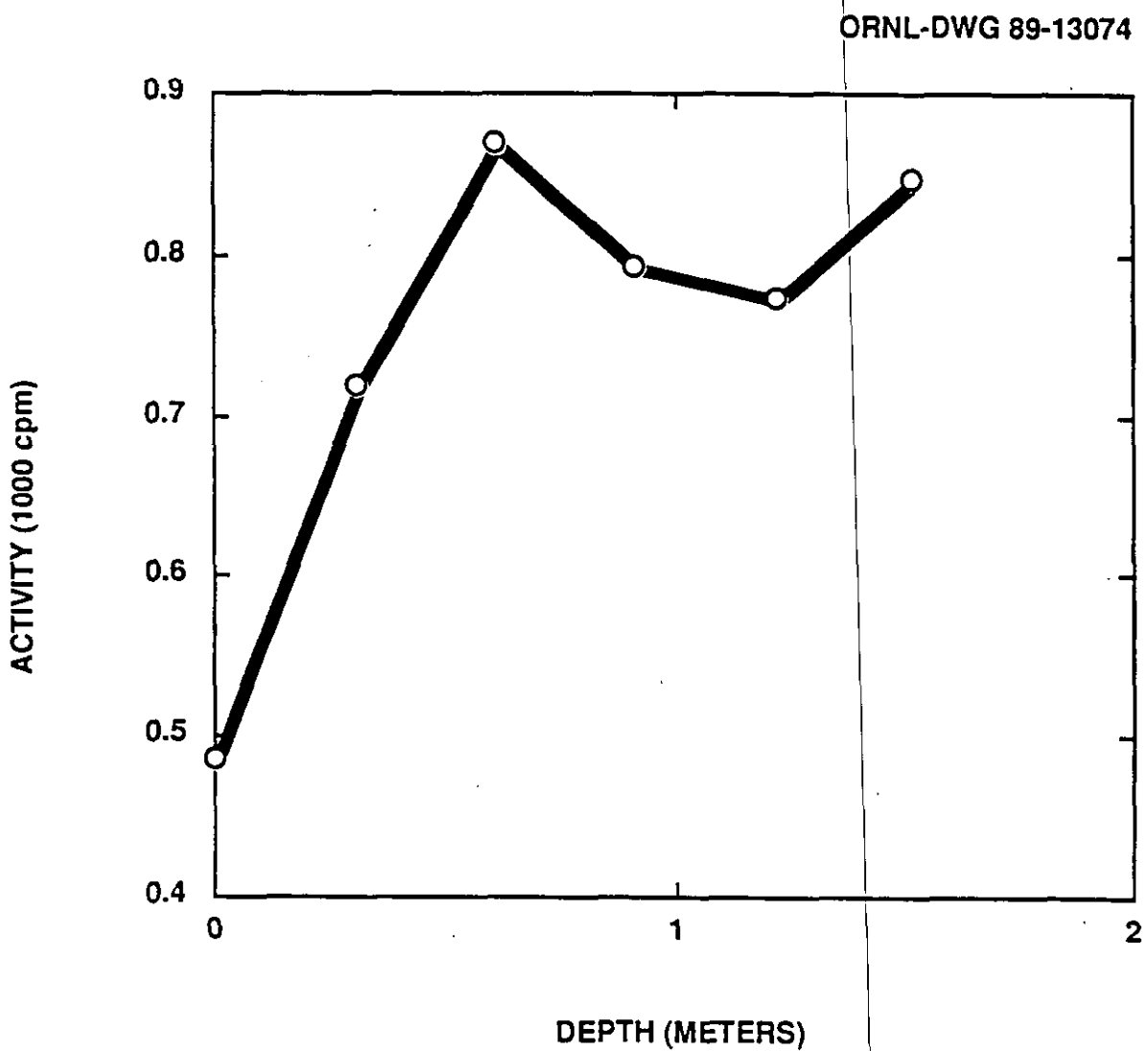

Fig. 10. Gamma profile for auger hole 2 (A2) at the former ore storage site, Palmerton, Pennsylvania (PP001).

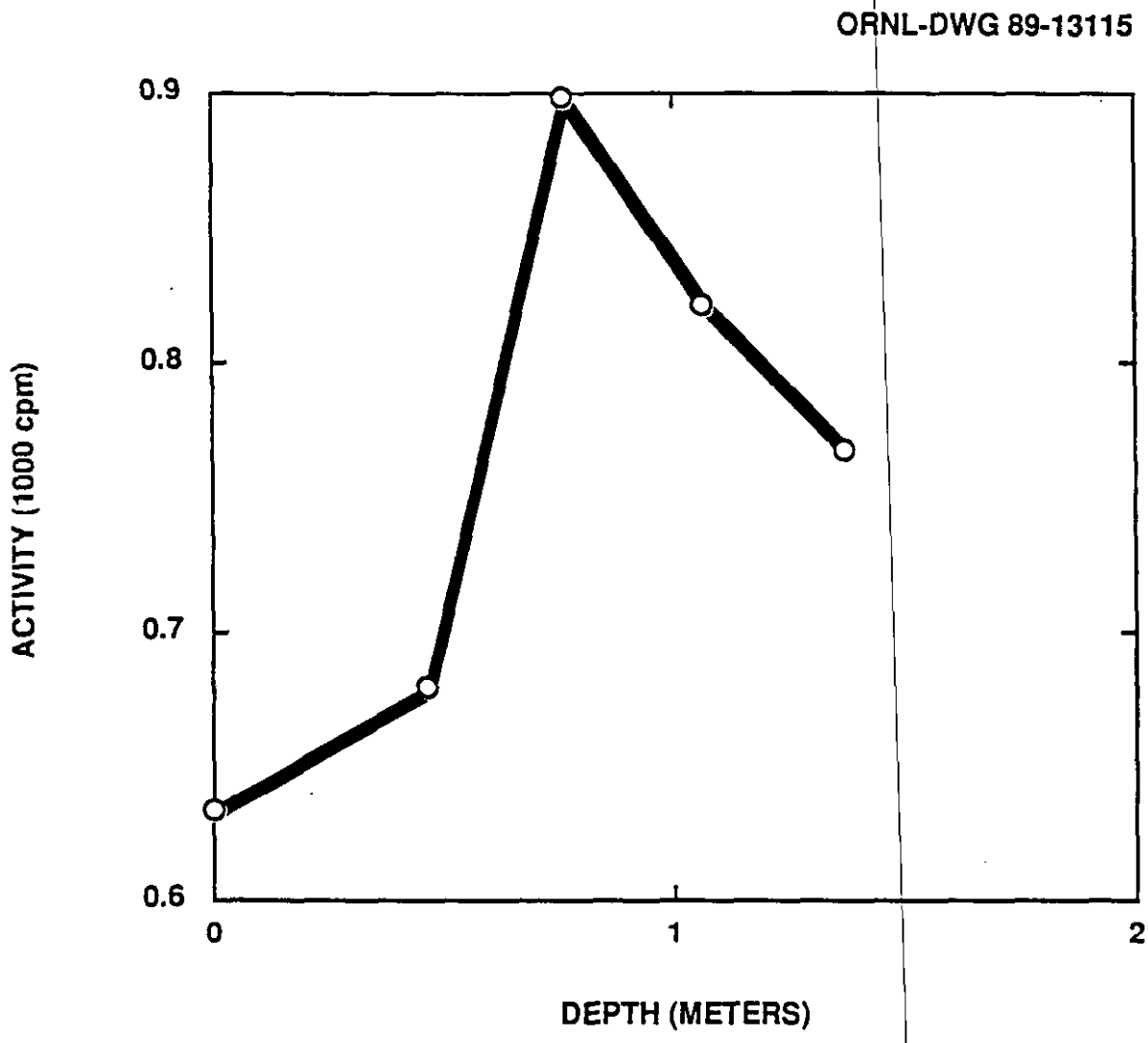

Fig. 11. Gamma profile for auger hole 3 (A3) at the former ore storage site, Palmerton, Pennsylvania (PP001).

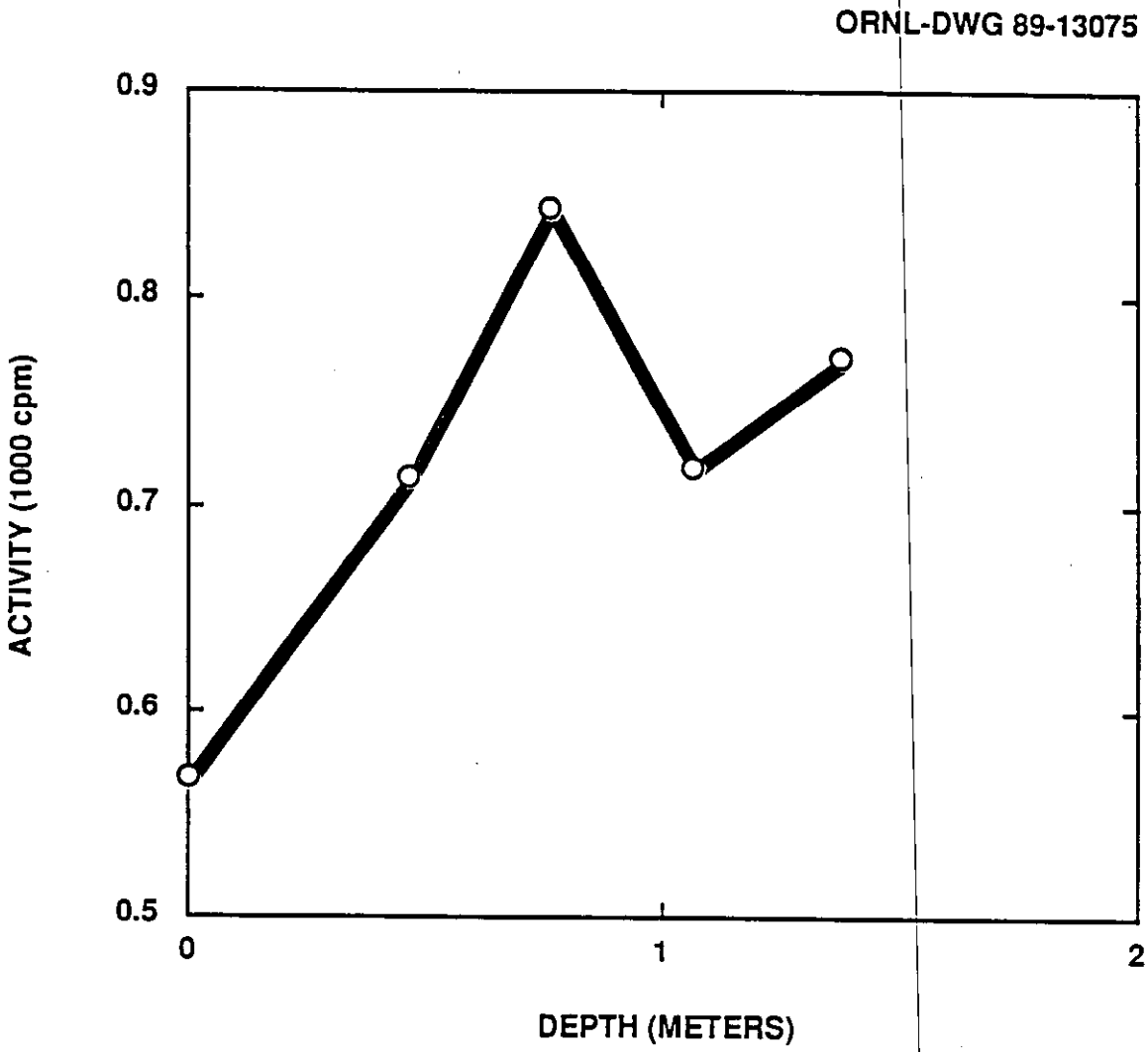

Fig. 12. Gamma profile for auger hole 4 (A4) at the former ore storage site, Palmerton, Pennsylvania (PP001).

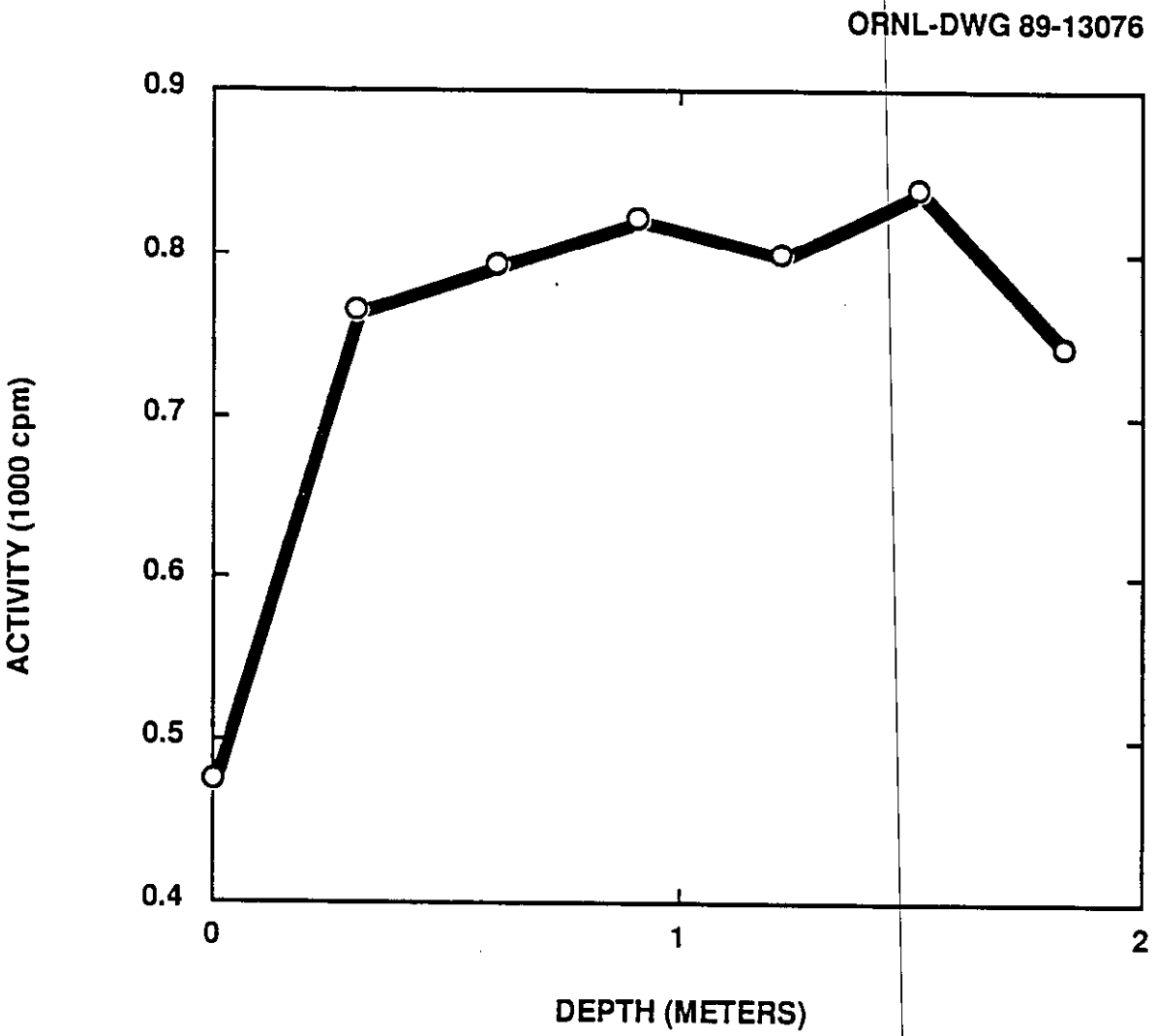

Fig. 13. Gamma profile for auger hole 5 (A5) at the former ore storage site, Palmerton, Pennsylvania (PP001).

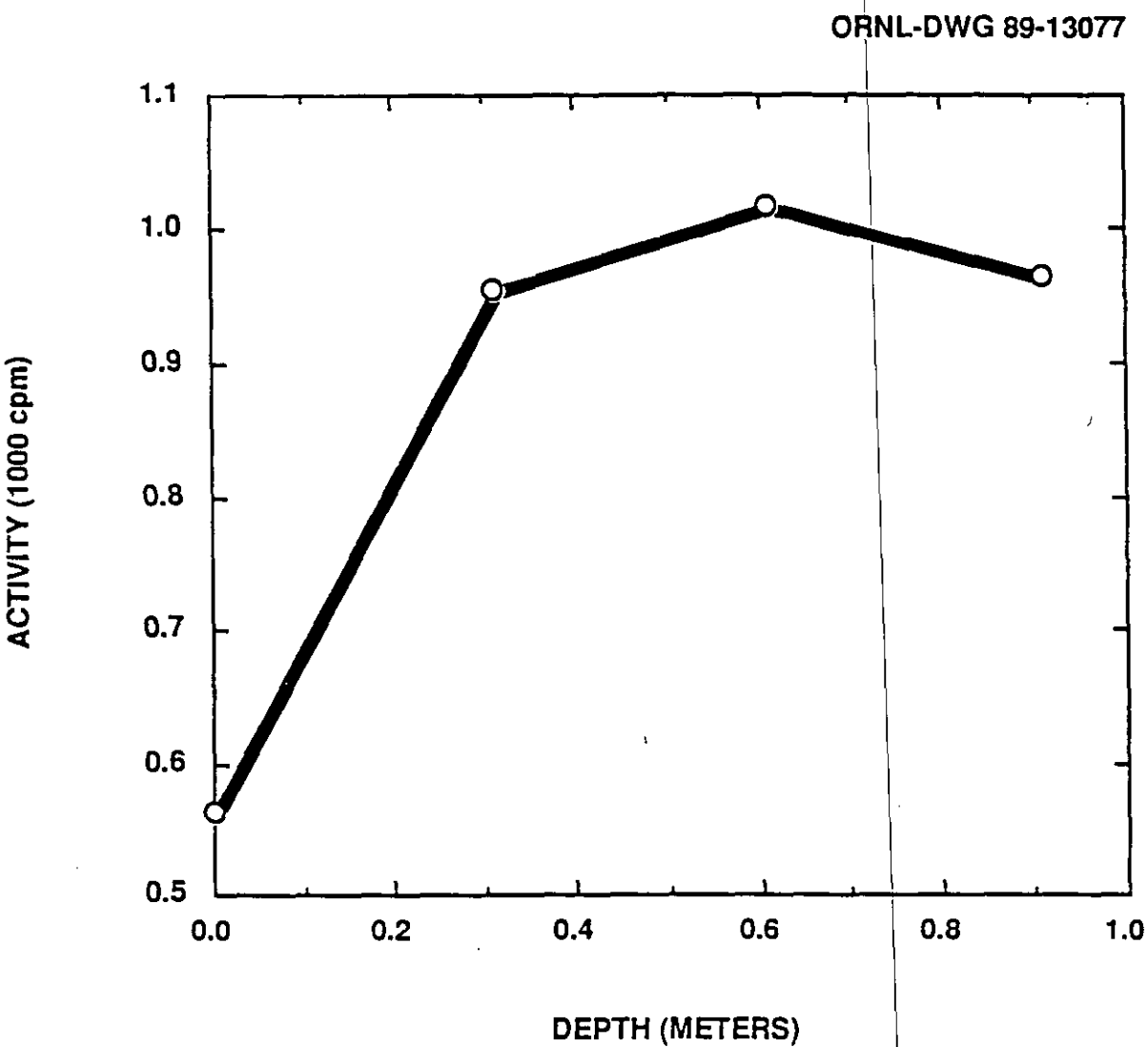

Fig. 14. Gamma profile for auger hole 6 (A6) at the former ore storage site, Palmerton, Pennsylvania (PP001).

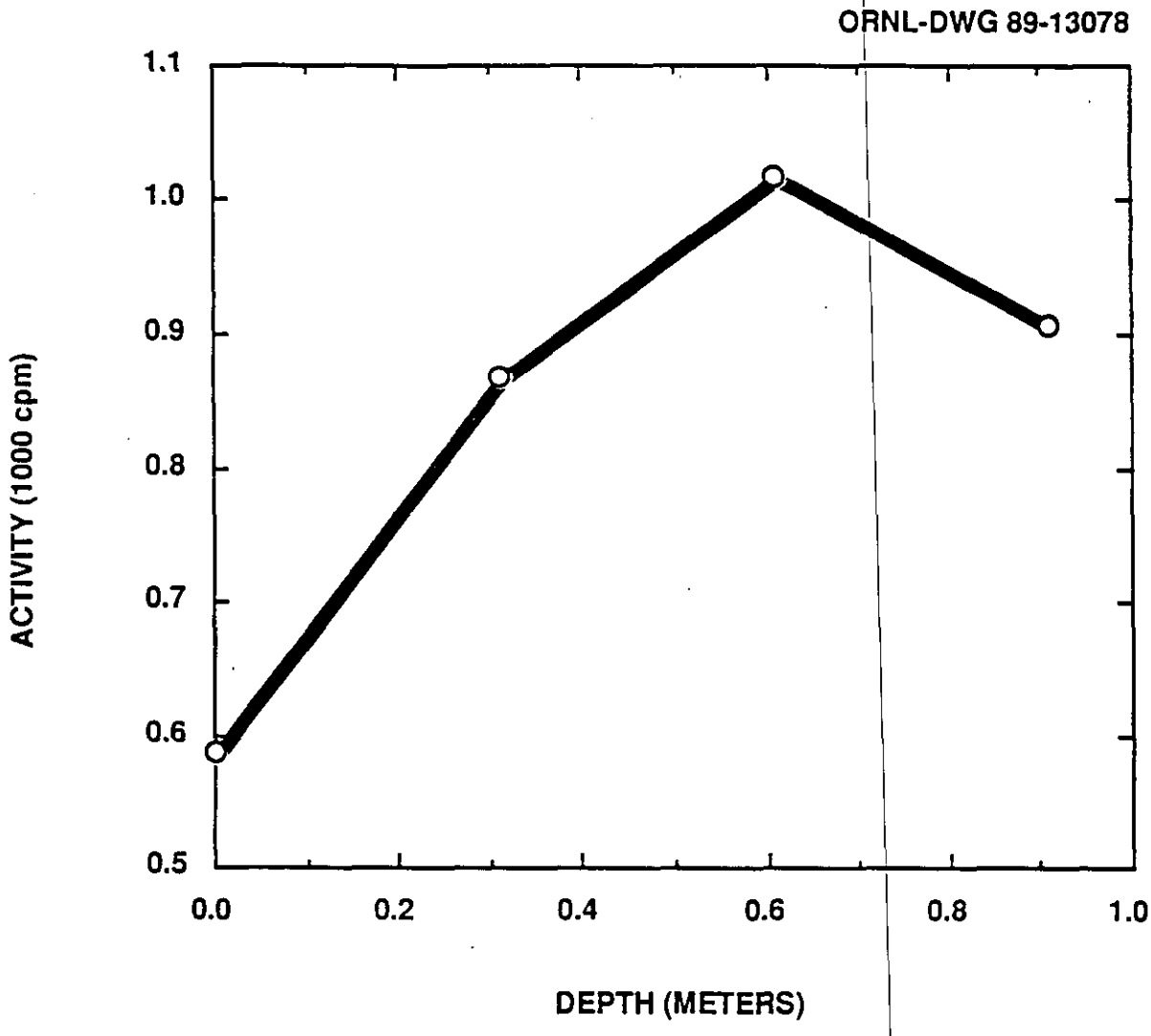

Fig. 15. Gamma profile for auger hole 7 (A7) at the former ore storage site, Palmerton, Pennsylvania (PP001).

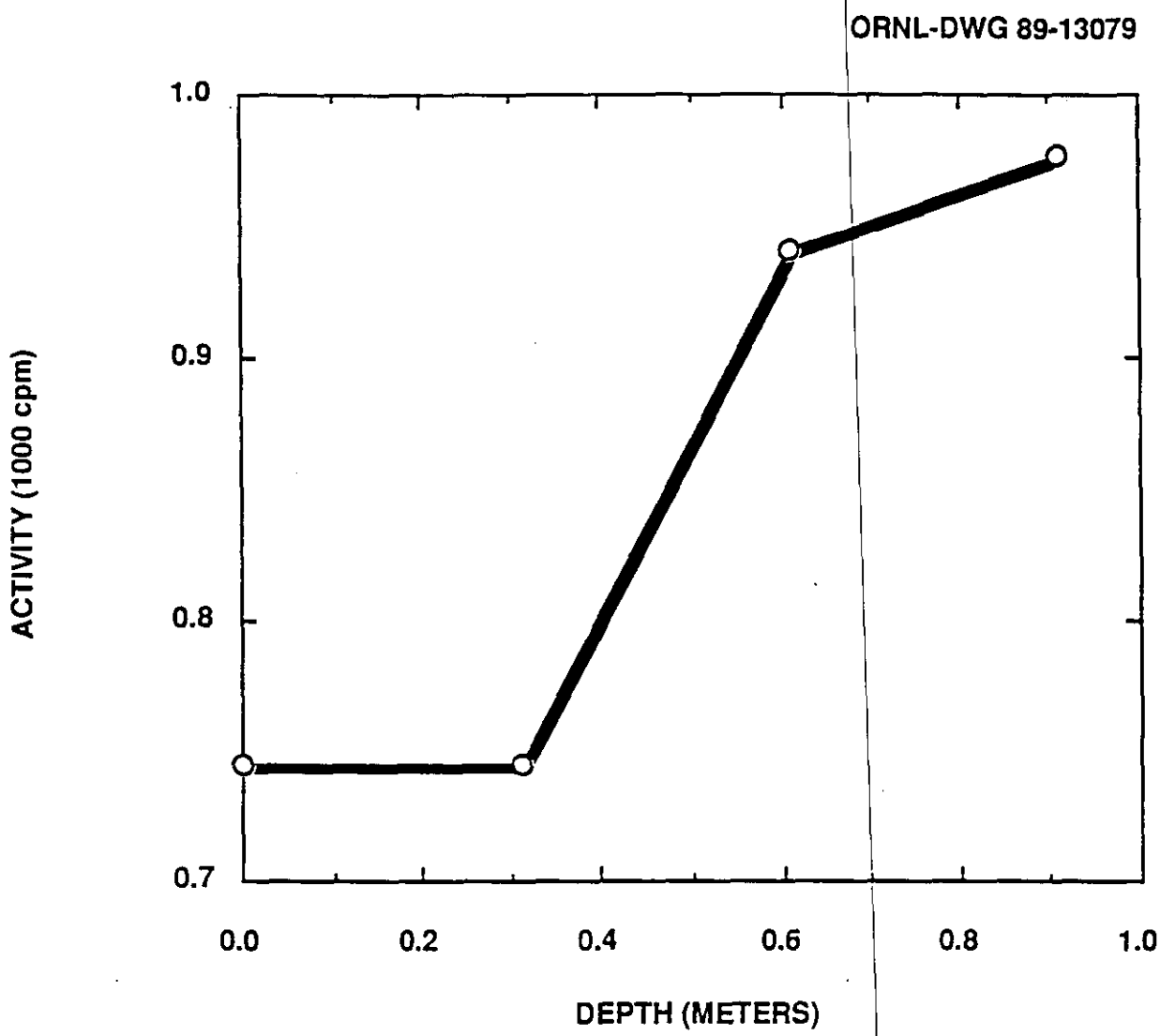

Fig. 16. Gamma profile for auger hole 8 (A8) at the former ore storage site, Palmerton, Pennsylvania (PP001).

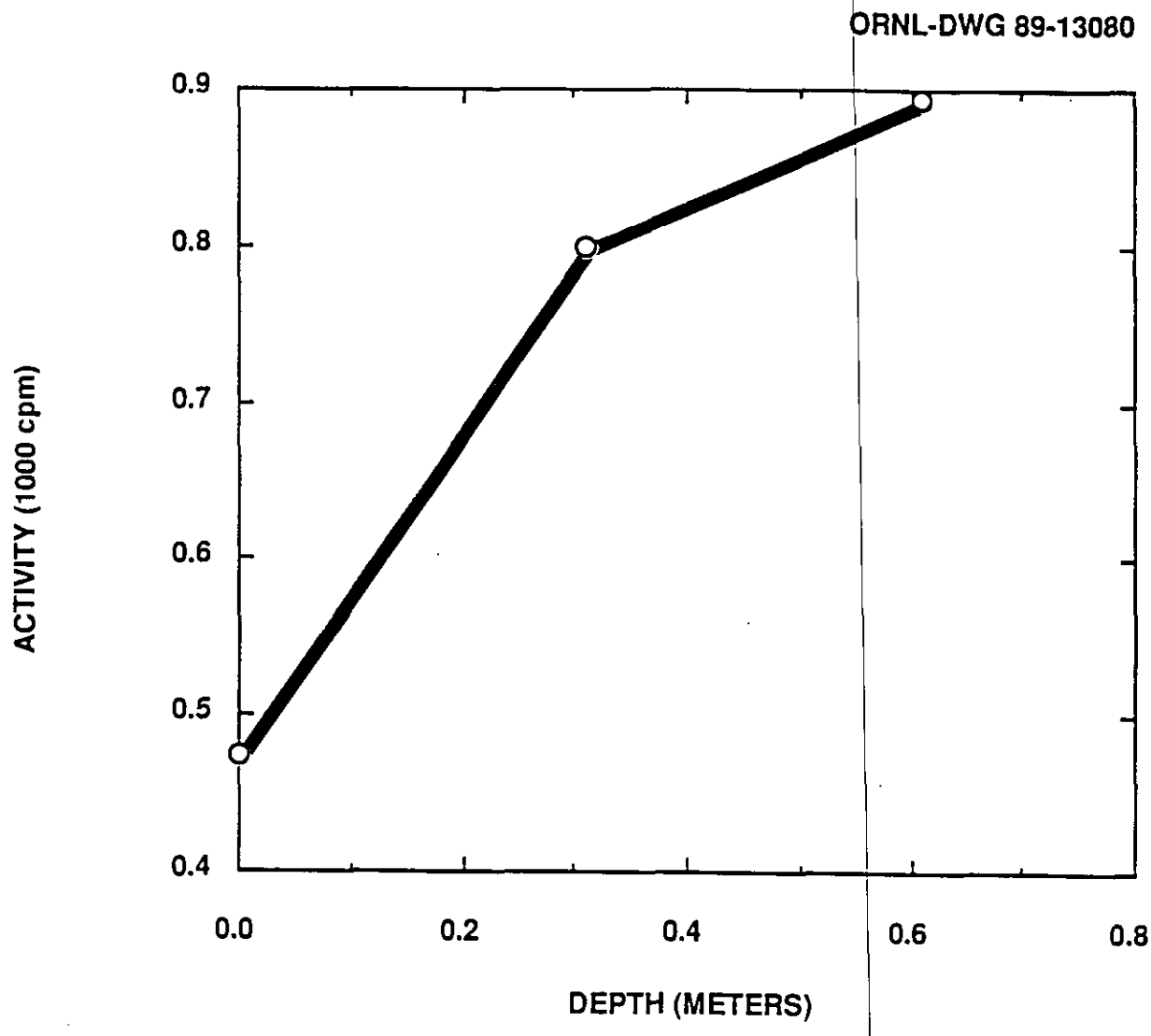

Fig. 17. Gamma profile for auger hole 9 (A9) at the former ore storage site, Palmerton, Pennsylvania (PP001).

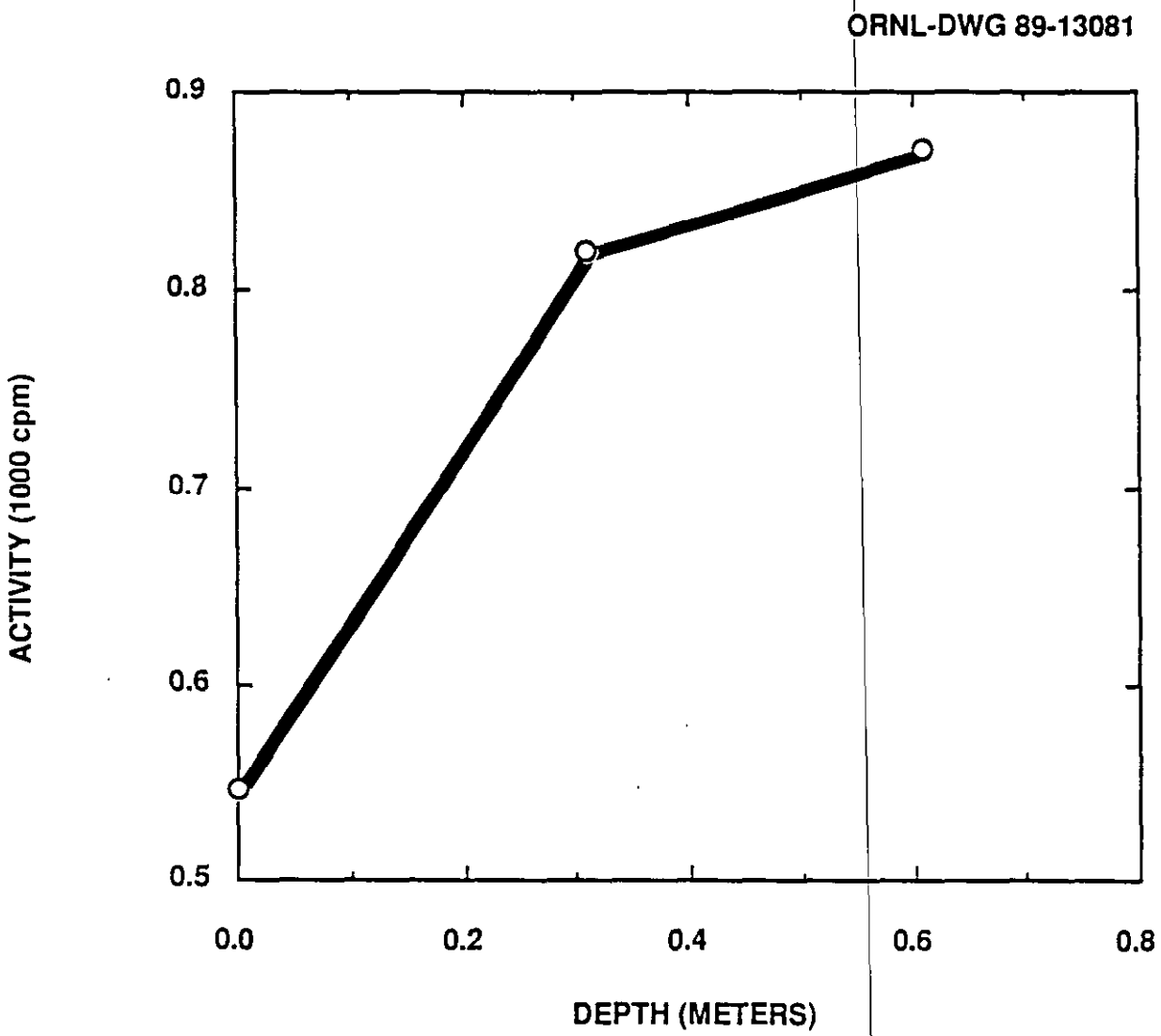

Fig. 18. Gamma profile for auger hole 10 (A10) at the former ore storage site, Palmerton, Pennsylvania (PP001).

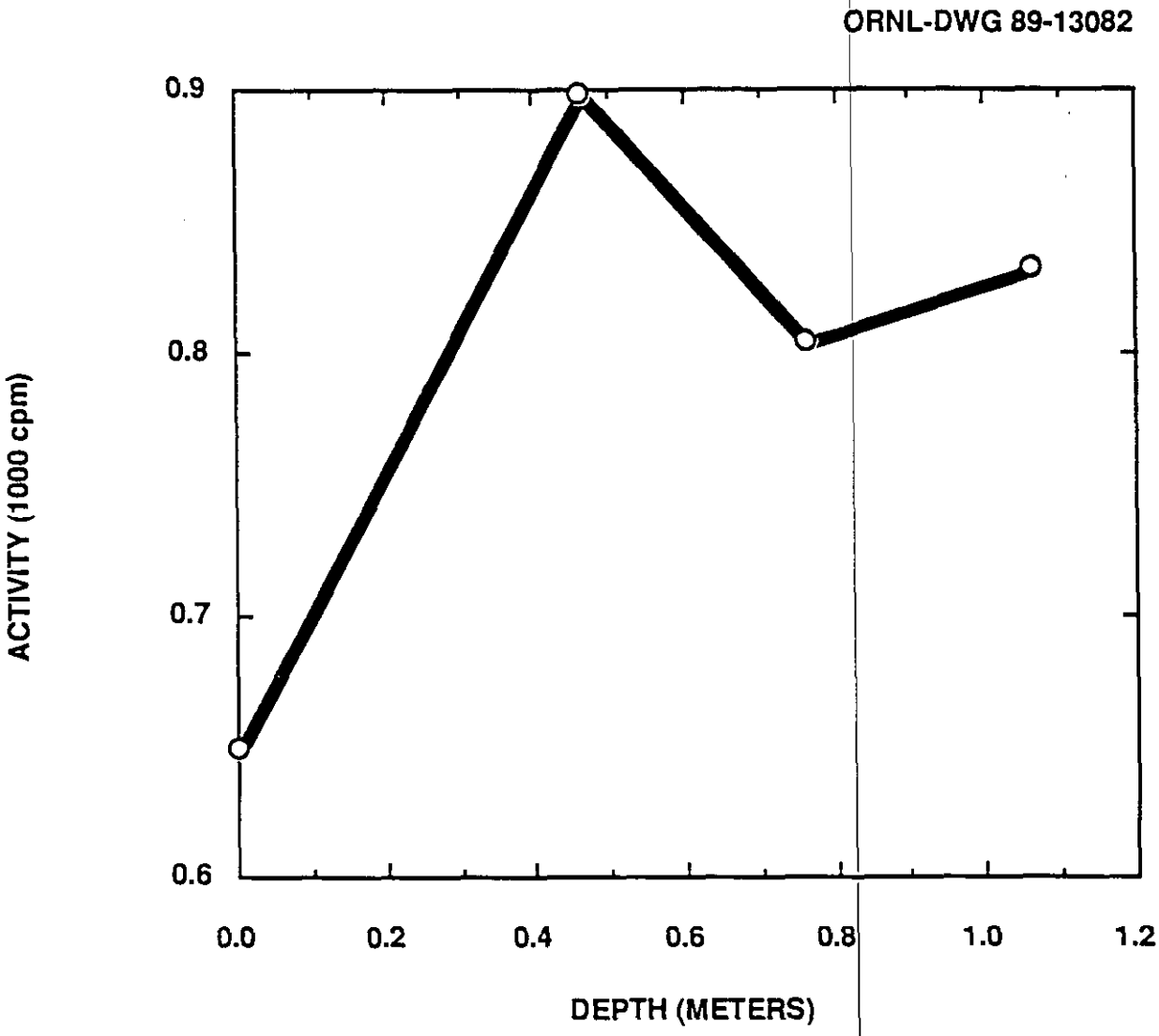

Fig. 19. Gamma profile for auger hole 11 (A11) at the former ore storage site, Palmerton, Pennsylvania (PP001).

