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# Geologic and Hydrologic Research at the Western New York Nuclear Service Center West Valley, New York

Annual Report
August 1981 - July 1982

Prepared by J. R. Albanese, S. L. Anderson, L. A. Dunne, B. A. Weir

New York State Geological Survey/State Museum
New York State Education Department

Prepared for
U.S. Nuclear Regulatory
Commission

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Prepared by
J. R. Albanese, S. L. Anderson, L. A. Dunne, B. A. Weir

New York State Geological Survey/State Museum
New York State Education Department
Albany, NY 12230

**Prepared for**
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# ABSTRACT

This report details the research accomplished during the second part of the New York State Geological Survey's (NYSGS) three part program of geologic and hydrologic investigations at the Western New York Nuclear Service Center (WNYNSC) at West Valley, New York. During this reporting period, July 1981 - July 1982, the surficial gravel and the underlying till surface of the North Plateau area were measured using core log data and seismic techniques. Contour and isopach maps are included and show the surficial gravel layer to be lenticular in cross section and approximately forty feet thick at its center. The history of drilling at the site and all available subsurface information pertaining to site stratigraphy has been compiled and standardized. Geologic sections based upon the locations of all wells and their geologic logs show that a sandy stratum, previously reported to extend under the entire site at an elevation of 1350 feet, is not a continous layer. Grain size analyses of gravel samples from the North Plateau indicate the two genetically different gravels have similiar particle size distributions. Analyses of surface and subsurface till samples show that Lavery Till can be subdivided into three subfacies using grain size distributions and the Kent Till can be distinguished from it by its higher silt content. Initial measurements for movement determination on two landslides yield an average downslope movement rate of 0.23 meters/year. A site slope domain map, establishing five domains of varying sliding potential, has been compiled from aerial photos and field mapping. The final phase of the Buttermilk Creek investigation and the study of the erosional history of the Cattaraugus Creek drainage basin have been initiated. Data collection for the cooperative USGS - NYSGS surface water and groundwater studies, initiated during earlier programs, is continuing. A preliminary characterization of the relationship between precipitation and runoff on the North Plateau shows the income to outflow ratio is 3:1 during the summer and nearly equal to one in the winter.

## EXECUTIVE SUMMARY

During the 1981-1982 period of the New York State Geological Survey (NYSGS) study of the geology and hydrology of the Western New York Nuclear Service Center (WNYNSC) at West Valley, New York, several investigations were completed and others continued in the effort to characterize this site. The results of the completed studies and reports on the status of the continuing studies are included in this annual report.

The stratigraphy of the site was more fully defined by standardizing all available well log records of borings and auger holes. This part of the study led to a better characterization and correlation of the glacial units and resulted in the production of more detailed site geologic cross sections. Our study of the stratigraphy of the Lavery till surrounding the NYS-licensed burial area has been completed, with special reference to all previously reported high-permeability layers. Grain size distribution from analyses of samples of gravel and till established definitions for three groupings of Lavery till and showed a textural similarity between the two genetically different layers of gravel on the North Plateau. The study of the North Plateau surficial gravel produced isopach and contour maps of this unit by combining the drill hole information and the results of a seismic refraction survey. Geomorphic studies of the rates and processes of erosion are continuing. Measurements of the rate of movement for two representative landslides were made and are similiar (0.7 and 0.8 meters/year) for both large and small scale slides. The large slide area studied is on Connoisarauley Creek, a nearby tributary of Cattaraugus Creek similar in scale to Buttermilk Creek but outside the WNYNSC property. The small slide area examined is near the north end of the NYS-licensed burial trenches. A slope map of the site, included in this report, shows five major slope domains and estimates their relative sliding potential. Data collection for the surface water program is continuing. Precipitation and discharge measurements are included and preliminary analyses of the relation among rainfall, snowmelt, runoff, and erosion were prepared.

During the final year, 1982-1983, of this NYSGS study the data synthesis will be completed and the geologic setting of the WNYNSC described. That report will include the results and conclusions of the entire study and will produce a base from which recommendations may be made.

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ACKNOWLEDGEMENTS

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We also extend our thanks to all those individuals at the WNYNSC, associated with WVNS, DOE, and Dames and Moore, for investing their time in this project and providing the NYSGS access to the site.

## ABBREVIATIONS

Agencies and Companies:

| | |
|---|---|
| NFS | Nuclear Fuel Services, Inc. |
| NYS | New York State |
| NYSASDA | New York State Atomic and Space Development Authority |
| NYSERDA | New York State Energy Research and Development Authority |
| NYSDEC | New York State Department of Environmental Conservation |
| NYSGS | New York State Geological Survey |
| USEPA | United States Environmental Protection Agency |
| USGS | United States Geological Survey |
| USNRC (or NRC) | United States Nuclear Regulatory Commission |
| WVNS | West Valley Nuclear Services |

Units of Measure:

| | |
|---|---|
| cm | centimeter |
| ft | foot |
| m | meter |
| sec | second |

Convention for Exponents:

n E +/- m : n multiplied by 10 raised to the plus or minus m power

## 1.0 INTRODUCTION

This report covers the second year, August 1, 1981, through July 31, 1982, of a three part study of the Western New York Nuclear Service Center (WNYNSC) located in West Valley, New York. This study, funded by the U.S. Nuclear Regulatory Commission (USNRC) under Contract No. NRC-04-79-205, is concerned with geologic characteristics and processes of western New York State as they affect the WNYNSC. The overall goal of this NYSGS study is to describe the geologic regime of the WNYNSC site, including the radioactive waste burial areas. The second year of this study was a continuation of the data collection efforts of previous years and the analysis of this data has begun.

### 1.1 Tasks Accomplished

Surface and ground water investigations undertaken in cooperation with the Water Resources Division of the United States Geological Survey (USGS) were continued from the first phase of this program. The surface water program included measuring stream stage, discharge, and suspended sediment concentrations at three permane[illegible] stream gaging stations on site and at a number of oth[illegible] stream locations. Precipitation data is being gathered to relate rainfall and runoff. Measurements of water levels were periodically taken in selected wells for use by the USGS in their groundwater model. This modelling effort will be detailed in a USGS report.

Detailed site stratigraphy was an important project in this year's research effort. All available geologic logs were compiled to improve the picture of the subsurface stratigraphy of the WNYNSC. In the North Plateau area seismic refraction, in combination with existing drill hole information, helped to refine the near-surface stratigraphy by revealing the thickness of the surficial gravel and the topography of the underlying till. The petrography of the deposits at the WNYNSC site was examined in some detail, and the characteristics of each sedimentary type were used to establish continuity between separate sampling points. This petrographic analysis is also the basis of a new, uniform, classification scheme. The entire stratigraphic section, particularly near the bedrock contact, will be examined in detail in the final report following the completion of the Deep Drilling Project.

The geomorphic studies focused on slope stability. Landsliding rates were measured in two locations and the site was classified as to areas of potential mass movement. Two additional projects, a study of stream erosion in Buttermilk Creek, and a study of the erosional history of the Cattaraugus Creek drainage basin, are underway.

## 1.2 Future Studies

The third and final year of this study will complete the analyses of the data collected during the first two years, as well as that collected since 1975 as part of earlier studies by the NYSGS. This will provide a basis for predictions regarding the geologic integrity of the burial areas and recommendations for the long term maintenance of the WNYNSC.

## 2.0 STRATIGRAPHY

### 2.1 Standardization of Geologic Logs

Over 250 holes and pits have been drilled or dug at the WNYNSC since 1961. Most of these are within the area now enclosed by the security fence, as are the main processing plant, the storage area for high-level liquid waste, the lagoons for processing low-level liquid waste, the NRC-licensed burial area for solid waste, and the NYS-licensed burial trenches for low-level solid waste (Plate 1). Geologic logs were made for many of these holes, using direct observation of the walls of pits, and from cuttings or core samples from drilled or augered holes. The format and resolution of details in these logs vary widely, primarily depending on the various purposes for which the holes were made, but also on the types of samples used and the depths of the holes.

The variations among the logs make it awkward to use logs from different sets of holes in the same cross-section or fence diagram. In order to simplify such efforts we rewrote all of the logs using a standard format. We tried to avoid sacrificing information that would be useful for characterizing or distinguishing lithologic units, or for locating contacts. Therefore, the format was designed to include as much information as feasible from the more detailed logs. One consequence is that the standardized versions of the less detailed logs contain many blank spaces.

A listing of hole locations and original geologic logs for the entire 3000-hectare area of the NYSERDA property at West Valley is being prepared by Marcel Bergeron, USGS, (personal communication). The present report is primarily concerned with the smaller area within the security fence. Only the logs for holes in this area were standardized. The locations of these holes are shown in Plate 1. The standardized logs are in Appendix A.

## 2.2 History of Drilling and Excavations

The first holes drilled in this area for scientific purposes were part of the initial site evaluation that preceded construction of the reprocessing plant and waste disposal sites These are designated on Plate 1 by "DH" followed by a number ("drill holes"), which were logged from cores, and "PAH" followed by a number ("power auger holes"), which were logged from auger cuttings. These holes were drilled in 1961 and 1962 and were logged by the New York State Department of Public Works (succeeded by the Department of Transportation). Some of the logs accompanied a report by Johnson (1961), and maps showing the locations of the holes appear in many early reports by Nuclear Fuel Services, Inc., the first site operator. These logs are quite brief, and most of the PAH holes are less than 10 m (32 ft) deep.

Dames and Moore drilled 43 holes for NFS, in the vicinity of the main processing plant, from 1962 through 1974. On Plate 1 these are indicated by numbers. Several of these holes are more than 20 m (65 ft) deep, and the geologic logs are more detailed than those from the Department of Public Works. Maps and logs appear in several Dames and Moore and NFS reports, and all are included in Duckworth, and others (1974). These will be referred to as D&M-n in the text that follows.

Another set of holes was drilled near the New York State licensed burial trenches in 1973-74 under the direction of NYSASDA (New York State Atomic and Space Development Authority), succeeded by NYSERDA. The locations of these holes are also indicated by numbers on Plate 1 and can be distinguished from the Dames and Moore holes by the fact that they are only found close to the NYS-licensed burial trenches. The holes were cored, most of them to a depth of 15.5 m (4.7 ft) to obtain samples for radionuclide analyses, in order to determine migration distances and rates close to the trenches. Most of the holes were logged only by the driller, in very brief form and with no attention to subtle changes or layering. These driller's logs appear in a NFS monthly report to NYSASDA (1973), in Giardina and others (1977), and in Duckworth and others (1974). Kernan Davis, of the New York State Department of Environmental Conservation (NYSDEC), logged holes 9A and 2A in great detail at the time of drilling. His logs are in a letter report (1974) to Thomas Cashman, NYSDEC, and also appear in Duckworth and others (1974). Samples from all of these holes were generally extracted in 2-ft (0.61 m) lengths, and substantial portions of each section were sent to the NYS Department of Health for radionuclide analyses (reported in Giardina, and others 1977). The remains were stored by NFS at the site, and were examined there by Henry Bailey, NYSGS, in 1975. Unfortunately, these samples were poorly marked, lacking any indication of top or bottom, or of the location of the remains within the 2-ft interval originally cored. Bailey's original logs are on file at NYSGS, and several were included in a letter report by Fakundiny and Bailey (1975) to Robert Dingman, USGS.

Dames and Moore drilled seven holes and dug seven test pits in 1974, most of them between the burial areas and the main processing plant as part of a feasibility study for a proposed reservoir along the West Branch of Frank's Creek. Nearly all of the borings ("B" followed by a number on Plate 1) are more than 30 m (98 ft) deep, and the test pits ("TP" followed by a number on Plate 1) are 2.5 to 3.5 m (8.2 to 11.5 ft) deep. The logs are comparable in quality with those from the Dames and Moore holes near the main processing plant. These will be referred to in the text as D&MB-n and D&MTP-n.

The USGS drilled and augered several holes near the NYS-licensed trenches from 1975 through 1977. These are indicated by letters A through Z, with numbers following some letters to distinguish holes in a cluster, on Plate 1. The holes east of the trenches indicated by "EB" followed by a number, were augered in 1977 through 1980 as a continuation of this drilling program. Piezometers were installed in many of the holes for observation of ground water levels. Most of the geologic logs from these holes are very detailed and thorough, and the standardization system used in this report was primarily designed around these logs. The original logs are to be published by Bergeron (personal communication). Many were used in LaFleur (1979), and some were referred to in Albanese and others (1981).

The USGS also drilled 6 holes through the trenches, and drove several well points into the trenches, in 1976-77. These holes are indicated by "n-na", where the first "n" is the trench number, on Plate 1. The well points were used to sample gas and water from the trenches. The drilled holes were cased through the trenches and used to extract core samples from underneath, in an attempt to measure the extent of radionuclide migration out of the trench bottoms. The logs of these cores are comparable in quality with those from the other USGS holes. The cored holes are 9 to 12 m (20.5 to 39.4 ft) deep. Logs of the cored holes were published in Prudic (1979), and Dana and others (1979). Information from the gas and water sampling program was presented in Husain and others (1977; the hyphens were omitted from the hole numbers), and Prudic (1978).

Ten holes were drilled by the USGS in 1980, and are shown on Plate 1 by "80" followed by a hyphen and a number. The cores were logged at the time of drilling by Todd Miller, USGS, and by Richard Dana and Vickie Ragan, NYSGS. The logs are comparable in quality with the other USGS holes. Logs from these holes have been published in Albanese and others (1981).

Two holes were augered by the NYSGS east of the NYS-licensed burial trenches, at positions shown by A-82-1 and A-82-2 on Plate 1. These holes were made to obtain information to supplement that from the EB-series holes augered previously by the USGS. The logs from these two holes are comparable in quality with those from the USGS holes.

Several other holes are shown on Plate 1, but no geologic information has yet been obtained for them. The sumps in the NYS-licensed trenches, indicated by "s" followed by a number, are driven well points, so no geologic logs can be expected from them. The lettered holes and pits in the main plant area were apparently drilled or dug by NFS, and several are known to have been used for obtaining water samples. No geologic information appears to have been made available from these holes.

## 2.3 General Stratigraphic Units

A study by LaFleur (1979) of the regional glacial stratigraphy suggests that the following basic units are present at the site, in order from top to bottom:

1. Holocene alluvium; gravelly;

2. Late Pleistocene alluvial-fluvial gravels and sands;

3. Lavery till; clay and silt, with some pebbles, and including pods and lenses of sand and gravel and deformed layers of clay and silt;

4. Kame deltas and other coarse gravel deposits, including outwash channel gravels; primarily sand and silty sand;

5. Lacustrine silt and clay with rhythmic layering; possibly bottomset distal beds of the kame deltas;

6. Kent(?) till; silt and clay with pebbles, stony, and with a greater proportion of exotic clasts than Lavery;

7. Bedrock; Devonian shale and carbonate rocks.

This sequence was primarily defined from field relationships, using exposures in the banks of deeply incised streams such as Buttermilk Creek. The entire sequence is penetrated by only a few drill holes inside the security fence, including DH-4 and D&M-32, but several deep holes extend into the coherent lacustrine beds (Unit 5). The sequence is illustrated in two cross-sections from Albanese and others (1981). The first section, shown here as Figure 1, extends from the middle of the reprocessing plant due south to Hole 80-10, which is 650 ft (200 m) due west of the NRC-licensed burial area. The line of section follows the contours of bedrock. The sandy unit overlying the lacustrine unit is shown as continuous and at an elevation of approximately 1350 ft (410 m), although three of the holes shown do not extend deep enough to demonstrate continuity. The other cross-section, shown here as Figure 2, extends from the reprocessing plant eastward toward the north end of the burial trenches. In this section the sand unit is shown as dipping down to the east, toward the axis of the buried bedrock valley, to an elevation of 1250 ft (380 m) near the trenches. At the west end a gravelly-sandy layer lies directly on bedrock, and is correlated with

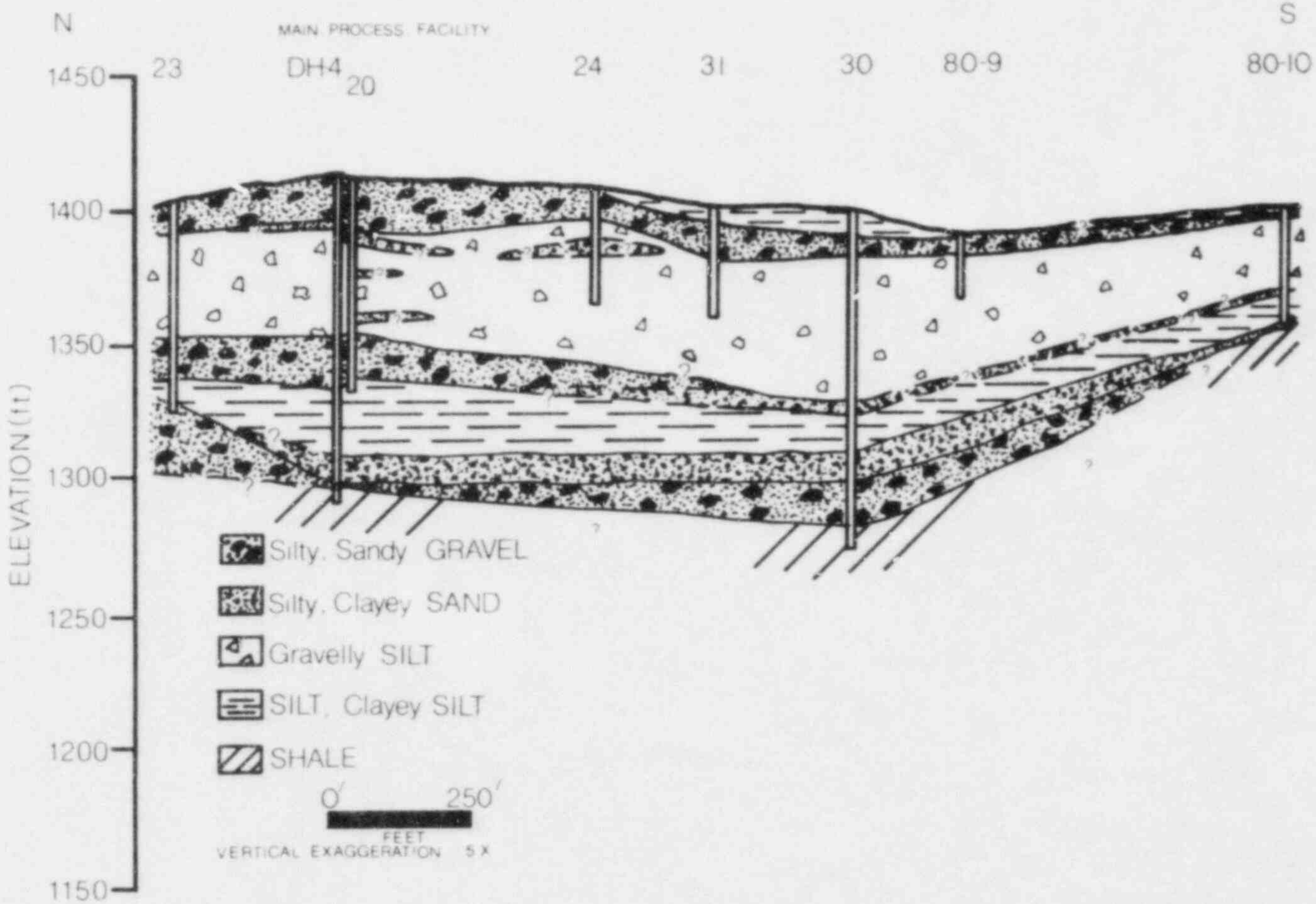


Figure 1. Generalized north-south stratigraphic cross-section across the plant area, originally published in Albanese, and others (1981). Note the elevation of the major coarse-grained unit.

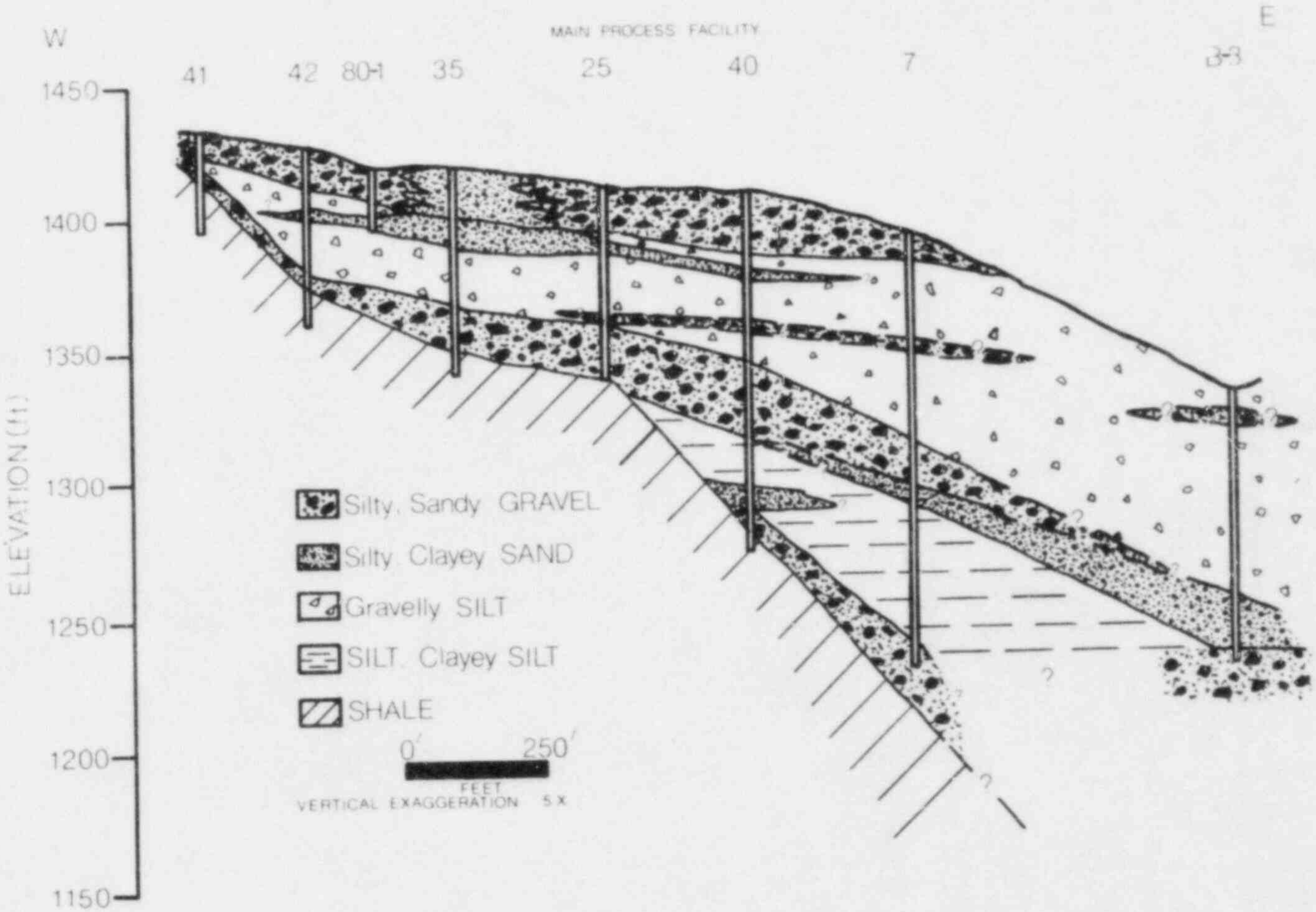


Figure 2. Generalized east-west stratigraphic cross-section across the plant area, originally published in Albanese, and others (1981). Note the change in elevation of the major coarse-grained unit.

the sand unit overlying the pinched-out edge of the lacustrine unit, which extends as far west as the center of the plant.

As can be seen in these cross-sections, other sandy and gravelly bodies have been encountered in several holes, but are shown as lenses or pods within the Lavery till. The keys used for correlation of the main sandy unit are its thickness of up to 50 ft (15 m), and position beneath the Lavery till and on top of the sequence of coherent lacustrine beds. The lacustrine unit appears to pinch out west of the plant at an elevation of 1350 ft (410 m), and the sandy unit above it pinches out against bedrock in nearly the same location. At that point the overlying Lavery till is less than 50 ft (15 m) thick. The lacustrine unit thickens eastward as the depth to bedrock increases, and there is also substantial relief on the surface upon which the sandy unit was deposited. The thickness of the sandy unit does not appear to show a systematic increase, and is in fact quite variable in both thickness and elevation. Figure 3 shows stratigraphic columns for D&M B-1 through B-5, a set of five deep holes north of the NYS-licensed burial trenches. Within this circle of 300 ft (100 m) diameter the elevation of the top of the sandy unit varies from below 1265 ft (385 m) to above 1318 ft (400 m) and the thickness and character of the unit vary from 15 ft (5 m) of sand or silty sand to less than 3 ft (1 m) of gravel. There may also be an additional coarse horizon within or below the lacustrine material in some of the holes, but not of any substantial thickness.

LaFleur (1979) described the main sandy unit as including a series of kame deltas deposited on the margins of a post-or-late Kent proglacial lake or lakes. The fact that the coarser materials generally do not interfinger on a large scale with the lacustrine clays and silts but usually lie on top of them suggests that in the plant and burial areas the kame deltas prograded out into the lake or lakes through time, possibly as the water level decreased so that coarse clastics no longer dropped to the bottom close to the sides of the valley. Part of the variation in thickness and elevation of the sand unit would be the logical result of its origin as an aggregation of individual deltas, and accumulations of debris derived from melting of large blocks of ice left in front of the retreating glacier. The unit is probably not a simple blanket of uniform thickness but rather a group of overlapping wedges. Another source of variation in the thickness of the sandy unit would be later erosion. LaFleur (1979) inferred that fluvial erosion took place in this area during the Erie Interstade, leading to local deposition of channel-fill gravels on top of the kame deltas, and possible removal of some of

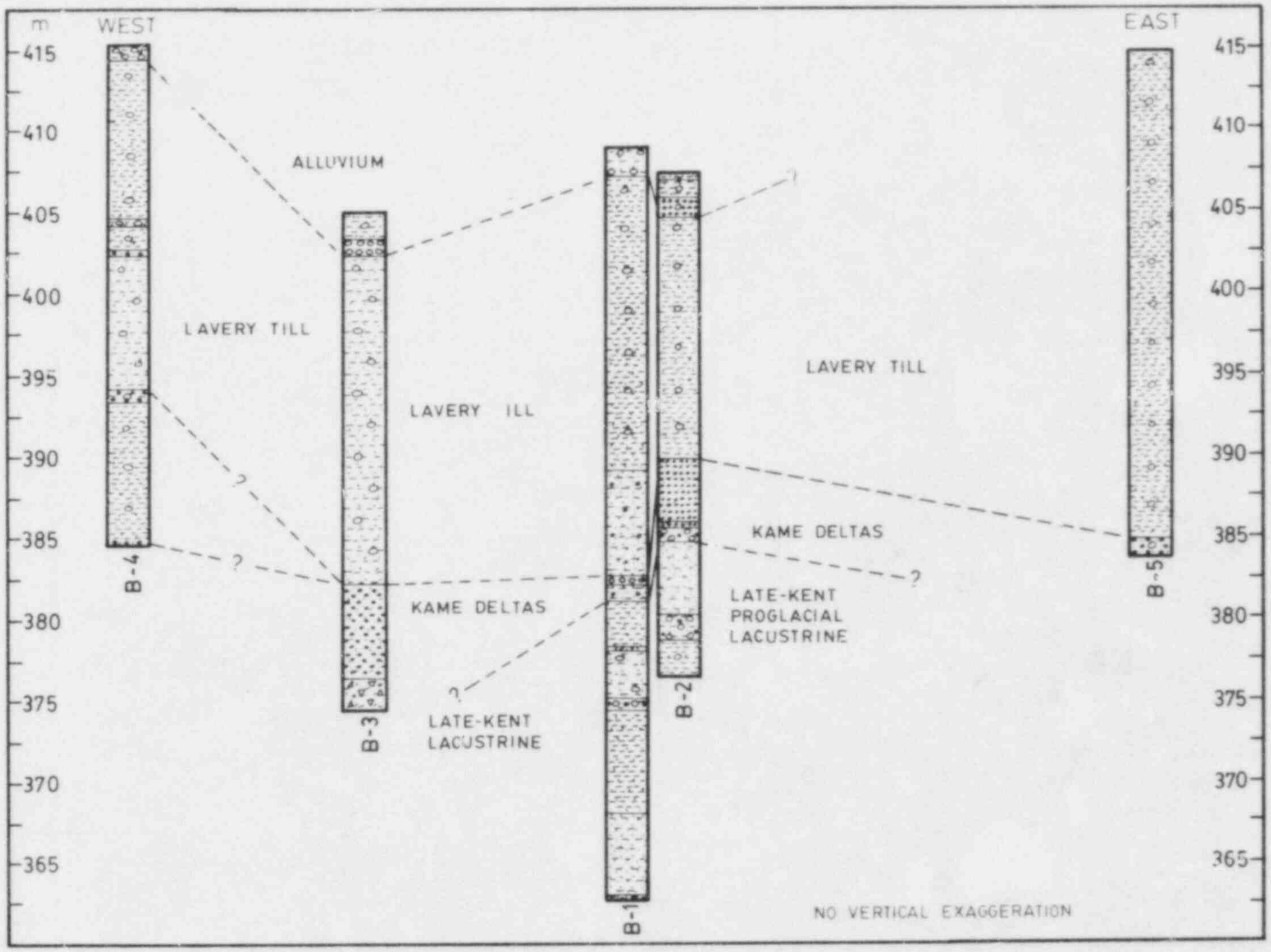


Figure 3. Generalized stratigraphic columns for holes B-1 through B-5, north of the NYS-licensed burial trenches. The columns have been projected to an east-west line through B-3 and D&M 7 (see Plate 1).

the delta material. The later glacier responsible for deposition of the overlying Lavery till might also have eroded and incorporated kame delta material, and perhaps even cut into the underlying lacustrine unit, although the sandy unit is seldom completely absent in the logs of holes that are deep enough to penetrate the late-Kent lacustrine unit.