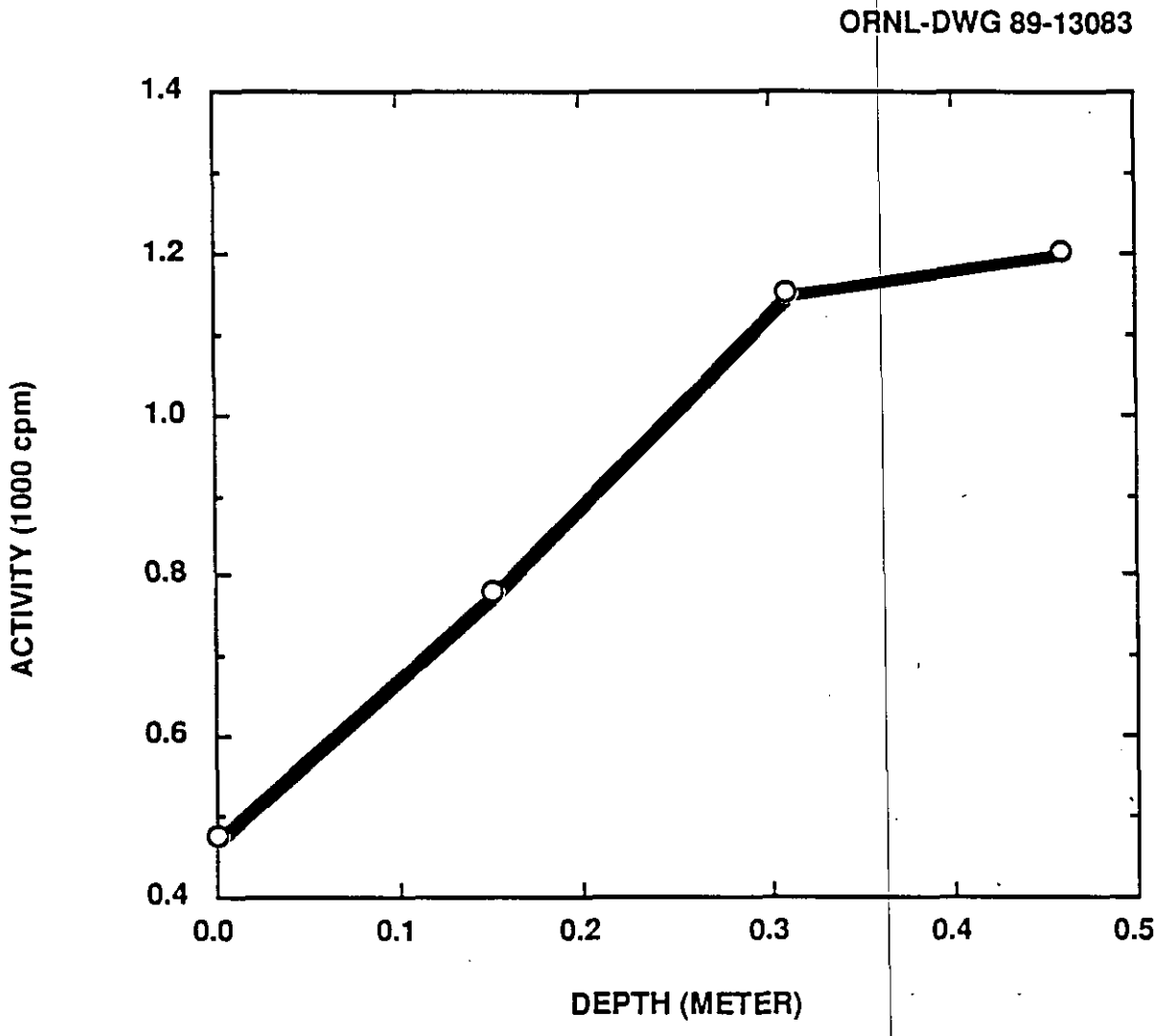

Fig. 20. Gamma profile for auger hole 12 (A12) at the former ore storage site, Palmerton, Pennsylvania (PP001).

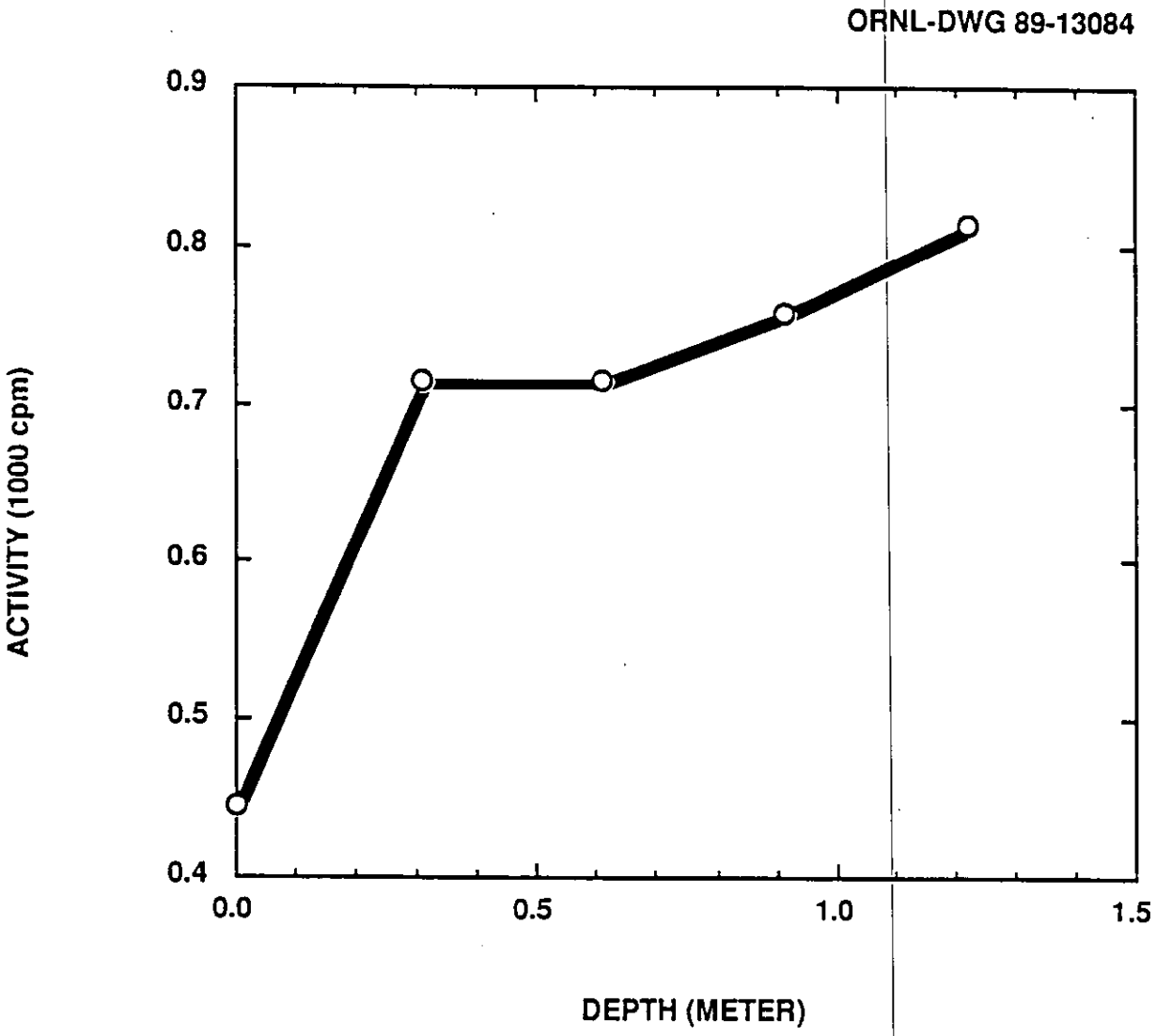

Fig. 21. Gamma profile for auger hole 13 (A13) at the former ore storage site, Palmerton, Pennsylvania (PP001).

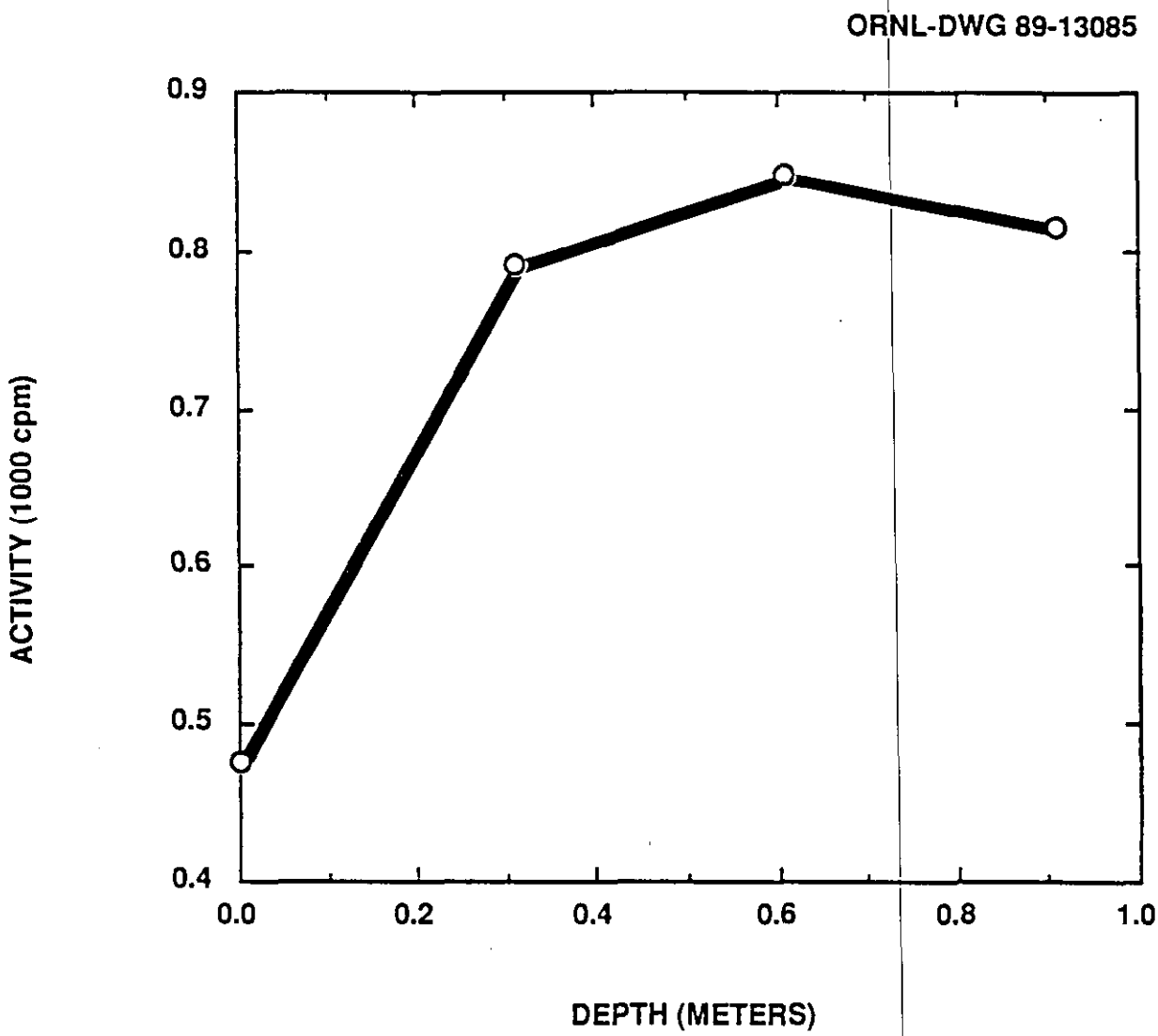

Fig. 22. Gamma profile for auger hole 14 (A14) at the former ore storage site, Palmerton, Pennsylvania (PP001).

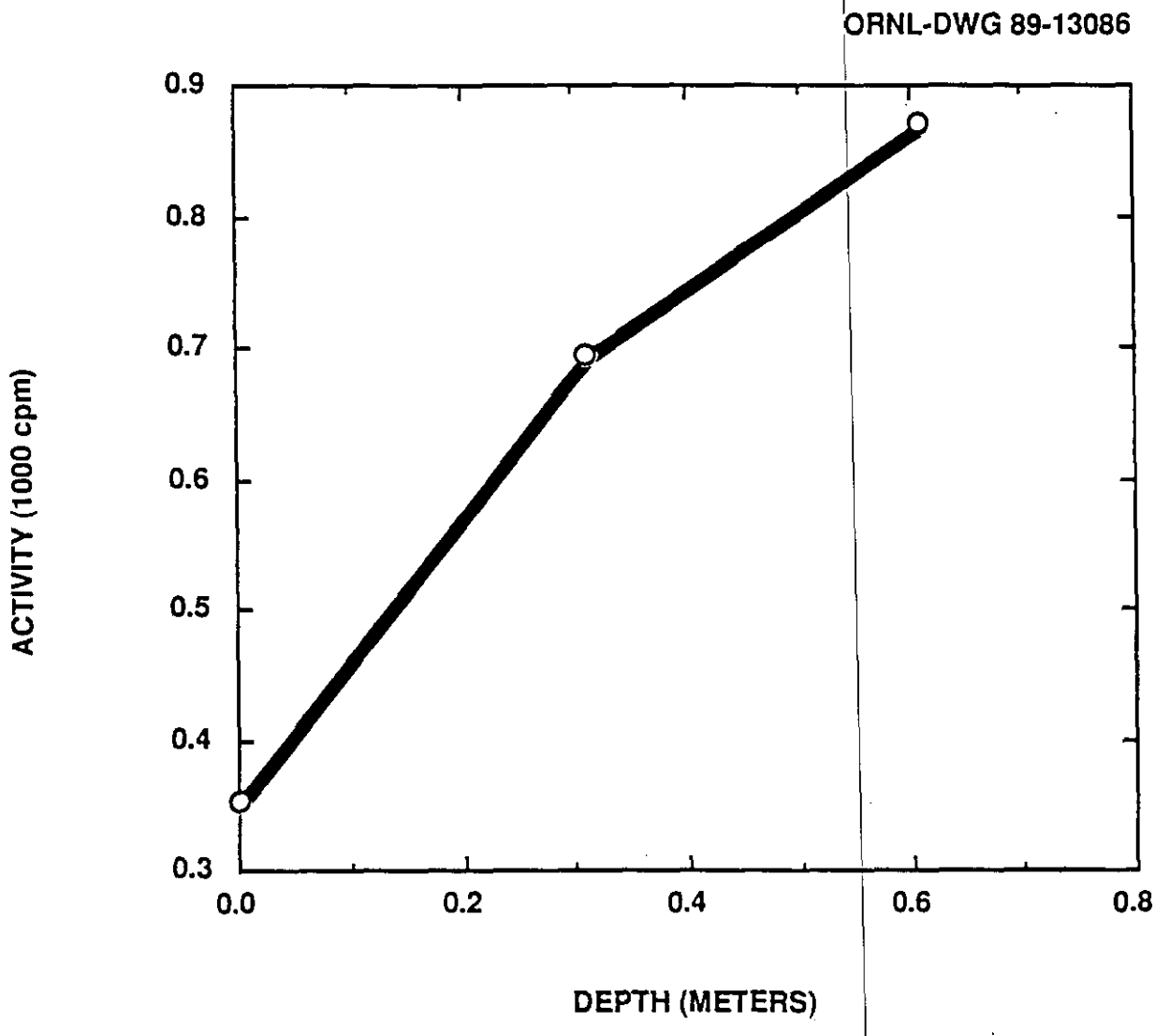

Fig. 23. Gamma profile for auger hole 15 (A15) at the former ore storage site, Palmerton, Pennsylvania (PP001).

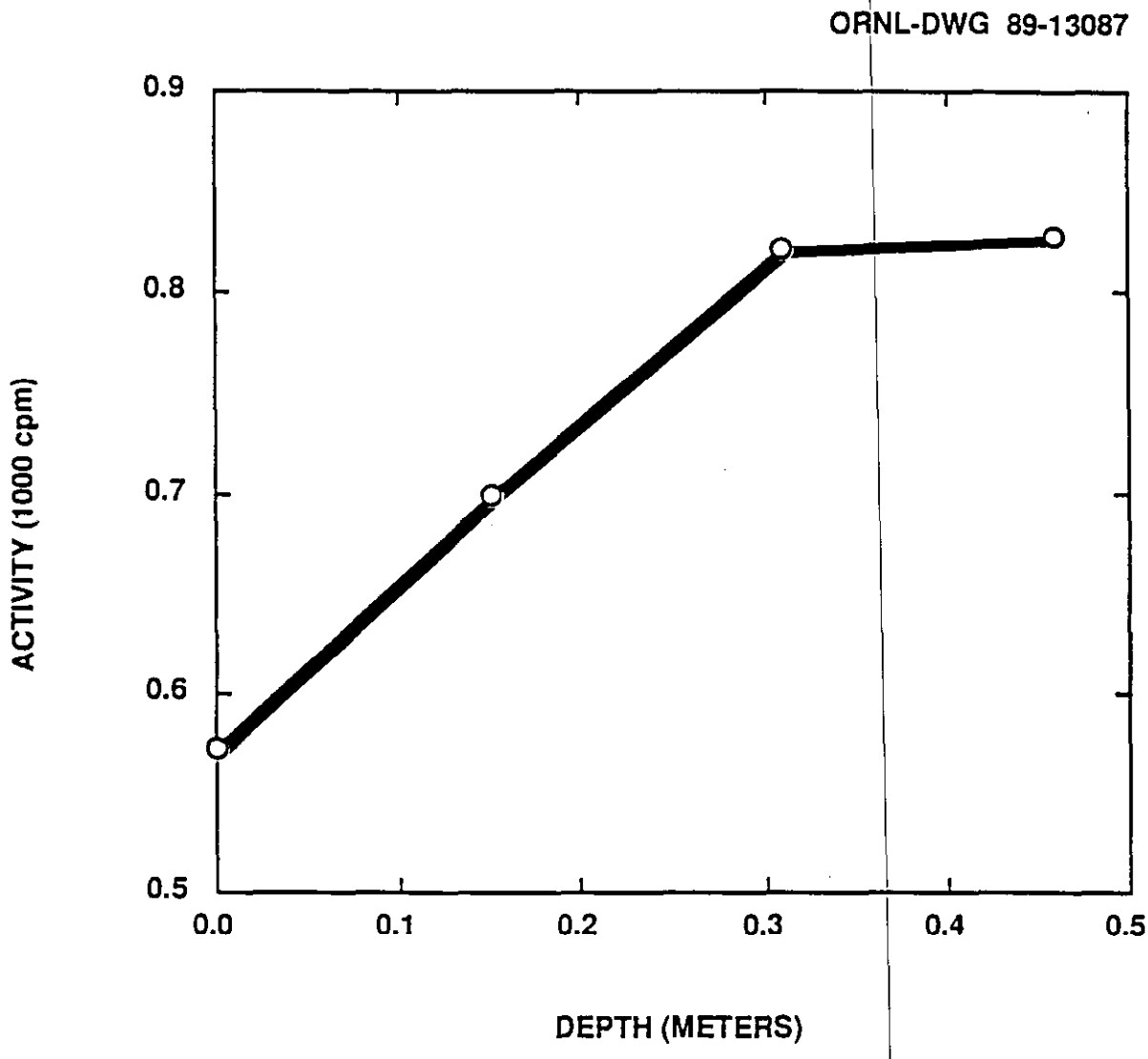

Fig. 24. Gamma profile for auger hole 16 (A16) at the former ore storage site, Palmerton, Pennsylvania (PP001).

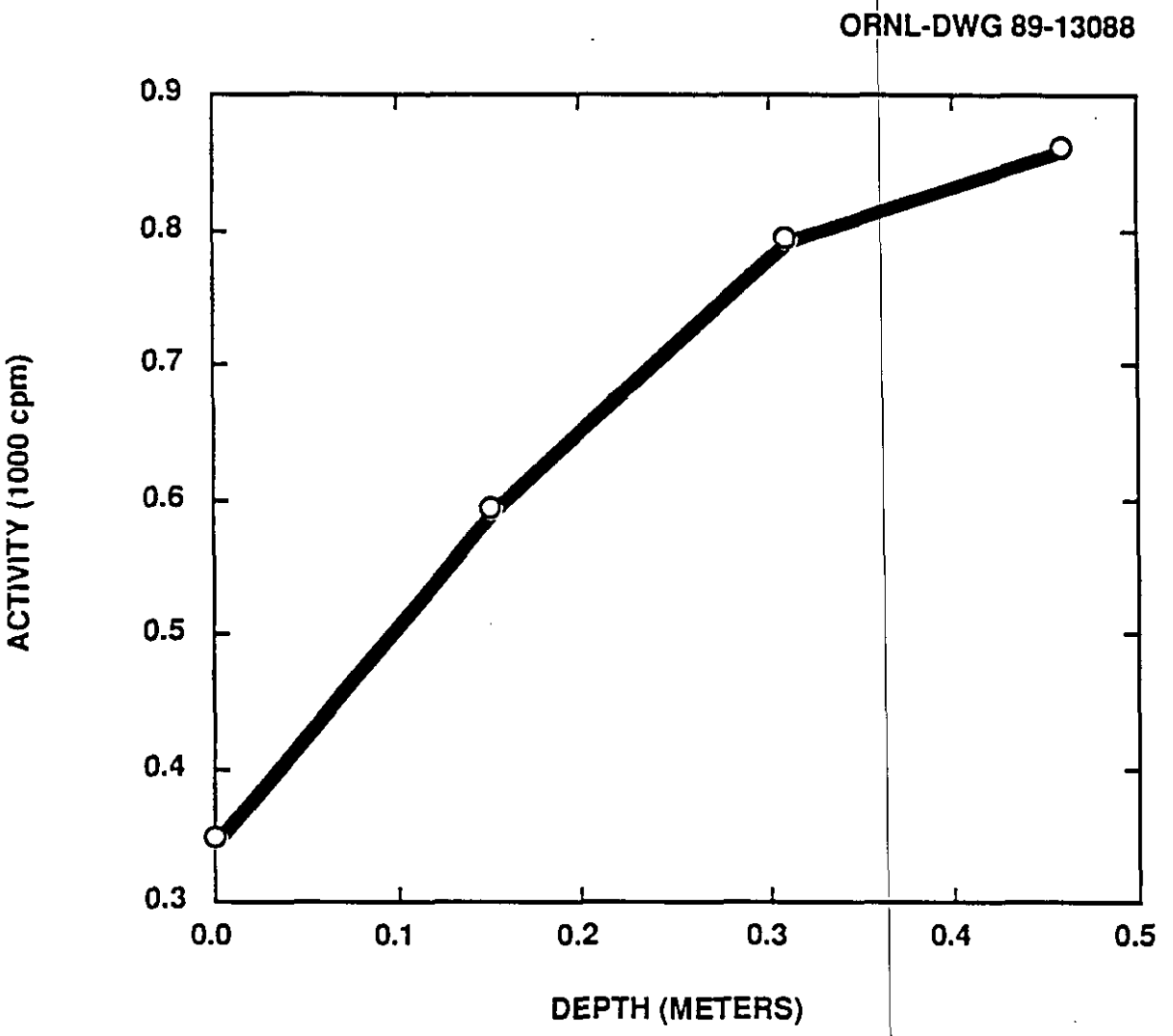

Fig. 25. Gamma profile for auger hole 17 (A17) at the former ore storage site, Palmerton, Pennsylvania (PP001).

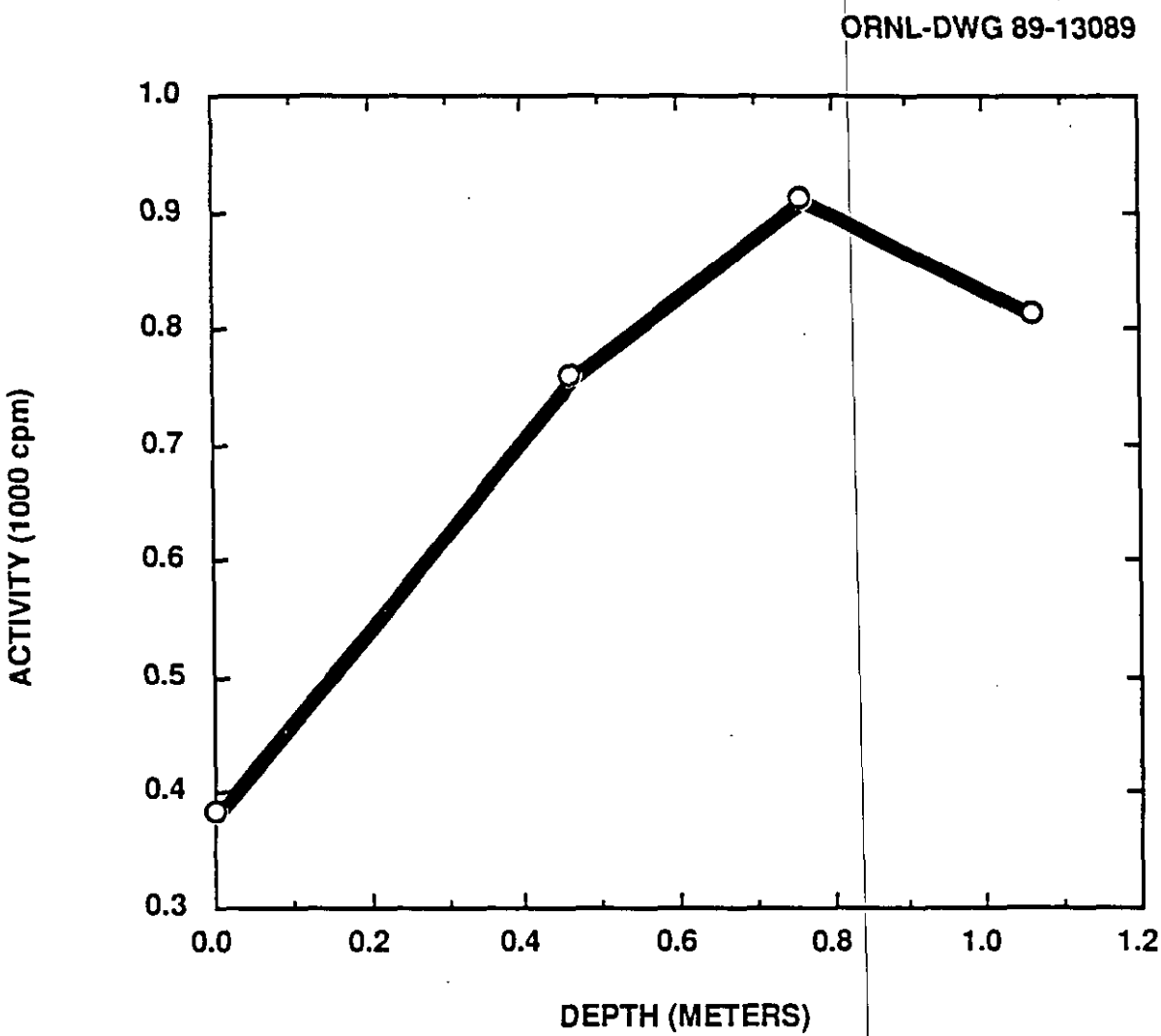

Fig. 26. Gamma profile for auger hole 18 (A18) at the former ore storage site, Palmerton, Pennsylvania (PP001).

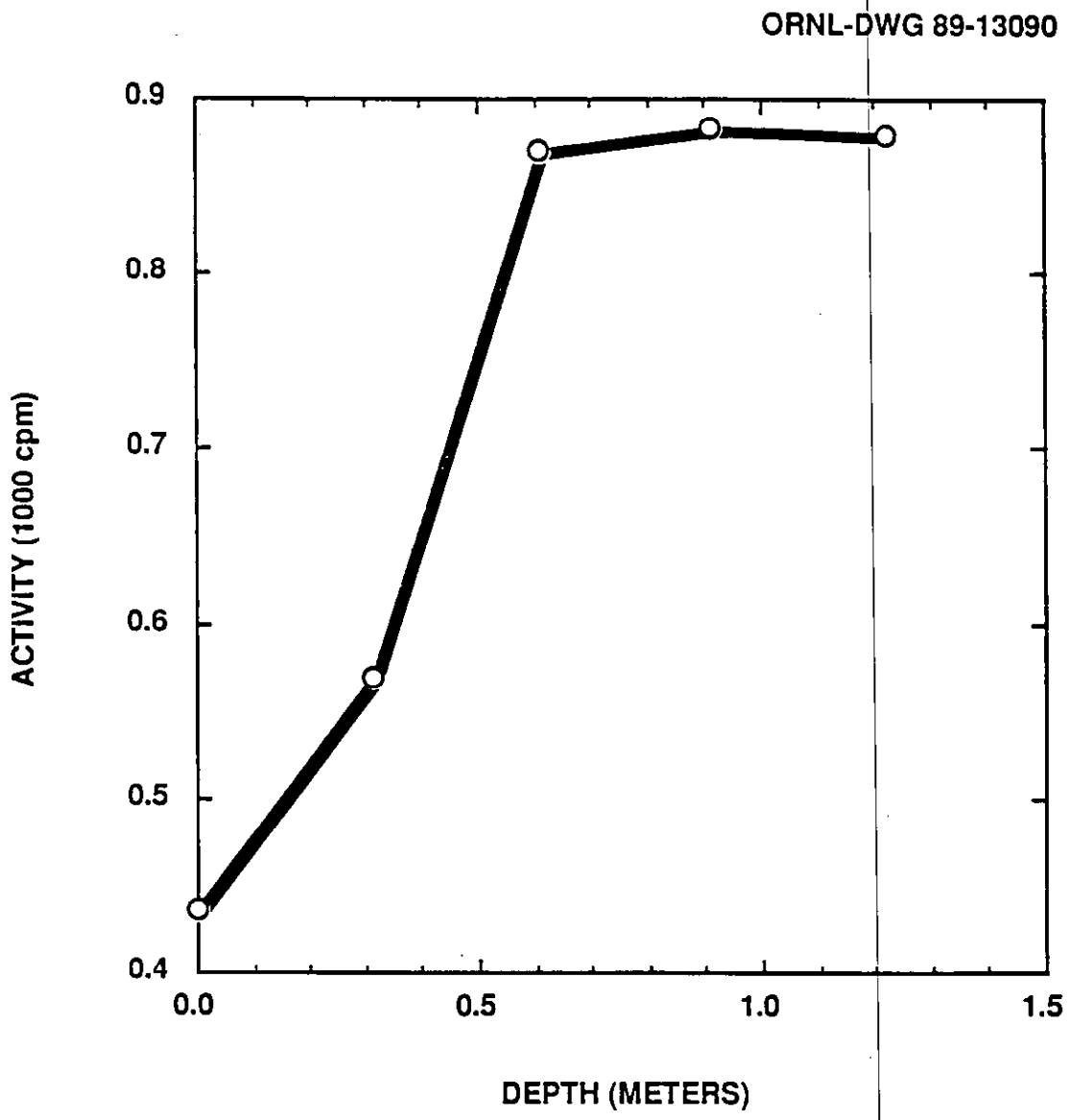

Fig. 27. Gamma profile for auger hole 19 (A19) at the former ore storage site, Palmerton, Pennsylvania (PP001).

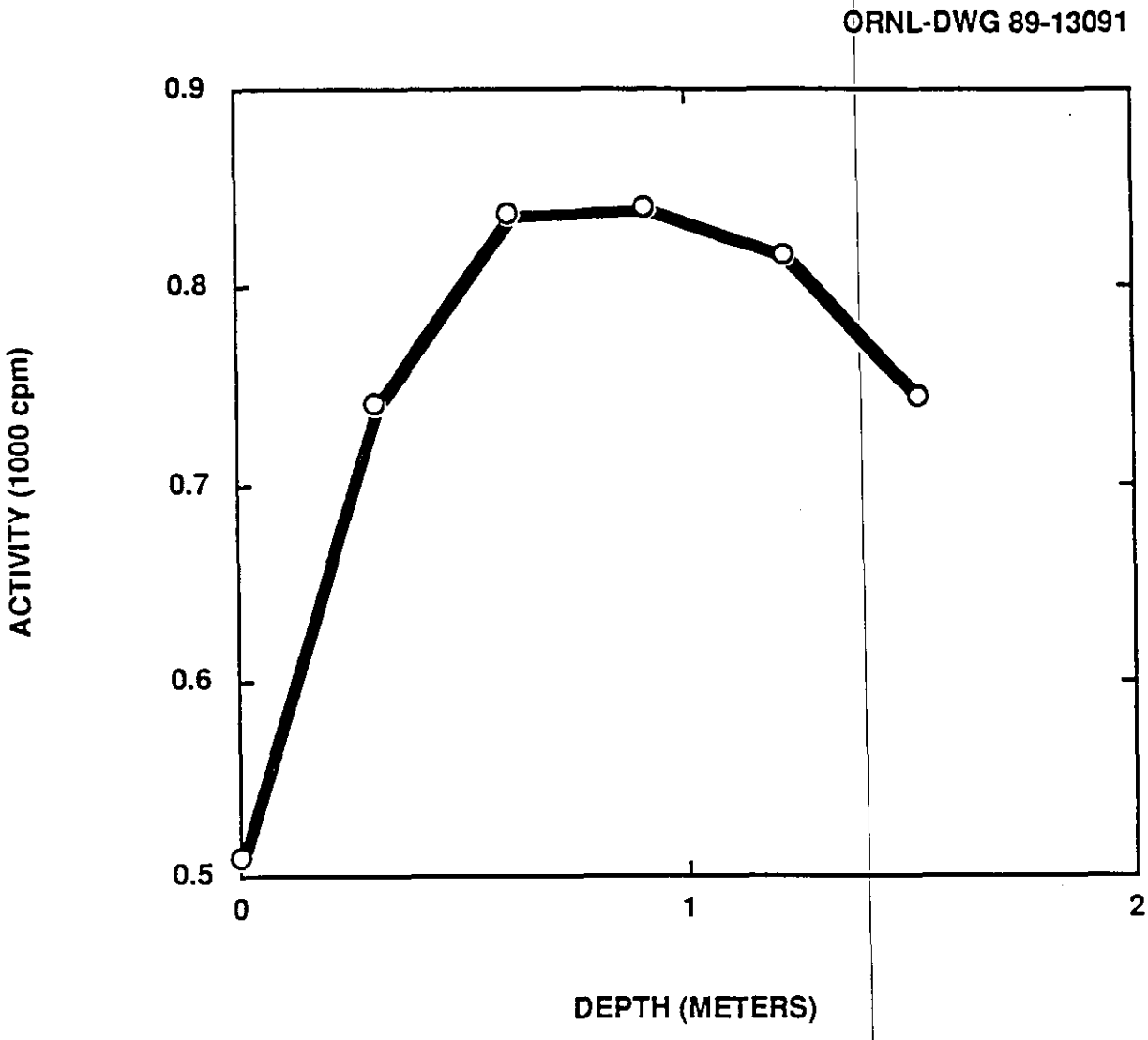

Fig. 28. Gamma profile for auger hole 20 (A20) at the former ore storage site, Palmerton, Pennsylvania (PP001).

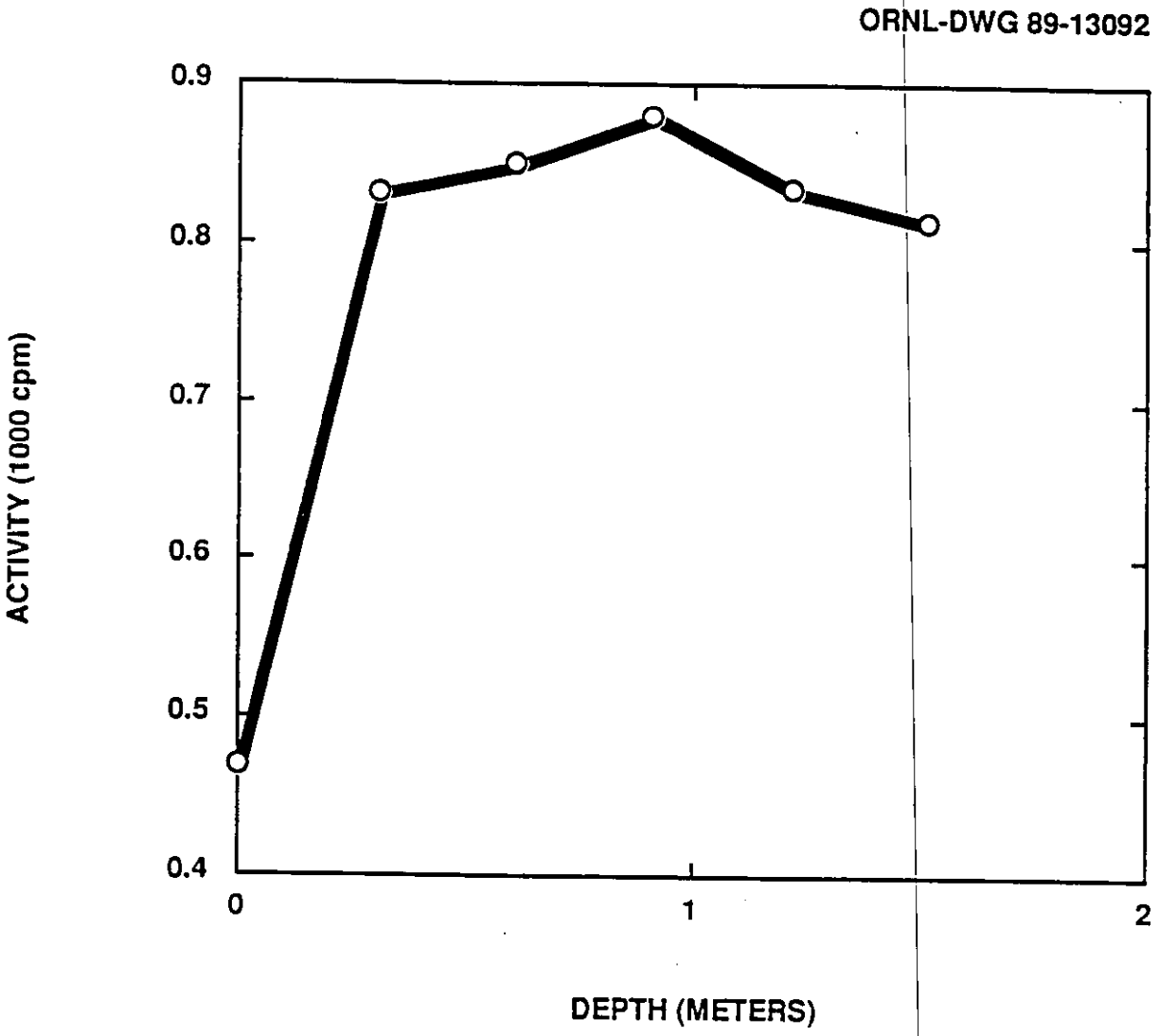

Fig. 29. Gamma profile for auger hole 21 (A21) at the former ore storage site, Palmerton, Pennsylvania (PP001).