The subsurface stratigraphy of the burial areas is of particular interest because of the potential hazard of subsurface migration of radionuclides through any extensive permeable layer or zone. The original geologic evaluation of the site (Nuclear Fuel Services, 1962) contained three stratigraphic cross-sections of the entire property which have been repeated in several later reports from NFS (see Plate 2). These cross-sections show two substantial, sand layers under the entire site, one at an elevation of 1350 ft (410 m) and another at 1300 ft (395 m). The upper one would be close enough to the surface to compromise the isolation of waste in the 50 ft (15 m) deep pits in the NRC-licensed burial area, and also close to the bottom of the NYS-licensed burial trenches. The upper sandy layer occurs in hole DH-4 in the center of the plant. It correlates with the main sandy layer defined by LaFleur (1979) as separating Lavery till from lacustrine beds, but it is shown in Albanese, and others (1981) as dipping to the east to an elevation of 1300 ft (395 m) near the trenches. In and around the burial areas at least 50 holes extend to an elevation of 1360 ft (415 m) and 20 of those go down to at least 1340 ft (408 m). In that interval none of these holes encountered a sand layer of the scale of that found at 1350 feet (410 meters) in DH-4, nor was there a boundary in that interval between Lavery till and coherent lacustrine beds. That boundary and the major sandy unit appear to be as much as 100 ft (30 m) below the surface under the burial areas, as shown in the west-to-east cross-section in Albanese, and others (1981).

Approximately a dozen holes in the south half of the fenced area extend below 1310 ft (400 m) elevation. Figure 4 is a west-to-east cross-section showing stratigraphic columns for several of these holes. The line of section passes along the north side of the NRC-licensed burial area and across the northern set of NYS-licensed burial trenches. Figure 5 is a north-to-south cross-section along the east edge of the NYS-licensed trenches, using more of these deep holes, including the cluster off the north end of the trenches shown in Figure 3. Notice that in the area of the burial trenches the major sandy unit separating Lavery till from the late-Kent coherent lacustrine beds is variable in thickness and elevation but the top is never above an

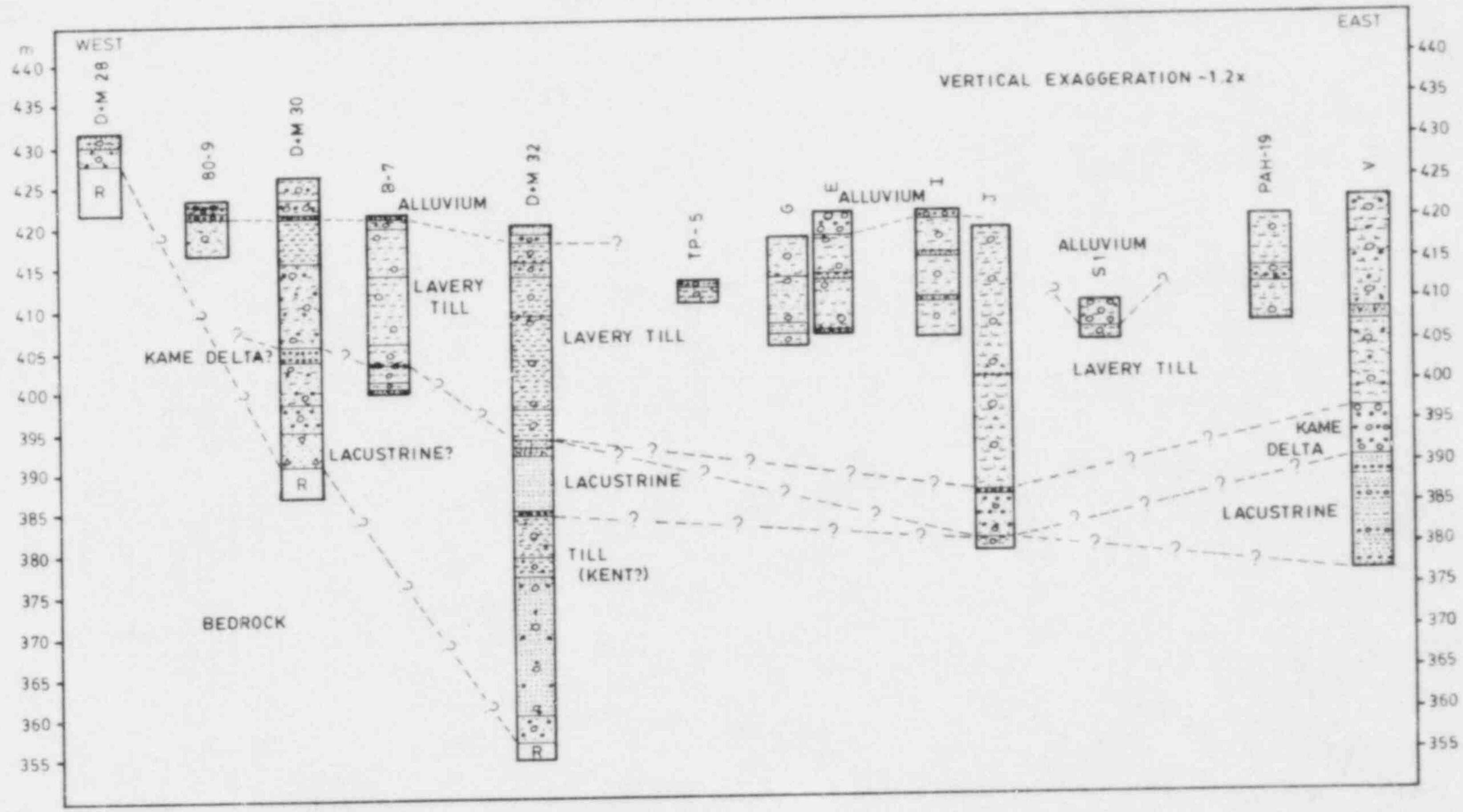


Figure 4. Generalized east-west stratigraphic cross-section across the plant area, using deep holes drilled by USGS, projected to a line through holes J and V (see Plate 1).

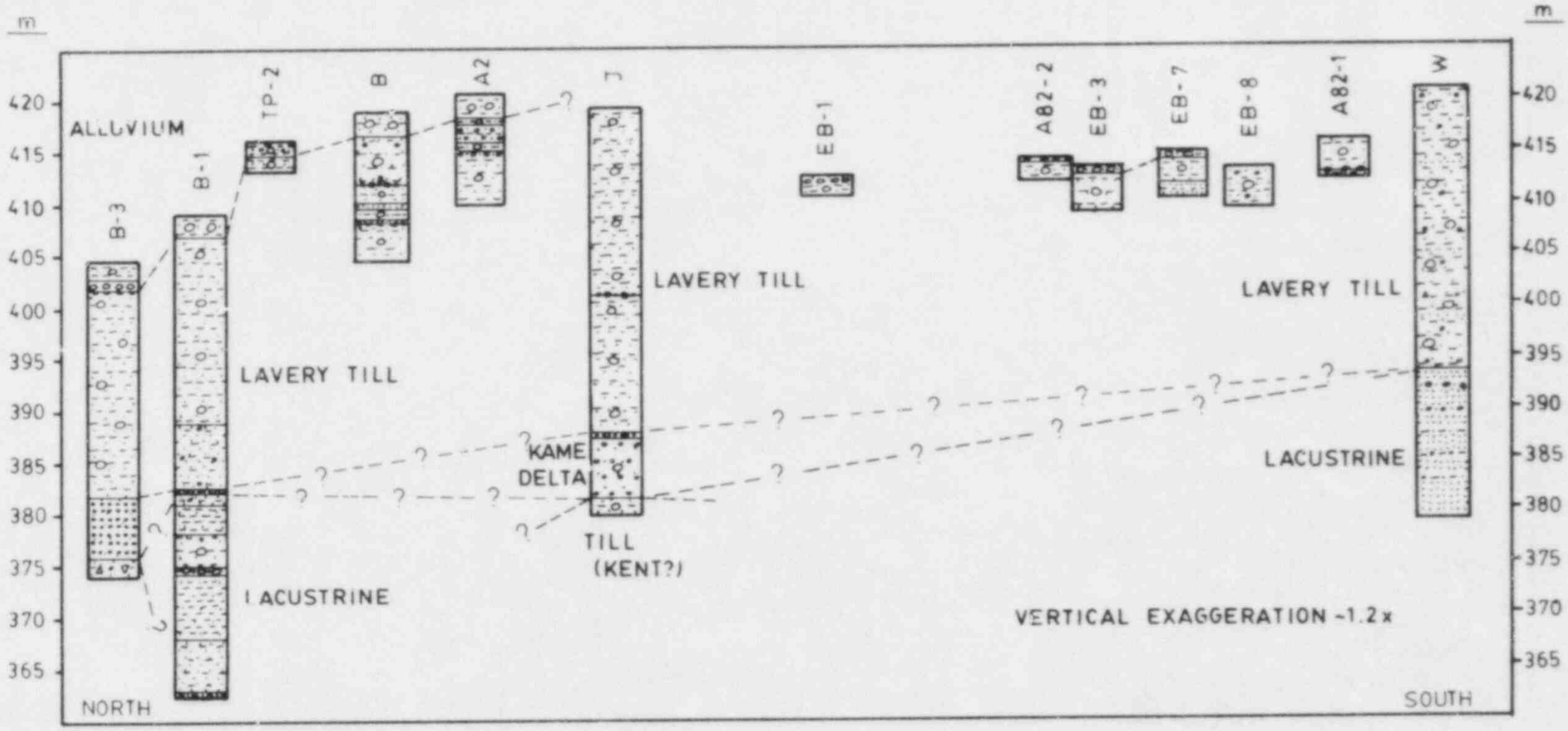


Figure 5. Generalized north-south stratigraphic cross-section across the plant area, using deep holes drilled by USGS, projected to a line through holes J and W.

elevation of 1314 feet (400 meters). This places it more than 36 feet (11 meters) below the bottom of the NYS-licensed trenches and 16.5 ft (5 m) below the bottom of the NRC-licensed pits.

The cross-sections in Figures 4 and 5 are in obvious conflict with the cross-sections from the 1962 NFS report, so we re-examined the earlier cross-sections and the logs on which they were based. We redrew the cross-sections from the logs, keeping in mind the stratigraphy that has since been developed for the area from surface exposures. This stratigraphy has been seen in several of the deeper holes that have been drilled since 1962. The comparisons are shown in Plate 2, and the logs, converted to standardized form, are included in Appendix A. The original cross-sections are not supported in detail by the original logs at several points and the cross-sections appear to have an excess of artistic license. The simple "layer-cake" stratigraphy implied by those cross-sections is not compatible with what is now known about the Pleistocene geologic history of the area, and is not supported by the results of later drilling.

2.4 Lavery Till in the Burial Area

The burial pits in the NRC-licensed burial area and the trenches in the NYS-licensed low-level waste area extend no more than 50 ft (15 m) below the surface, and the Holocene alluvium that blankets the north half of the fenced area does not extend over the burial areas. Therefore, the solid wastes are entirely enclosed in Lavery till, with caps derived from the same material. Over 70 holes have been drilled and augered in and around the low-level trenches to examine the Lavery till in detail there, although not all extend down far enough to show the entire thickness used for burial. The geologic logs from these holes vary widely in quality and resolution; the most detailed stratigrapic information about features within the Lavery till comes from holes drilled and augered by the USGS from 1975 to 1977 and again in 1980, and those augered by the NYSGS in 1982. Only four holes have been drilled or augered within 100 feet (30 m) of the north, west and south borders of the NRC-licensed burial area. New drilling has begun, intended to increase that coverage efficiently by adding two holes to at least 120 ft (36.5 m), three to at least 50 feet (15 meters), and several shorter auger holes for piezometers. Data from these will be combined with information from a few deep holes previously drilled in the southwest quadrant of the fenced area in a separate report.

As described by LaFleur (1979) from surface exposures and seen in test trenches to the south of the burial areas in the low-level burial trenches and in detailed logs of many holes on the site, the Lavery till is essentially a homogeneous and isotropic mixture of clay and silt with minor pebbles. Fresh, unoxidized Lavery till has a hydraulic conductivity of less than 10E -8 centimeters/second (.01 feet/year) (Prudic, 1982). For comparision, Todd (1967) indicates that good aquifers of clean sand and gravel have hydraulic conductivities of 0.001 to 10 centimeters/second (1,000 to 10,000,000 feet/year), while impervious unweathered clays have hydraulic conductivities of 10E-7 centimeters/second or less. That is, most of the Lavery till would be classed as an aquiclude, and does not even approach the permeability required for an aquifer.

LaFleur (1979) defined three subfacies of the Lavery till, based on surface and stream-cut exposures and some of the earlier drilling logs:

Subfacies 1: pebbles and cobbles are 10 to 20 percent of the sediment, in a matrix of clay and silt in subequal amounts, with some sand;

Subfacies 2: stones make up less than 5 percent of the sediment, in a clay-silt matrix that also contains numerous thin, torn wisps of gray silt; and

Subfacies 3: lenticular, discontinuous bodies of stratified sand and gravel, with torn masses of till of Subfacies 1 and of rhythmic clay laminae.

According to LaFleur, the first two subfacies make up at least 70 percent of the volume of the Lavery till unit and occur together as interfingering masses, internally deformed. LaFleur recognized the third subfacies at depths of 7 to 12 ft (2 to 3.5 m) in the burial area. He described this material as posible proglacial sediments overridden by a later advance of the Lavery glacier.

Subfacies 3 poses a possible hazard to long-term isolation of the radioactive waste buried in Lavery till. A gravelly-sandy lens in contact with or near the buried waste could potentially be extensive and permeable enough to allow migration of contaminated water to the surface.

Detailed logs of holes near the NYS-licensed trenches suggest that the Lavery till also includes scattered individual layers and zones of interlayered clay, silt, and fine sand. These are not always associated with gravelly lenses, and occur at depths greater than 12 ft (3.5 m) below the surface. Many of these layers are deformed and discontinuous, even on the scale of a 3-inch (8 cm) core, and may be of the same class as the silt wisps of LaFleur's Subfacies 2. Sandy layers seen in cores taken below probable alluvium or backfill tend to be only a few centimeters thick. Again, the concern is that some such sandy layer might be sufficiently extensive to act as a pathway to the surface for radioactive contaminants.

2.4.1 Trench 13 Sand Lens

One large coarse-grained lens was observed in 1974 in a NYS-licensed burial trench by visiting geologists while burial was in progress. Kernan Davis, NYSDEC, reported (1974) the lens as being near the south end of Trench 13. He gave dimensions of 2 ft (0.6 m) thick, and 65 ft (19.8 m) long. At various points in his report he described the lens as "gravel", "sand", and "sandy-gravelly". He did not provide any data on depth below the surface, color, water content, shape, or internal structures. A similar description is found in Giardina, and others (1977), but for Trench 12. One of the authors of that report, Lewis Meyer of the U.S. Environmental Protection Agency (USEPA), was with Davis of NYSDEC on the day he observed the sandy lens described above. By that time Trench 12 had already been filled and covered. Therefore, we conclude that both reports refer to Trench 13.

After discovery of this sandy lens, burial operations were temporarily suspended until its extent could be determined. NFS used a backhoe to dig 15 shallow holes to investigate the lens. Their results suggest that the lens was saucer-shaped, concave upwards, and thicker in the center and that the base was at no point more than 7 ft (2.1 m) below the original surface. The longest dimension extended northwest from Trench 13 for nearly 300 ft (91 m) across Trench 14 and the planned locations for Trenches 15, 16, 17, and 18 as shown in Figures 6 and 7 (from unpub. map and notes by Dana, 1974, and 1980, using data provided by Oldham of NFS, 1974). The location corresponds with that of a low swampy area that existed in the burial area before surface modifications were made (NYSGS letter to Meyer, 1980).

In other holes nearby no mention is made of a unit dominated by sand and gravel, although rare, thin partings of sand were seen in Hole L in a 0.5-ft (0.15 m) thick interval at a depth of 7.2 to 7.8 ft (2.2 to 2.4 m) below the surface. In Hole Q, highly deformed layers of coarse silt to fine sand were noted in a unit that was dominantly clayey-silty till, at a depth of 11.6 to 12.2 ft (3.5 to 3.7 m) below the surface, approximately 5.5 ft (1.7 m) below the sandy partings seen in Hole L only 100 ft (30.5 m) away (Figure 8).

### 2.4.2 Research Trench 2 Sand Body

Another major sand body near the surface in the Lavery till was seen in Research Trench 2, south of the NYS-licensed burial trenches, as shown in Figure 9. Because this sandy body had such poor cohesion the north wall of the trench collapsed, so that it was not possible to extend the trench to its planned depth. Several scaled sketches were made of the north and south walls (the east and west ends were used as ramps for the bulldozer) and of the floor at several stages during excavation. These drawings are shown in Figures 10 and 11, revised to emphasize the shape of the coarse-grained bodies (revised after Dana, et al. 1978, unpub. report to EPA, Part I, Phase II). Taken together these drawings provide some idea of the form of the body in three dimensions, emphasizing its highly irregular shape.

### 2.4.3 Trench 8 Suspected Sandy Layer

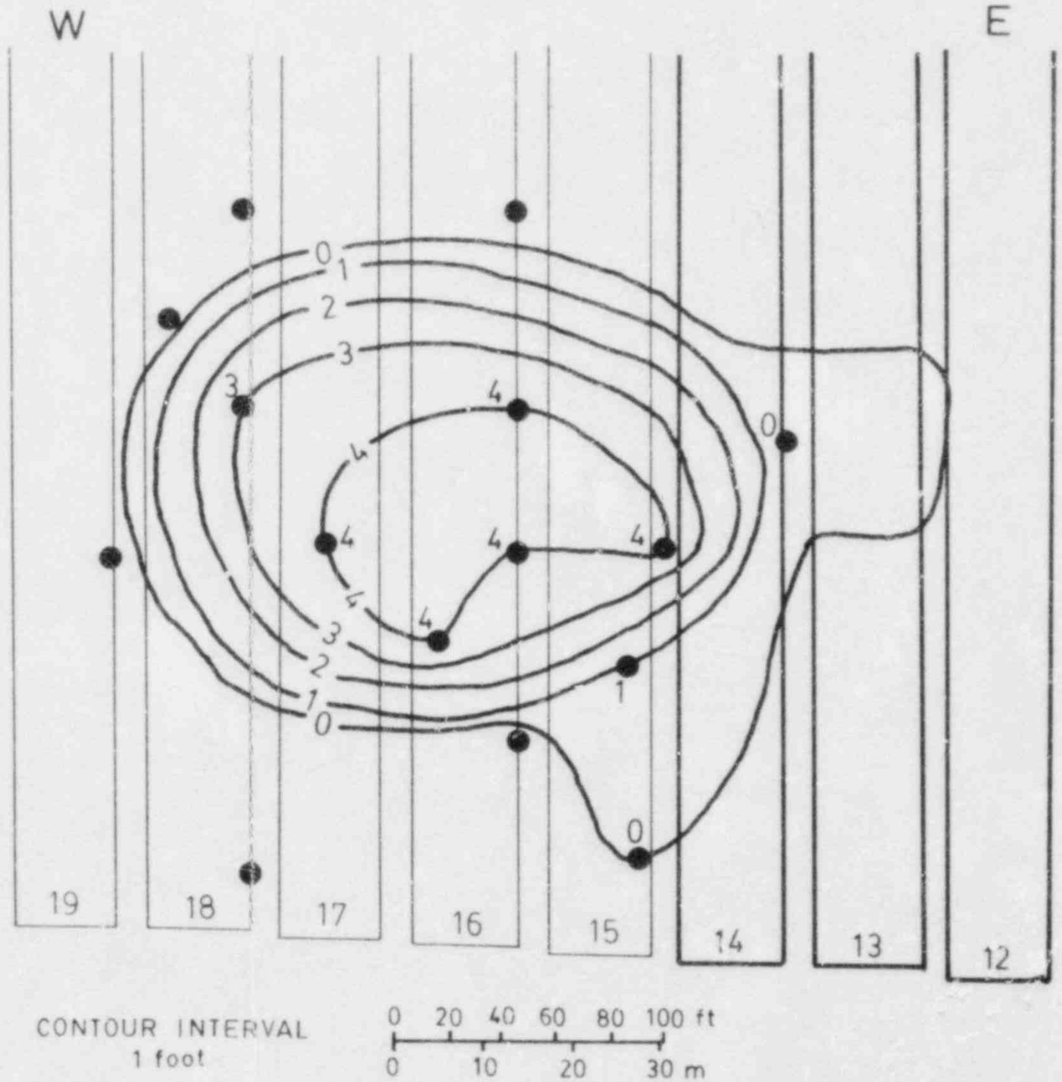


Figure 6. Contour map showing depth to the top of the sand lens first seen in Trench 13. Contours are in feet. (Based on data from Oldham, 1974, and maps and notes from Dana, 1974 and 1980.)

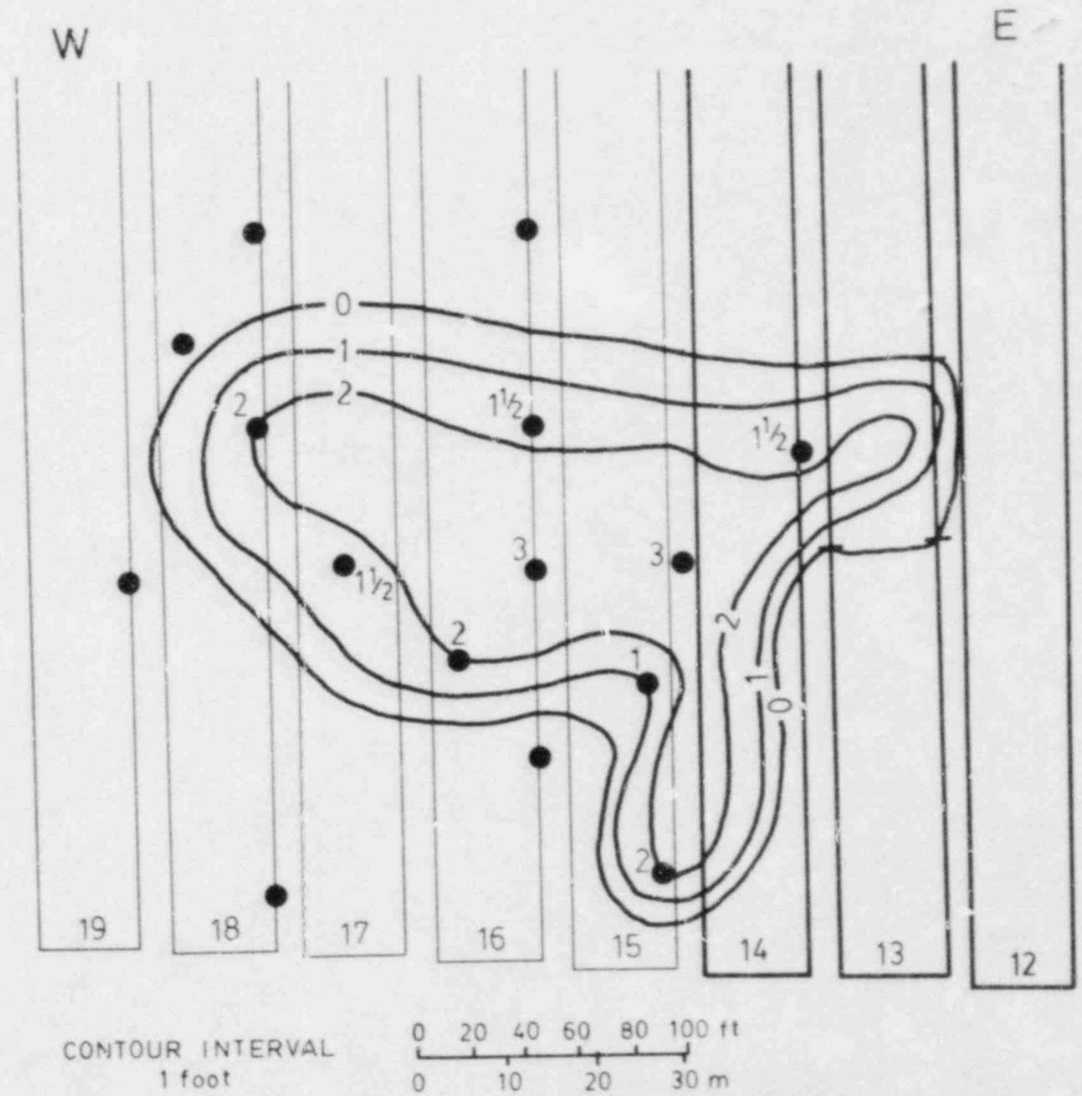


Figure 7. Isopach map showing thickness of the sand lens first seen in Trench 13. Thicknesses are shown in feet. (Based on data from Oldham, 1974, and maps and notes from Dana, 1974 and 1980.)

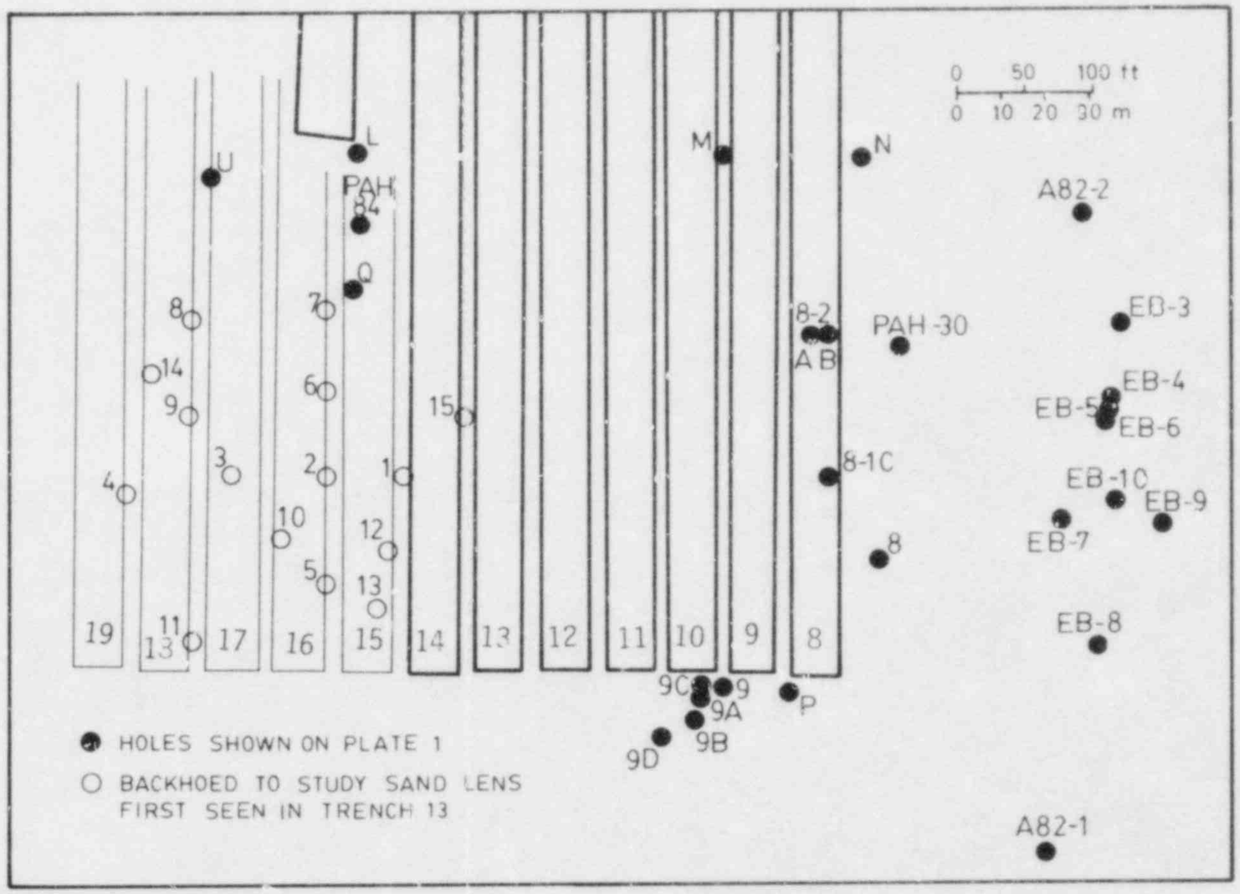


Figure 8. Detail from Plate 1 showing locations of holes used to investigate sand occurrences in the south set of NYS-licensed burial trenches. Trench 14 was the last used; 15 through 19 were not excavated.

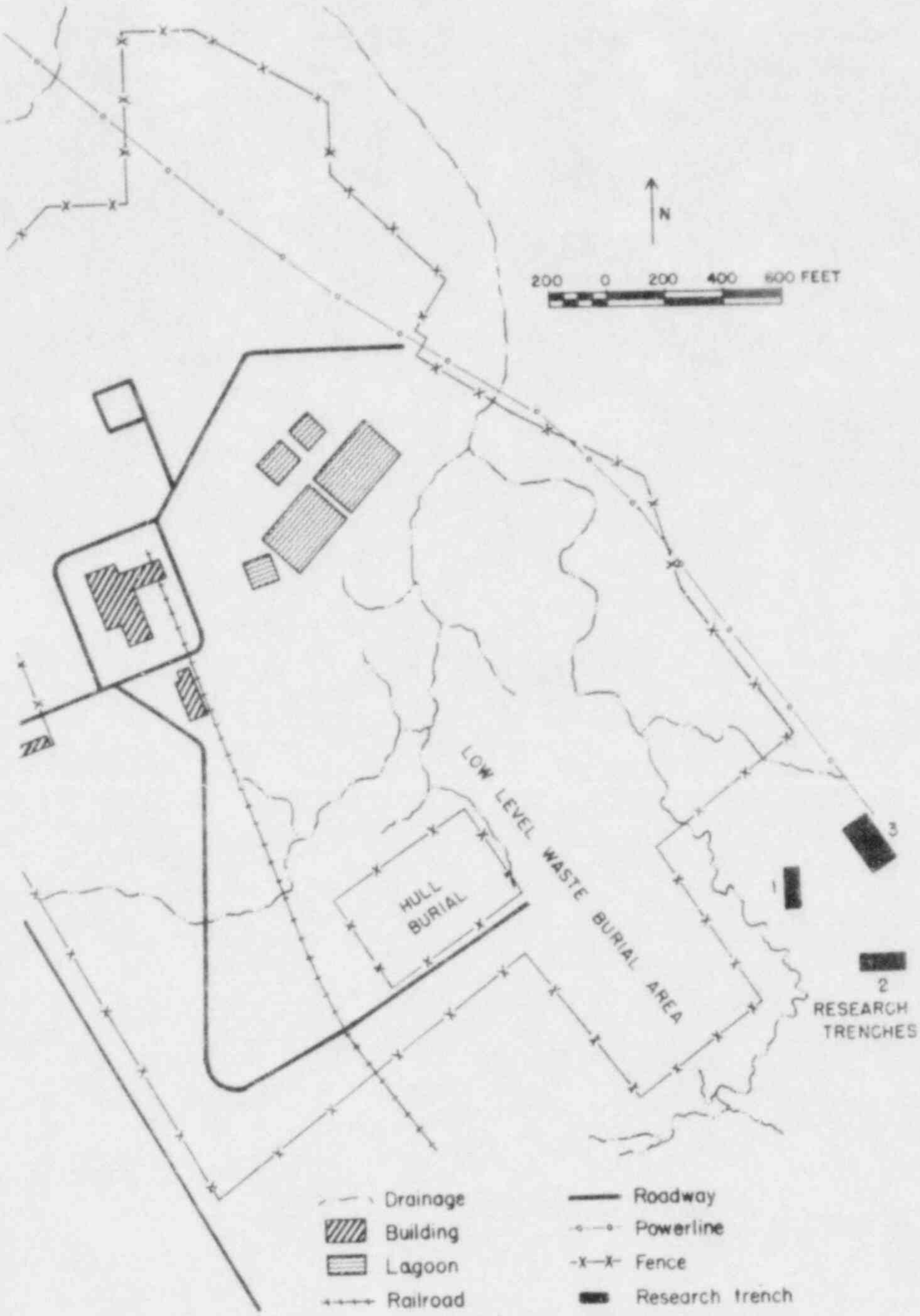


Figure 9. Map showing the locations of three research trenches excavated by NYSGS in 1975 south of the NYS-licensed burial trenches. A sandy-gravelly zone in Research Trench 2 is discussed in the text.