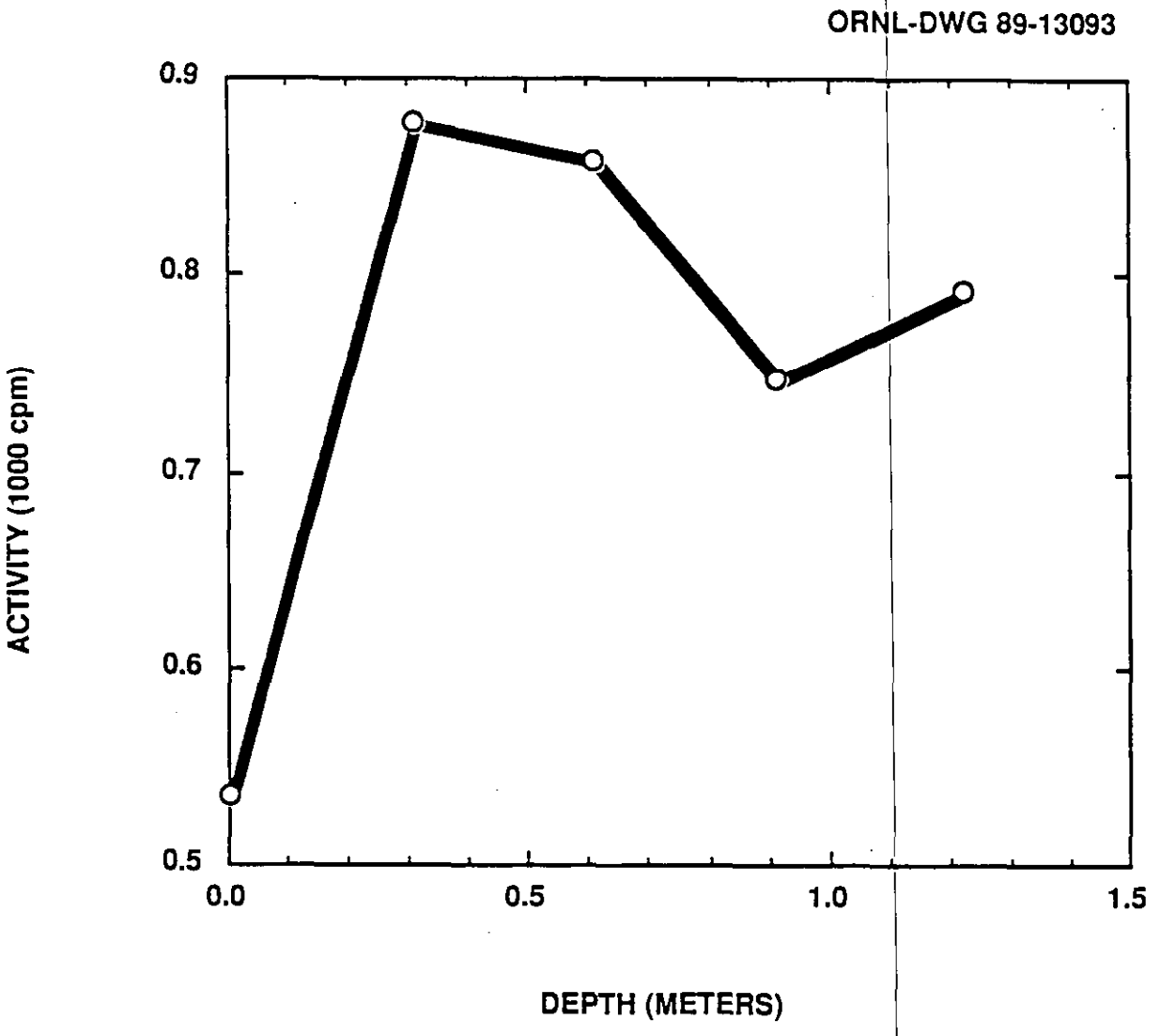

Fig. 30. Gamma profile for auger hole 22 (A22) at the former ore storage site, Palmerton, Pennsylvania (PP001).

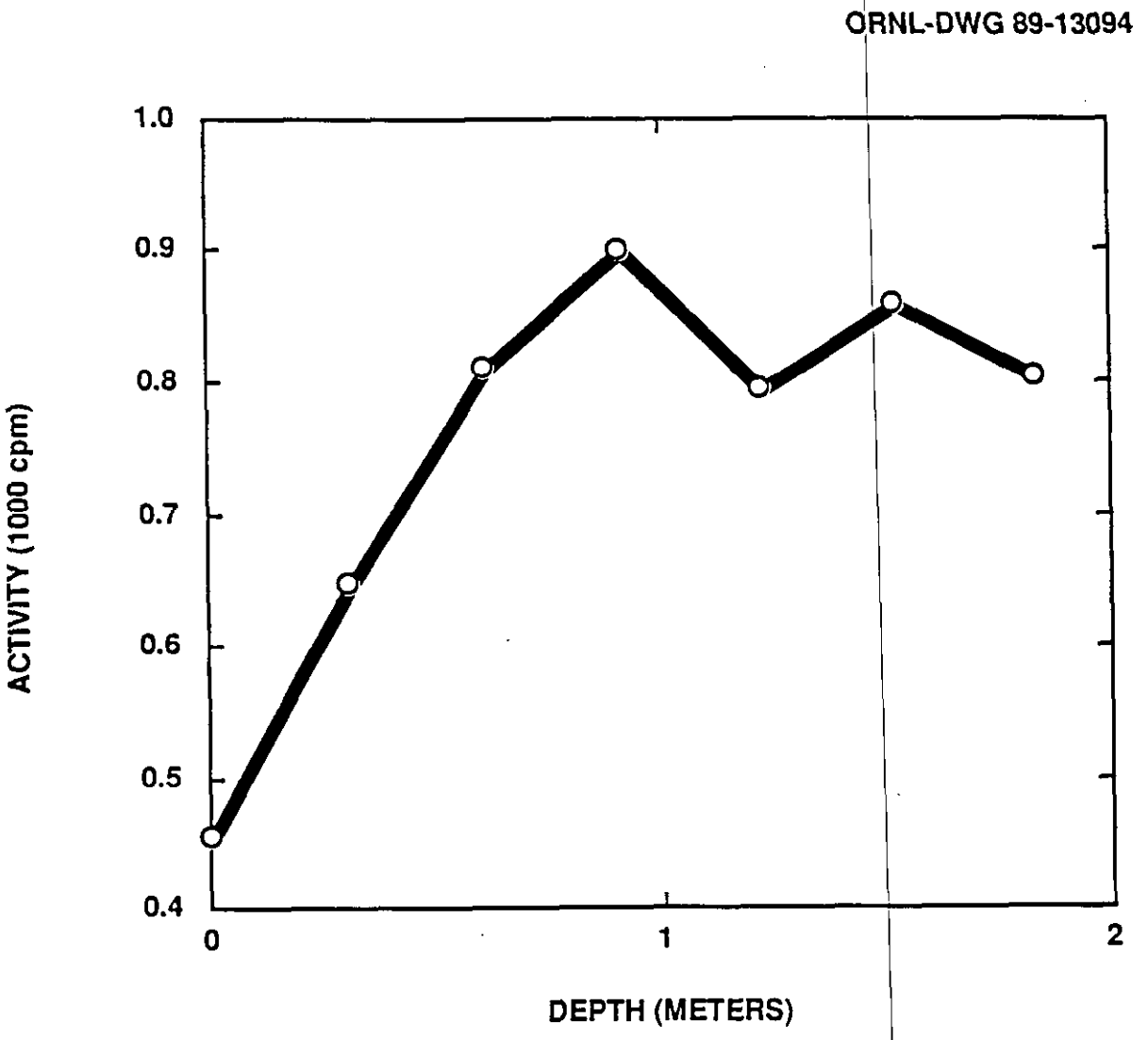

Fig. 31. Gamma profile for auger hole 23 (A23) at the former ore storage site, Palmerton, Pennsylvania (PP001).

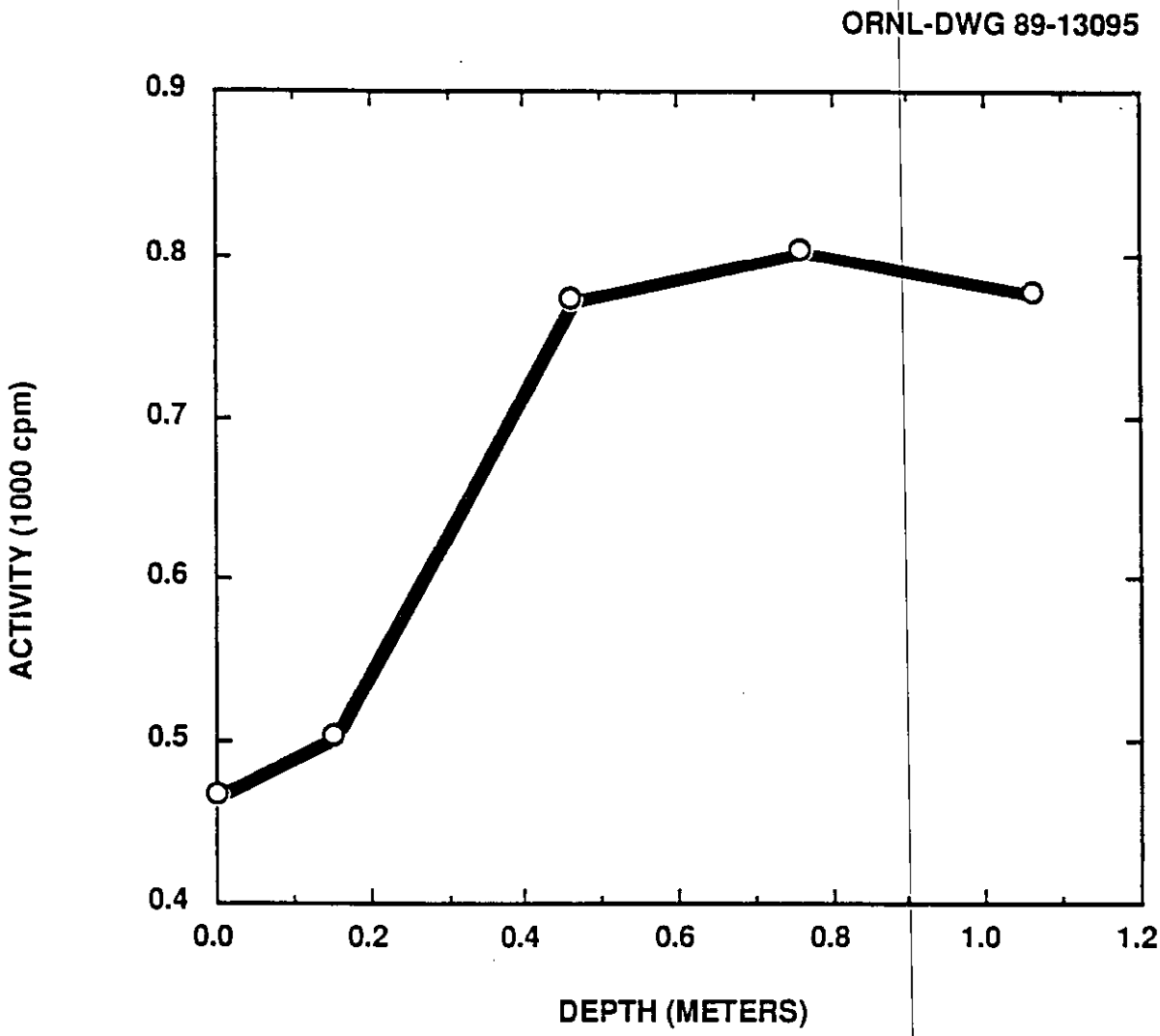

Fig. 32. Gamma profile for auger hole 24 (A24) at the former ore storage site, Palmerton, Pennsylvania (PP001).

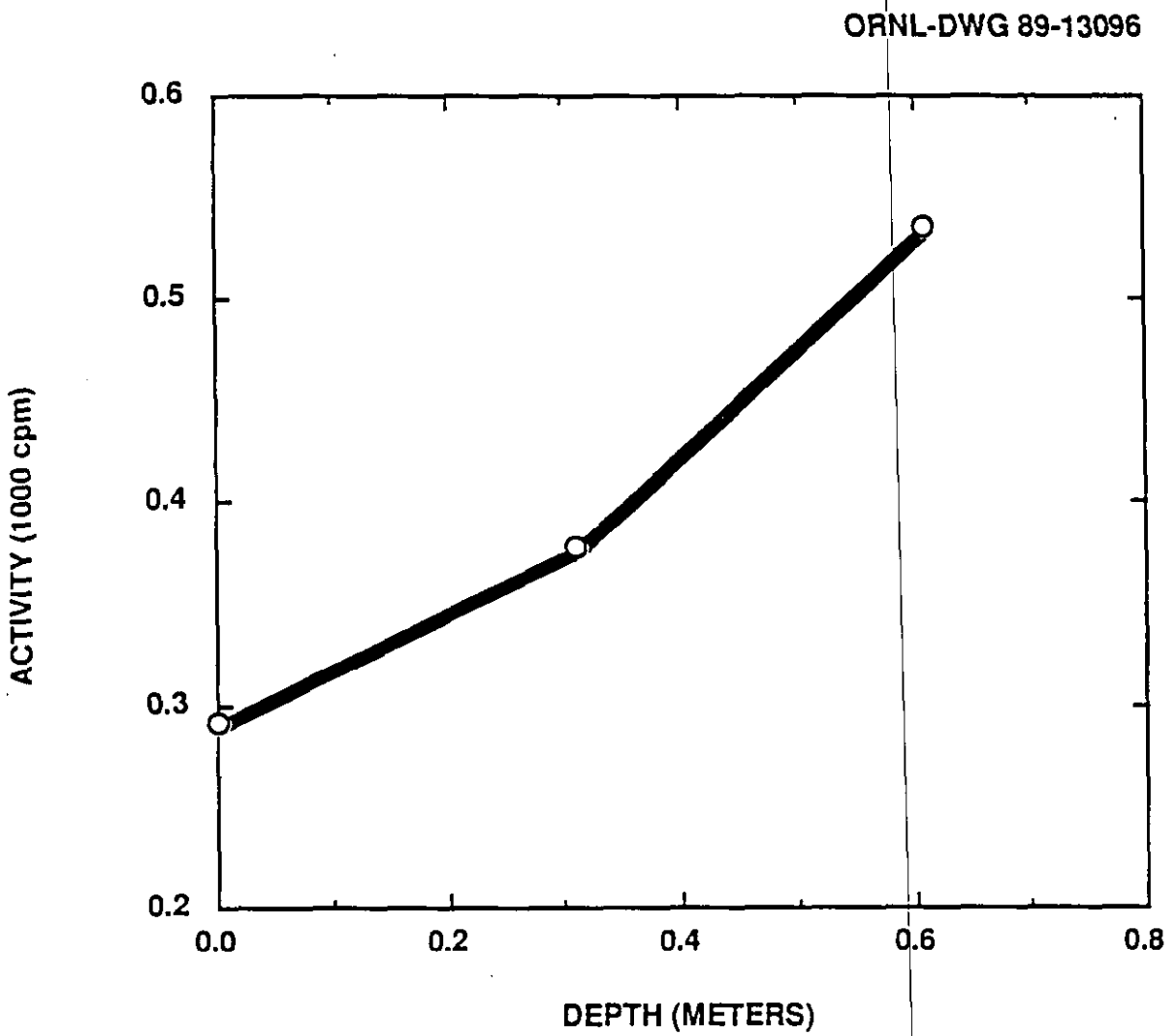

Fig. 33. Gamma profile for auger hole 25 (A25) at the former ore storage site, Palmerton, Pennsylvania (PP001).

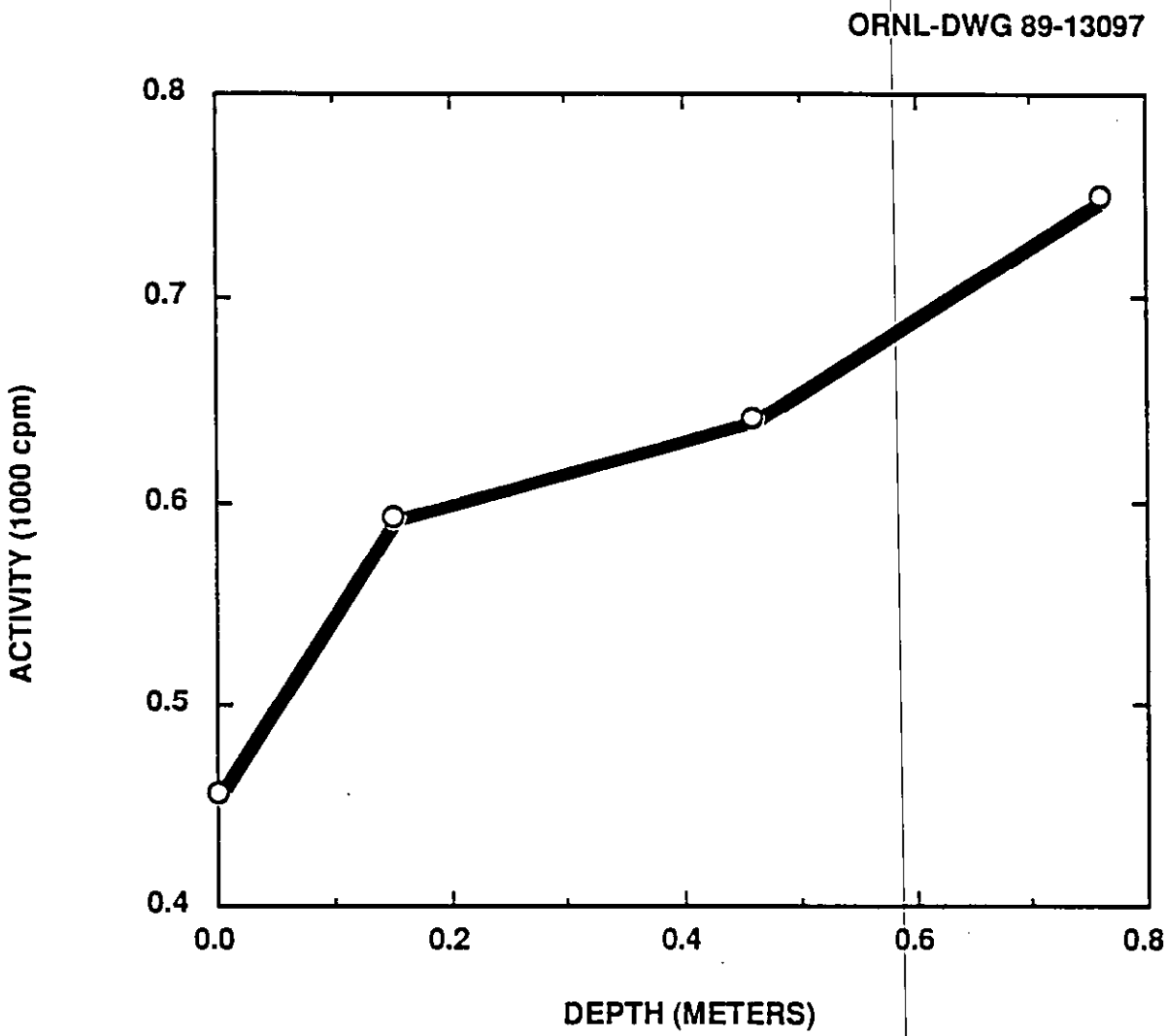

Fig. 34. Gamma profile for auger hole 26 (A26) at the former ore storage site, Palmerton, Pennsylvania (PP001).

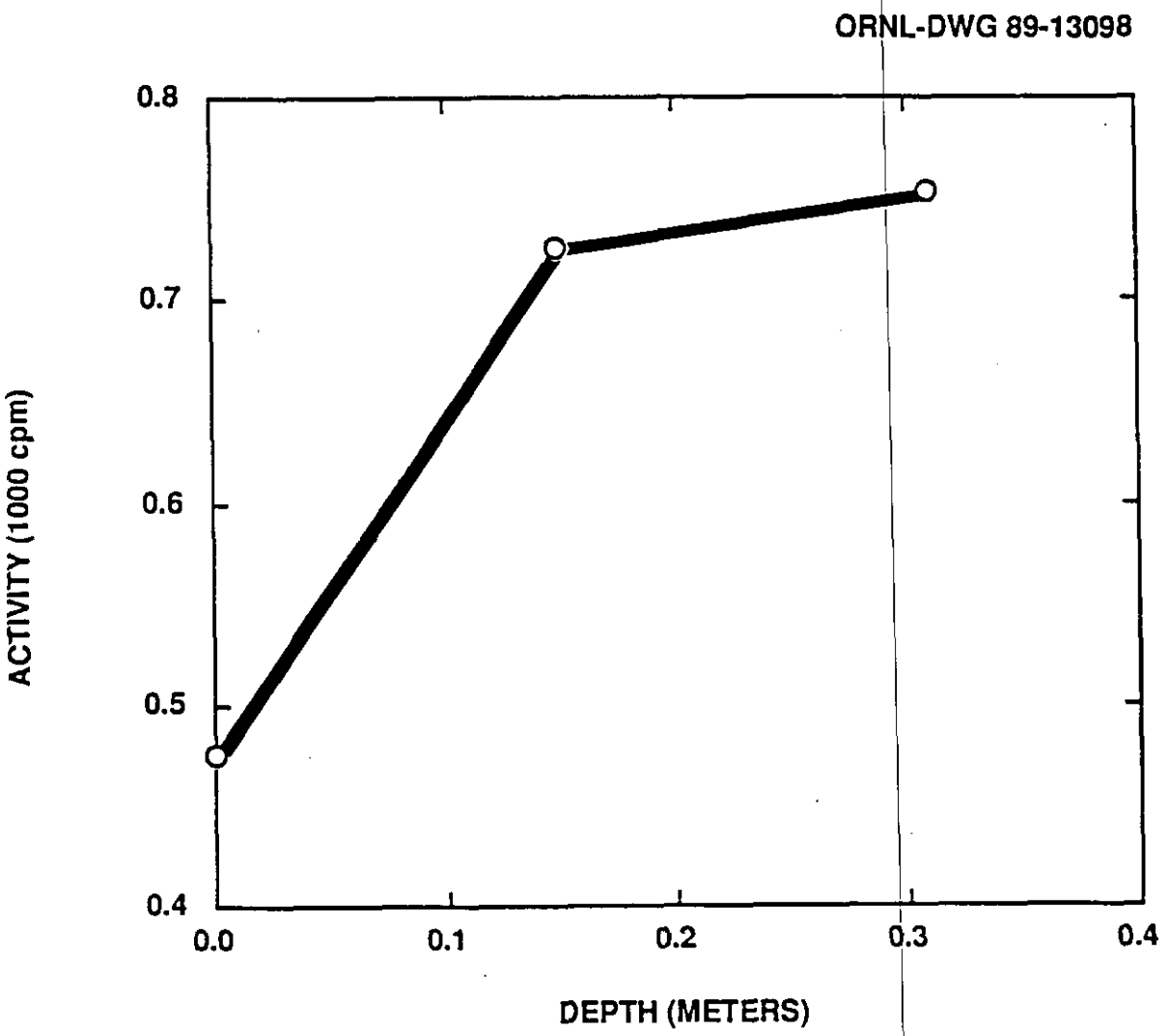

Fig. 35. Gamma profile for auger hole 27 (A27) at the former ore storage site, Palmerton, Pennsylvania (PP001).

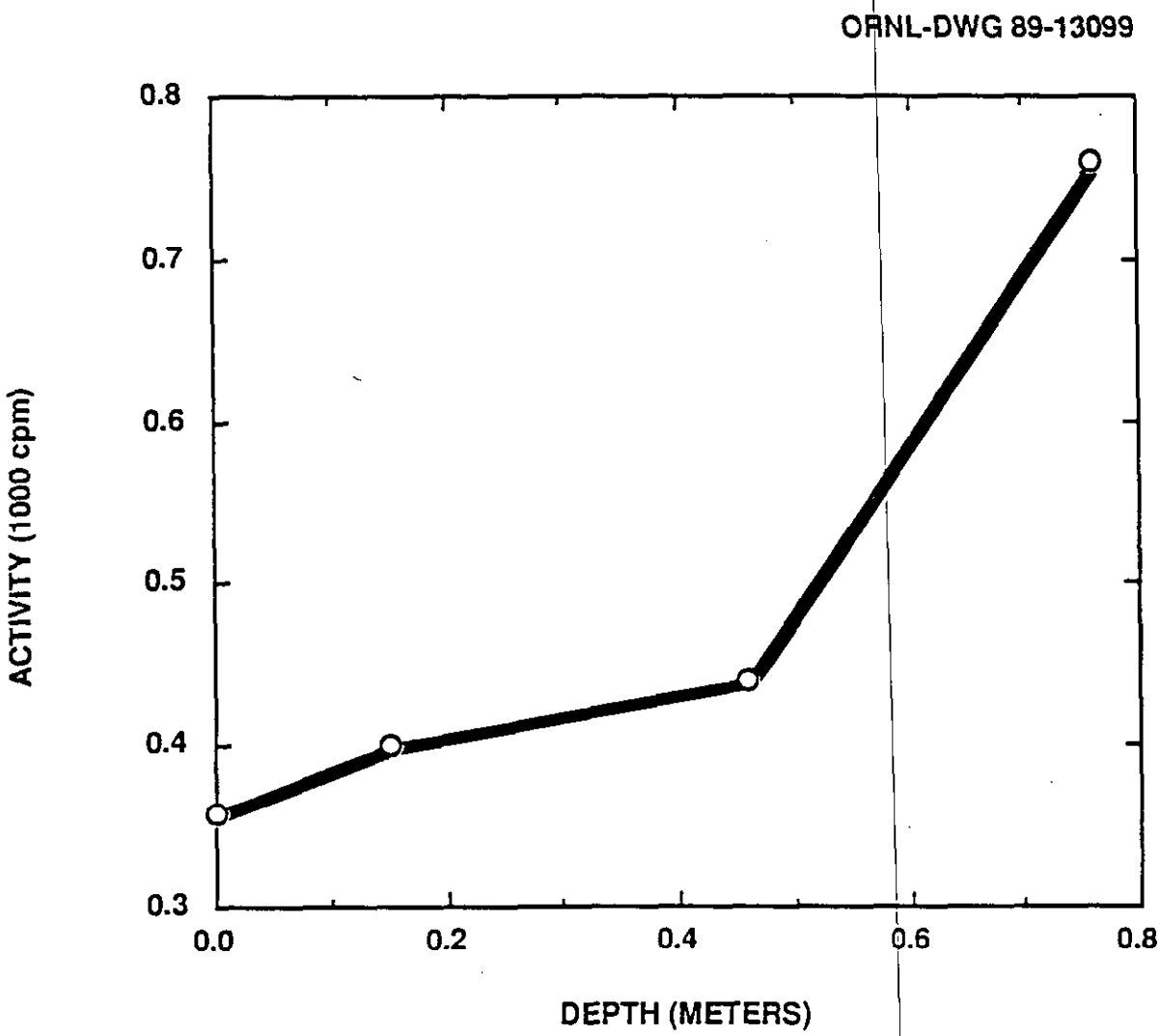

Fig. 36. Gamma profile for auger hole 28 (A28) at the former ore storage site, Palmerton, Pennsylvania (PP001).

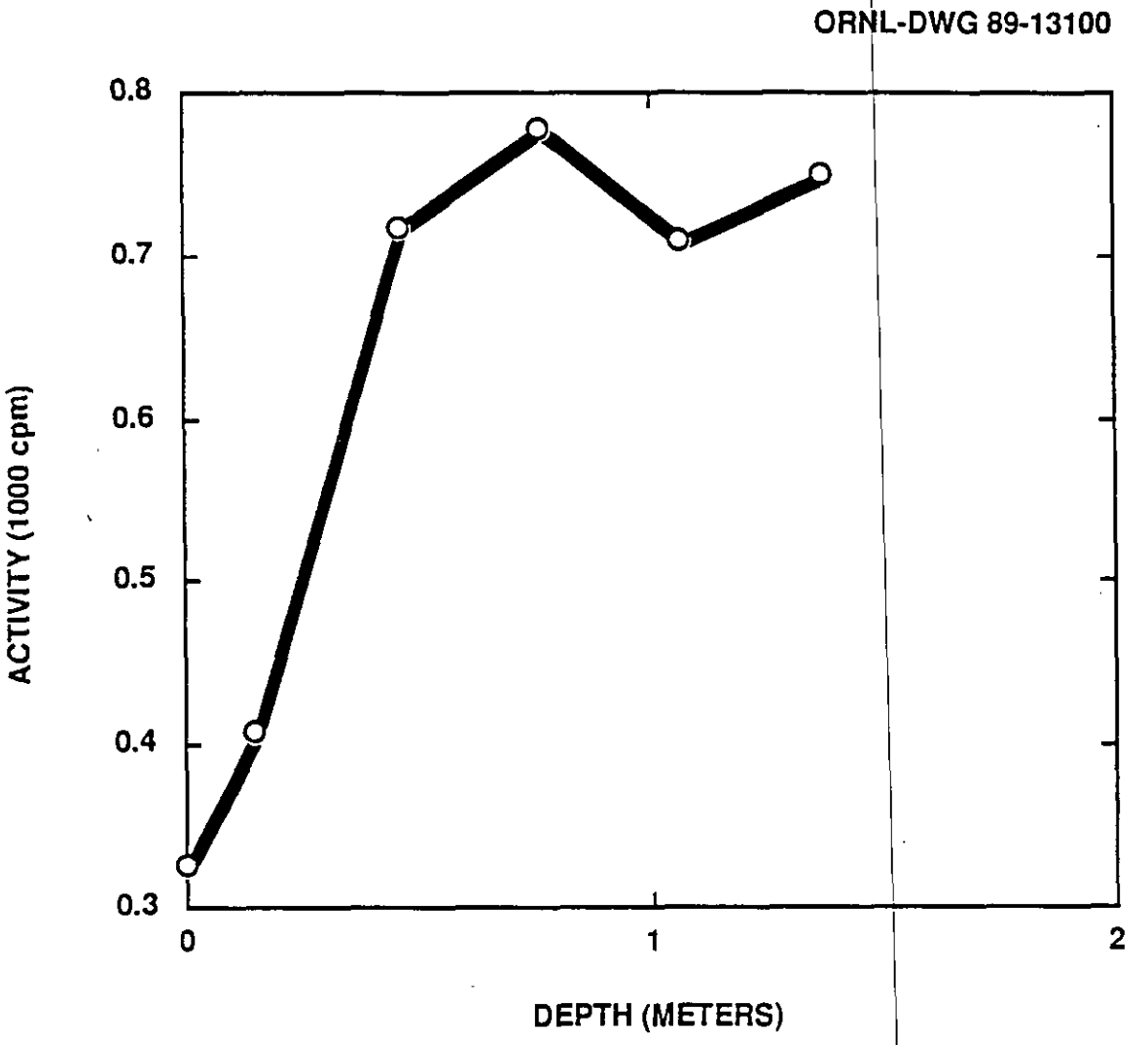

Fig. 37. Gamma profile for auger hole 29 (A29) at the former ore storage site, Palmerton, Pennsylvania (PP001).

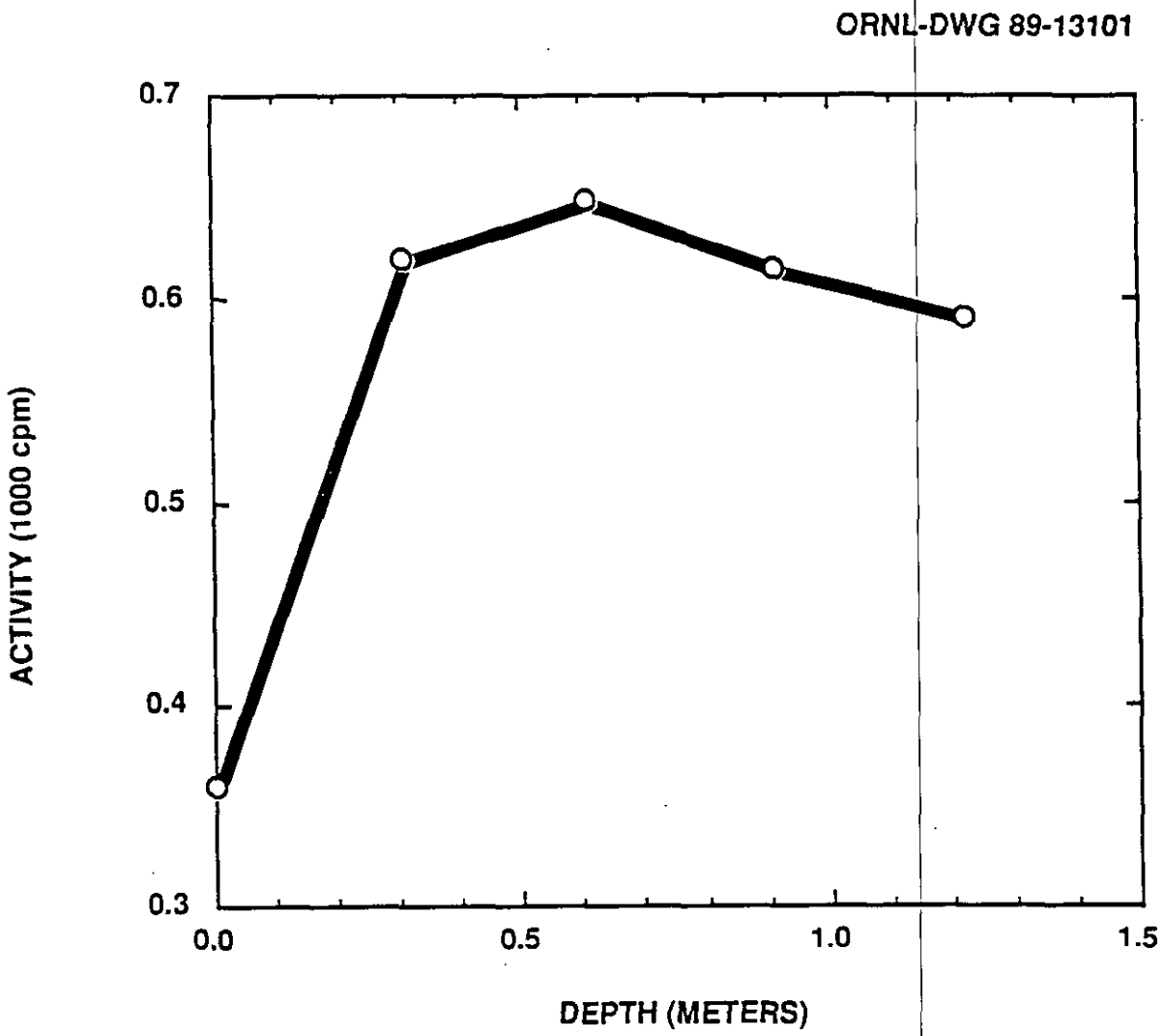

Fig. 38. Gamma profile for auger hole 30 (A30) at the former ore storage site, Palmerton, Pennsylvania (PP001).

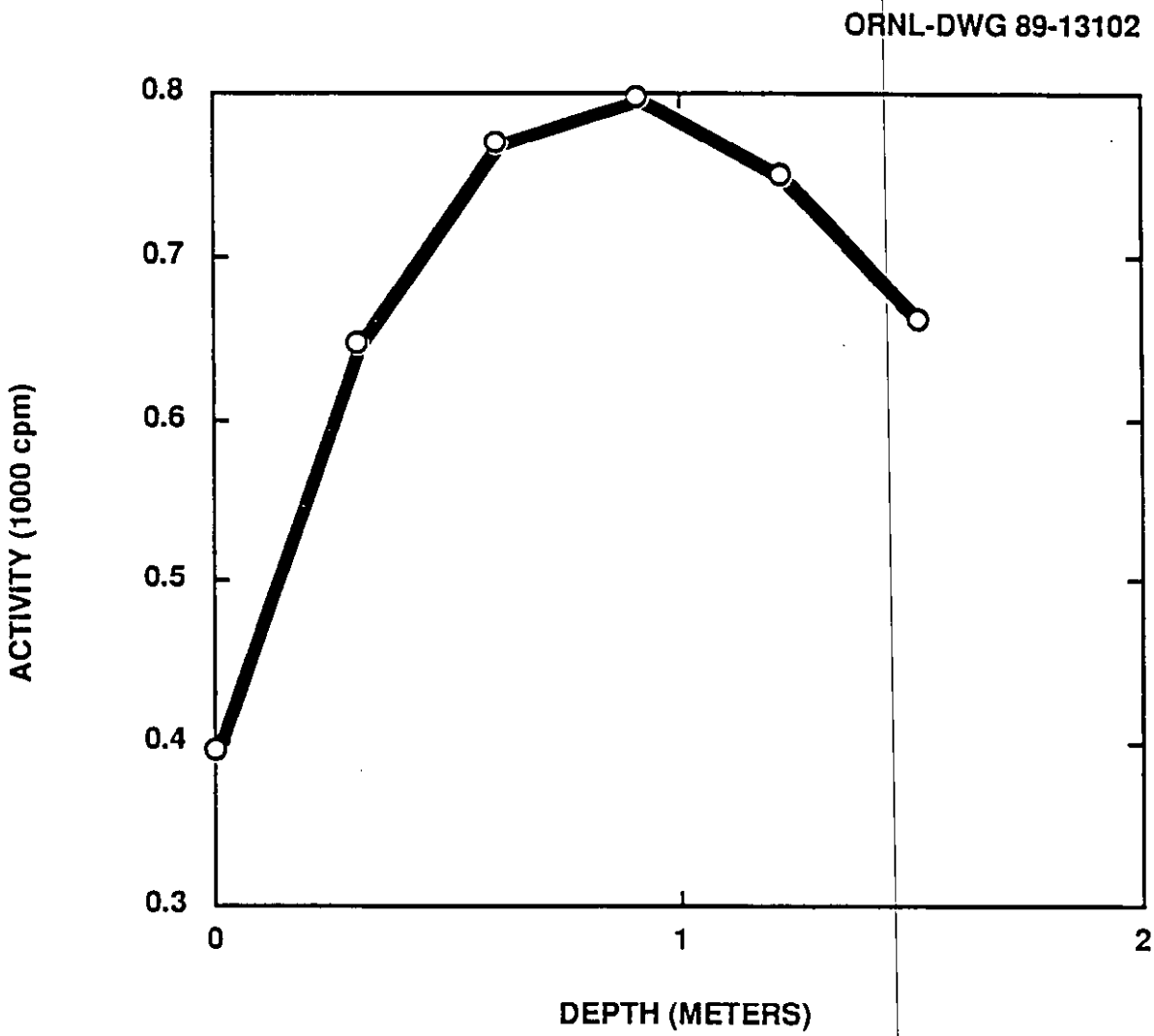

Fig. 39. Gamma profile for auger hole 31 (A31) at the former ore storage site, Palmerton, Pennsylvania (PP001).