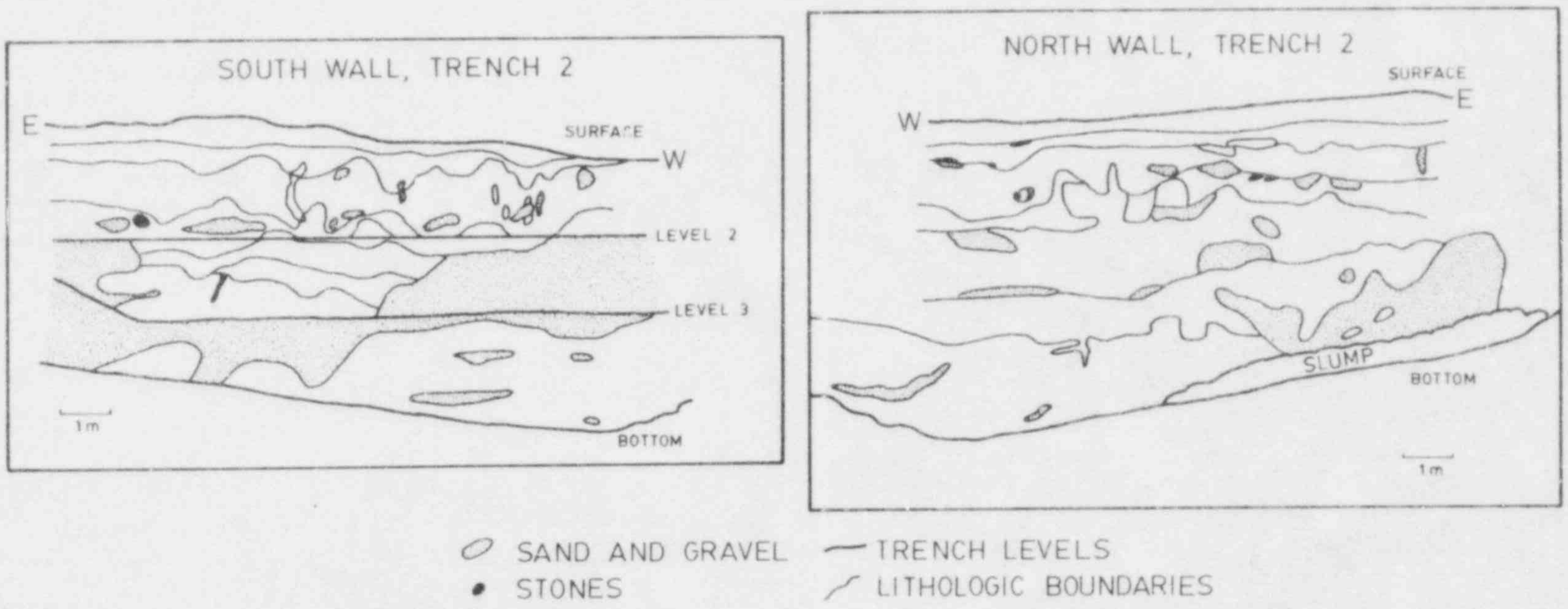


Figure 10. Scale drawings of the north and south walls of Research Trench 2, modified from Dana, and others (1978), to emphasize the form of the coarse-grained units.

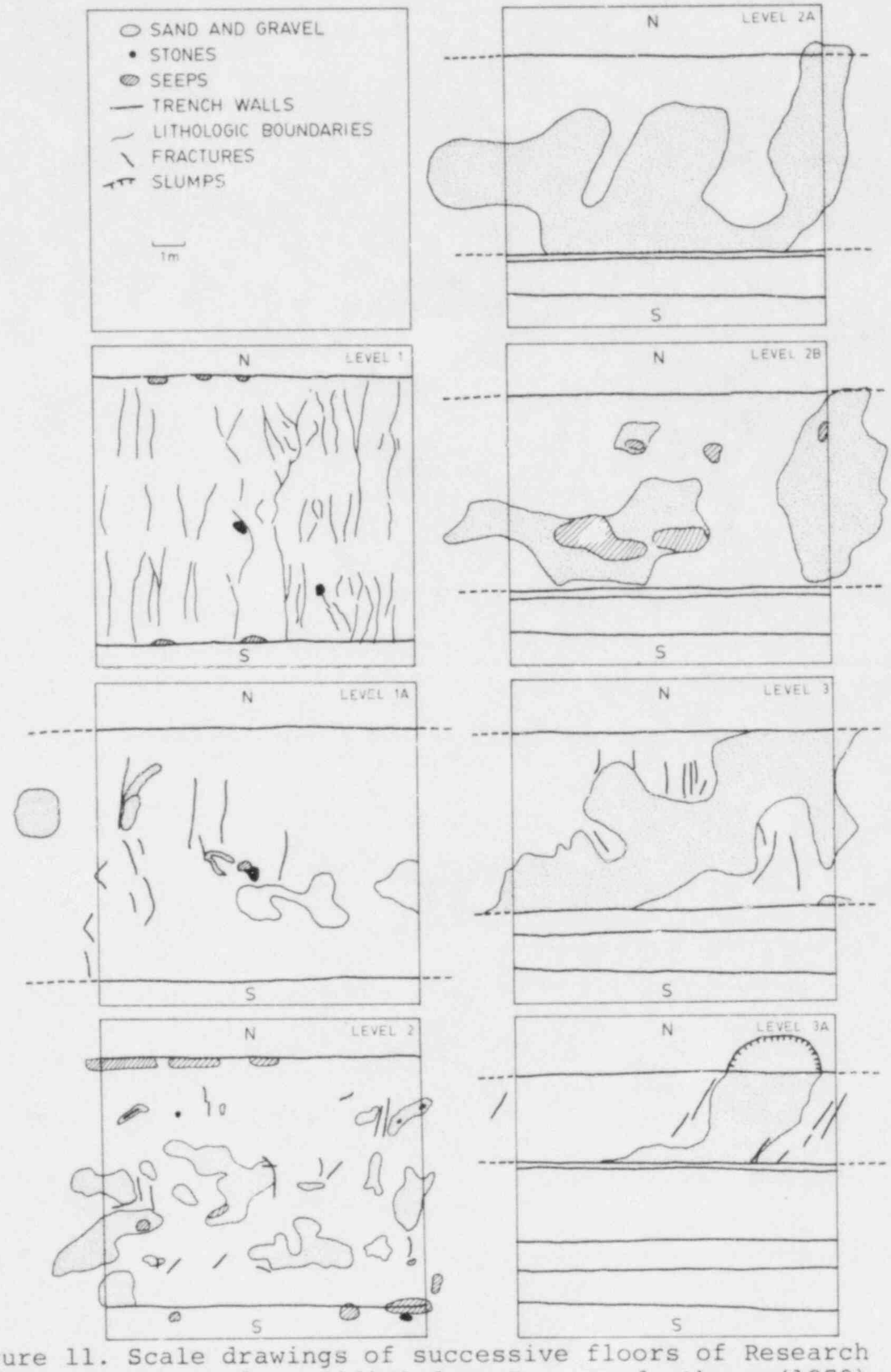


Figure 11. Scale drawings of successive floors of Research Trench 2, modified from Dana, and others (1978), to emphasize the form of the coarse-grained units.

Another relatively coarse-grained zone was discovered in the vicinity of the south trenches on the east side of the NYS-licensed burial area. In this case the material is in layers a few centimeters thick rather than pods, generally no coarser than medium sand, and the layers are often described as distorted. The material most closely resembles LaFleur's (1979) Subfacies 2 of the Lavery till, with thin, torn wisps of gray silt. Prudic of the USGS first reported the possibility that a layered zone with some sand found under Trench 8 in hole 8-1C might continue eastward to the banks of the East Branch of Frank's Creek, based on similar material seen in auger Hole EB-7 (memo by R. Dana to H. Bailey, 1979, NYSGS). Hole EB-7 was augered in 1979 as part of a series investigating the stratigraphy between Trench 8 and the branch of Frank's Creek that flows along the east side of the burial area. As can be seen in Figure 8, information is available from several holes in this vicinity, including two (A82-1 and A82-2) augered by NYSGS as part of the present study. As can be seen from the examination of the standardized logs in Appendix A, no evidence of layering was reported in the logs for the following holes of this group: PAH-30, 8, 9, 9B, 9C, EB-6. Only thin layers (less than 5 cm (2 inches)), partings, blebs, or wisps of silt, often described as deformed, and typical of LaFleur's (1979) Subfacies 2 of Lavery till, were reported from the following holes: EB-3, EB-4, EB-5, N, A82-2. Holes 9A and EB-10 each contain a thin layer of pebbles or gravel (less than 5 cm (2 inches)), and the following holes contain layers of sand: 9A, 9D, 8-1C, 8-2B, EB-2, EB-7, EB-8, EB-9, EB-10, M, P, A82-1. These layers are commonly thin (less than 5 cm (2 inches)) and distorted, and accompanied by the wisps of silt typical of Subfacies 2 of the Lavery till. However, grain-size analyses, discussed in the next chapter, suggest that these layers are spatially associated with the somewhat more gravelly Subfacies 1. Figure 12 is a vertical cross-section showing zones with silt, sand or gravel layers for the holes in and near Trench 8, drawn by projecting all of the stratigraphic columns to a line parallel with the axis of Trench 8. The zones shown indicate units, or sections of core, that contain relatively coarse-grained layers; the entire interval is not silt, sand or gravel. The sand-containing interval between 1348.5 and 1351.8 ft (411 and 412 m) in EB-10 and EB-7 is the only one that can be confidently traced from one hole to another. It is possible that some of the sand-containing zones grade laterally into zones containing layers of silt. However, given the frequency of reports of deformed layering and of wisps and blebs in the logs of these holes, it is more likely that no single layer or group of layers is coherent for more than a few feet laterally. The layers

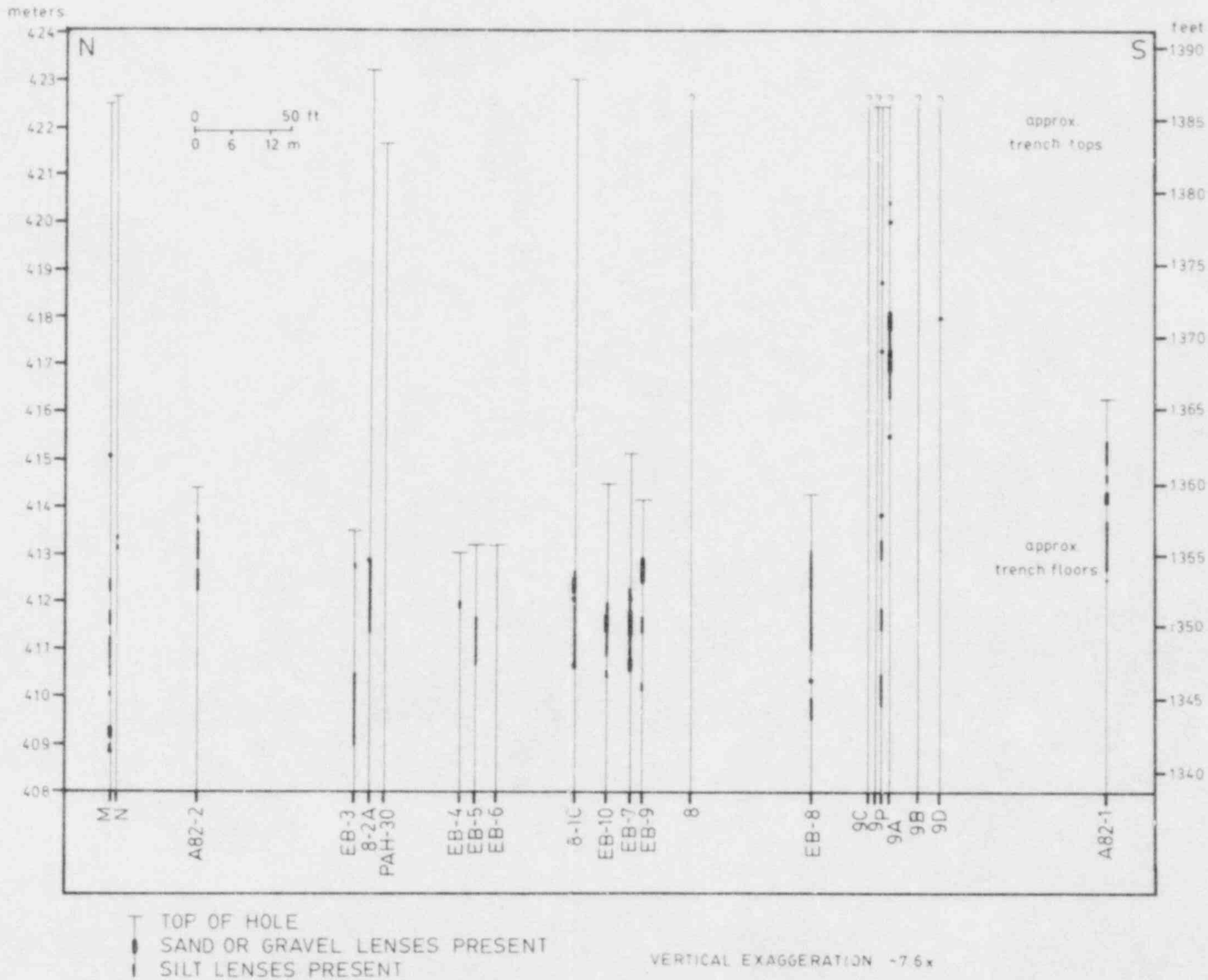


Figure 12. North-south cross-section parallel with the axis of NYS-licensed burial trench 8, showing zones containing layers, usually distorted or disrupted, of silt, sand or gravel.

were probably deposited in temporary lakes or ponds in front of the Lavery glacier during relatively short-lived retreats, or perhaps even deposited in water underneath the ice (LaFleur, 1979). Gravelly layers are seen below 1355 ft (413 m) only in some of the EB series holes east of the southern set of trenches, but there the surface is near that elevation. These gravels are likely to be alluvium, or else backfill from operations related to trench excavation and recapping.

2.4.4 Summary

With the exception of the sand lens in Trenches 13 and 14 and the sandy layer under Trench 8, it appears that the NYS-licensed trenches were excavated in Lavery till most closely resembling LaFleur's Subfacies 1 and 2. His characterization of Subfacies 2 is here tentatively extended to include the sort of discontinuous, deformed layers of clay, silt, and sand, enclosed in till, that were seen at the level of the sandy layer found in Hole 8-1C, beneath Trench 8. Such recognizable layers in Lavery till, seen in many core samples, were presumably somewhat more coherent than the silty layers that were disrupted to form the silty wisps seen by LaFleur in surface exposures and used to characterize Subfacies 2 originally. The layers within the Lavery till are not as continuous, thick, or coherent as the layers in the thick late-Kent lacustrine unit found at greater depth, below the coarse-grained kame-delta unit. In the Lavery, layers and zones containing layers are generally not found to have the same thickness or be at the same elevation from one hole to another, even over distances of less than 100 ft (30 m).

Plates 3 and 4 show detailed stratigraphic columns in the NYS-licensed trench area, constructed using the logs of several holes cored or augered by the USGS in the past eight years. Notice that layers and zones of layers enclosed in till, characteristic of Subfacies 2 as redefined above, are not common above an elevation of 1355 ft (413 m). That is the approximate elevation of the trench floors. Exceptions are seen in Holes I and G, near the north end of the trenches, and Holes L and K, on the southwest margin of the burial area. Even in those areas individual layers are thin, often described as deformed, and cannot be definitely traced from hole to hole. Therefore, most of the material in the trench walls, which is potentially in contact with water that has accumulated around the radioactive waste, is homogeneous clay-silt till. Layers in the Lavery till appear to be more common below 1355 ft (413 m) in this area, below the trench floors. These layers are generally dominated by clay or silt, although some are sandy. Gravelly layers are seen below 1355 ft (413 m) only in some of the EB-series holes east of the southern set of trenches, where the surface is near that elevation. These gravel layers are likely to be alluvium or backfill from operations related to trench excavation and recapping.

## 3.0 PETROGRAPHY

### 3.1 Laboratory Techniques for Grain Size Analysis

To better characterize the lithology of specific geological units and to identify any significant trends within them, selected samples were analyzed for grain size distribution. The units investigated include the surficial gravels on the North Plateau, the Lavery Till, and the Kent Till. Samples were obtained from surface exposures and subsurface drill cores, and represent coverage of a wide geographical area and thick stratigraphic interval.

As is customary in grain size distribution analyses, grain diameters were measured according to the phi-scale of Krumbein (1934). By 1934, grain size class limits had already been standardized as powers of 2, such as 2E-4 to 2E-8 millimeters for silt. Because sedimentologists are often most interested in measuring small grains, Krumbein proposed using the exponent of 2 multiplied by -1, so that one would work mainly with positive integers. The limits of the silt class become 4 to 8 phi. Obviously, 1.0 phi intervals vary exponentially, in terms of millimeters. The phi units used in the following paragraphs are: -2.0 phi, equals 4 millimeters, and 4.0 phi, equals 1/16 millimeters.

The procedure used for the grain size analyses presented in this report follows the methods of Folk (1974), with minor modifications. These modifications proved to be necessary in the analysis of gravel and till samples collected at West Valley. Initial sediment samples ranged in mass from 50 to 400 grams. Each sample was dry-sieved to separate gravel (greater than -2.0 phi) from mixed sand and fines (-2.0 phi or less). The gravel clasts were brushed to remove most of the adhering sand and fines, which were added to the mixed sand and fines from the first dry-sieving. A split of 10 to 15 grams was then taken from the mixed sand and fines, including brushings. A splitting factor was calculated by dividing the mass of the total amount of sand and fines (obtained by dry sieving and brushing the gravel) by the mass of the split.

The 10 to 15 gram split was then wet-sieved to separate sand (greater than 4.0 phi) from fines (4.0 phi or less). This sand was then dried and sieved using an Allen-Bradley Sonic Sifter with sieves at ).5 phi intervals. The mass of sand from each sieve was recorded.

The brushed gravel (greater than -2.0 phi) was washed with a Calgon solution to remove any remaining sand and fines. The gravel was then dried and sieved using 8-inch (approx. 20 cm) diameter round-hole sieves at 0.5 phi intervals. The mass of gravel from each sieve was recorded, and then divided by the splitting factor calculated above, in order to normalize the amount in each interval to correspond with the results from analyses of the 10 to 15 gram split of sand and fines.

The Calgon-solution washings from the gravel were wet-sieved to separate sand (greater than 4.0 phi) from fines (less than 4.0 phi) as was done with the original 10 to 15 gram split. The fines and water used in the wet sieving were poured into a graduated cylinder and this volume measured. The volume was divided by the splitting factor calculated above, and the indicated volume was removed from the graduated cylinder by pipette and added to the fines from the original 10 to 15 gram split. The remaining fines from the washing of the gravel were discarded. The fines from the original split and the portion added from the washings were further analyzed together using pipette procedures described in Folk (1974).

If the mass of the sand from the washings was greater than 1 gram, then it was dried and sieved using an Allen-Bradley Sonic Sifter with sieves for 0.5 phi intervals, as had been done with the sand from the initial 10 to 15 gram split. The masses from each sieve were measured, and each divided by the splitting factor. These masses were added to those for each interval for sand from the initial 10 to 15 gram split. The results were plotted as arithmetic cumulative weight percent coarser curves following the procedures in Folk (1974).

Results of this study were used in conjunction with analyses previously done by the USGS (1974) and Boothroyd and others (1981) to develop a better understanding of the lithologies. Appendix B, Gravel Grainsize Analyses, includes all gravel samples, and Appendix C, Till Grainsize Analyses, includes all till samples shown on the textural plots (Figures 13, 14, 15).

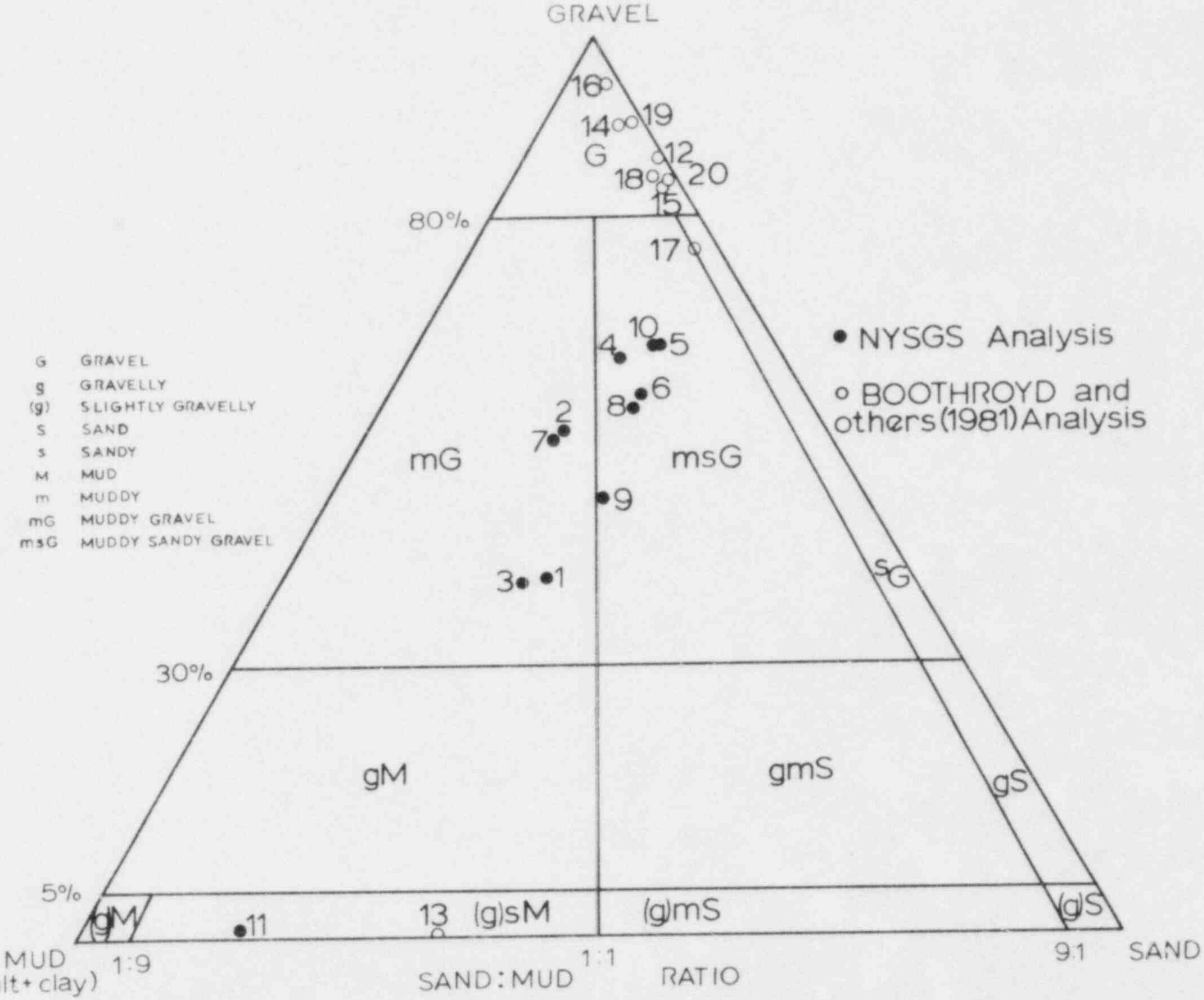


Figure 13. Textural Class Plot of Gravel Samples from the North Plateau Surficial Gravel.

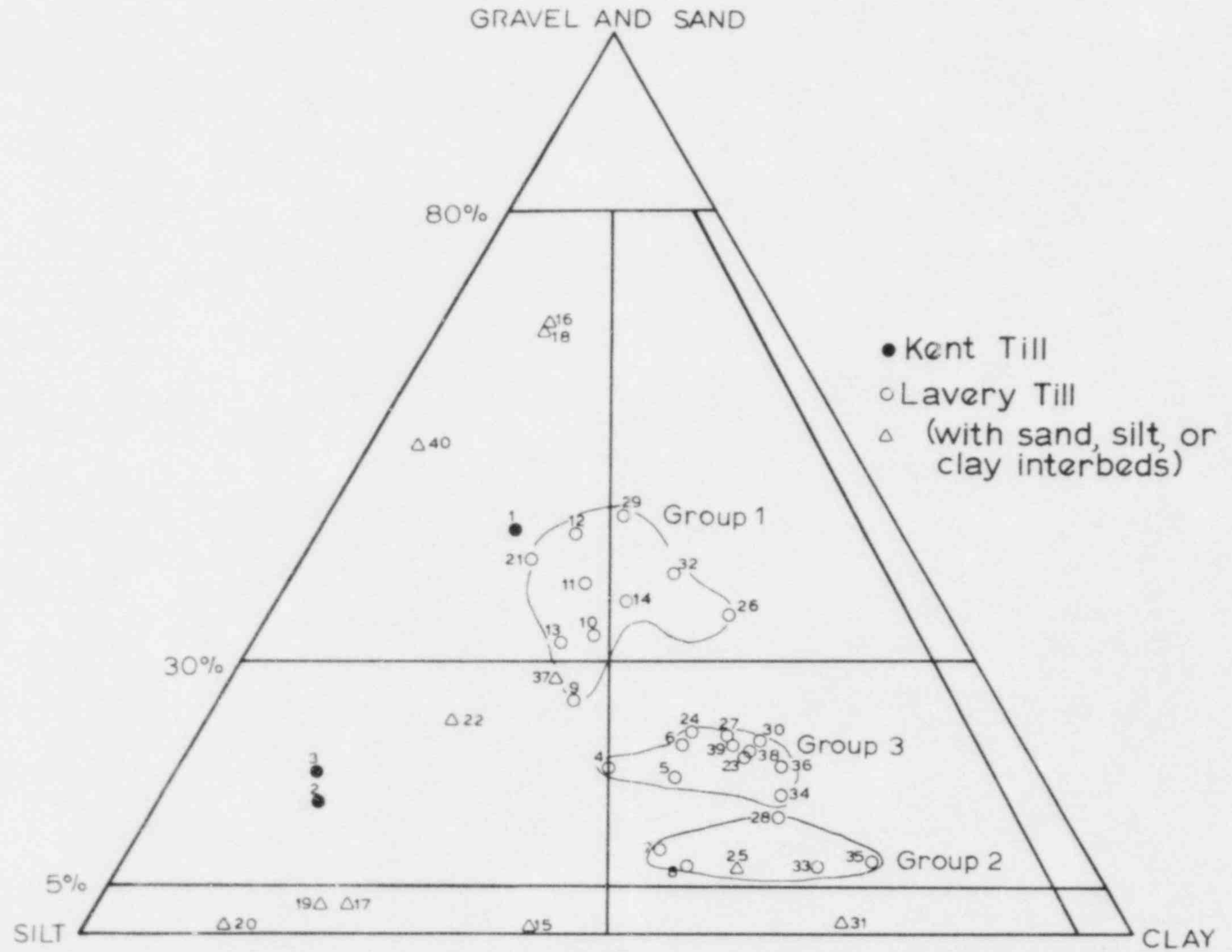


Figure 14. Plot of Gravel and Sand-Silt-Clay for till samples obtained from the area of the WNYNSC.