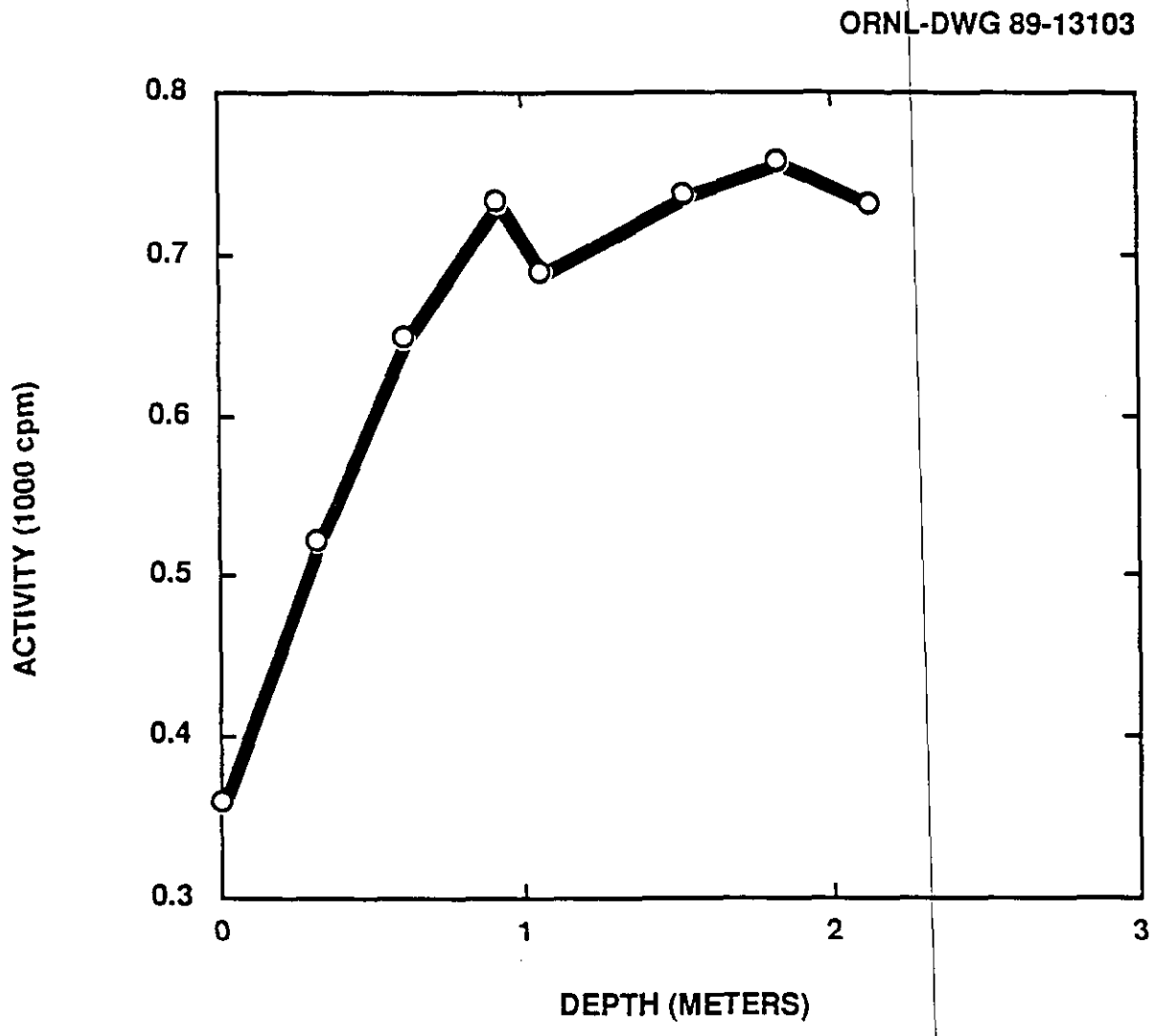

Fig. 40. Gamma profile for auger hole 32 (A32) at the former ore storage site, Palmerton, Pennsylvania (PP001).

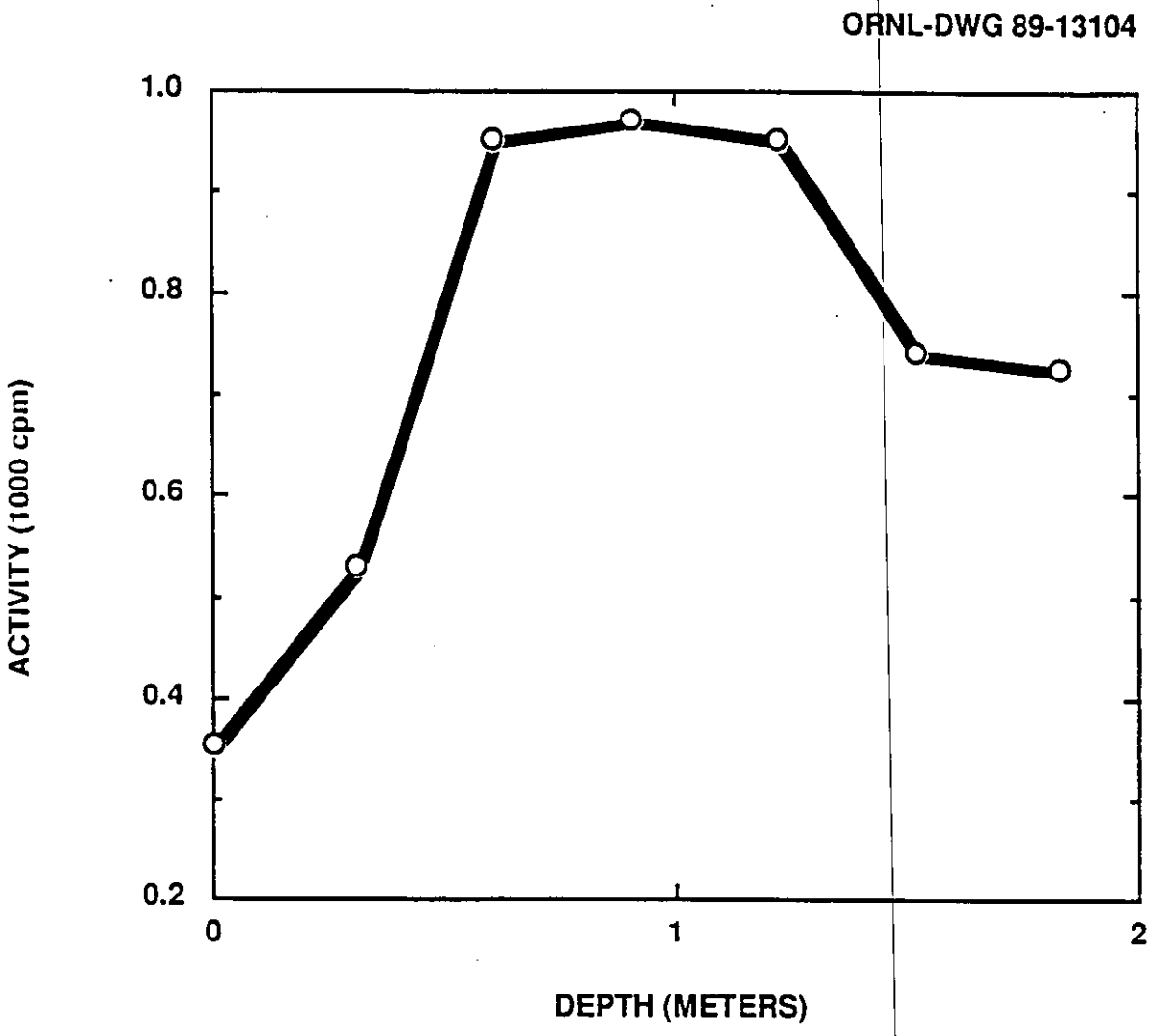

Fig. 41. Gamma profile for auger hole 33 (A33) at the former ore storage site, Palmerton, Pennsylvania (PP001).

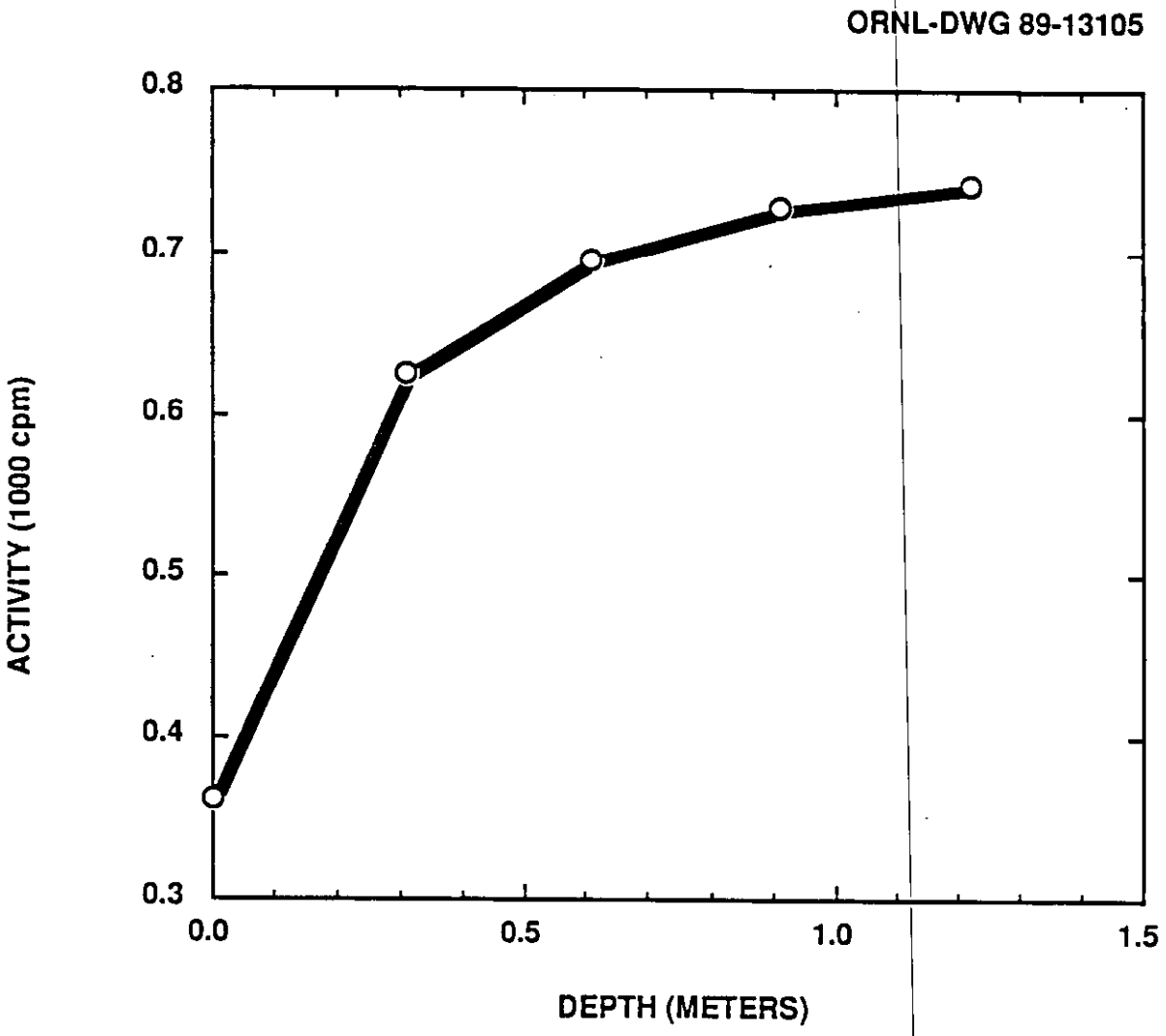

Fig. 42. Gamma profile for auger hole 34 (A34) at the former ore storage site, Palmerton, Pennsylvania (PP001).

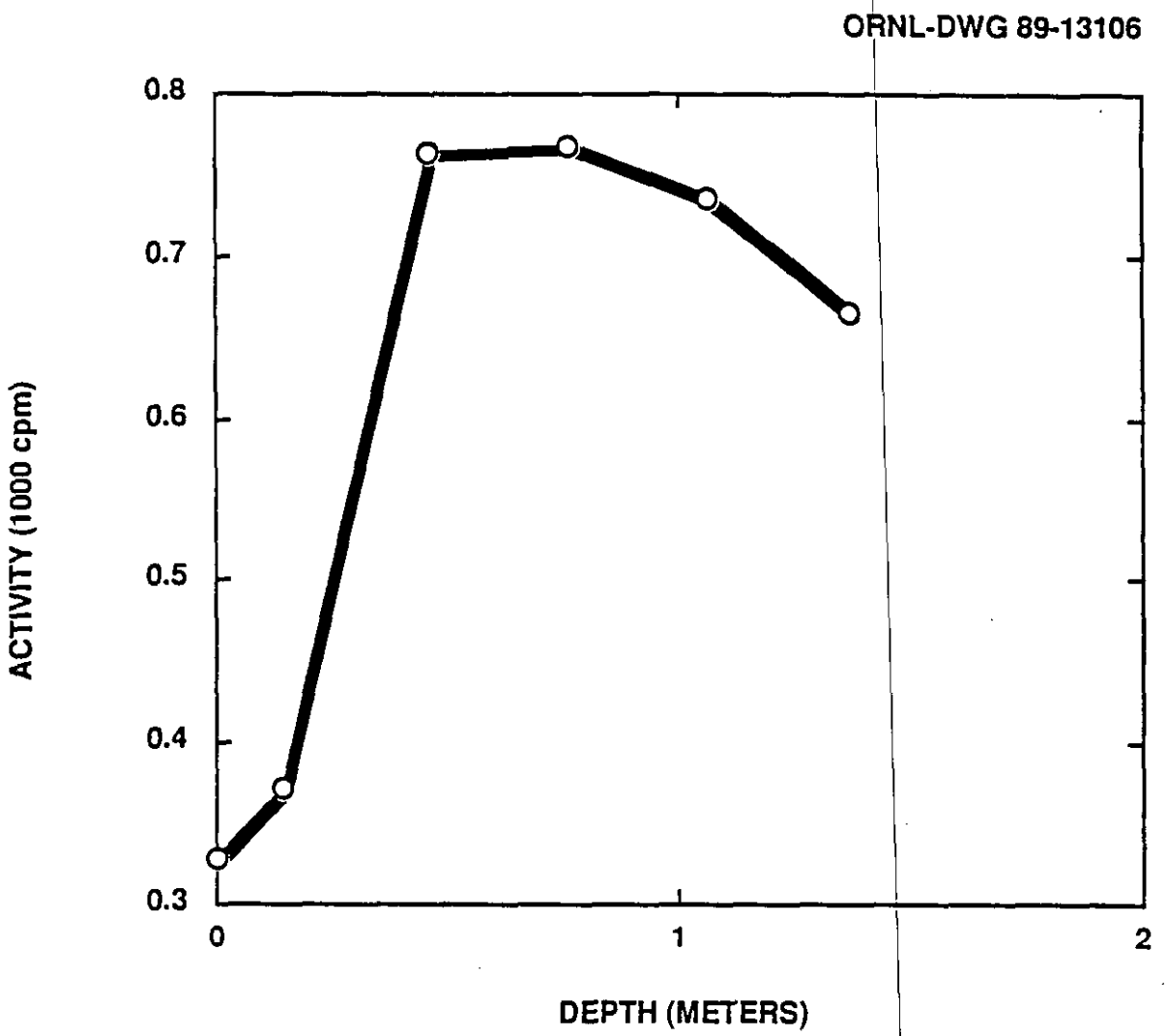

Fig. 43. Gamma profile for auger hole 35 (A35) at the former ore storage site, Palmerton, Pennsylvania (PP001).

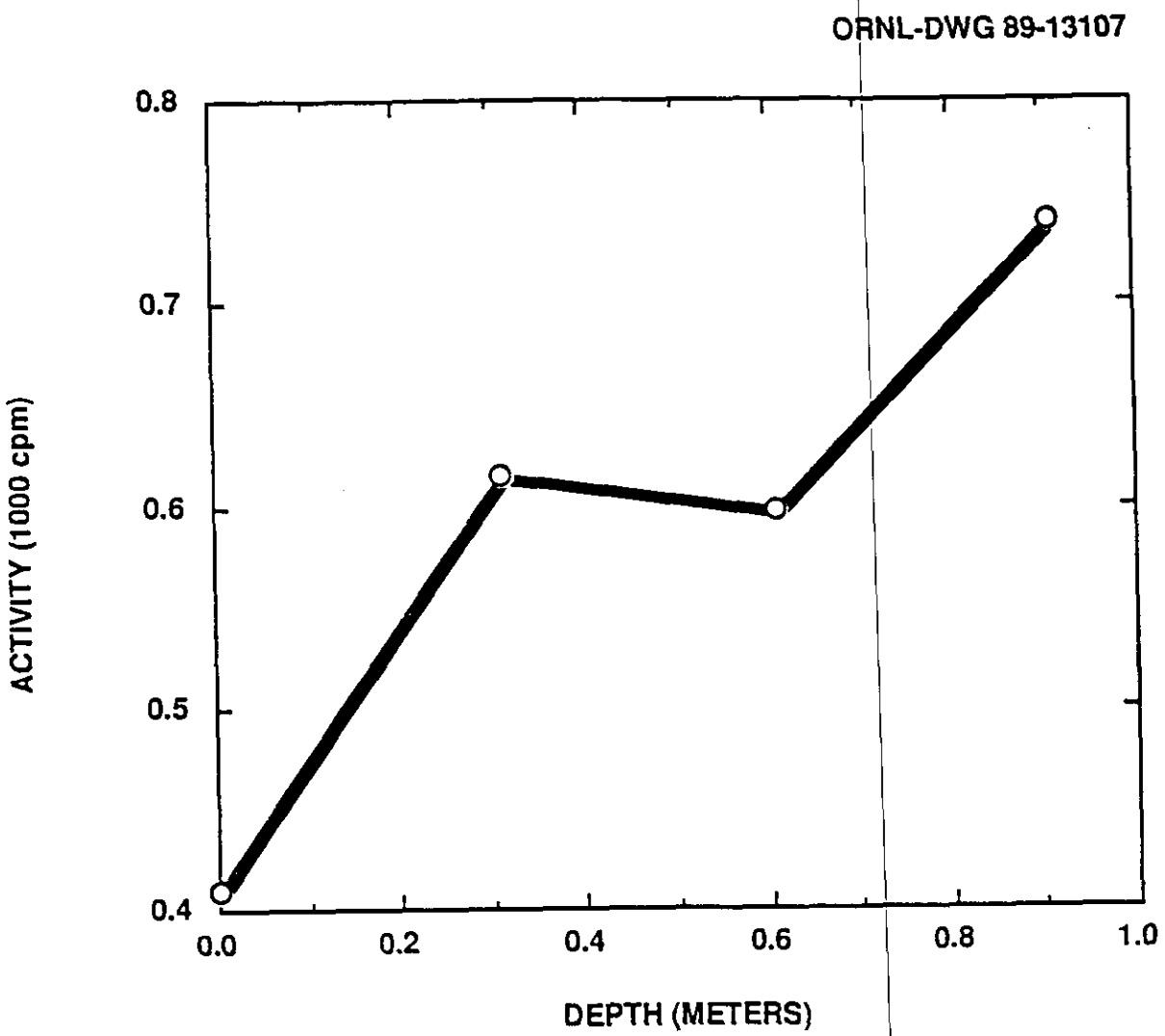

Fig. 44. Gamma profile for auger hole 36 (A36) at the former ore storage site, Palmerton, Pennsylvania (PP001).

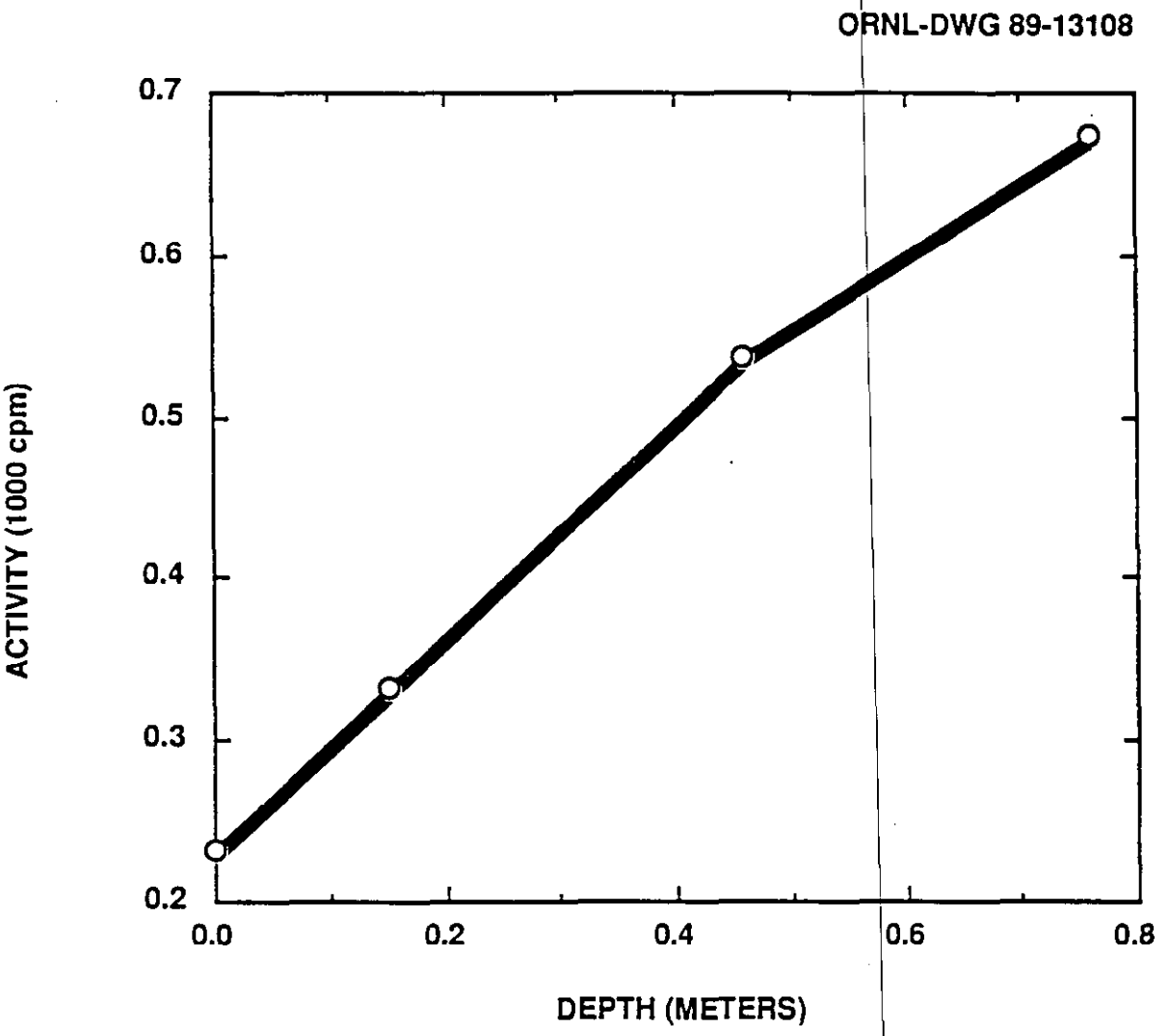

Fig. 45. Gamma profile for auger hole 37 (A37) at the former ore storage site, Palmerton, Pennsylvania (PP001).

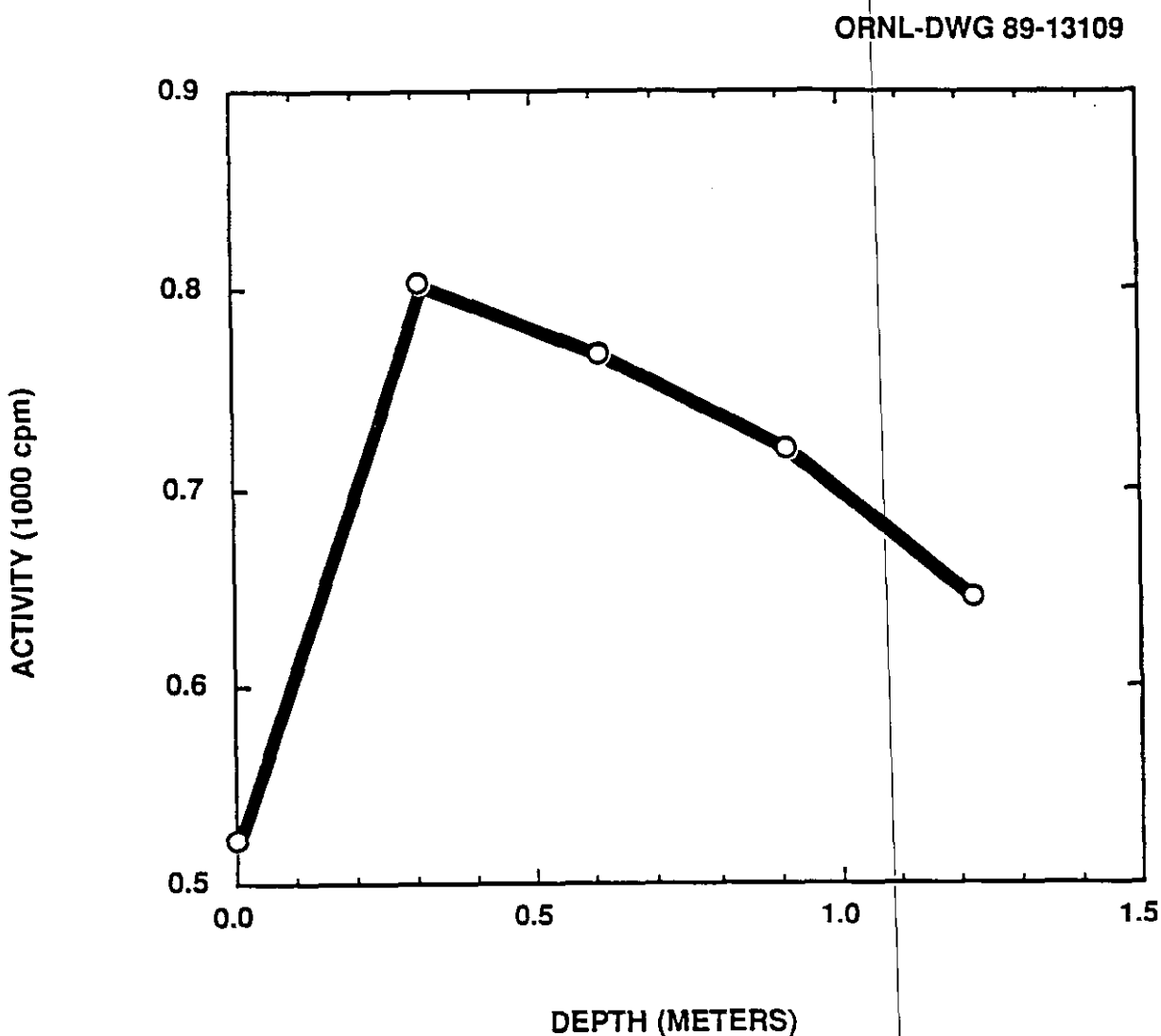

Fig. 46. Gamma profile for auger hole 38 (A38) at the former ore storage site, Palmerton, Pennsylvania (PP001).

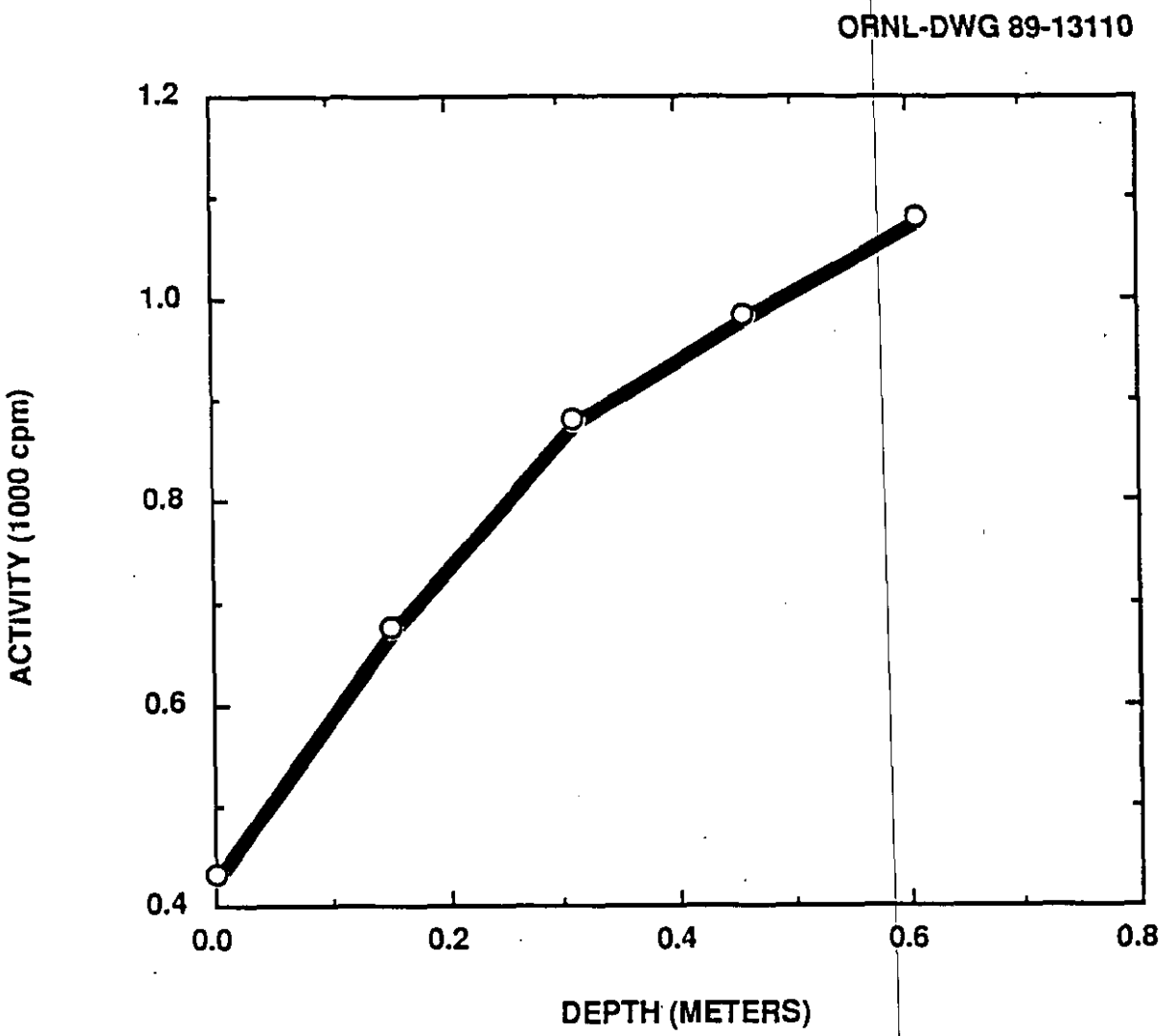

Fig. 47. Gamma profile for auger hole 39 (A39) at the former ore storage site, Palmerton, Pennsylvania (PP001).

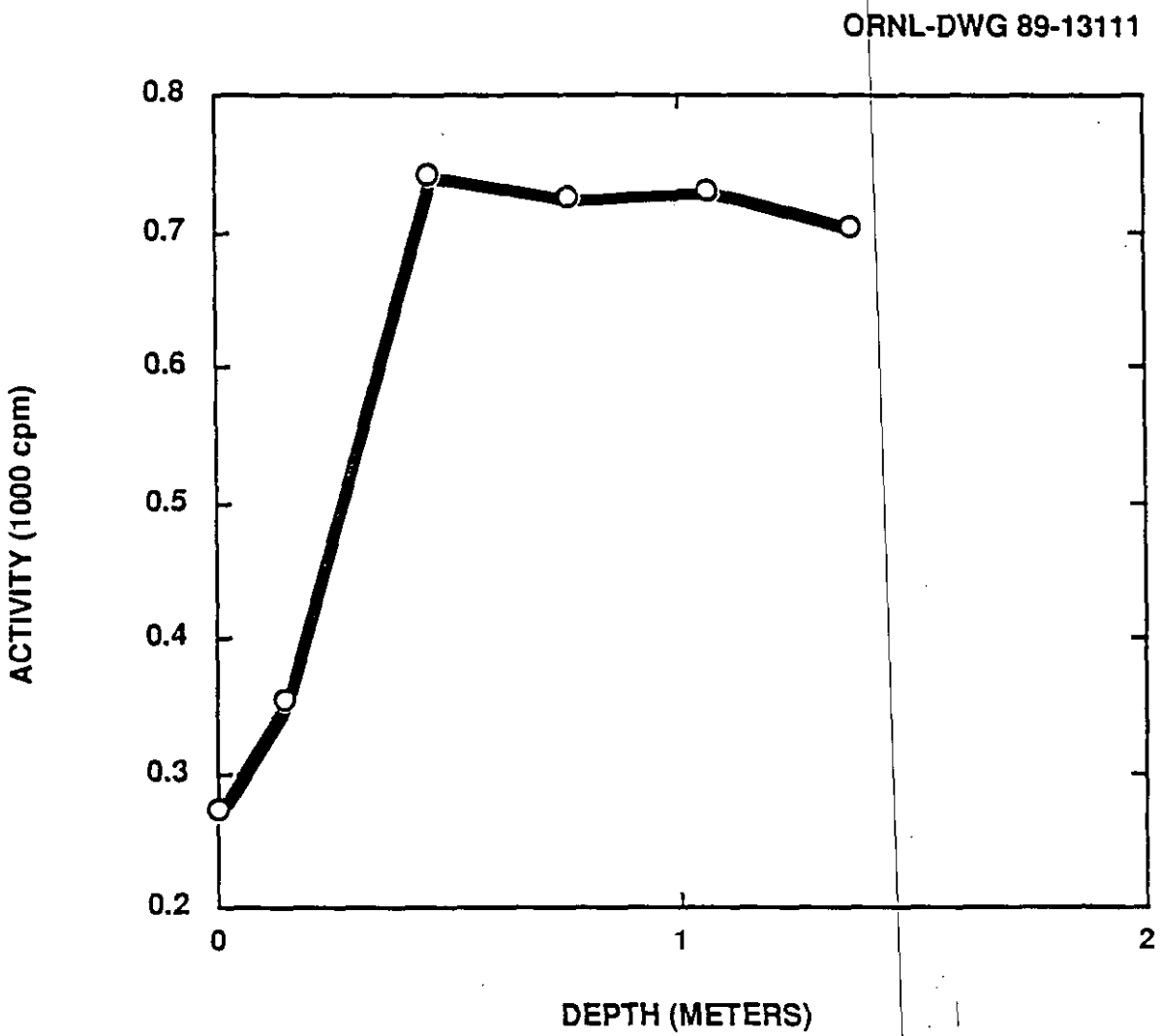

Fig. 48. Gamma profile for auger hole 40 (A40) at the former ore storage site, Palmerton, Pennsylvania (PP001).

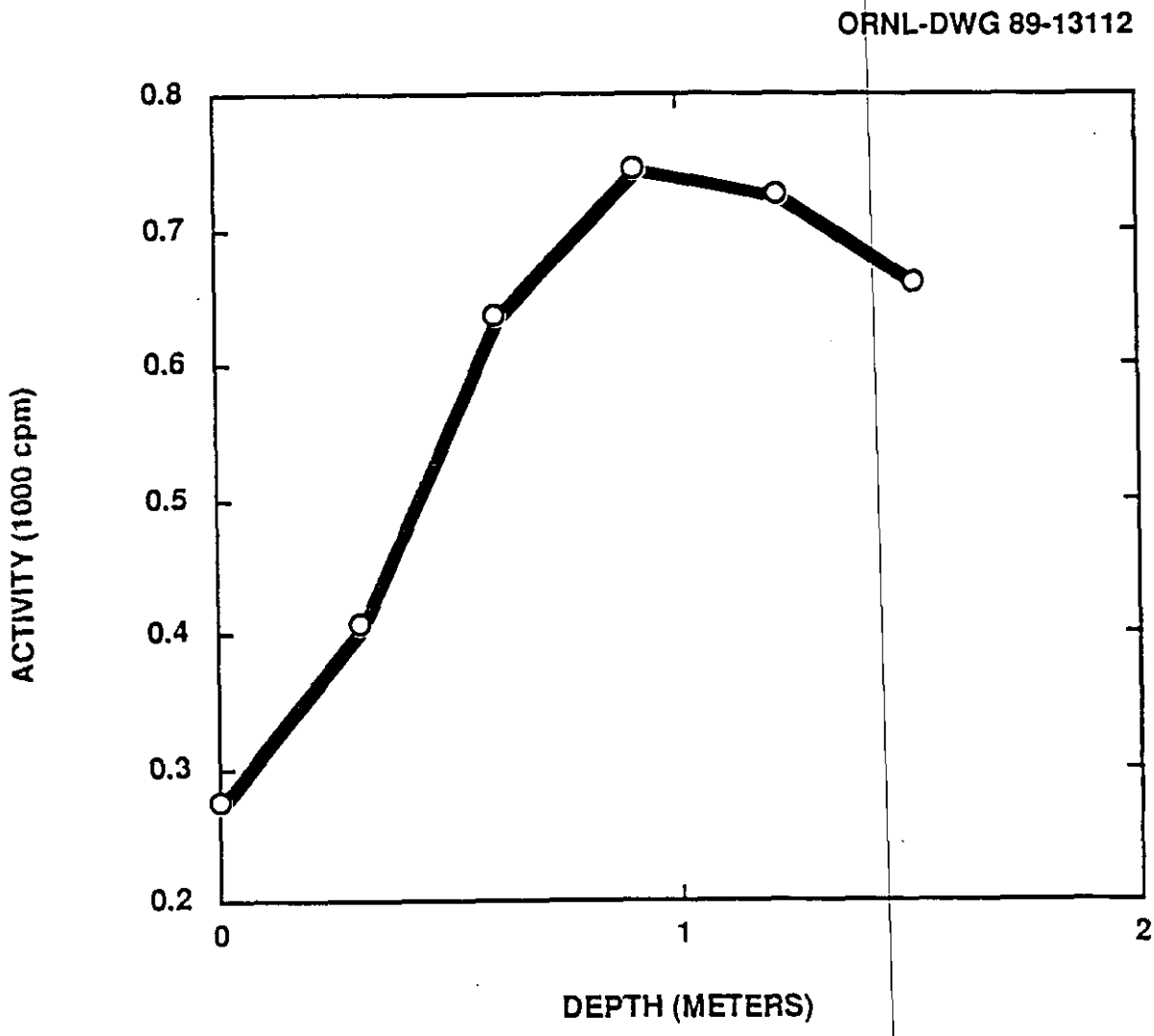

Fig. 49. Gamma profile for auger hole 41 (A41) at the former ore storage site, Palmerton, Pennsylvania (PP001).

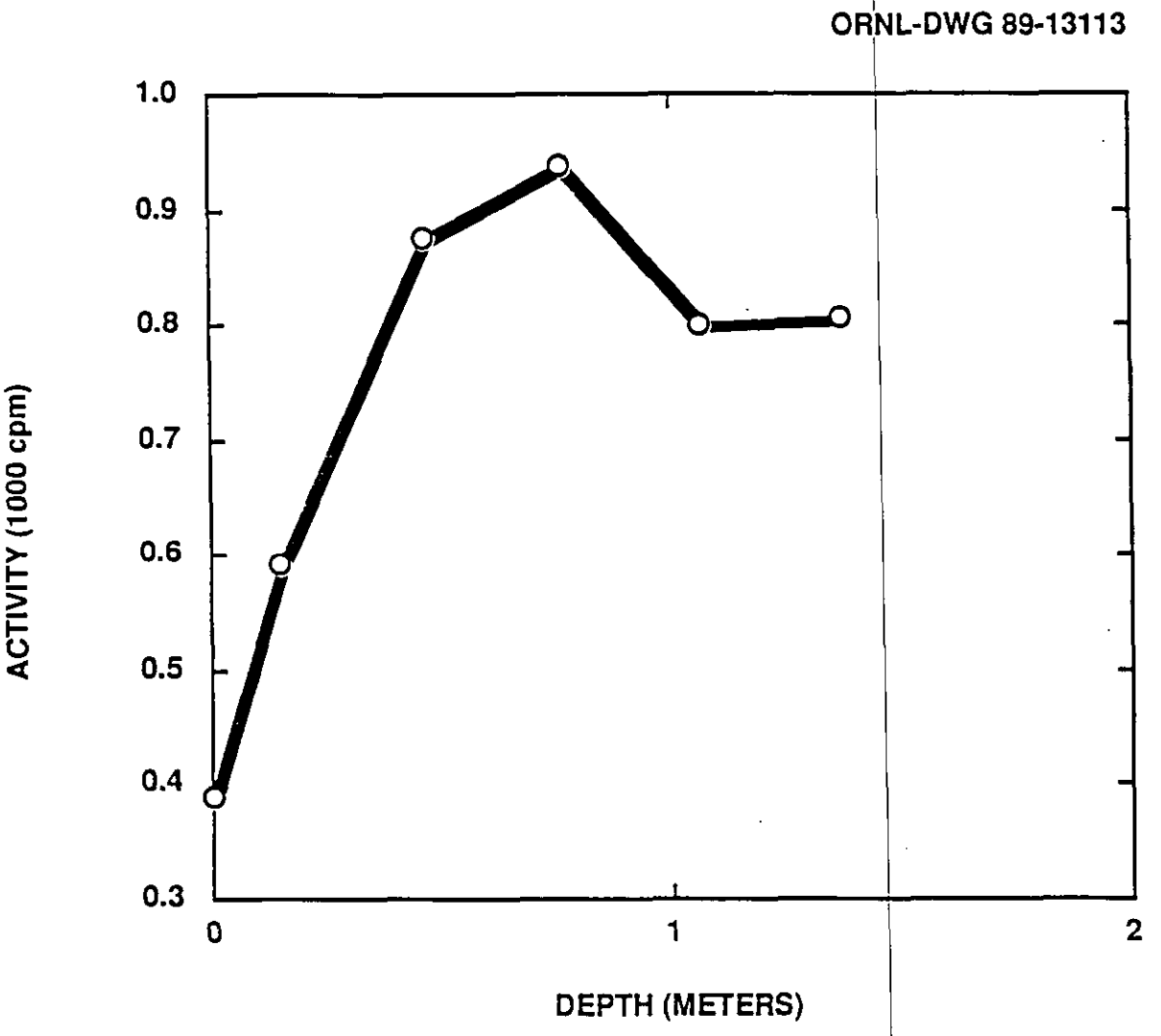

Fig. 50. Gamma profile for auger hole 42 (A42) at the former ore storage site, Palmerton, Pennsylvania (PP001).

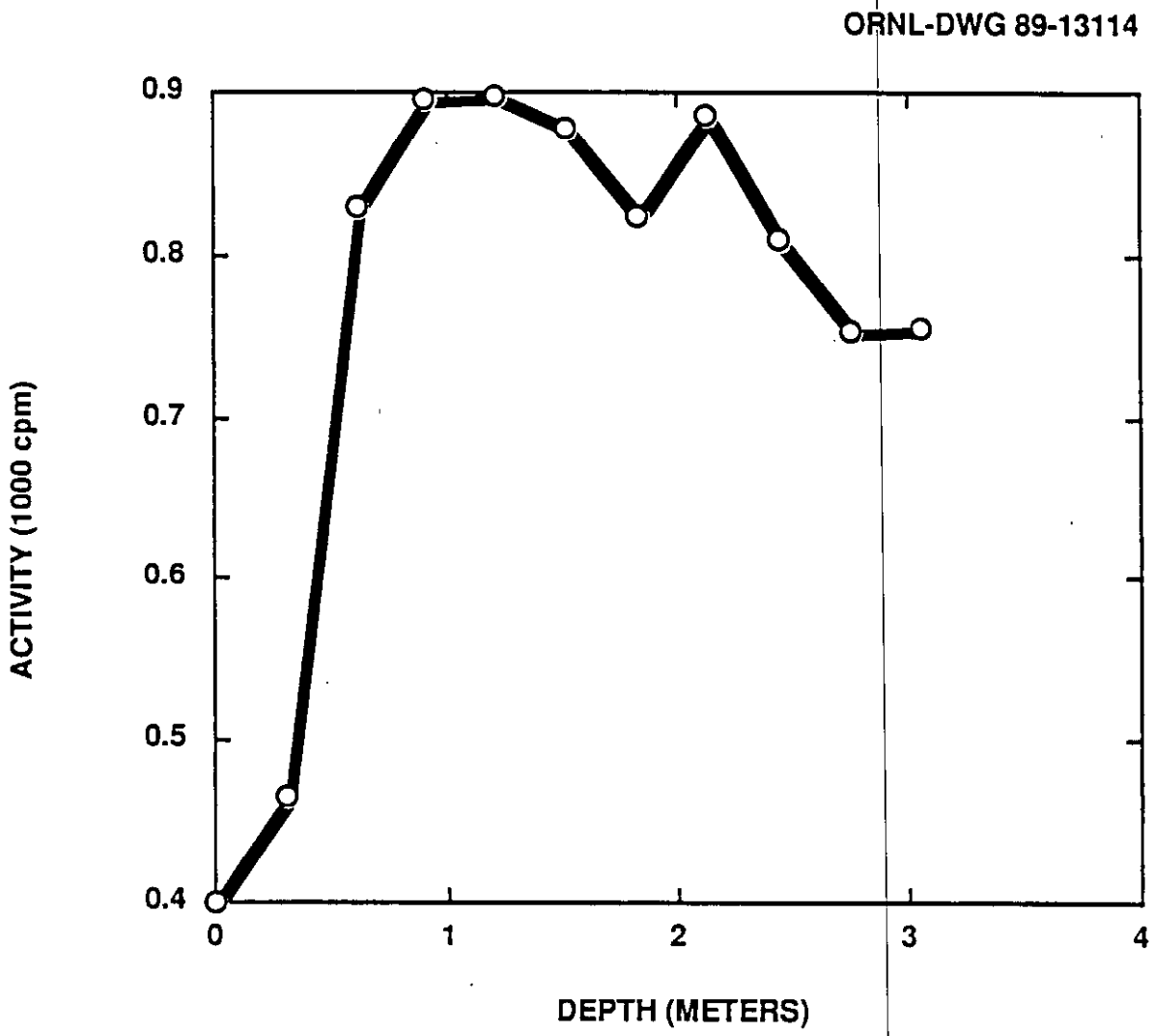

Fig. 51. Gamma profile for auger hole 43 (A43) at the former ore storage site, Palmerton, Pennsylvania (PP001).

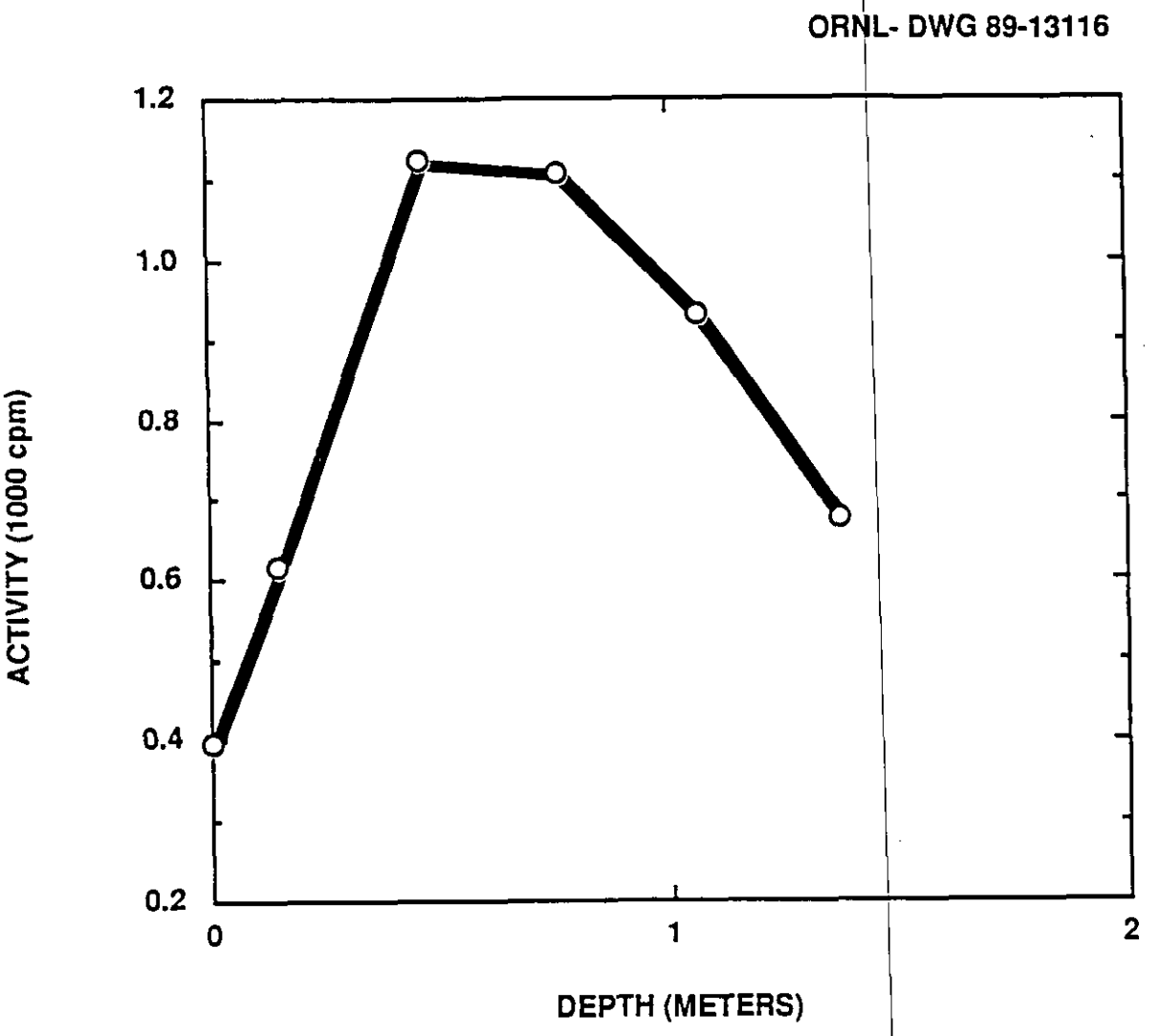

Fig. 52. Gamma profile for auger hole 44 (A44) at the former ore storage site, Palmerton, Pennsylvania (PP001).

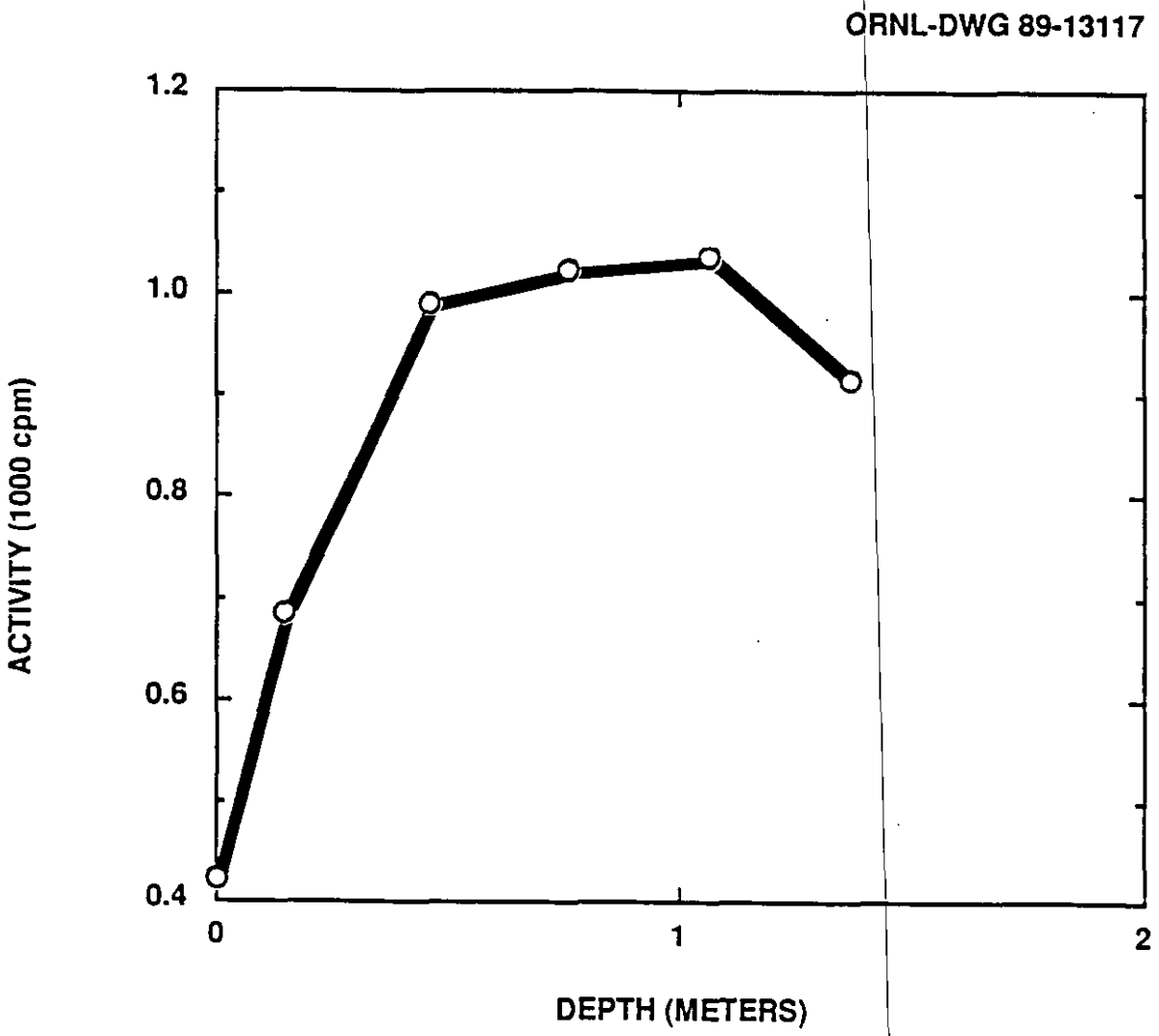

Fig. 53. Gamma profile for auger hole 45 (A45) at the former ore storage site, Palmerton, Pennsylvania (PP001).

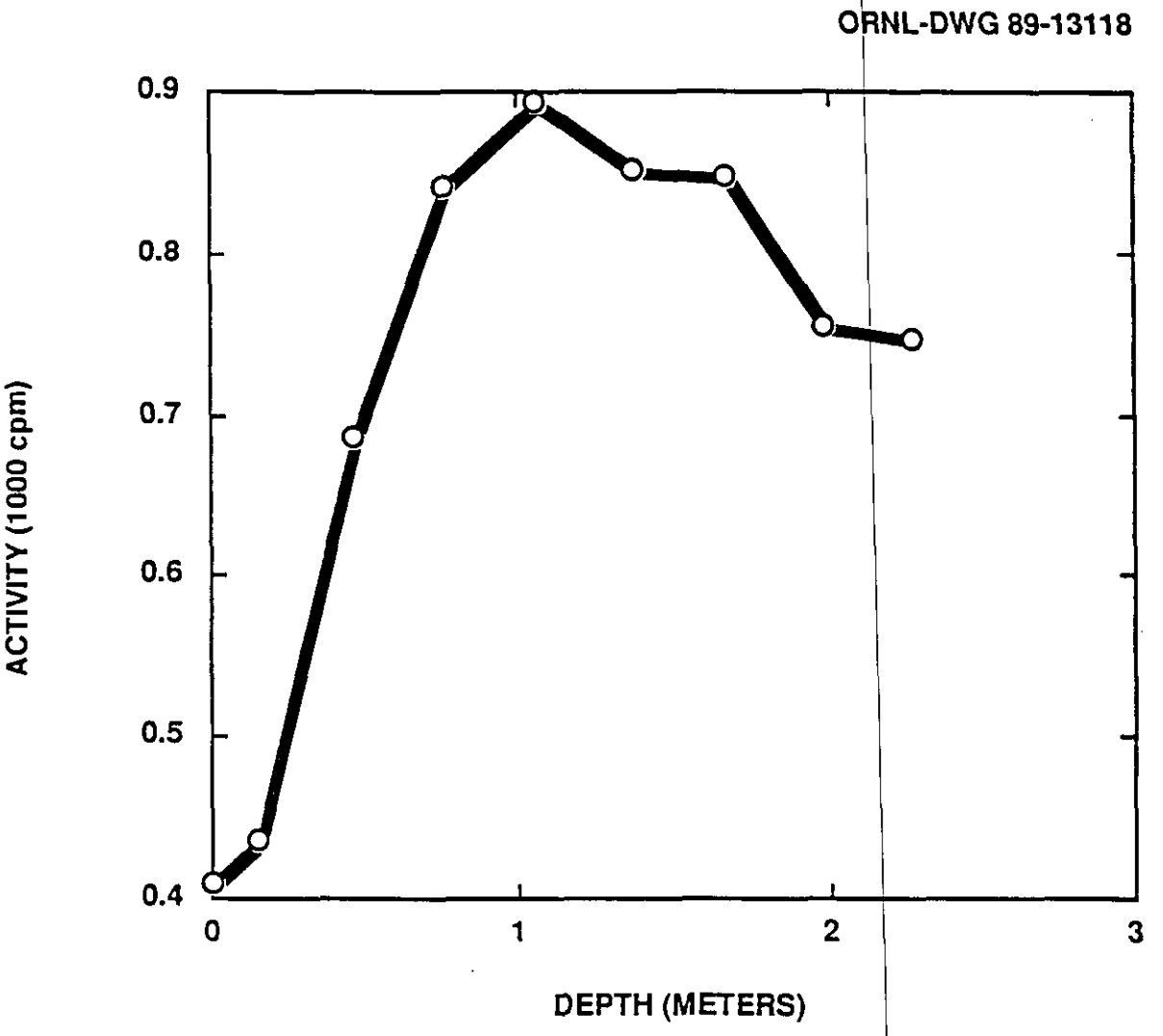

Fig. 54. Gamma profile for auger hole 46 (A46) at the former ore storage site, Palmerton, Pennsylvania (PP001).

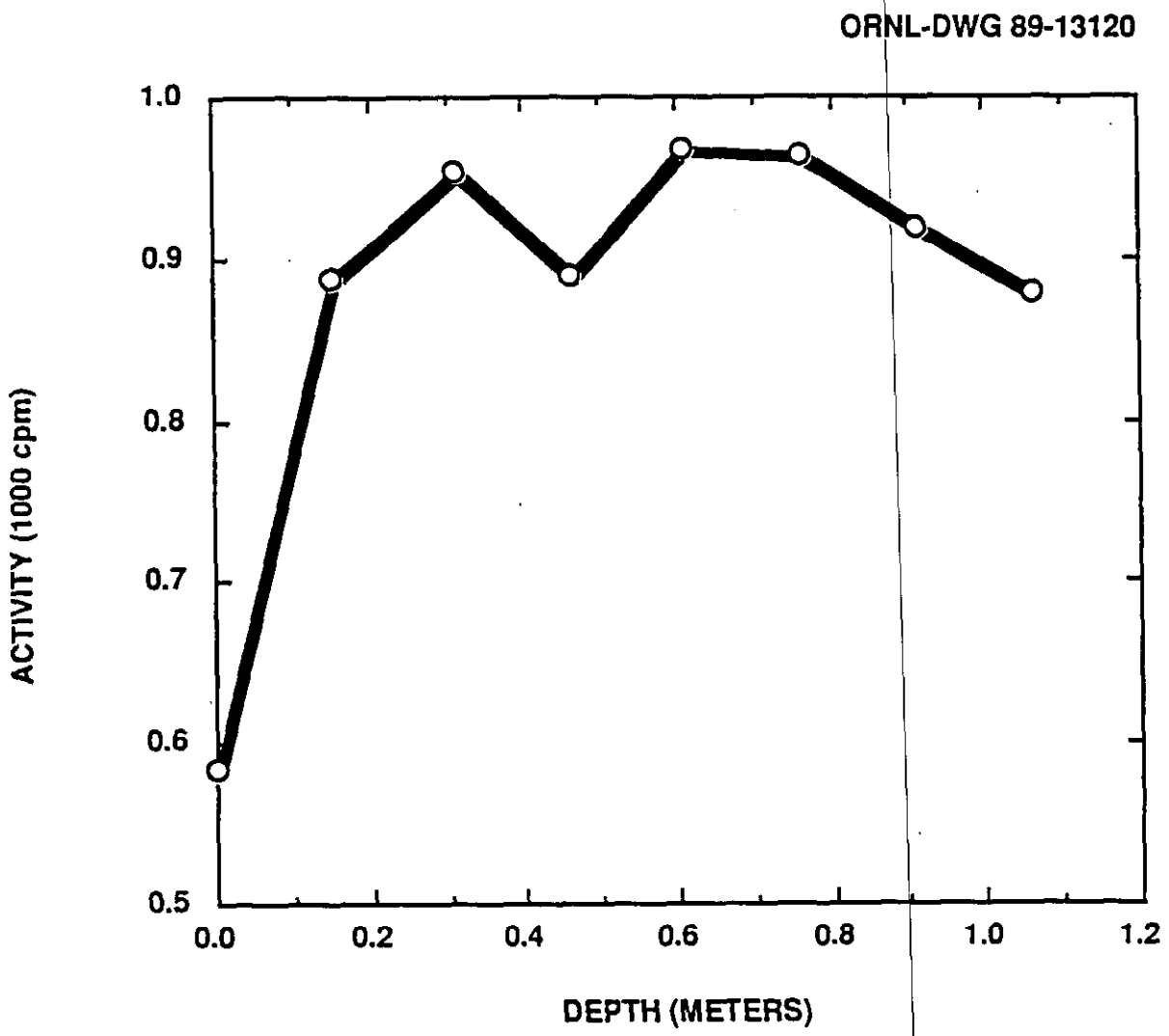

Fig. 55. Gamma profile for auger hole 47 (A47) at the former ore storage site, Palmerton, Pennsylvania (PP001).

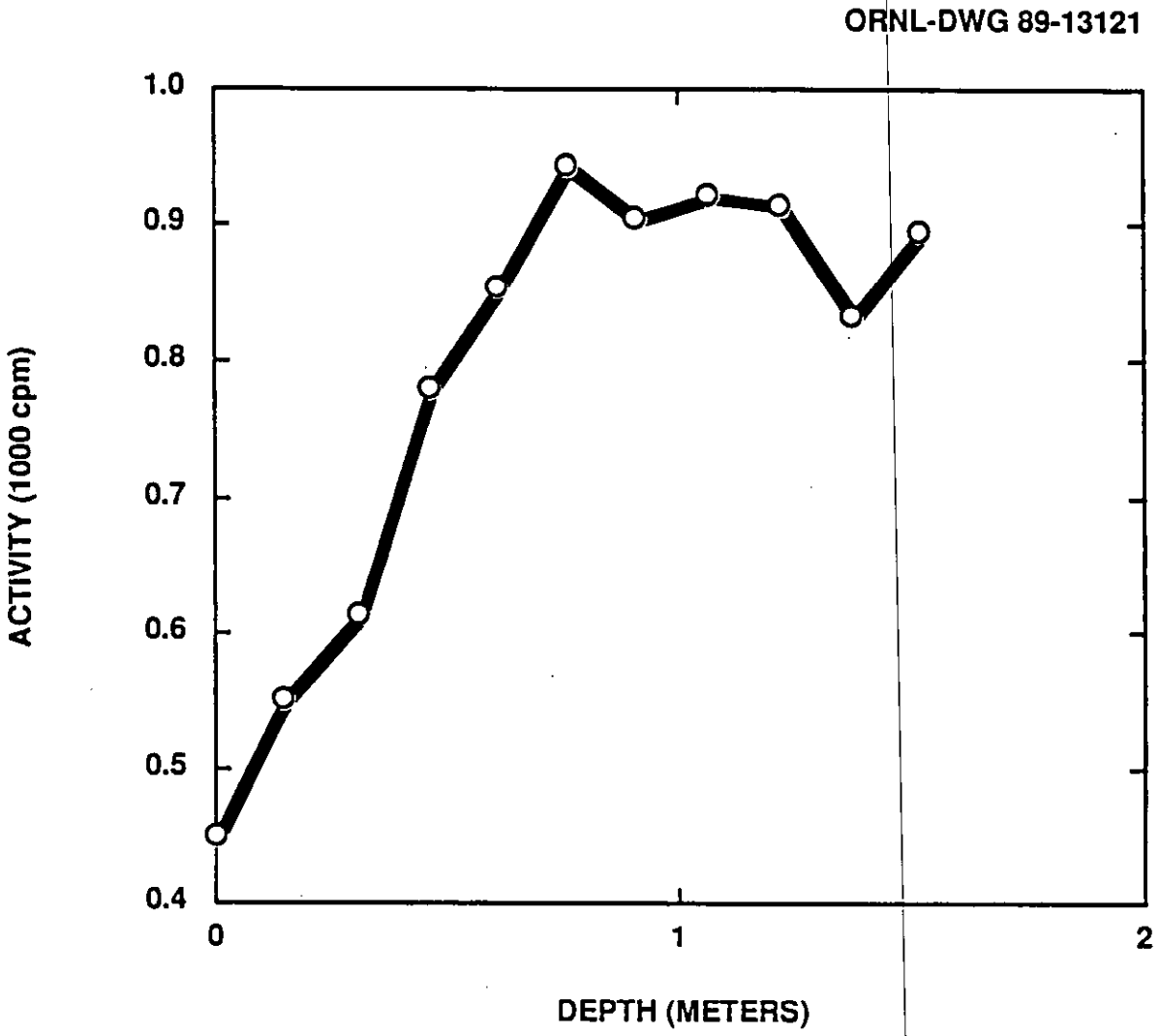

Fig. 56. Gamma profile for auger hole 48 (A48) at the former ore storage site, Palmerton, Pennsylvania (PP001).

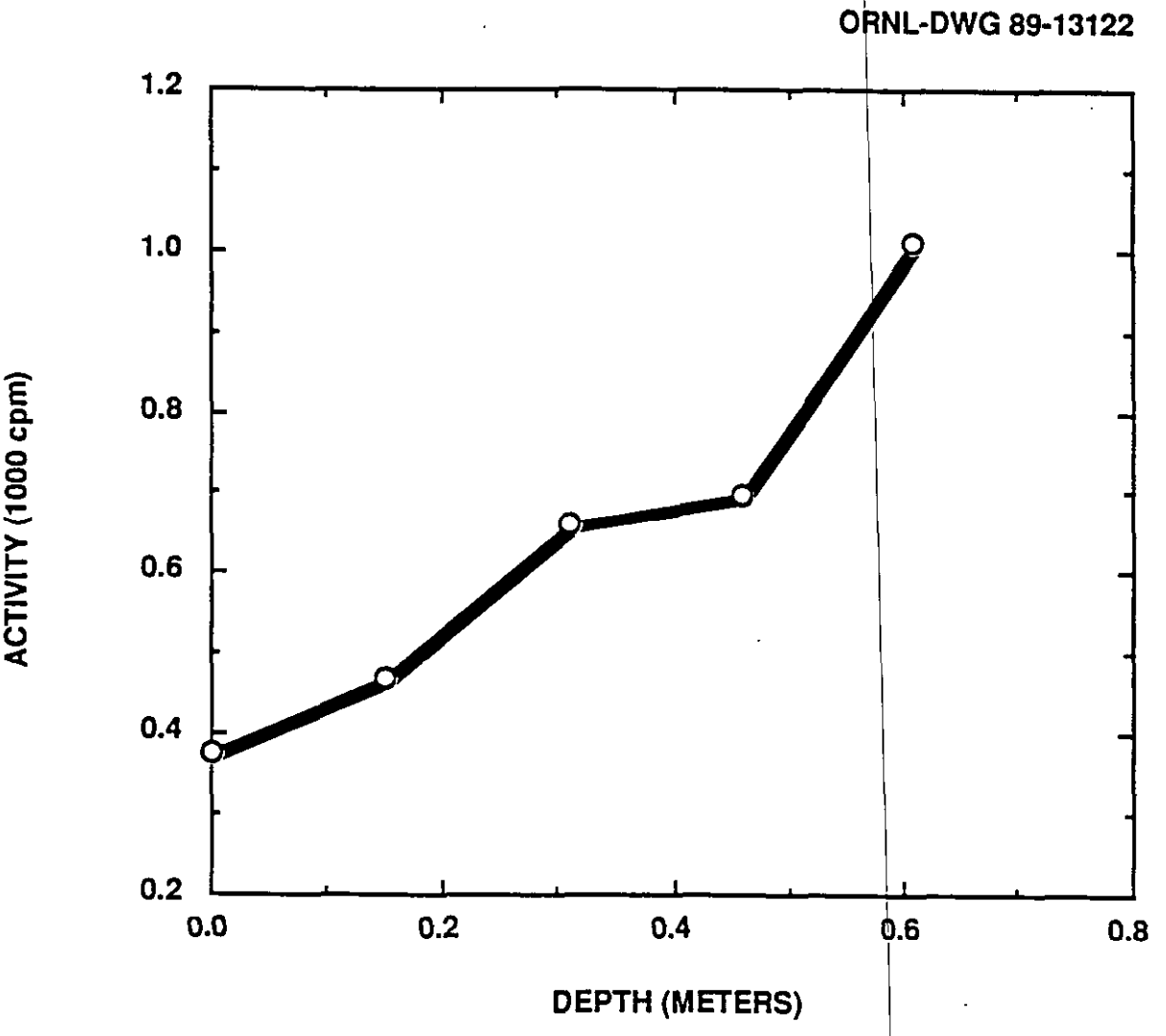

Fig. 57. Gamma profile for auger hole 49 (A49) at the former ore storage site, Palmerton, Pennsylvania (PP001).

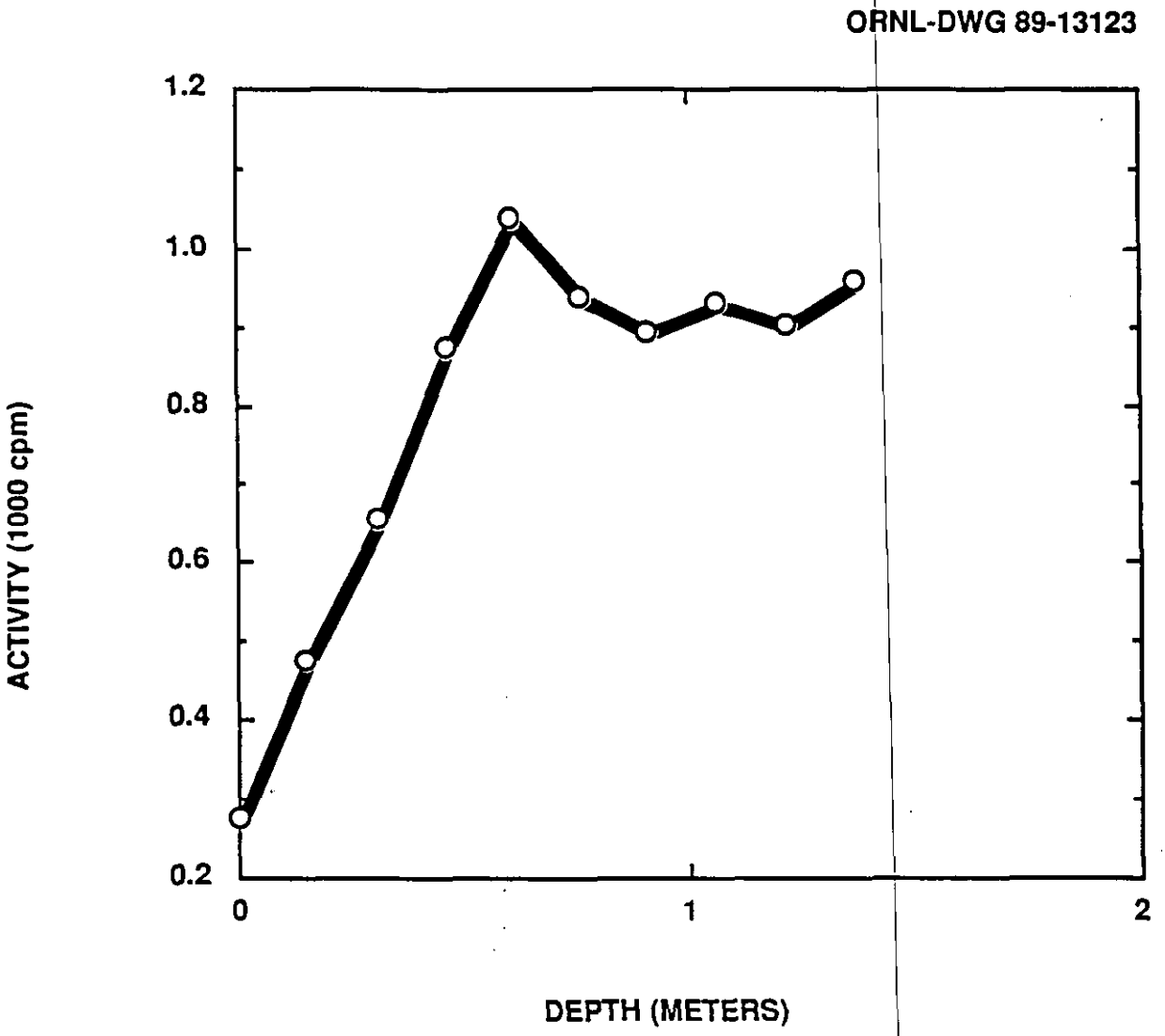

Fig. 58. Gamma profile for auger hole 50 (A50) at the former ore storage site, Palmerton, Pennsylvania (PP001).