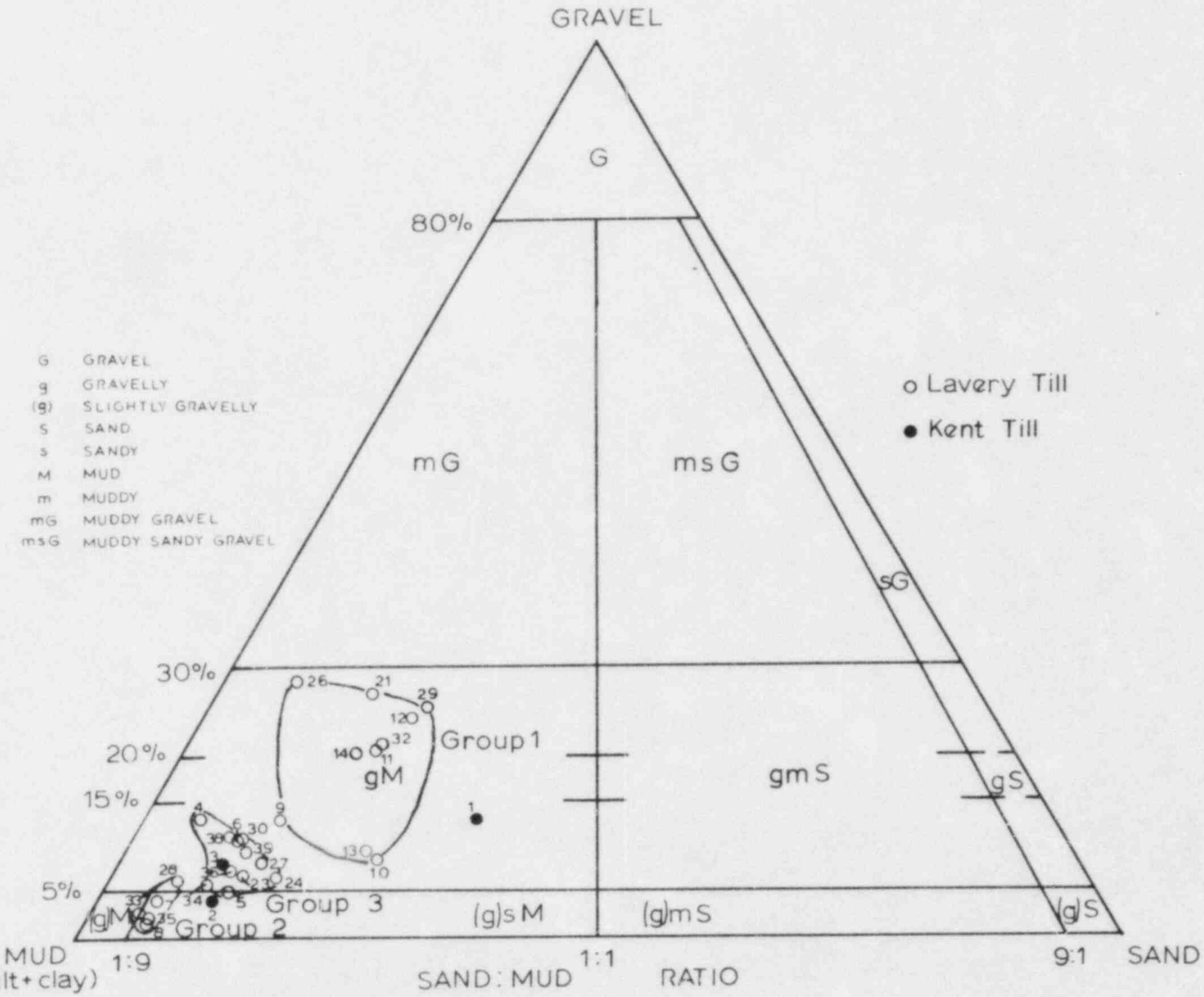


Figure 15. Plot of Gravel-Sand-Mud for till samples obtained from the area of the WNYNSC.

## 3.2 Gravel Analysis

The surficial gravel on the North Plateau includes two genetically different gravels. LaFleur (1979) identified an older, thin Wisconsinan fluvial gravel (Wfg) found along the valley axis, and a more extensive, thicker fan gravel (Haf) overlying the Lavery Till and onlapping "Wfg" along the valley wall. Ten gravel samples, including samples from both "Haf" and "Wfg" as mapped by LaFleur (1979), were analyzed. The mean proportions of the major fractions of the North Plateau surficial gravels are: gravel 56 percent, sand 22 percent, silt 13 percent, and clay 9 percent. The cumulative curves show grain size distribution to be truncated in fines. Folk's inclusive graphic standard deviation shows the gravels to be extremely poorly to very poorly sorted. A textural class plot of these samples (Figure 13) reveals that although there are identifiable groupings of samples, "Haf" and "Wfg" gravels are indistinguishable. This would indicate that the surficial gravel can be considered as a single unit for some purposes. The textural class groupings indicate that the surface and distal portions of the gravel deposit (Samples 2, 4, 5, 6, 7, 8, 10) can be classified as muddy and muddy sandy gravels. They have relatively less mud and more gravel and sand than the deeper, more medial parts of the deposit (Samples 1, 3, 9). This may reflect more fluvial reworking and removal of the fine component on the surface and along the distal periphery of the deposit. It is inferred that sorting on the surface and along the margins of the unit is better than in its central portions.

A single sample (11) of one of the thin, fine-grained layers interbedded with the gravel was also analyzed and found to have the following size fractions: gravel 1 percent, sand 15 percent, silt 59.5 percent, and clay 24.5 percent. It is texturally very dissimilar from the gravel (Figure 13). It is important to note that these finer-grained layers are interbedded in the gravel but that they comprise only a small percentage of the entire unit.

Also shown on Figure 13 are fluvial gravel samples (samples 12-20) from Buttermilk Creek which were analyzed by Boothroyd and others (1981). A comparison of the North Plateau and Buttermilk Creek gravels illustrates their textural dissimilarity. The North Plateau gravels contain more mud and less gravel than the Buttermilk Creek gravels. The fluvial sorting action of Buttermilk Creek has removed the finer-grained constituents and produced a well-sorted, clean gravel. The North Plateau gravels have not experienced the same extent of fluvial activity and contain a greater percentage of fine-grained material and are less well-sorted.

The cumulative grain size distribution curves for these three groups within the surficial gravel are shown in Appendix B, in Figures 23, 24, and 25.

### 3.3 Till Analyses

The grain size distributions of Lavery and Kent Till samples were investigated to differentiate between the two tills and to delineate subfacies within the Lavery Till Complex. Results of the analyses are plotted on textural class diagrams. The Gravel & Sand-Silt-Clay diagram (Figure 14) illustrates the amount of coarses and proportions of silt and clay. It is particularly useful in defining differences between tills. The Gravel-Sand-Mud (mud = silt + clay) diagram (Figure 15) illustrates the relative proportion of gravel to fines, and aids in the delineation of the Lavery Till subfacies. The till samples are classified as gravelly mud, slightly gravelly sand mud, or slightly gravelly mud after Folk (1974). Table 1 gives the mean percentage of the major grain size fractions for the till groups identified on the textural class diagrams.

#### 3.3.1 Lavery Till Complex

The Lavery Till is composed of subordinate gravel and sand dispersed in a fine-grained, silty-clay matrix. LaFleur (1979, 1980) identified three interfingering subfacies of the Lavery Till Complex based on surface exposures and test boring observations. The most prevalent subfacies was described as a pebble and cobble till with a gravel content of 10-20 percent and varying percentages of silt and clay. The second subfacies contains less than 5 percent gravel and more silt in the form of thin, disrupted interlaminations, but is otherwise texturally similar to the first subfacies. The third subfacies is limited in extent and is characterized by discontinuous, torn masses of the first subfacies, rhythmic clay and stratified sand and gravel. The Lavery Till Complex is interpreted as reworked proglacial lacustrine deposits which were incorporated into the Lavery readvance (Muller, 1975; LaFleur, 1979; 1980). For a detailed description of the Lavery Till, refer to Lavery Till in the NYS Burial Area, Section 2.4 of the Stratigraphy chapter.

Three groups of Lavery Till are distinguishable on the textural class diagrams. Silt percentage is constant in all three groups, with variation in the gravel, sand, and clay fractions. The inclusive graphic standard

TABLE 1. Grain-sizes of Till Samples

| | | MEAN % | STANDARD DEVIATION | VARIANCE |
|---|---|---|---|---|
| KENT | Gravel | 9 | 4.5 | 20.3 |
| N=3 | Sand | 17 | 12.4 | 153.8 |
| | Silt | 59 | 19.2 | 368.6 |
| | Clay | 15 | 2.8 | 7.8 |
| LAVERY GROUP 1 | Gravel | 20 | 7.2 | 51.8 |
| N=10 | Sand | 18 | 5.1 | 26.0 |
| (LaFleur's | Silt | 31 | 6.4 | 41.0 |
| Subfacies 1 ?) | Clay | 31 | 6.2 | 38.4 |
| LAVERY GROUP 2 | Gravel | 3 | 1.9 | 3.6 |
| N=5 | Sand | 6 | 0.7 | 0.5 |
| (LaFleur's | Silt | 31 | 8.5 | 72.3 |
| Subfacies 2 ?) | Clay | 60 | 8.7 | 75.7 |
| LAVERY GROUP 3 | Gravel | 8 | 2.25 | 5.1 |
| N=11 | Sand | 12 | 1.92 | 3.7 |
| | Silt | 29 | 4.99 | 24.9 |
| | Clay | 51 | 5.19 | 26.9 |

deviation method (Folk, 1974) shows the Lavery Till to be very poorly sorted. Lavery Group A (Samples 9, 10, 11, 12, 13, 14, 21, 26, 29, and 32) is characterized by a high percentage of gravel and a low percentage of clay, although there is a fair amount of diversity among individual samples. The cumulative curves for this group are predominately logarithmic-normal, indicating a heterogeneity of grain sizes similar to many other tills. This group appears to be equivalent to LaFleur's Lavery Subfacies 1. The cumulative grain size distribution curves for these samples are shown in Figure 26 in Appendix C.

Lavery Group B (Samples 7, 8, 28, 33, and 35) is almost devoid of gravel and very clay rich. Individual samples are less diverse than those in Group A. The cumulative curves are truncated in coarses, and several grain size modes are present, particularly in the silt and clay ranges. This indicates that some sorting occurred to remove the coarses. This group may be equivalent to the Subfacies 2 of LaFleur (1979). The cumulative grain size distribution curves for these samples are shown in Figure 27 in Appendix C.

Lavery Group C (Samples 4, 5, 6, 23, 24, 27, 30, 34, 36, 38, and 39) has a moderate amount of gravel and is clay rich. Individual samples are less variable within the group than those of either Group A or Group B. The cumulative curves of Group C samples closely resemble those of Group A and are logarithmic-normal in their grain size distribution. This group, although containing one-half as much gravel and more clay than Group A, could also be included in LaFleur's Subfacies 1. The grain size distribution curves for these samples are shown in Figure 28 in Appendix C.

There are interbeds of discontinuous, randomly oriented pods or masses of stratified sand, gravel, silt, and rhythmic clay-silt laminations incorporated within the Lavery Till. These interbeds are most commonly associated with Group A and occur in the 411 to 417 m (1350 to 1370 ft) interval at the WNYNSC site. Eleven samples of Lavery interbeds were analyzed and three classes were identified. The first class (samples 16 and 18) is composed of silty sands with subordinate clay and have a bimodal distribution with modes in the sand and silt fractions. The second class (Samples 15, 17, 19, and 20) includes clayey silts with subordinate sand. The grain size distributions are strongly truncated in coarses, with a logarithmic-normal grain size distribution. The third class (Samples 22, 25, 31, 37, and 40) is a combination of the first two classes of Lavery interbeds. Cumulative grain size distribution curves for these three classes of interbeds are shown in

Figures 29,30, and 31 in Appendix C. In general, the interbeds in the Lavery Till may be equivalent to LaFleur's (1979) Subfacies 3, but might also be more coherent layers related to the silty wisps in Subfacies 2. The interbeds are poorly sorted as determined by Folk's inclusive graphic standard deviation method. They are interpreted to be proglacial lacustrine beds which were partially preserved after reworking and incorporation into a Lavery readvance till (Muller, 1975).

In summary, the Lavery Till Complex can be lithologically subdivided into specific groups or subfacies distinguishable by relative percentages of gravel and clay. Lavery Group A is enriched in gravel, low in clay, and associated with Lavery interbeds of sand, silt, and clay. Lavery Group B is depleted in gravel and rich in clay. Lavery Group C is intermediate between the two groups, but there is a distinct absence of samples containing 15 to 20 percent gravel.

Although Group A and the interbeds are most frequently found above 411 m (1350 ft) in the vicinity of the WNYNSC site, and Groups B and C frequently occur below that elevation, there does not appear to be any systematic stratigraphic or areal trend in grain size parameters. This supports LaFleur's (1979) contention that the Lavery subfacies are complexly interbedded and each body of one subfacies is limited in extent.

3.3.2 Kent Till

The Kent Till has been described as a pebble and cobble (20-40 percent gravel) till with a clayey-silt matrix (Muller, 1975; LaFleur, 1979; 1980). Our analyses of three Kent Till samples (1, 2, and 3) indicate it is dominated by the silt-size fraction with an average composition of: gravel 9 percent, sand 17 percent, silt 59 percent, and clay 15 percent sorting, determined by Folk's (1974) inclusive graphic standard deviation technique, shows the Kent Till to be extremely poorly to very poorly sorted. The silt-rich nature of the Kent easily distinguishes it from the Lavery Till. The individual cumulative grain size curves of the Kent Till have a logarithmic-normal distribution, as shown in Figure 32 in Appendix C. Such a distribution is common in many tills as it represents a random population of grain sizes such as would be derived from disintegration of bedrock by glacial ice. Little sorting occurs in glacial till-depositing environments.

## 4.0 THE NORTH PLATEAU SURFICIAL GRAVEL

### 4.1 Geologic Description

The form and character of the surficial gravel deposits are important factors in the ground water regime of the North Plateau. LaFleur (1979) identified two gravel deposits of different ages, as discussed in the section on Gravel Analysis (Section 3.2). From a hydrological point of view, these two gravel deposits are sufficiently similar in grain size distribution to be considered one unit.

The sandy gravels of the surficial Holocene alluvial fan and the late Wisconsinan fluvial gravel units are relatively permeable. They allow surface infiltration of precipitation and subsurface movement of water. Rates of horizontal permeability in this unconfined aquifer are on the order of 10E-6 to 10E-7 cm/sec ( Dames and Moore, 1976). Further rapid downward migration of groundwater is prevented by the underlying silty clays of the Lavery till unit, with low horizontal and vertical permeabilities on the order of 10E-8 to 10E-9 cm/sec (Dames and Moore, 1976; Fickies and others 1979; Prudic, 1982). It is conjectured that ground water moves both horizontally and vertically through the gravel, and then, laterally along the interface between the gravel and till units. The areal extent and thickness of the gravel unit, and the topographic configuration of the underlying till surface are essential to determining groundwater behavior in the North Plateau.

### 4.2 Techniques of Study

Several avenues of investigation were used to define the configurations of both the surficial gravel and till surface. Subsurface information from drill, auger, and bore holes were used to determine the thickness of the gravel and the elevation of the base of the gravel. A seismic refraction survey was conducted to supplement data from the holes. The preliminary survey was conducted in October 1981, before the first snowfall, and subsequent traverses were run after snowmelt up until June 1982. Seismic traverse lines were chosen so as to obtain coverage of the North Plateau and adjacent areas where the gravel overlays the till (Figure 16). Traverse lines intersect drill holes, where the subsurface lithologies are known, to provide correlation with the stratigraphic sequence. The seismic survey data and the subsurface lithologic data have a high degree of agreement.

A Huntec FS-3 portable seismograph with a paper print out, in the form of a time-distance plot, was used. Penetration of the soundings is approximately 60 ft (18.3 m). The impulse source consisted of a sixteen pound sledge hammer impacting on a one inch (2.5 cm) thick steel plate. Shot points were spaced at 10 ft (3 m) intervals along traverses of approximately 300 ft (91 m) in total length. First arrivals times were used in a computer program (Mooney, 1973) which applies an elevation correction and calculates velocities for each layer present in the subsurface. Velocities estimated by this program were reexamined using the method of Scott and others (1972) to recalculate the thickness of each layer. The agreement of the results of the two methods was used as a check on the original interpretations. A resistivity survey (Figure 16) was also undertaken. The data obtained were generally of very limited use because of numerous buried pipes, culverts, electrical lines, and metallic objects, all of which made it difficult or impossible to obtain good results. However, several resistivity traverses helped in identifying the gravel/till contact and the results corroborate those obtained from the subsurface lithological data and the seismic method. Groundwater seeps along the stream valley walls, marking the elevation of the gravel/till contact, were located by the USGS (W. Kappel, 1982 personal communication).