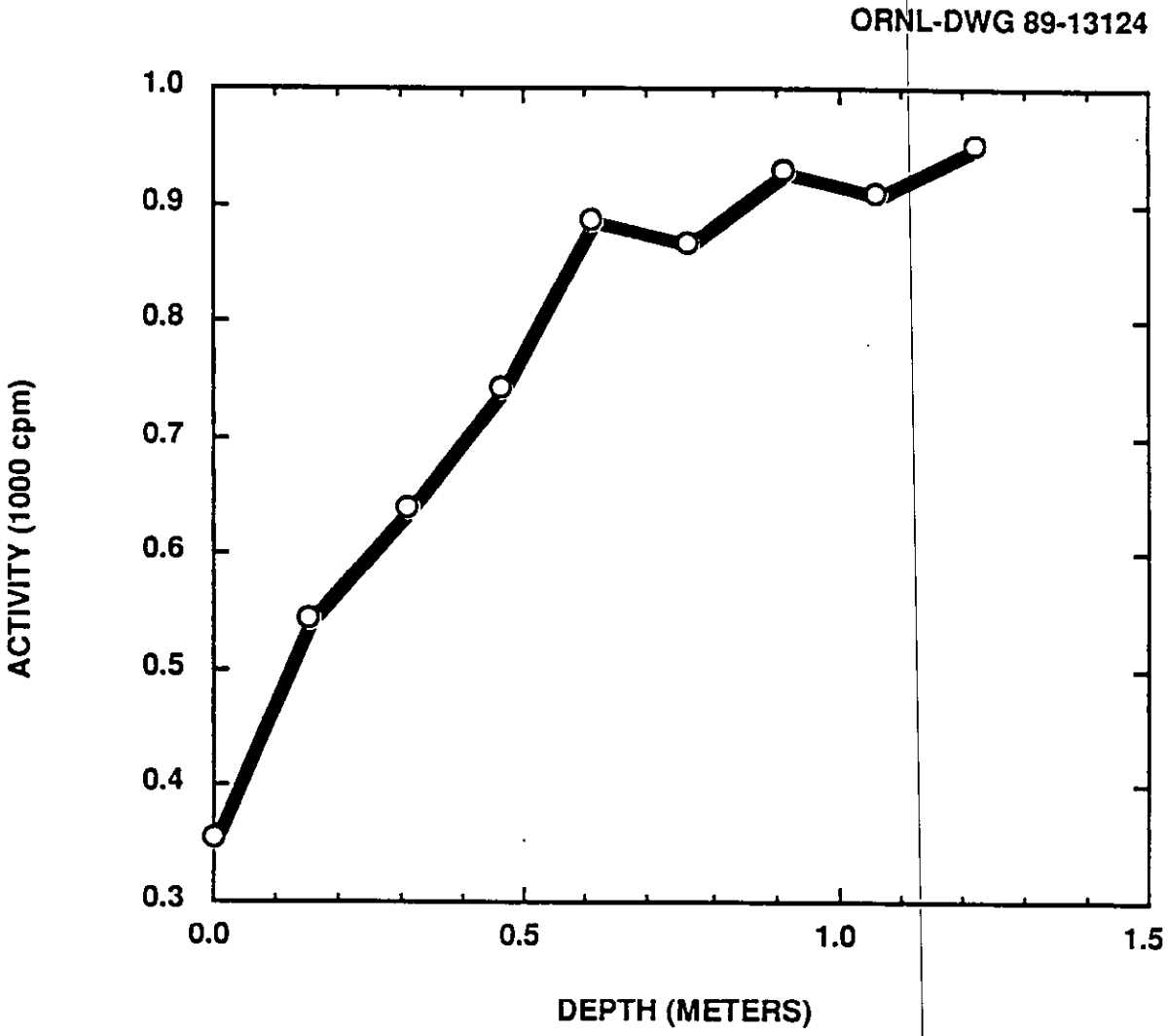

Fig. 59. Gamma profile for auger hole 51 (A51) at the former ore storage site, Palmerton, Pennsylvania (PP001).

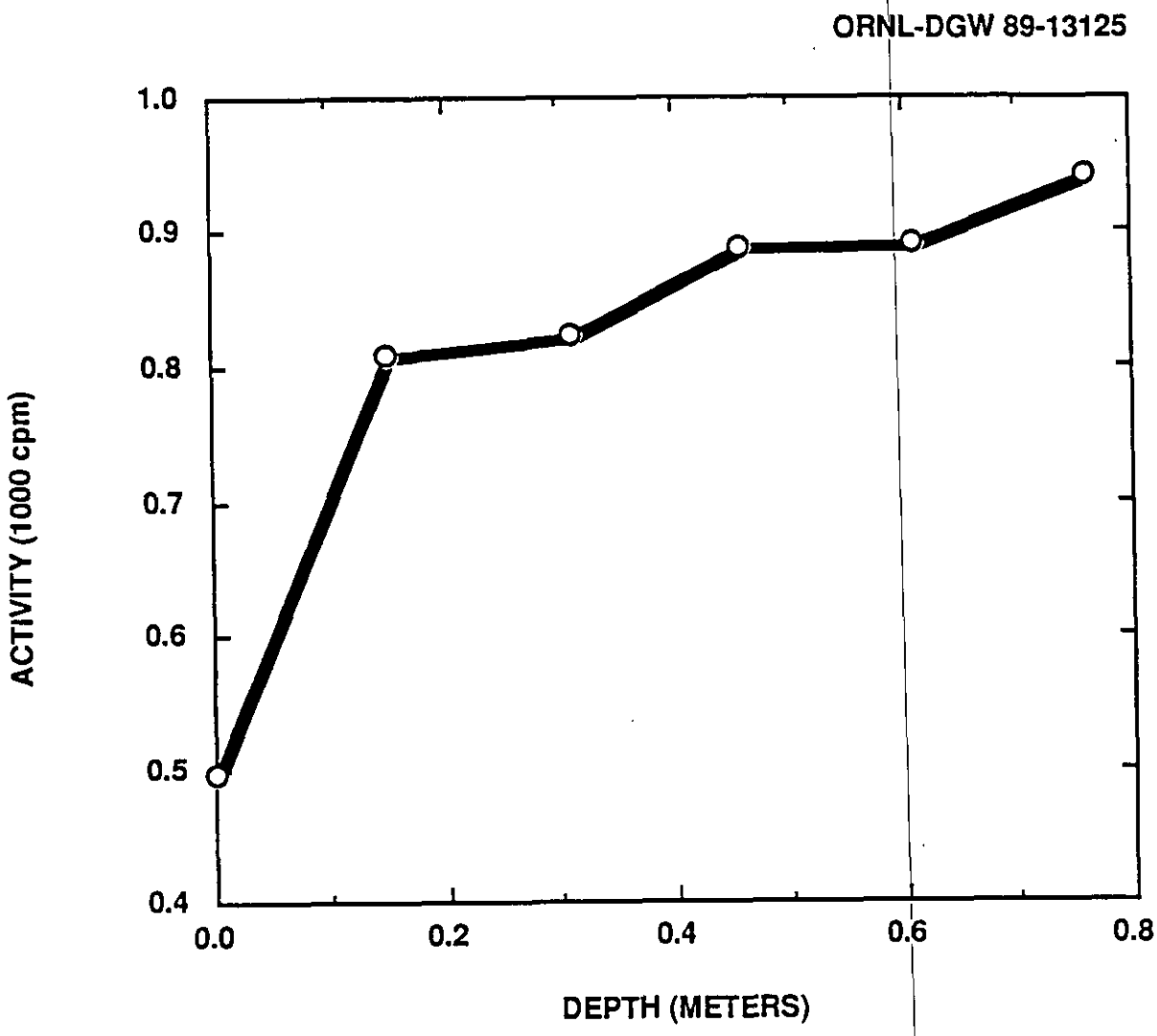

Fig. 60. Gamma profile for auger hole 52 (A52) at the former ore storage site, Palmerton, Pennsylvania (PP001).

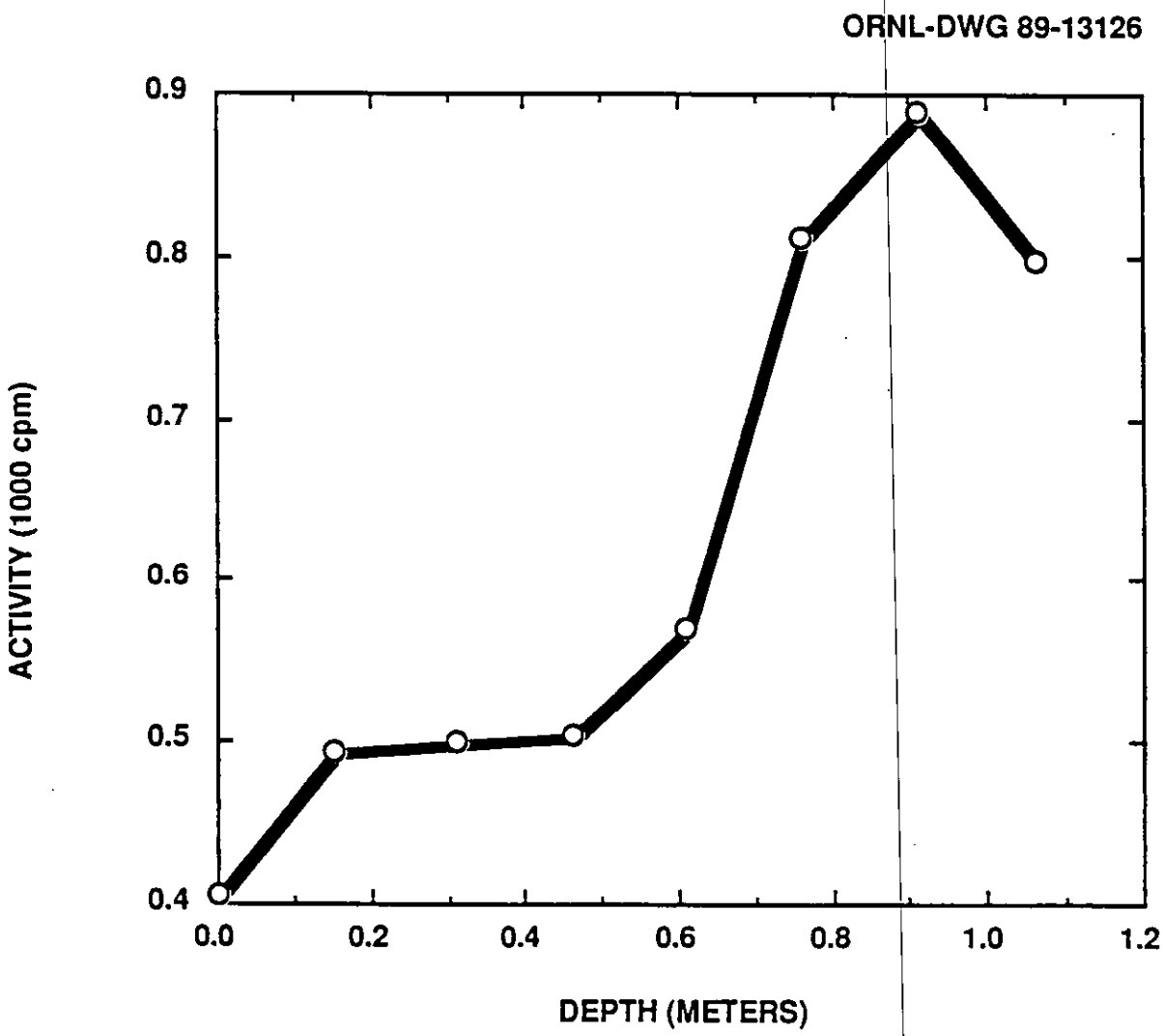

Fig. 61. Gamma profile for auger hole 53 (A53) at the former ore storage site, Palmerton, Pennsylvania (PP001).

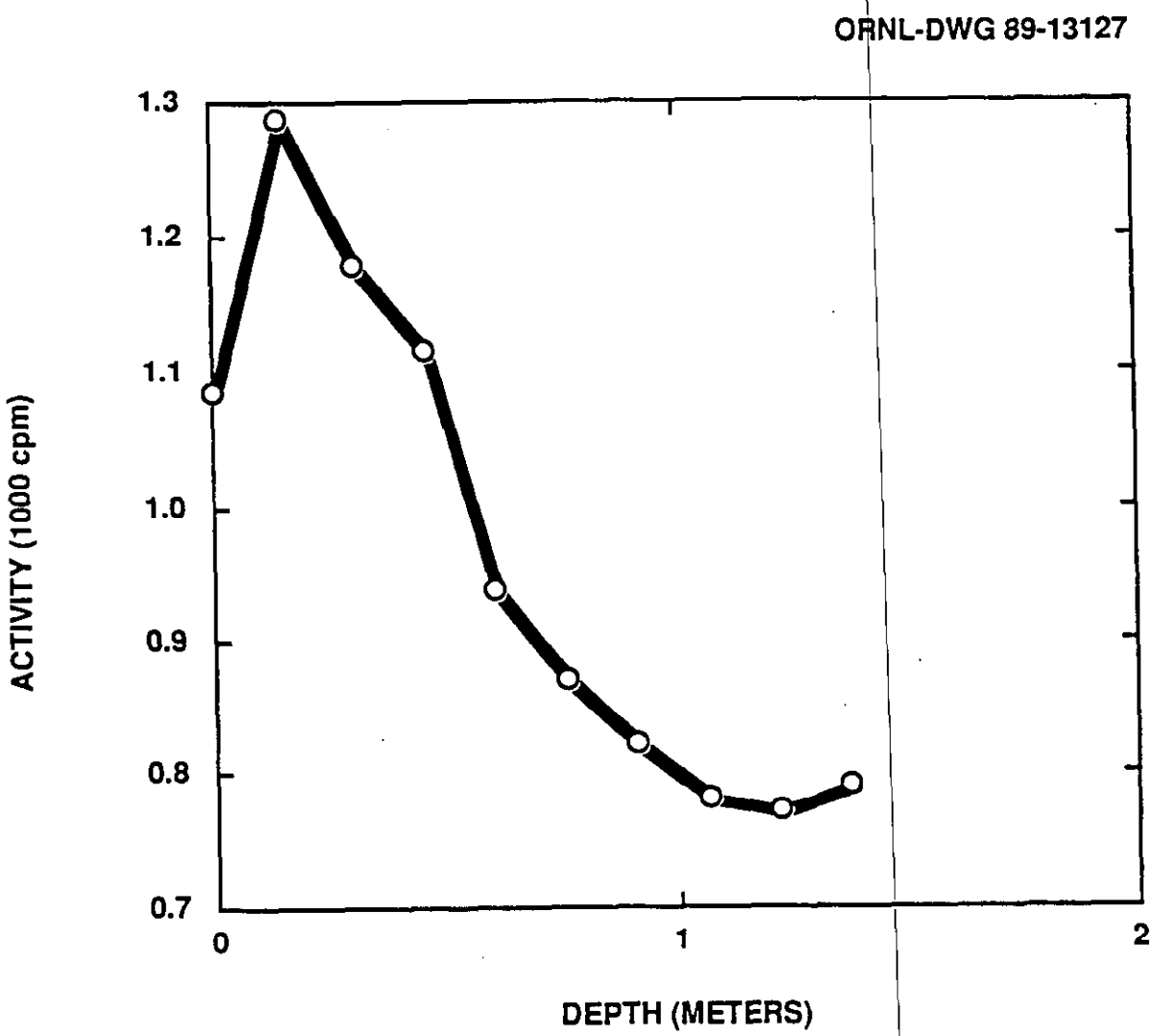

Fig. 62. Gamma profile for auger hole 54 (A54) at the former ore storage site, Palmerton, Pennsylvania (PP001).

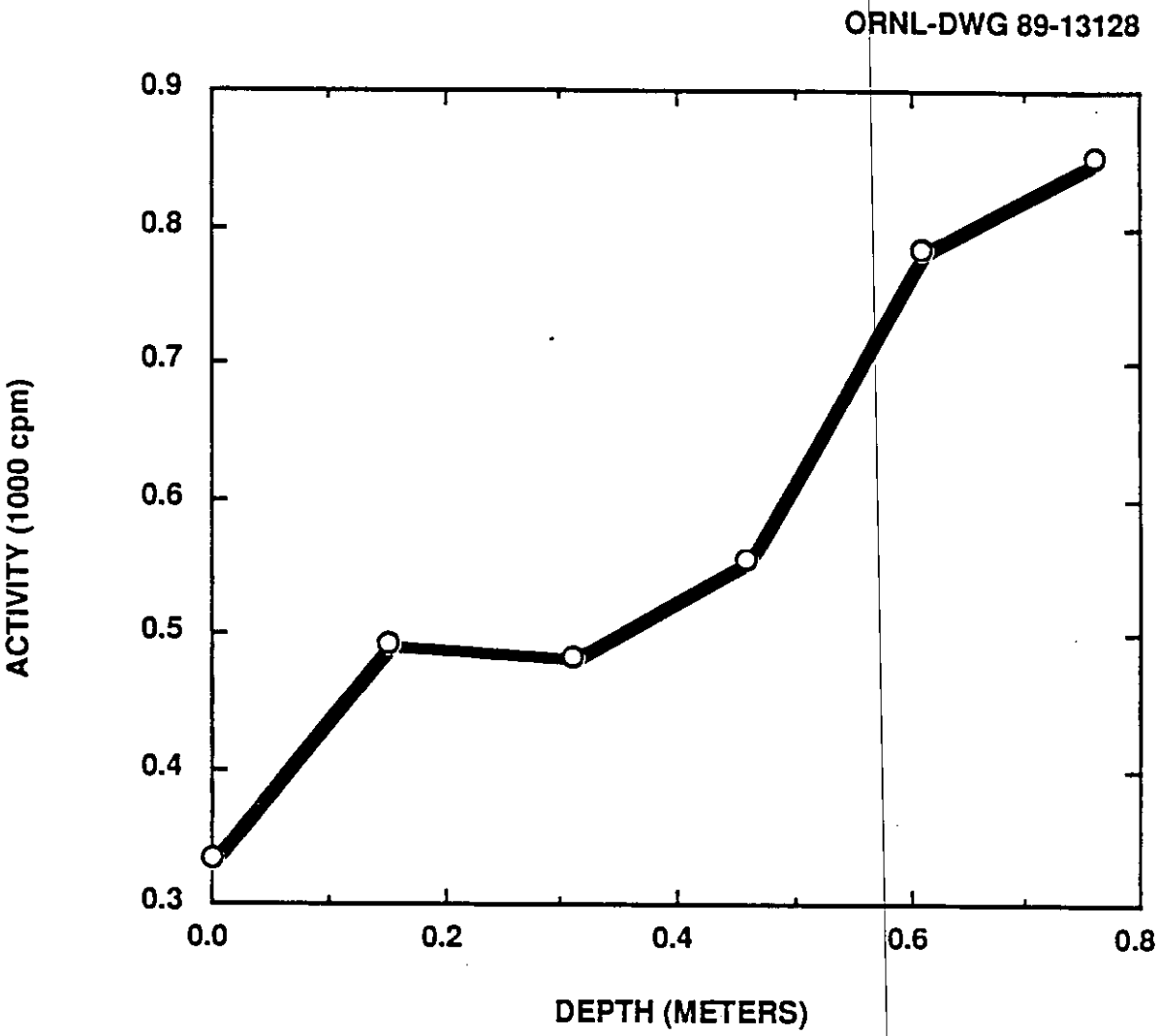

Fig. 63. Gamma profile for auger hole 55 (A55) at the former ore storage site, Palmerton, Pennsylvania (PP001).

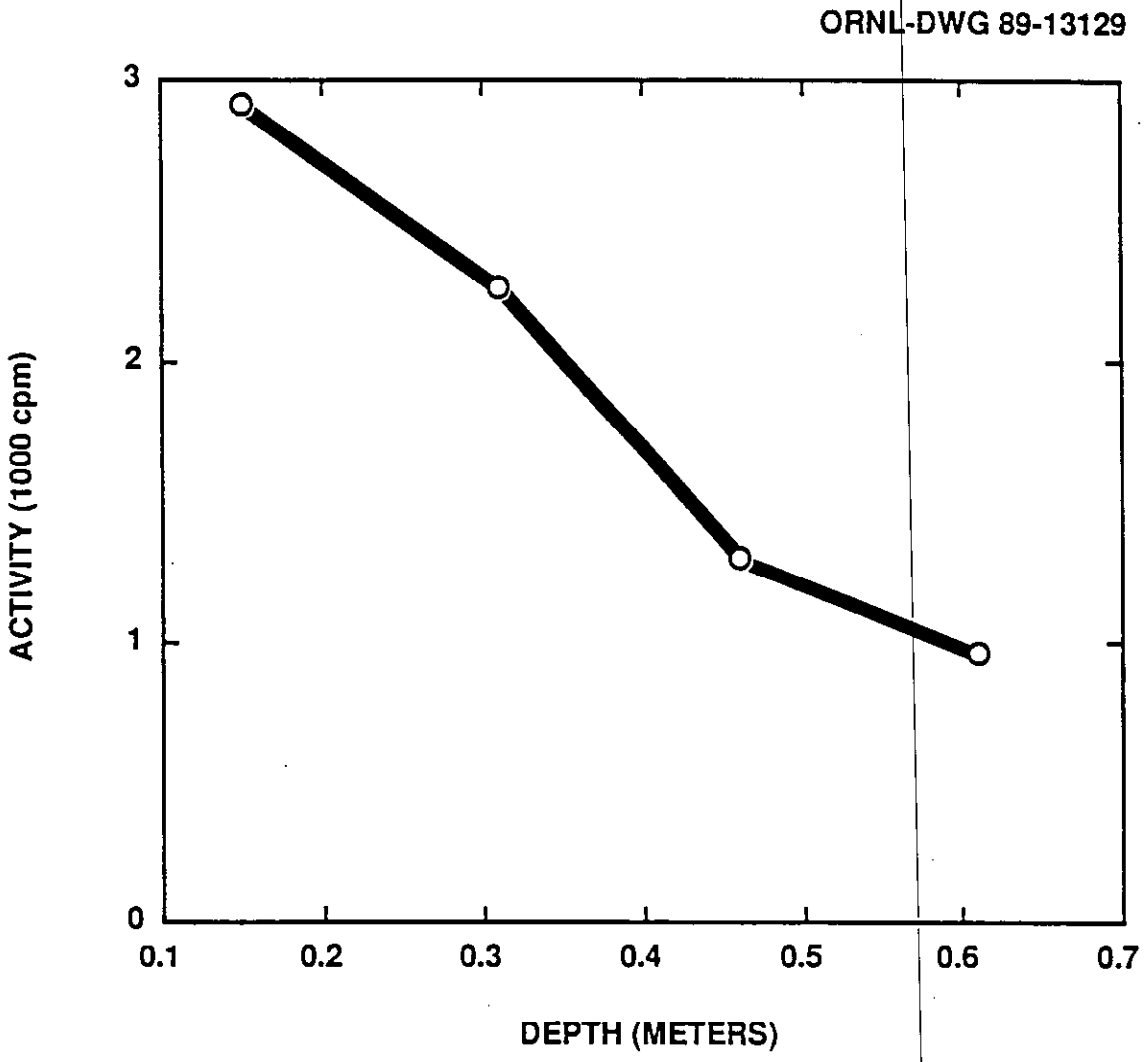

Fig. 64. Gamma profile for auger hole 56 (A56) at the former ore storage site, Palmerton, Pennsylvania (PP001).

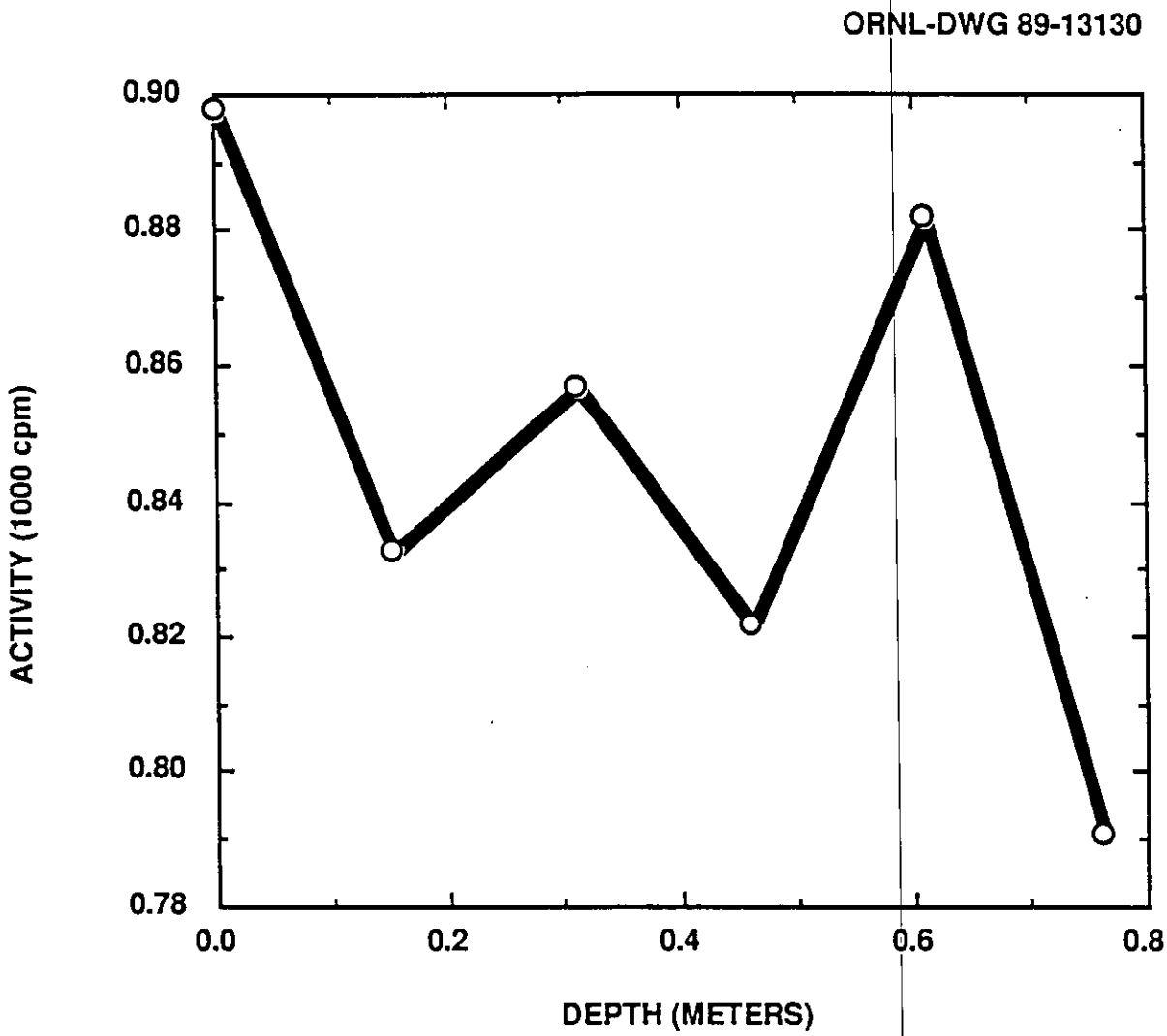

Fig. 65. Gamma profile for auger hole 57 (A57) at the former ore storage site, Palmerton, Pennsylvania (PP001).

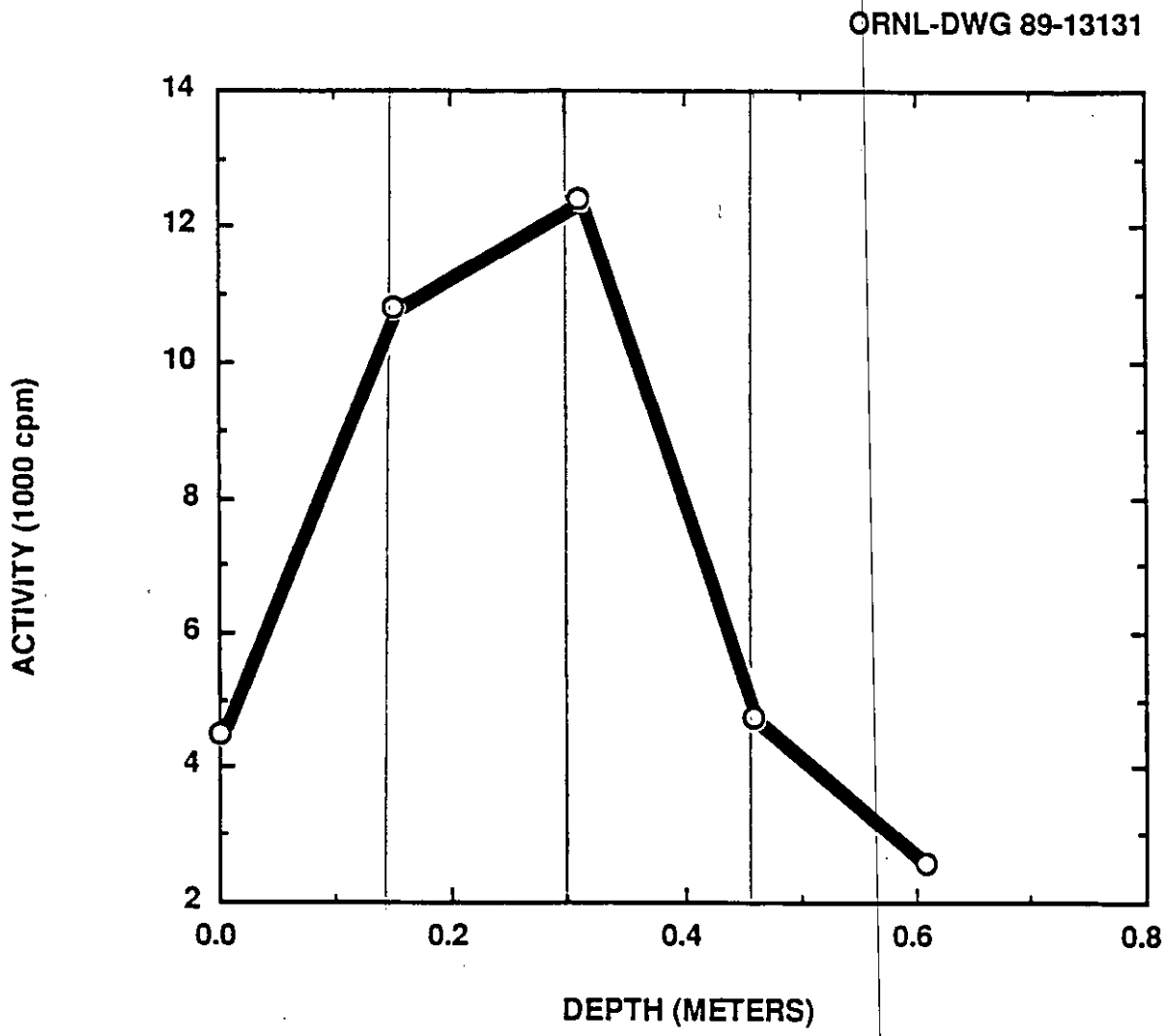

Fig. 66. Gamma profile for auger hole 58 (A58) at the former ore storage site, Palmerton, Pennsylvania (PP001).

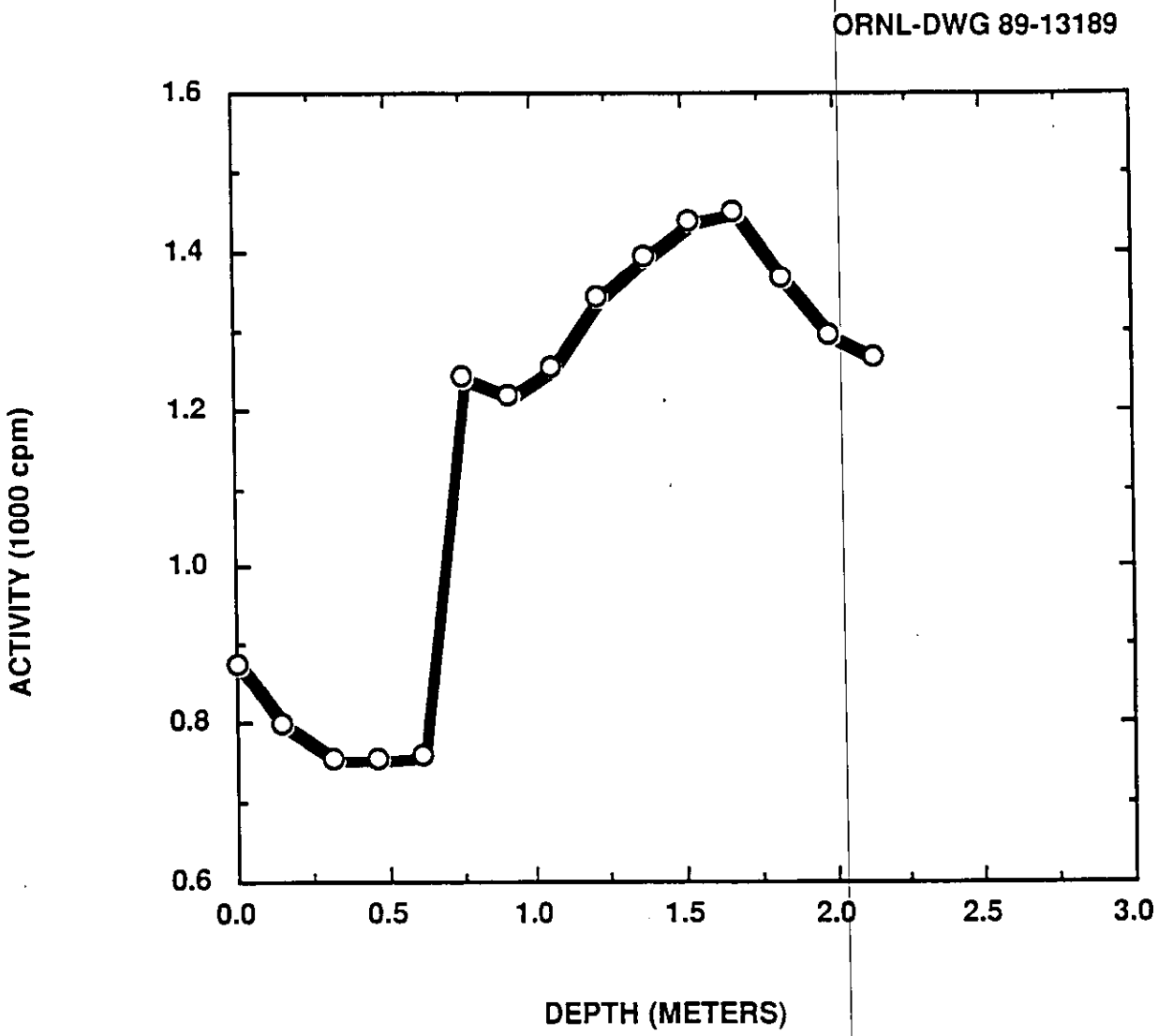

Fig. 67. Gamma profile for auger hole 59 (A59) at the former ore storage site, Palmerton, Pennsylvania (PP001).

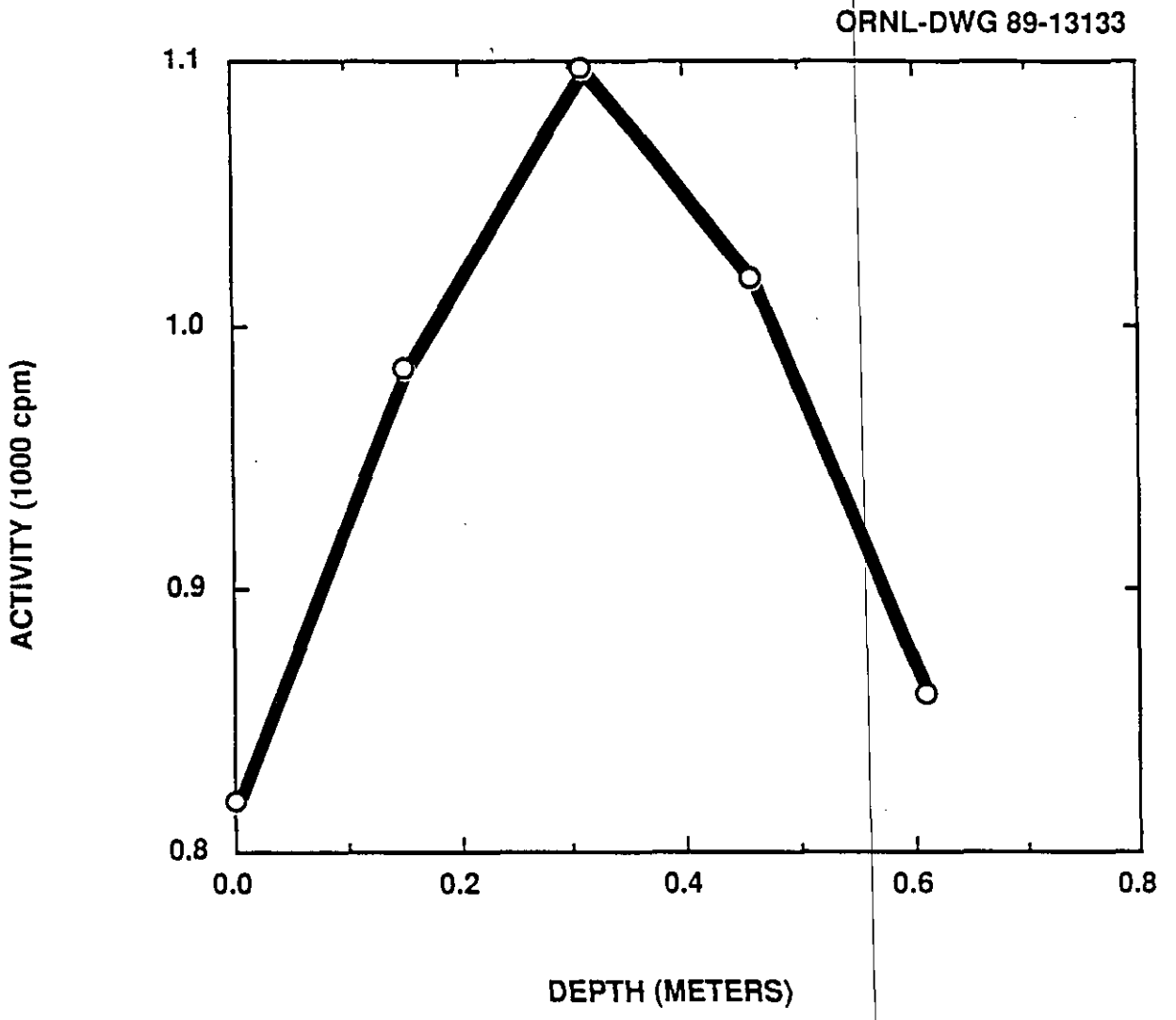

Fig. 68. Gamma profile for auger hole 60 (A60) at the former ore storage site, Palmerton, Pennsylvania (PP001).

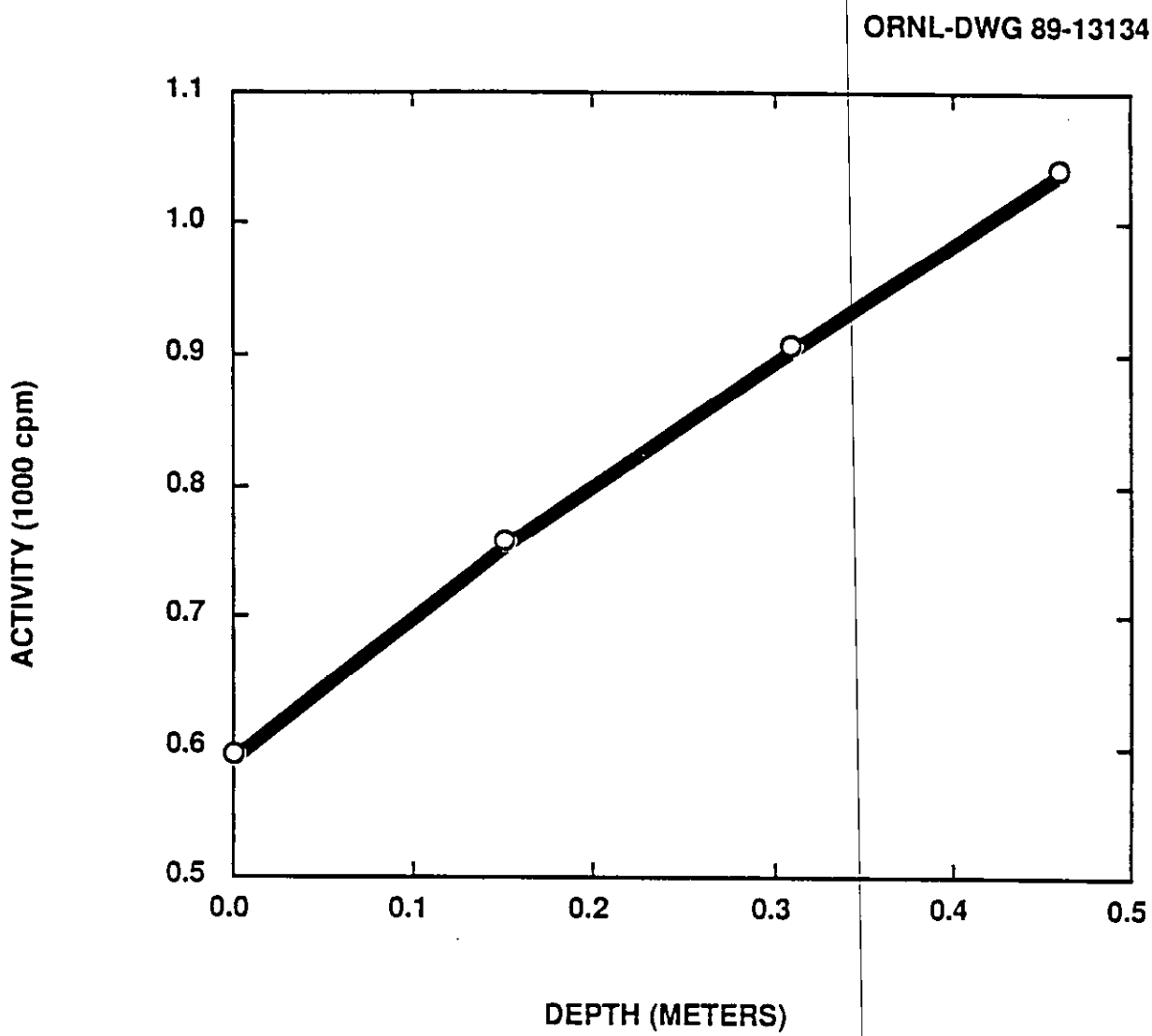

Fig. 69. Gamma profile for auger hole 61 (A61) at the former ore storage site, Palmerton, Pennsylvania (PP001).

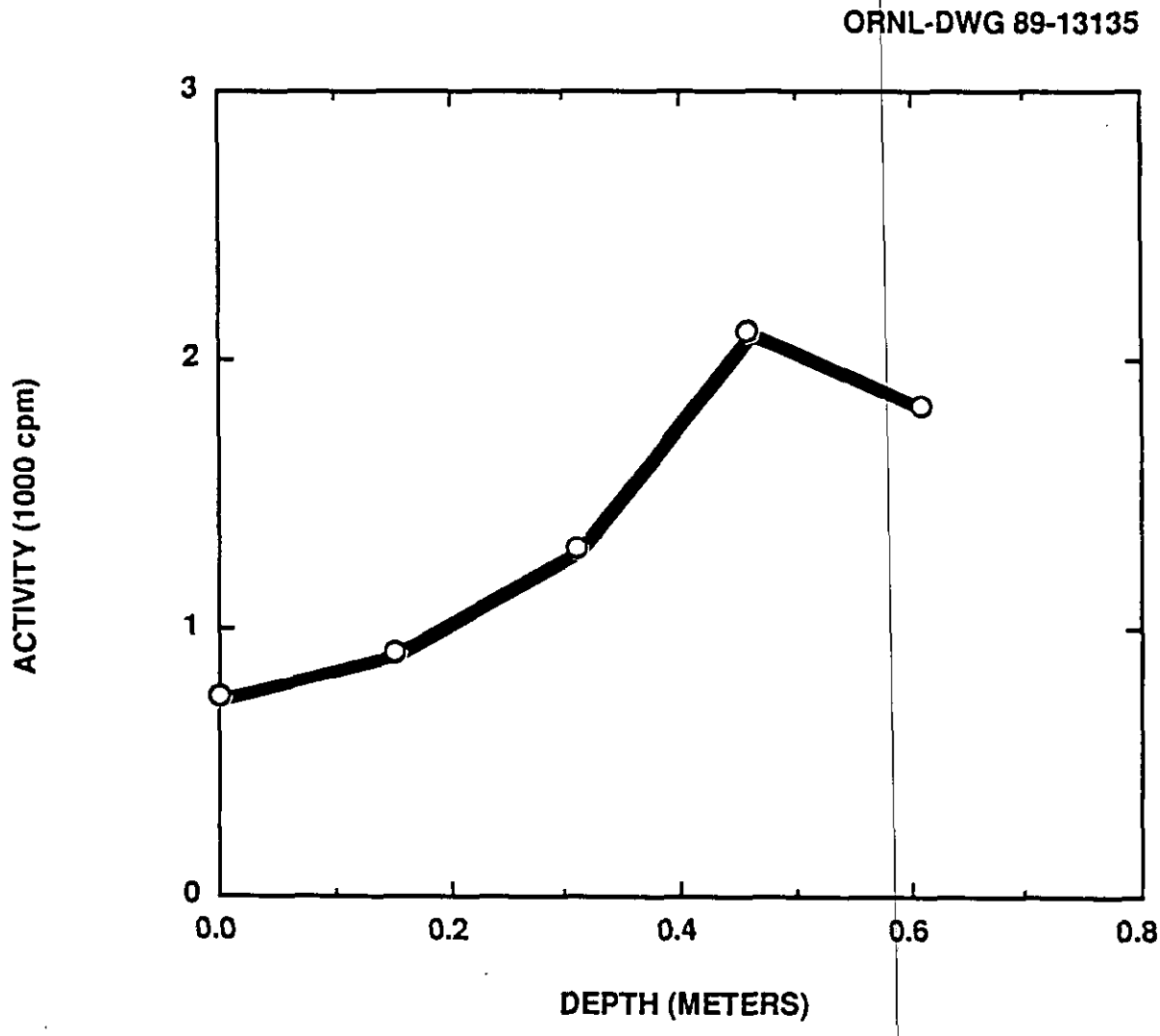

Fig. 70. Gamma profile for auger hole 62 (A62) at the former ore storage site, Palmerton, Pennsylvania (PP001).

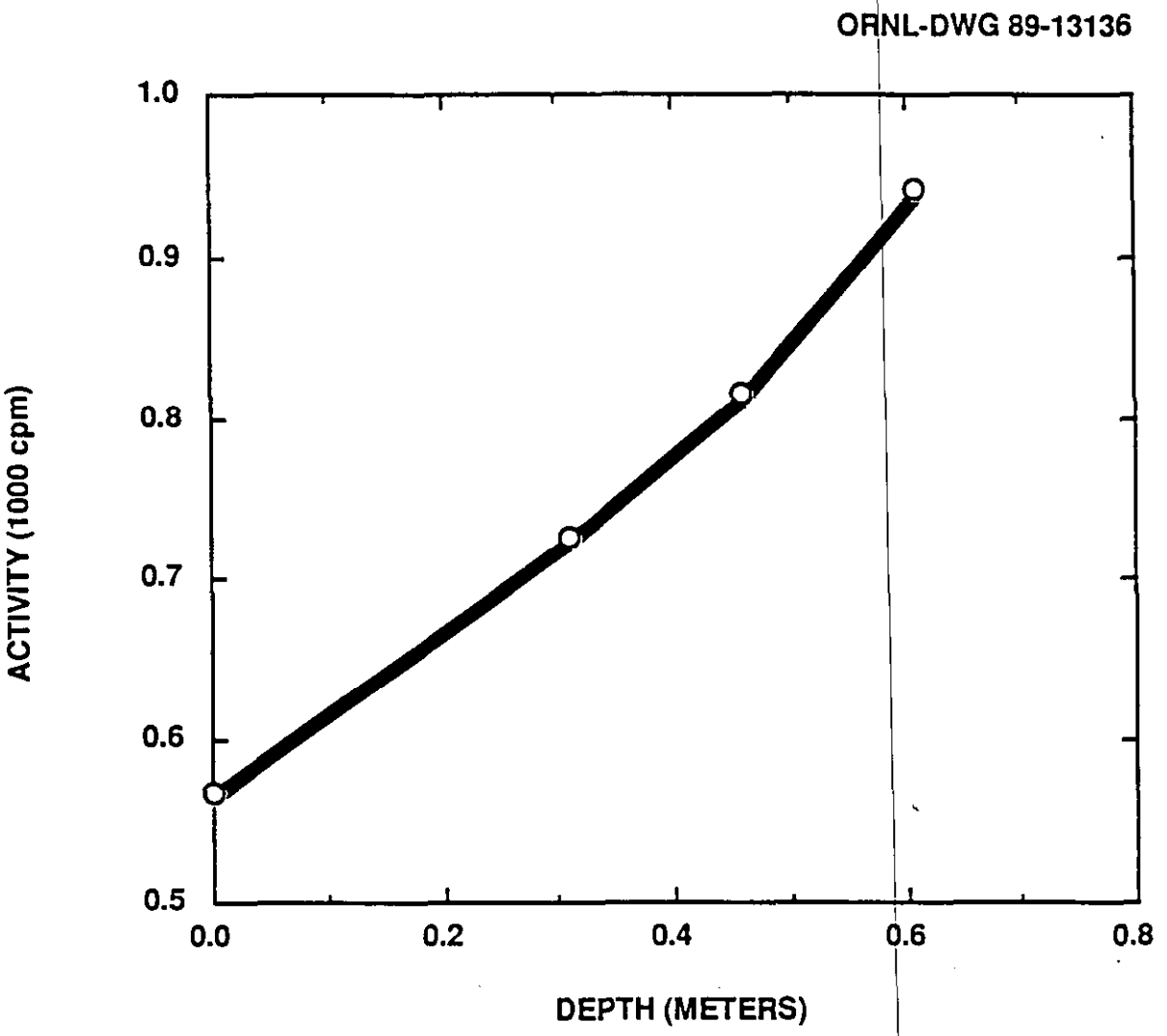

Fig. 71. Gamma profile for auger hole 63 (A63) at the former ore storage site, Palmerton, Pennsylvania (PP001).

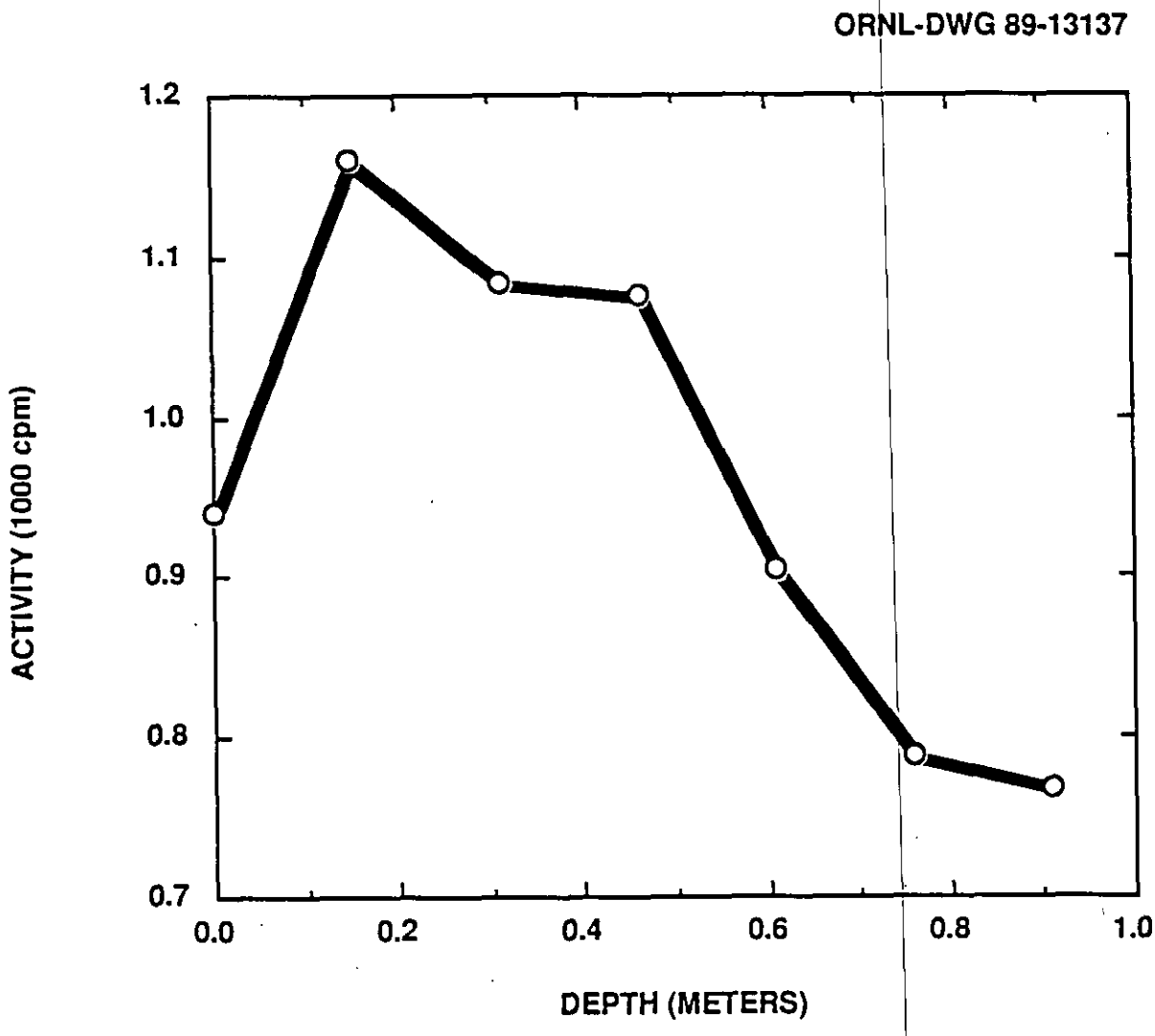

Fig. 72. Gamma profile for auger hole 64 (A64) at the former ore storage site, Palmerton, Pennsylvania (PP001).

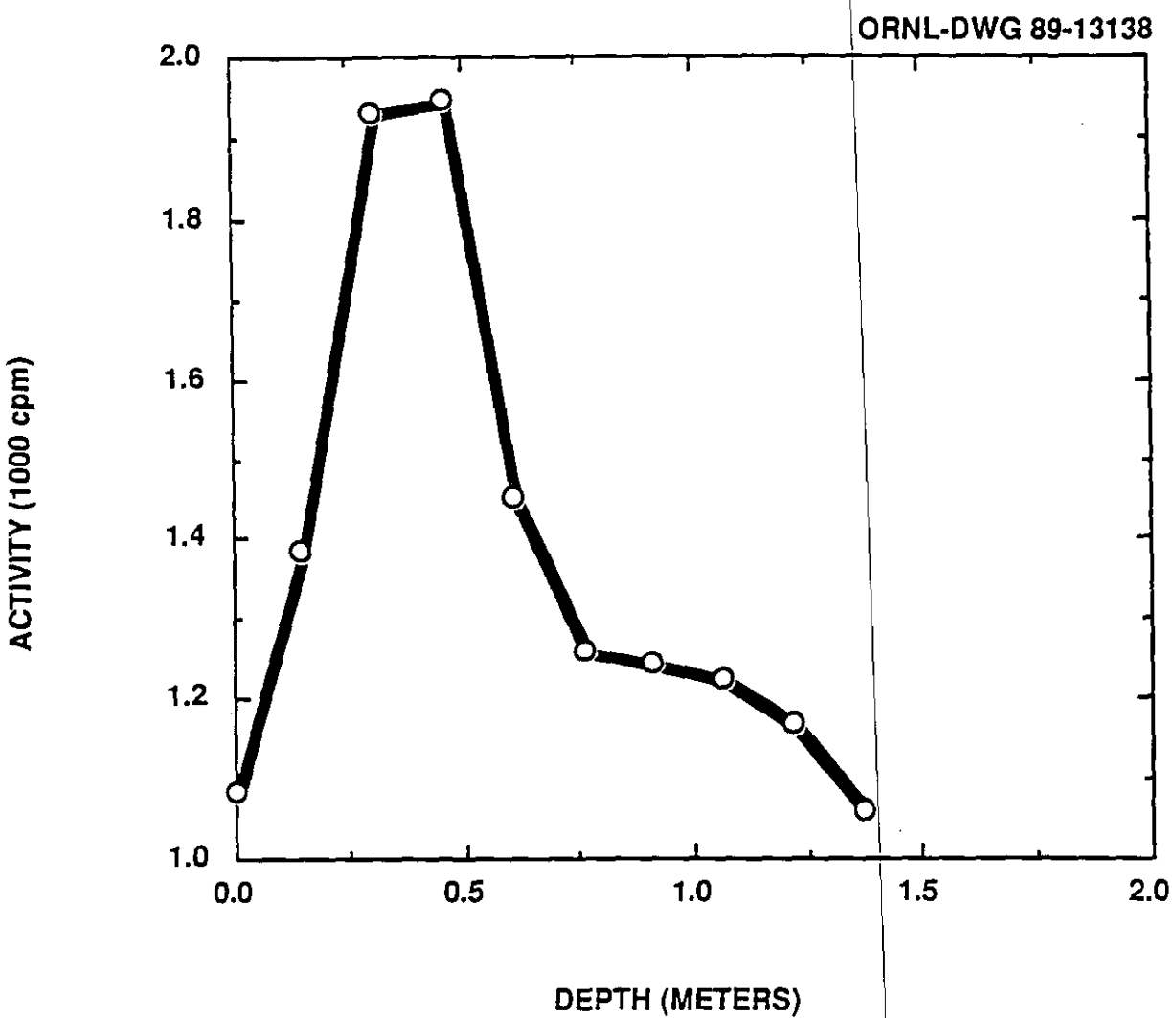

Fig. 73. Gamma profile for auger hole 65 (A65) at the former ore storage site, Palmerton, Pennsylvania (PP001).

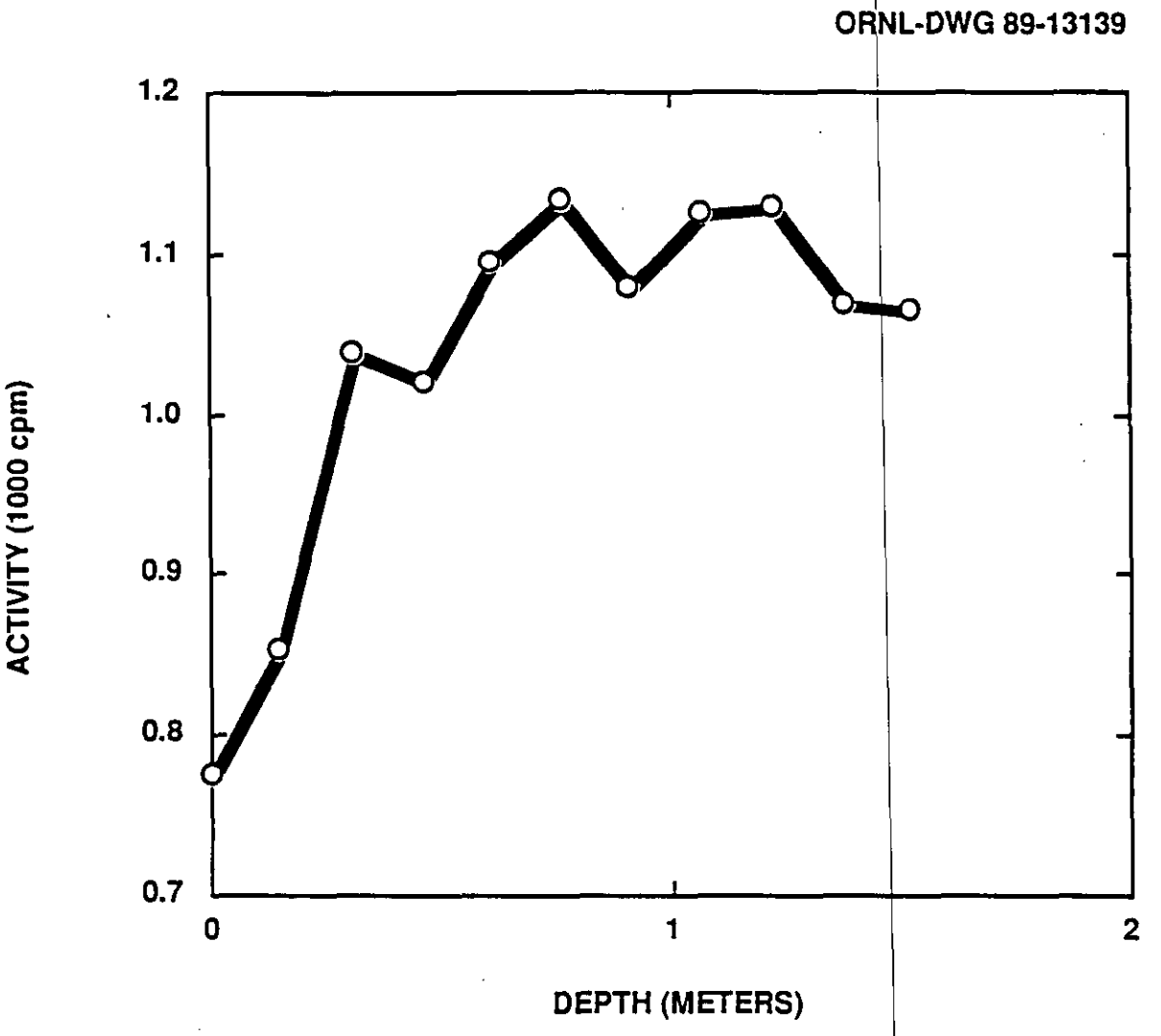

Fig. 74. Gamma profile for auger hole 66 (A66) at the former ore storage site, Palmerton, Pennsylvania (PP001).

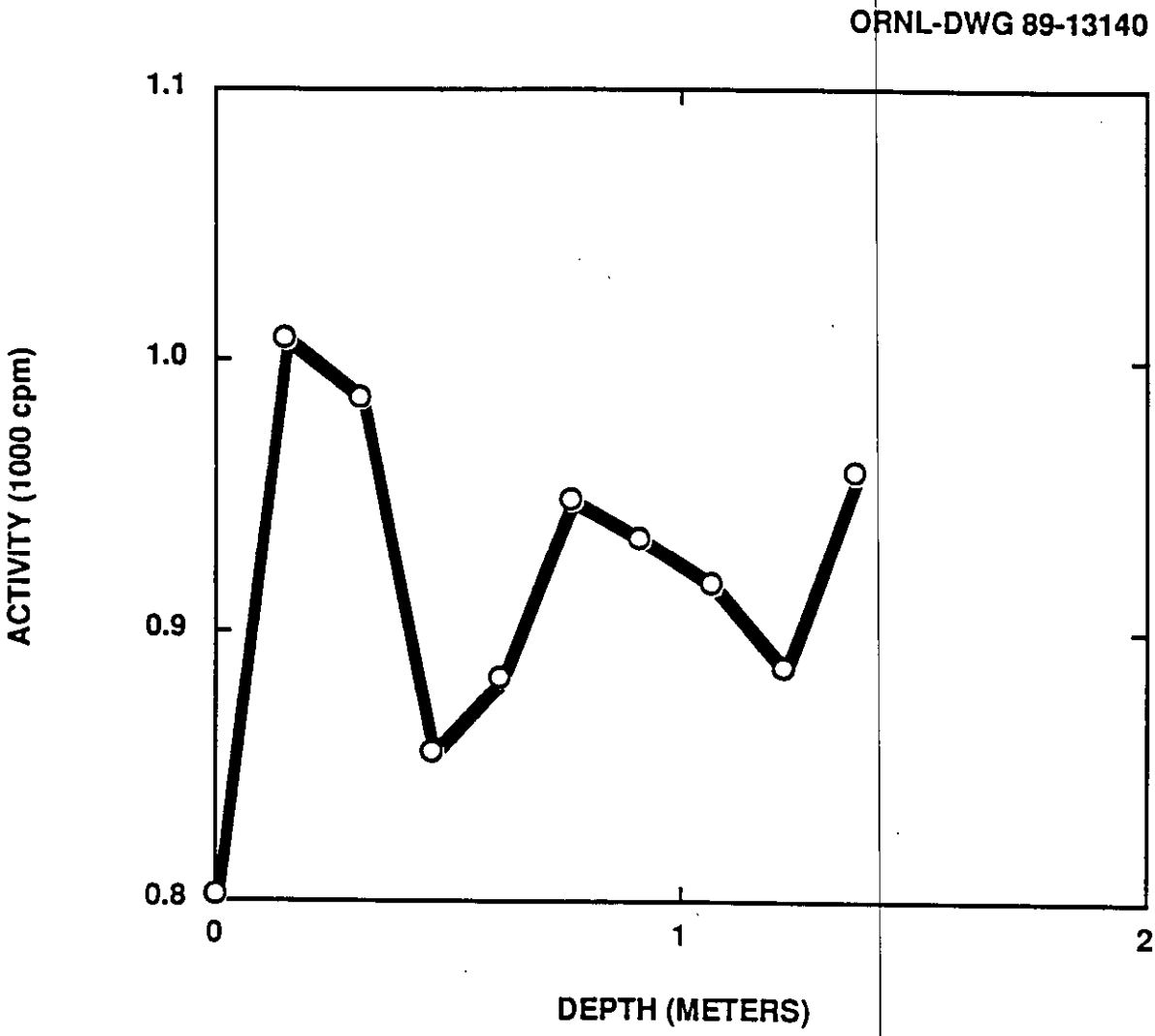

Fig. 75. Gamma profile for auger hole 67 (A67) at the former ore storage site, Palmerton, Pennsylvania (PP001).

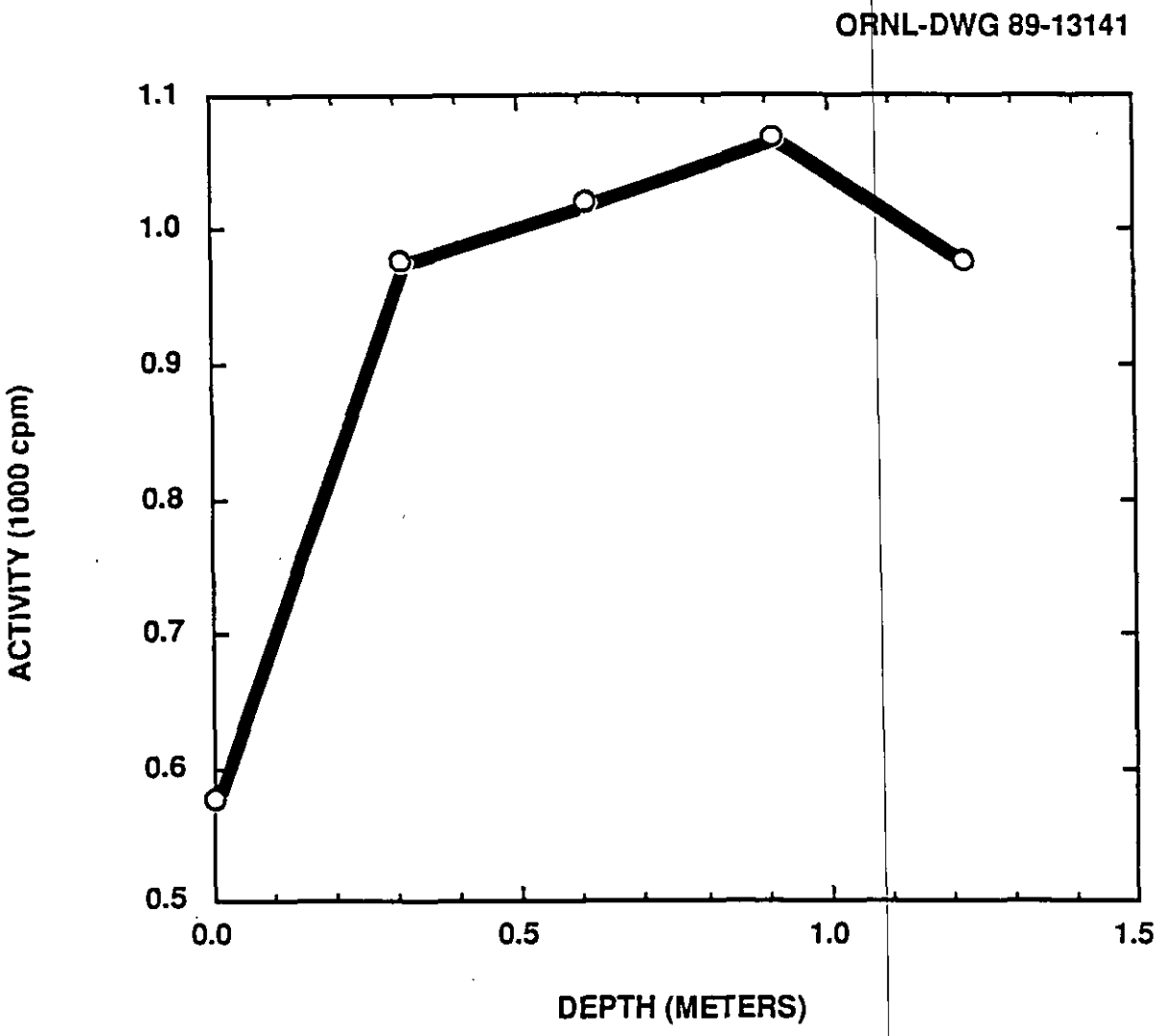

Fig. 76. Gamma profile for auger hole 68 (A68) at the former ore storage site, Palmerton, Pennsylvania (PP001).

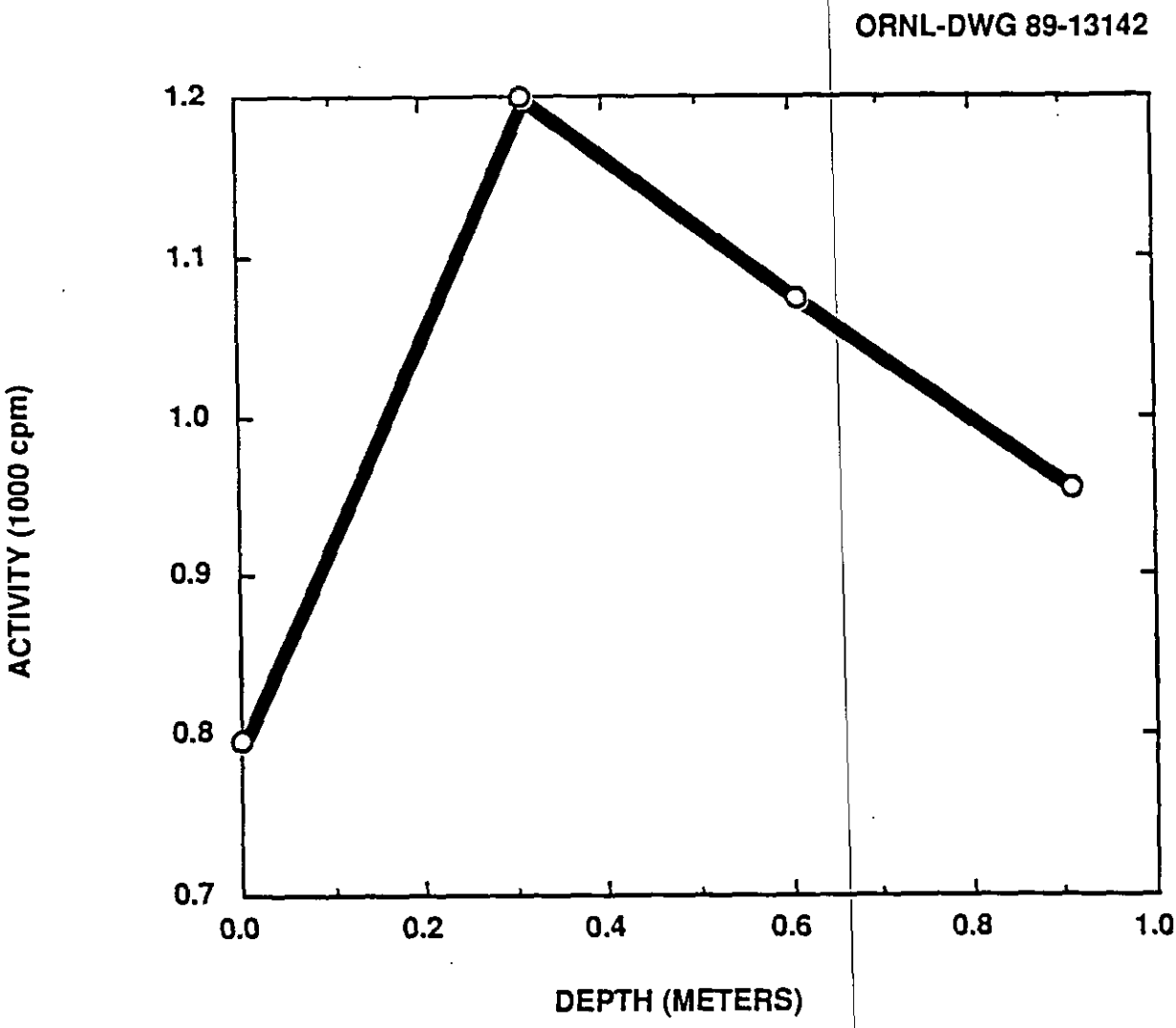

Fig. 77. Gamma profile for auger hole 69 (A69) at the former ore storage site, Palmerton, Pennsylvania (PP001).

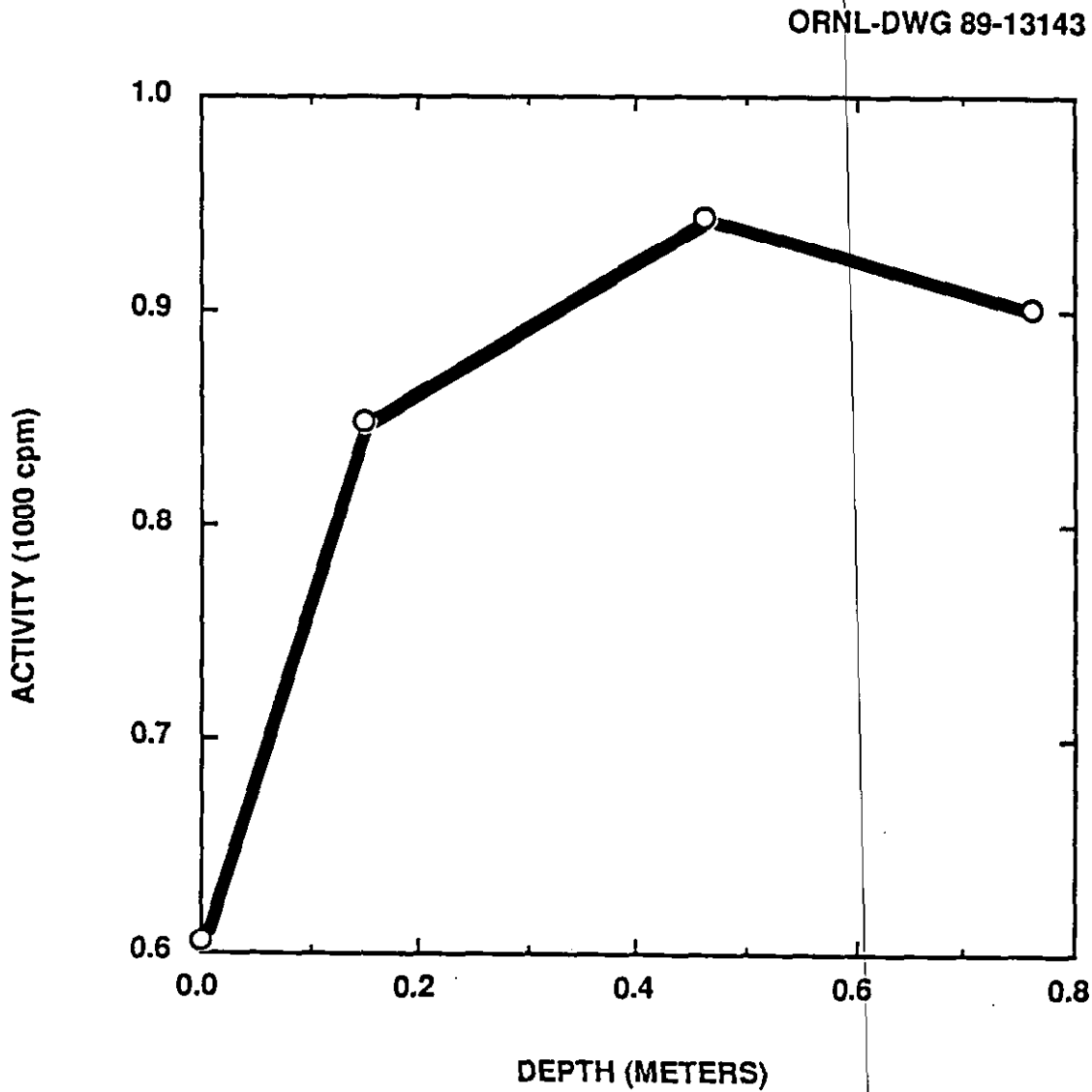

Fig. 78. Gamma profile for auger hole 70 (A70) at the former ore storage site, Palmerton, Pennsylvania (PP001).

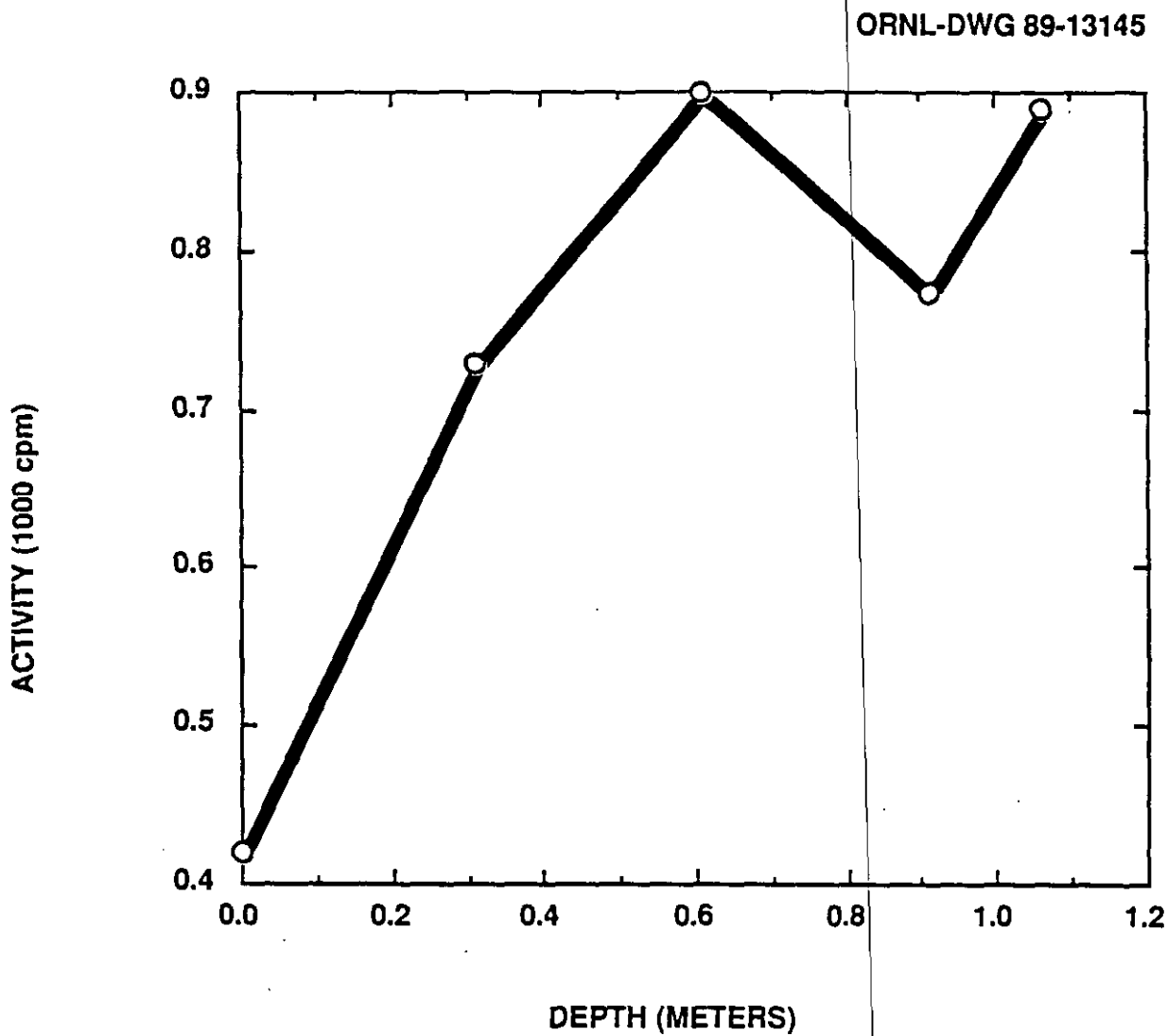

Fig. 79. Gamma profile for auger hole 71 (A71) at the former ore storage site, Palmerton, Pennsylvania (PP001).

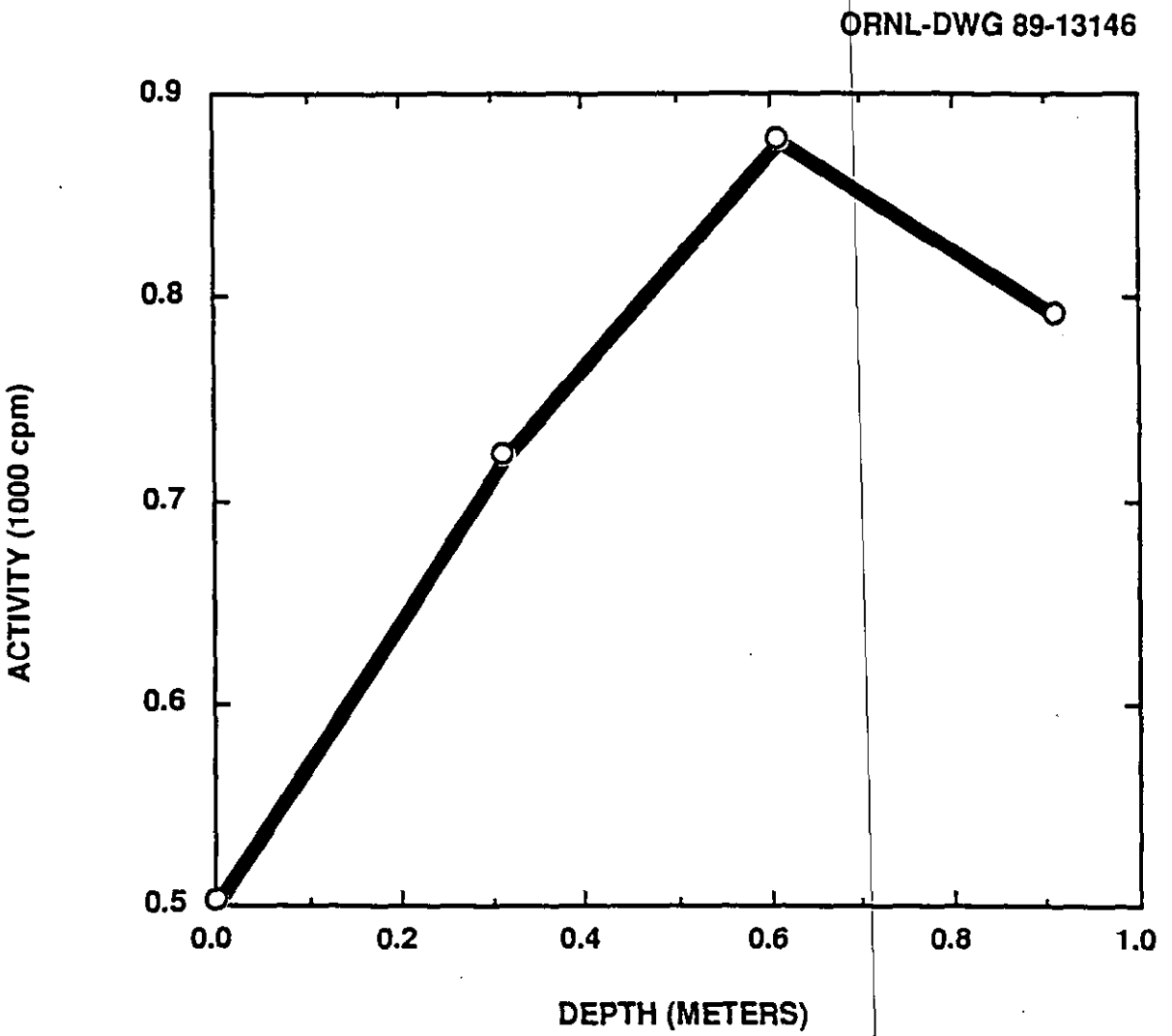

Fig. 80. Gamma profile for auger hole 72 (A72) at the former ore storage site, Palmerton, Pennsylvania (PP001).

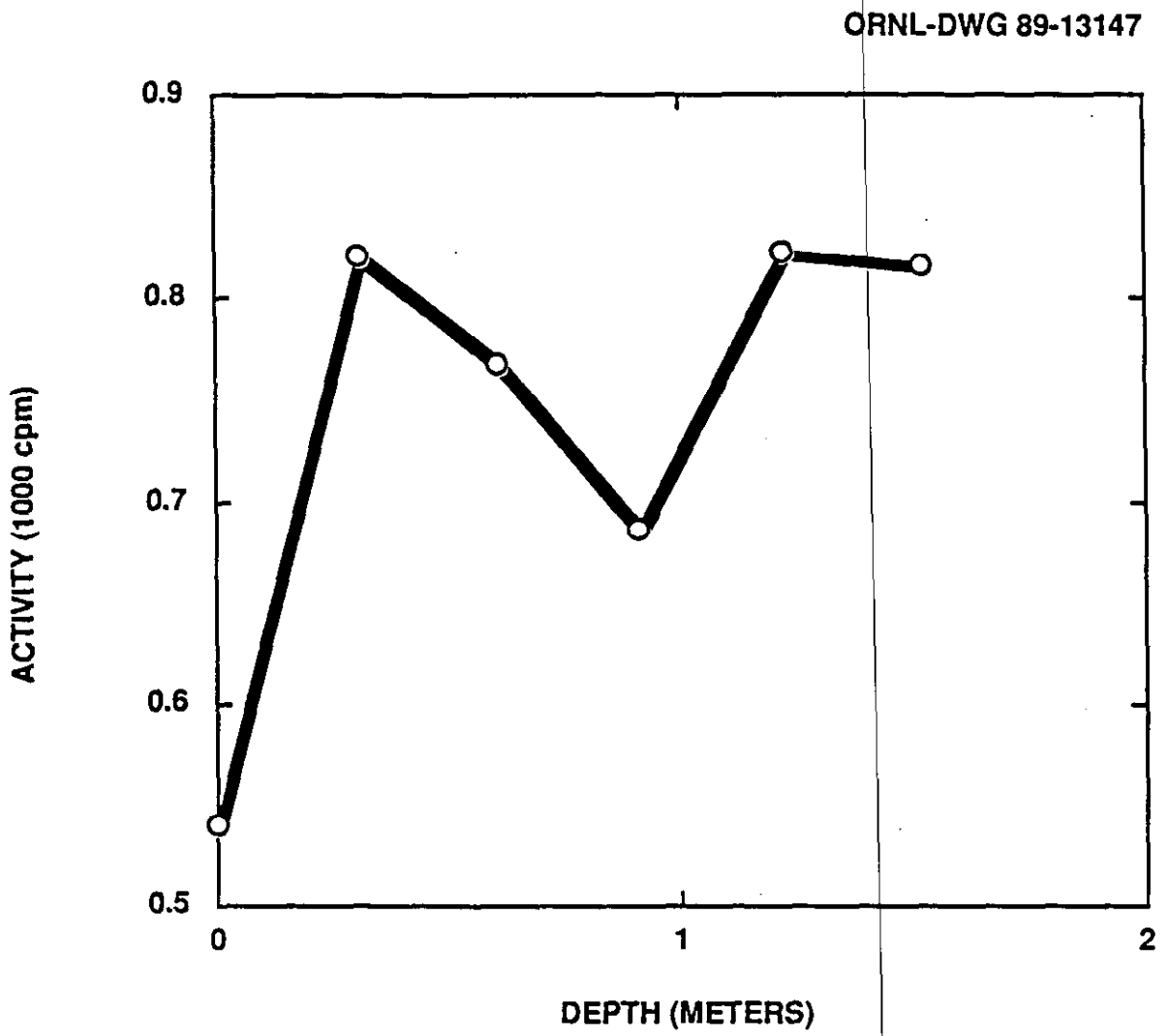

Fig. 81. Gamma profile for auger hole 73 (A73) at the former ore storage site, Palmerton, Pennsylvania (PP001).

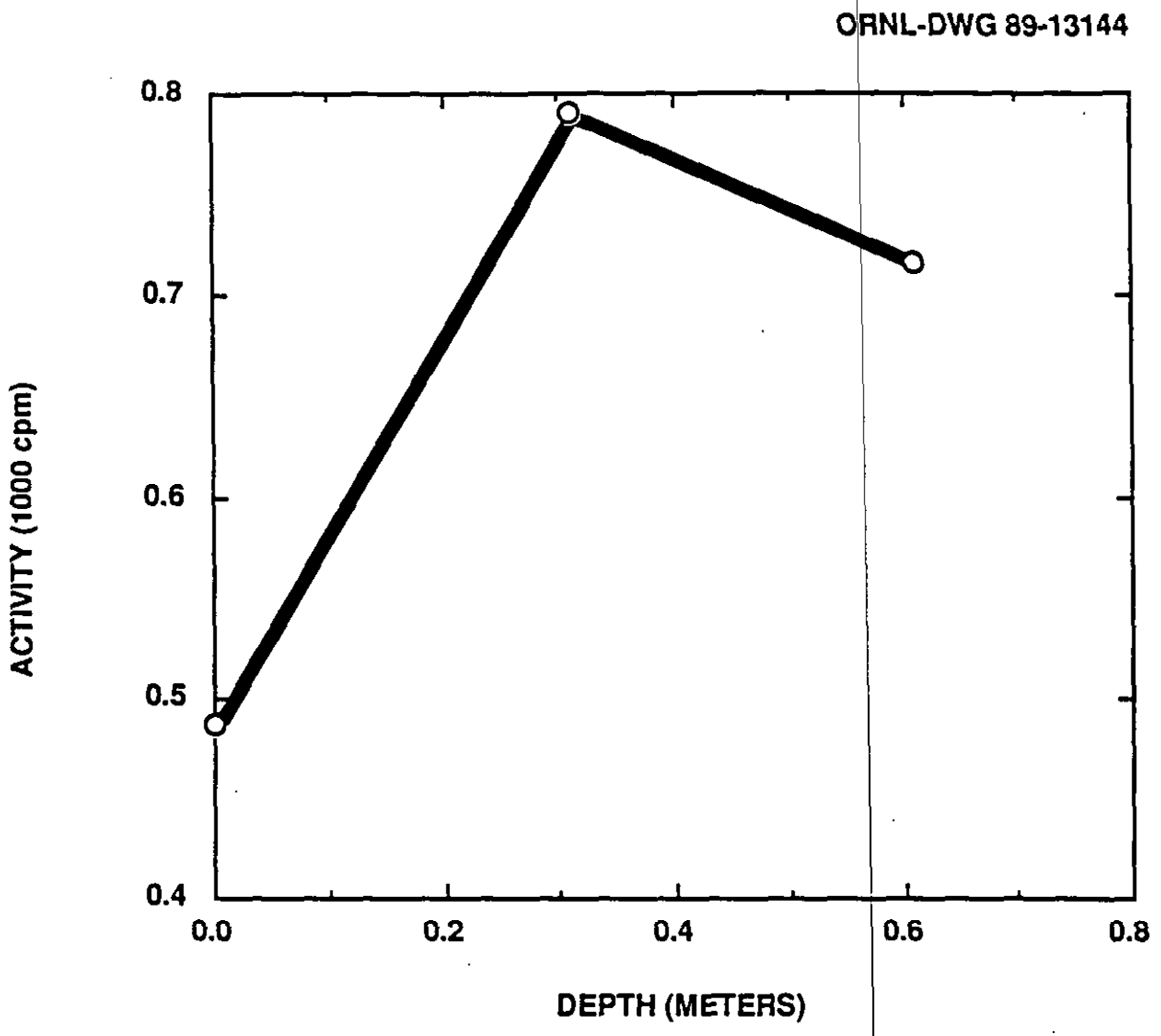

Fig. 82. Gamma profile for auger hole 74 (A74) at the former ore storage site, Palmerton, Pennsylvania (PP001).

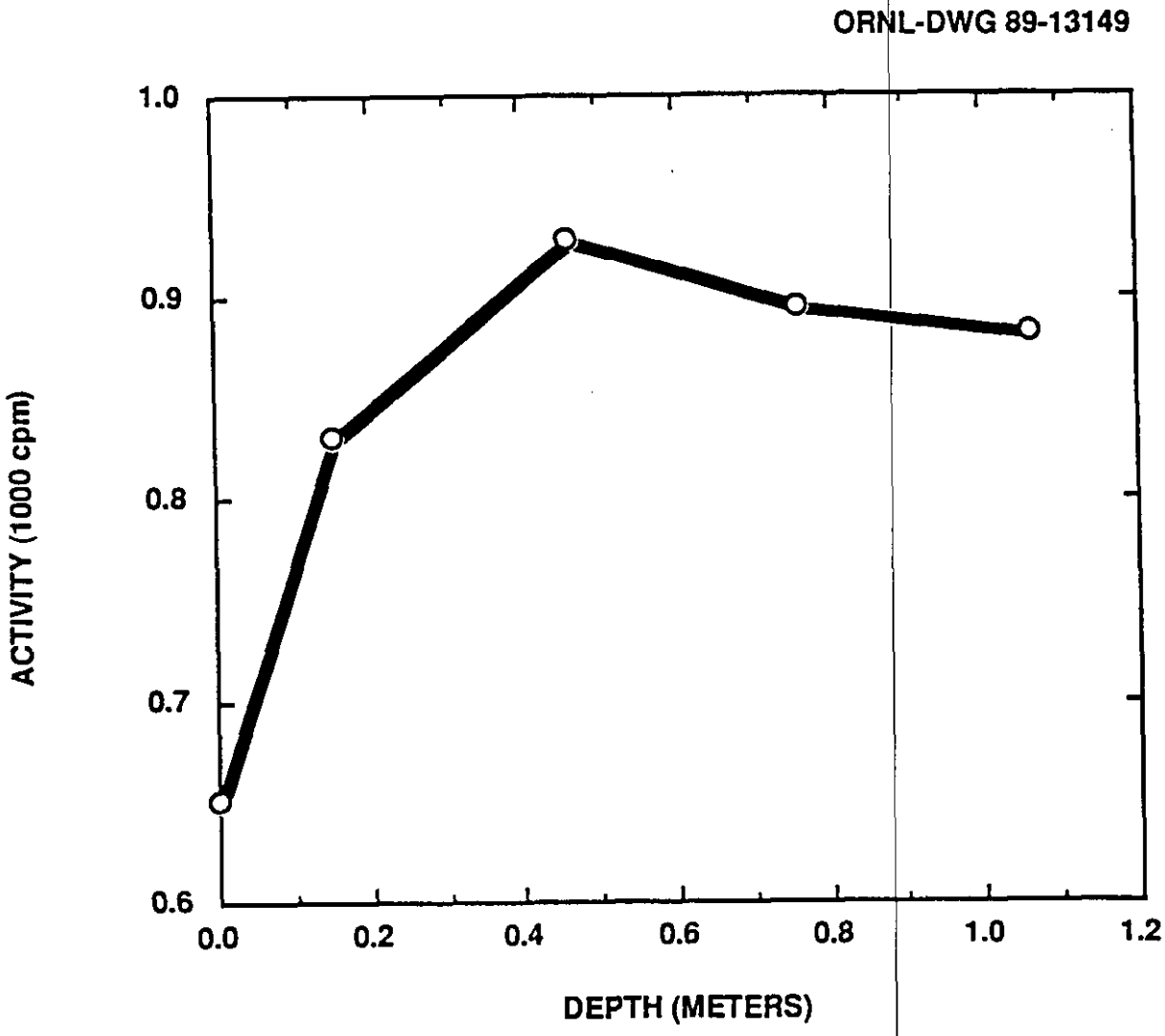

Fig. 83. Gamma profile for auger hole 75 (A75) at the former ore storage site, Palmerton, Pennsylvania (PP001).

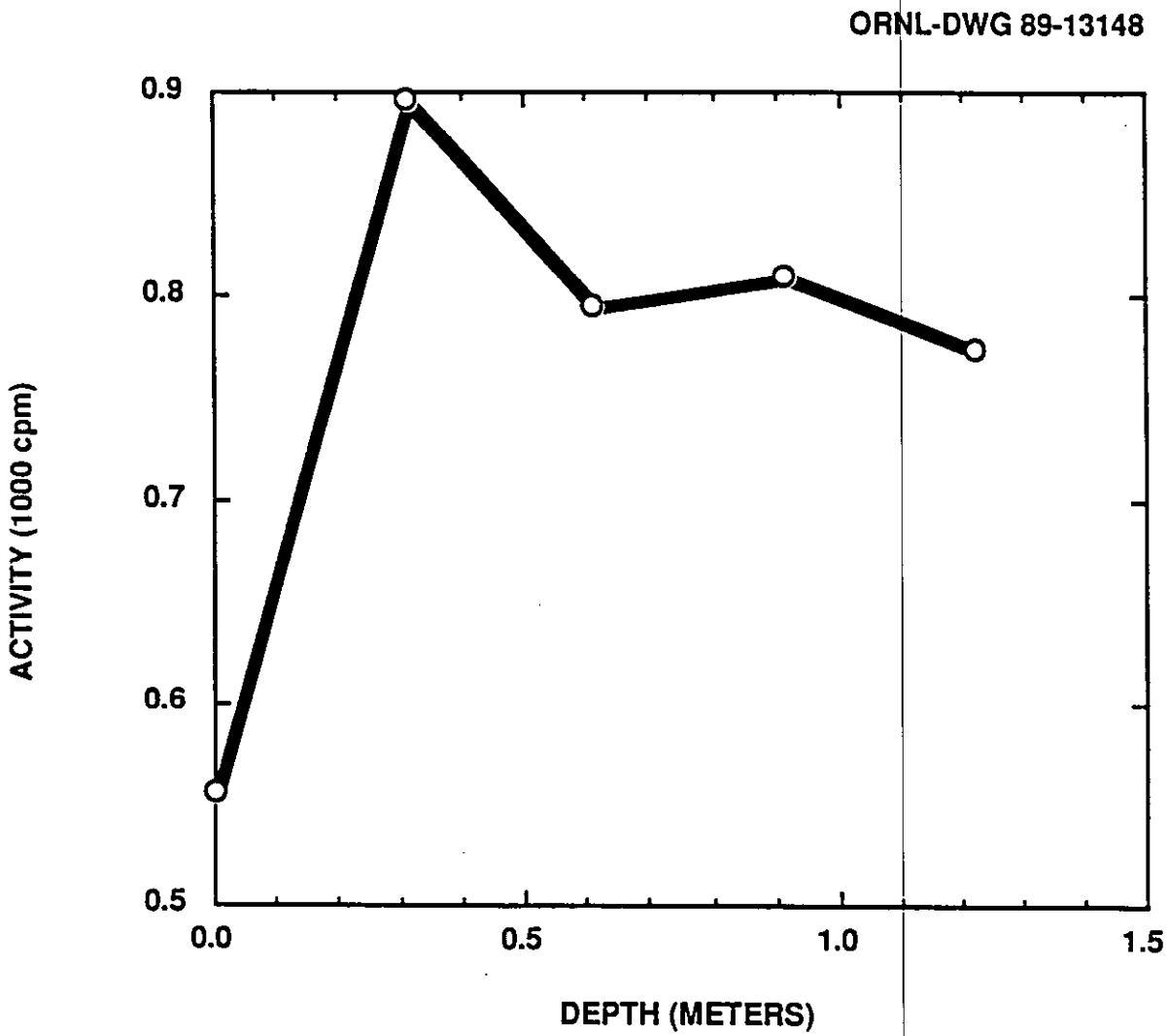

Fig. 84. Gamma profile for auger hole 76 (A76) at the former ore storage site, Palmerton, Pennsylvania (PP001).

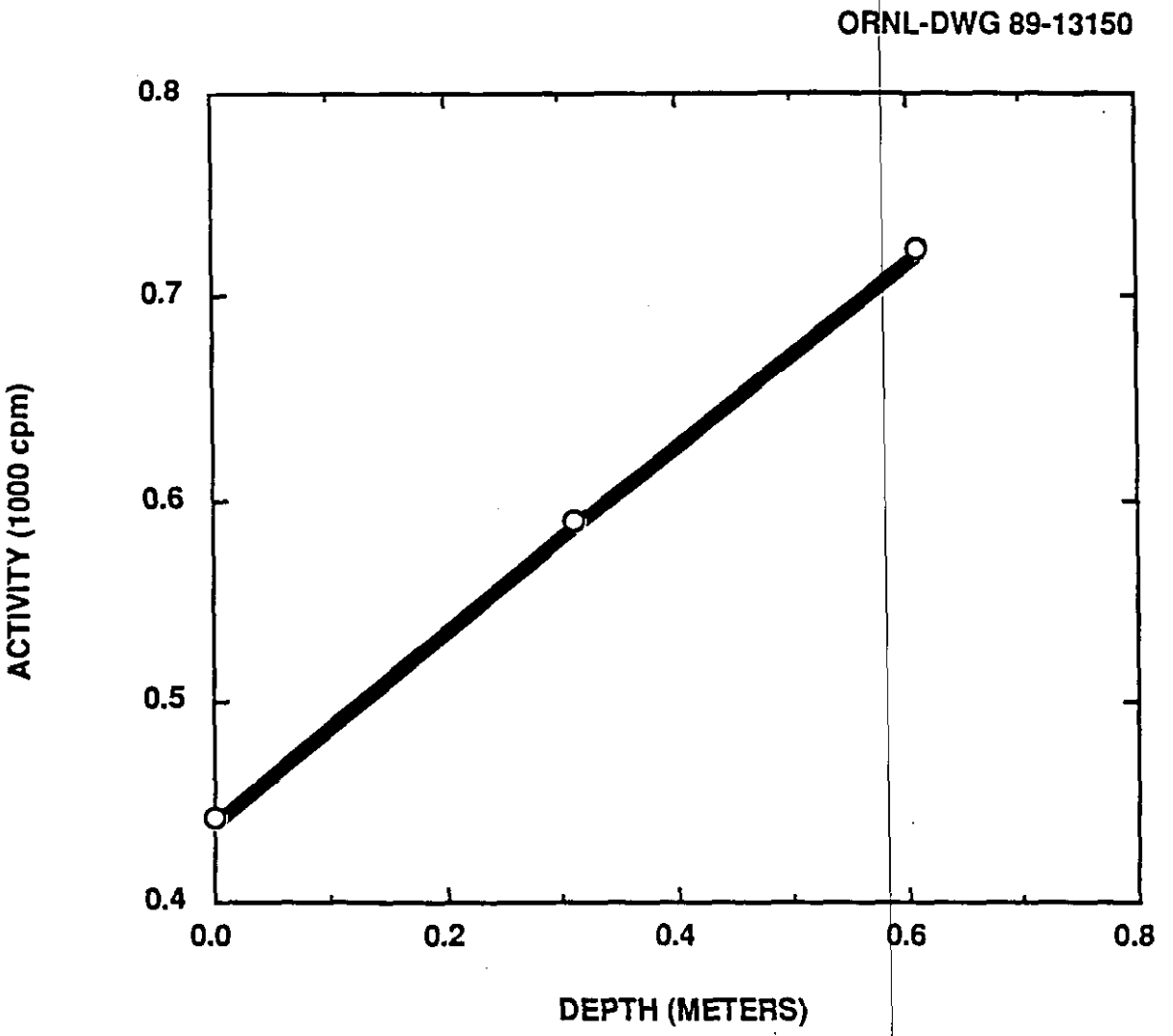

Fig. 85. Gamma profile for auger hole 77 (A77) at the former ore storage site, Palmerton, Pennsylvania (PP001).

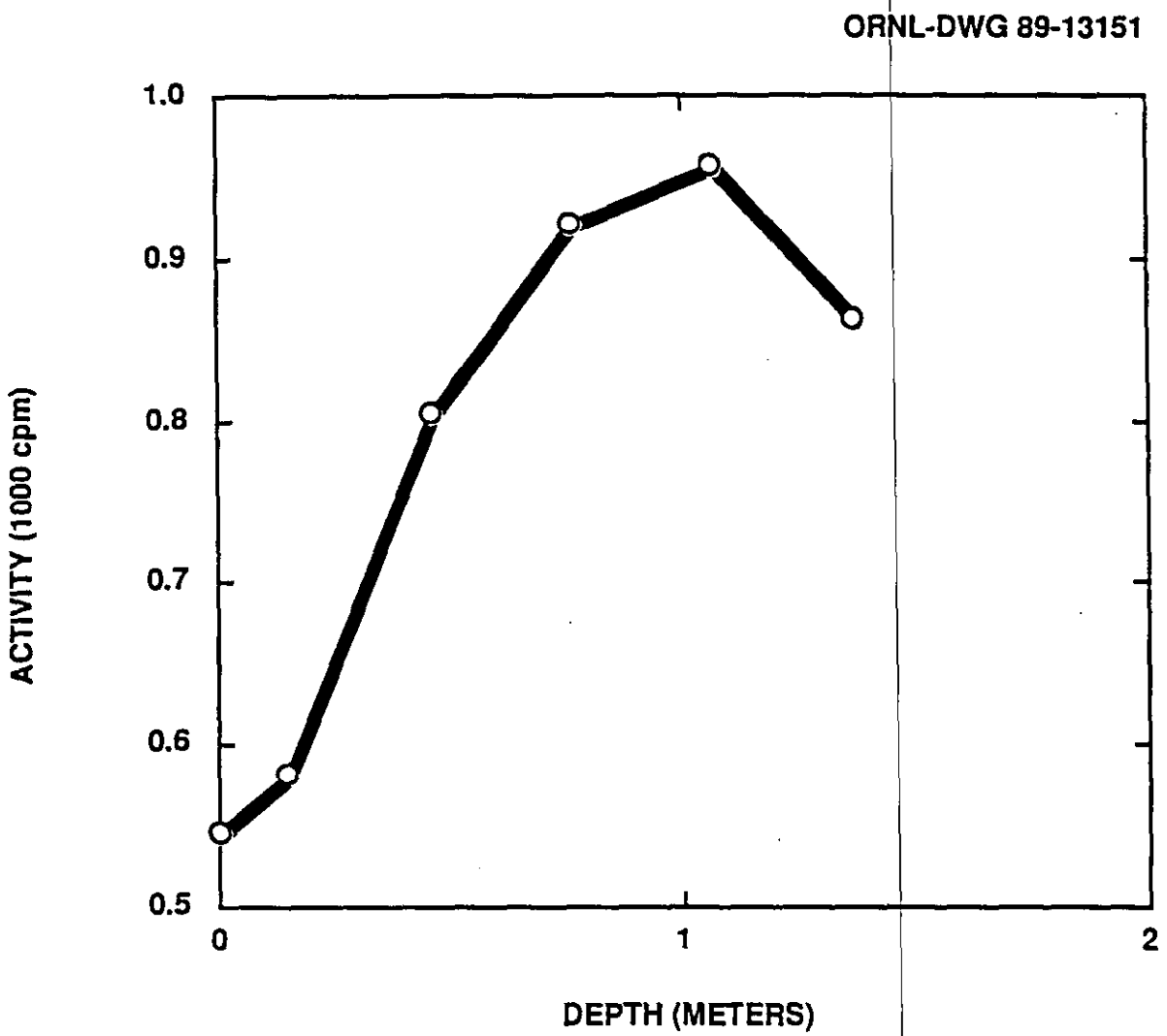

Fig. 86. Gamma profile for auger hole 78 (A78) at the former ore storage site, Palmerton, Pennsylvania (PP001).

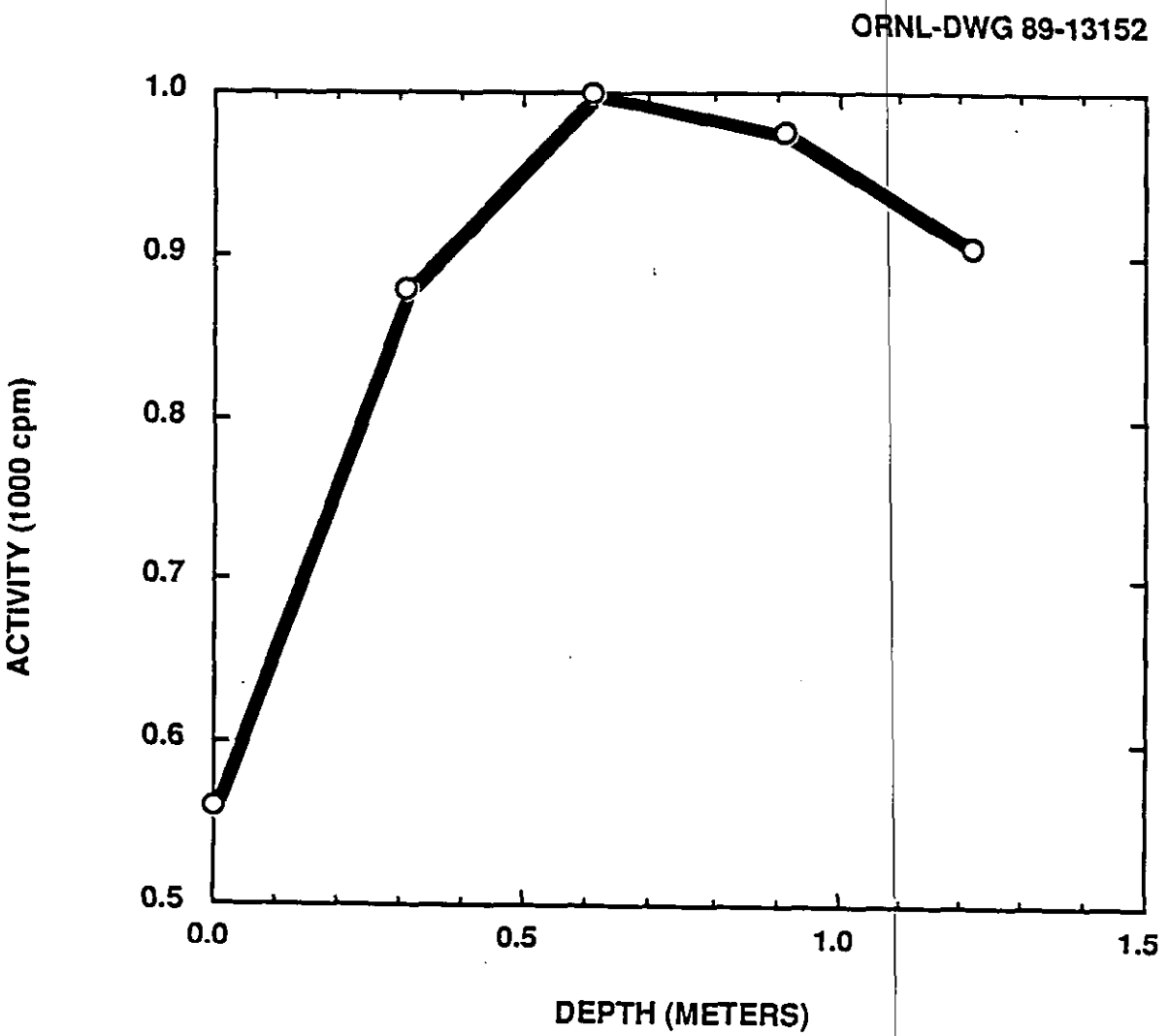

Fig. 87. Gamma profile for auger hole 79 (A79) at the former ore storage site, Palmerton, Pennsylvania (PP001).

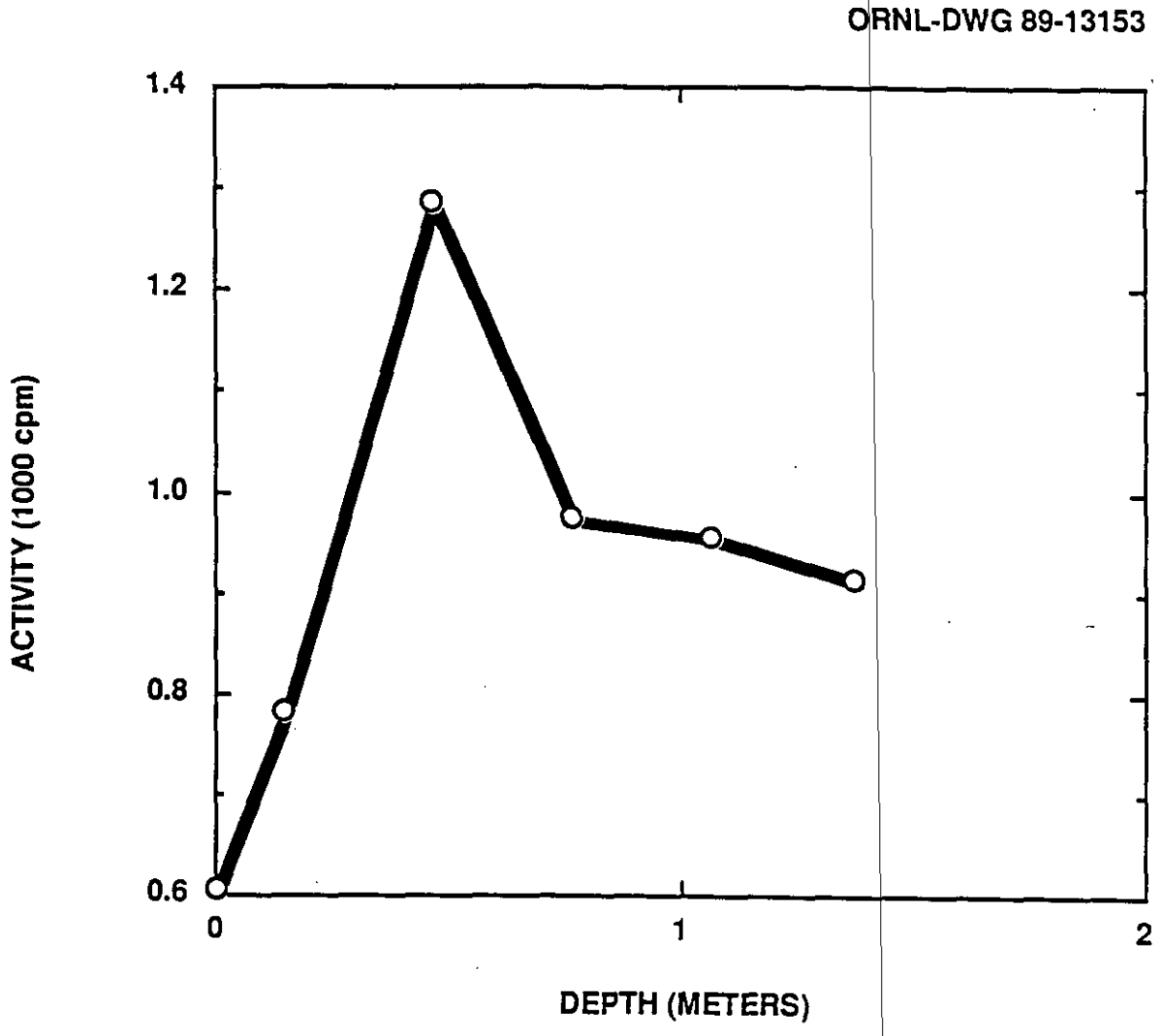

Fig. 88. Gamma profile for auger hole 80 (A80) at the former ore storage site, Palmerton, Pennsylvania (PP001).