Detailed maps of the areal extent and thickness of the gravel (Plate 5) and of the surface topography of the till unit (Plate 6) were derived from a combination of data: stratigraphy in drill holes, the seismic survey, the resistivity survey, and seeps at the gravel-till interface in valley walls.

## 4.3 Description of the Gravel Unit

Plate 5 is a detailed isopach map of the surficial gravel unit on the North Plateau, constructed from the elevation difference between the surface and the gravel/till contact (Plate 9 illustrates the seismic lines used to construct the contour lines). The zero

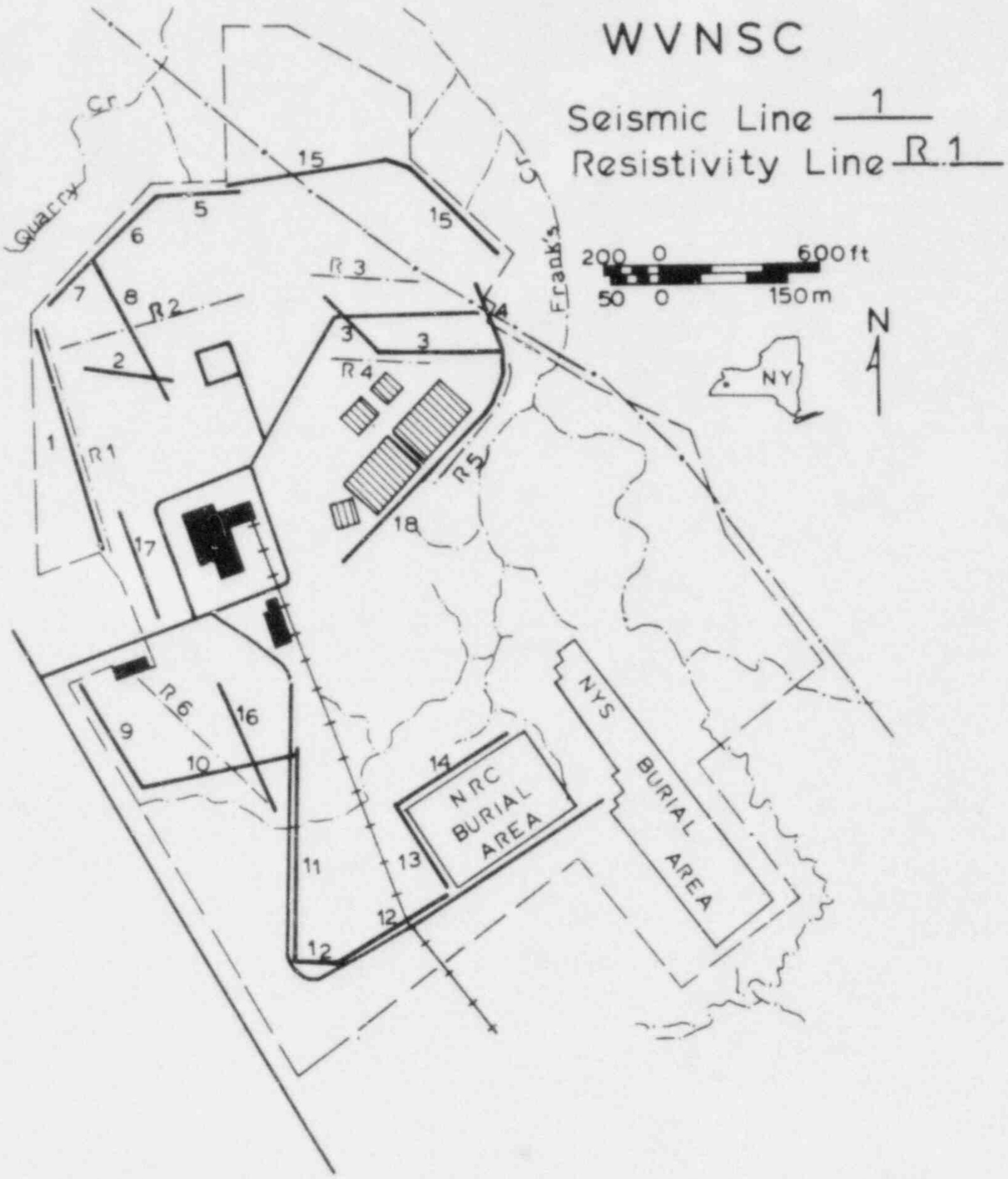


Figure 16. Map of a Portion of the WNYNSC illustrating locations for the seismic and resisitivity survey.

isopach line is an erosional edge. Although the thickness of the gravel does not directly reflect the topography of the underlying till surface, the gravel generally thickens over lows and thins over highs on that surface. The gravel is thickest in the vicinity of the main plant facilities (34 ft (12 m)) and thins in all directions away from this area. Along the westernmost margin of the deposit is a slightly thicker linear belt of gravel trending northeast-southwest. The gravel is thinnest (less than 2 ft (0.7 m)) near the swampy area north of the hardstand. The unit is generally a plano-convex lens, thickest in the center and thinning in all directions away from the main plant area (Plate 7). The directional rate of movement of ground water through the gravel deposit are unknown at present.

4.4 Description of the Buried Till Surface

Plate 6 is a topographic map of the till surface buried under the surficial gravel (Plate 9 ilustrates the seismic lines used to construct the contour lines). The two-foot contour interval permits several subtle topographic features on this surface to be expressed. Southwest of the plant the surface is relatively steep, 5 to 8 degrees, and uniform. This gradient flattens at the 1390 ft (495 m) contour. A ridge trending east west underlies the main plant facilities, forming a topographic divide which splits into two more subtle ridges to the east. One branch trends north-south and underlies the machine shop facilities, and the other continues to the northeast. This ridge system creates three major topographic lows. One low lies adjacent and parallel to the southern flank of the main ridge. This low has a closed depression in its central section. It dips 1.7 degrees and widens to the east-southeast. A minor ridge to the south confines this low. The second low lies between the two subbranches of the ridge and underlies Lagoons 1, 2 and 3. This low dips 1 degree and widens to the east- southeast. The third low is adjacent to and trends along the western flank of the north-south trending ridge subbranch. This low dips 1.7 degrees and widens to the north where it flattens to a gradient of less than 1 degree. The west side of this low is confined by a broad, subtle high. A hypothetical drainage pattern suggested by this till surface topography is indicated by the arrows on Plate 6 and represents the inferred direction of groundwater movement along the gravel/till interface.

## 5.0 SURFACE WATER PROGRAM

The surface water study has been continued through the period of this investigation. This study required long term continuous data collection to characterize the hydrologic regime of the WNYNSC. As in previous years, the surface water studies being conducted by the NYSGS are part of a cooperative program with the USGS, which is responsible for the ground water aspects of these studies. The USGS has overseen the installation and instrumentation of stream stations and groundwater-monitoring wells. The NYSGS has been maintaining the stations, taking measurements and collecting samples for suspended sediment analysis. All data collected from the stations and wells is made available to the USGS for use in their research and the development of a groundwater model.

### 5.1 Stream Station Operations

Three locations chosen by the NYSGS and the USGS have been maintained as measurement and sample points for this program. These stations, Burial 1 (B1), North Plateau 1 (NP1), and North Plateau 3 (NP3), have been used to measure stage, discharge, and suspended sediment. In addition, three Belford raingages are being operated to measure water income as precipitation. Stage, discharge, and suspended sediment concentration measurements have also been taken at Thomas Corners Road Bridge on the Buttermilk Creek to supplement the surface water data obtained on site.

The operation of the stream gaging stations has proven to be more complex than originally anticipated, resulting in the collection of a smaller amount of data than desired. A setback to this program occurred when NFS, the site operator at that time, denied access to the NYSGS as the result of litigation involving problems with other State agencies. This condition existed from June 19, 1981 until the USNRC and NFS agreed on conditions that would allow the NYSGS to complete some of the work as planned. This agreement took effect September 28, 1981, at which time the NYSGS resumed relatively normal site operations.

During the fall and winter, severe slumping of the channel walls enclosed under each of the stream stations made data collection difficult. This slumping forced the abandonment of the B1 station from December, 1981 through March, 1982. The slumping necessitated daily cleanout of the channels and rendered the automatic sampling equipment useless. Also, the stream channels under the NP1 and NP3 stations froze occasionally during January and February 1982, despite propane-heated enclosures. In April, 1982, as the result of road construction by the new site operator, West Valley Nuclear Services (WVNS), the channel under NP3 was washed out. That station required significant repair before being returned to operation during June 1982.

5.2 Precipitation Data Analyses

Precipitation data were collected during this reporting period at three rain gages on the WNYNSC site, on an almost continuous basis and during a survey of snowfall. The weekly total precipitation data for May, 1981, through May, 1982, are listed in Table 2 and plotted for the same time period in Figure 17. The largest rainfalls occurred during the fall of 1981.

A survey of water income as snow was made during an unusually heavy spring snowfall in April, 1982. The snow began falling about midnight on April 3 and continued until the morning of April 7. The depth of snow was measured at Rain Gage No. 1, and gage readings were recorded and temperatures taken at the times shown in Figure 18, a plot of cumulative snowfall. The stage recorders at NP1 and NP3 were functioning during this storm . Using the stage records, rating curves provided by the USGS (Harding, 1982, per. com.), and discharge measurements taken on April 13, the runoff through the stations was measured and is plotted in Figure 18. As can be seen, stream discharge peaked approximately 7.5 days after the snow began to melt.

On April 7, after the snow had stopped, measurements of snow depth were taken in the NP1 and NP3 drainage basins in an attempt to establish a quantitative relationship between the snowfall and the runoff. The snow was measured at nine locations in the NP1 drainage, yielding an average depth of 6.71 inches (17.0 cm), with a range of 3.1 to 11.0 inches (9.6 to 27.9 cm), and at seven locations in the NP3 drainage, averaging 7.04 inches (17.9 cm) and ranging between 5.0 and 11.0 inches (12.7 to 27.9 cm). Using the record from Rain Gage No.

TABLE 2. Weekly Total Precipitation for May 1981 to May 1982

| WEEK OF | INCHES | WEEK OF | INCHES |
|---|---|---|---|
| 05-01-81 | 0.210 | 11-15-81 | 1.153 |
| 05-07-81 | 0.347 | 11-21-81 | 1.260 |
| 05-15-81 | 0.693 | 12-01-81 | 0.180 |
| 05-21-81 | 1.120 | 12-07-81 | 0.727 |
| 06-01-81 | 2.123 | 12-15-81 | 0.170 |
| 06-07-81 | 1.797 | 12-21-81 | 0.447 |
| 06-15-81 | 0.503 | 01-01-82 | 0.205 |
| 06-21-81 | 0.508 | 01-07-82 | 0.000 |
| 07-01-81 | 0.000 | 01-15-82 | 0.330 |
| 07-07-81 | 1.665 | 01-21-82 | 0.220 |
| 07-15-81 | 0.907 | 02-01-81 | 0.300 |
| 07-21-81 | 0.265 | 02-07-82 | 0.640 |
| 08-01-81 | 1.795 | 02-15-82 | 0.220 |
| 08-07-81 | 0.675 | 02-21-82 | 0.110 |
| 08-15-81 | 0.117 | 03-01-82 | 0.230 |
| 08-21-81 | 1.263 | 03-07-82 | 0.640 |
| 09-01-81 | 0.974 | 03-15-82 | 0.120 |
| 09-07-81 | 0.407 | 03-21-82 | 0.540 |
| 09-15-81 | 2.063 | 04-01-82 | 0.080 |
| 09-21-81 | 0.297 | 04-07-82 | 0.090 |
| 10-01-81 | 2.670 | 04-15-82 | 0.750 |
| 10-07-81 | 0.000 | 04-21-81 | 0.090 |
| 10-15-81 | 0.903 | 05-01-82 | 0.250 |
| 10-21-81 | 1.413 | 05-07-82 | 0.060 |
| 11-01-81 | 0.000 | 05-15-82 | 0.000 |
| 11-07-81 | 0.720 | 05-21-82 | 0.000 |

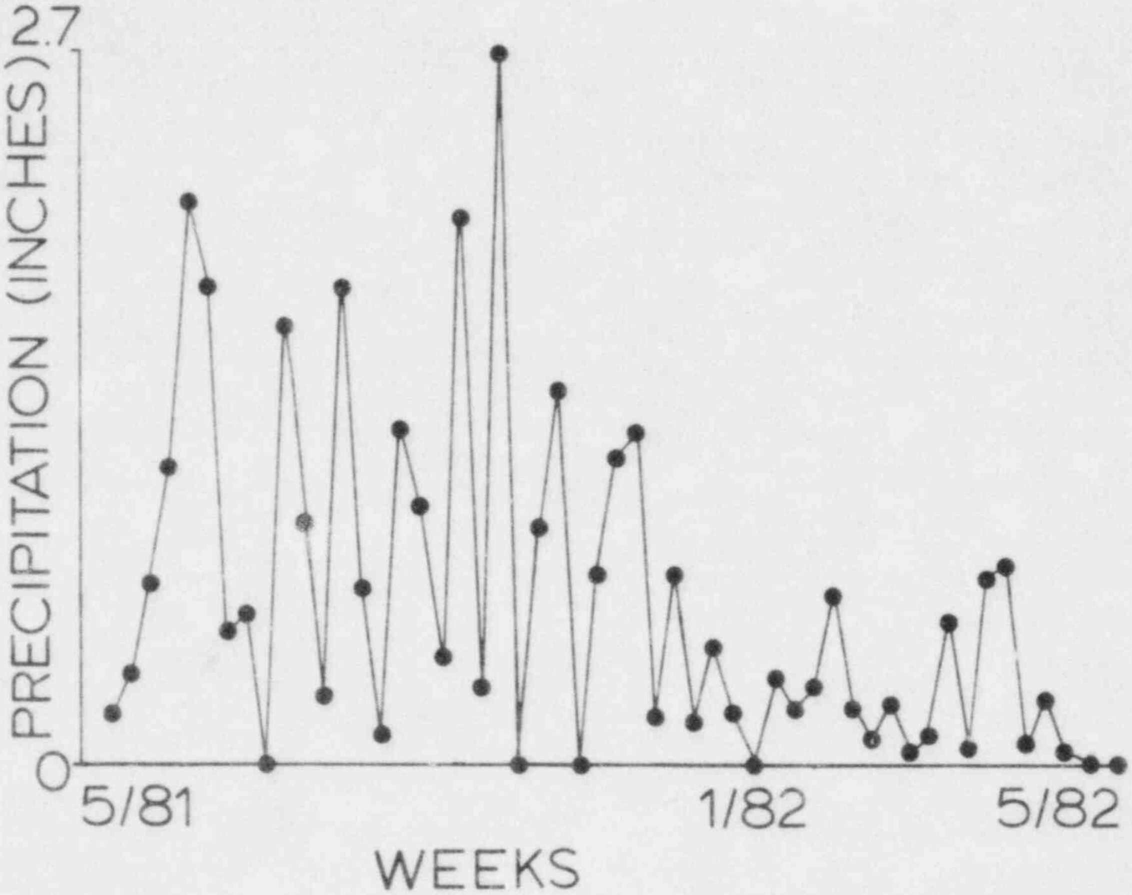


Figure 17. Plot of total weekly precipitation from May 1981 through May 1982.

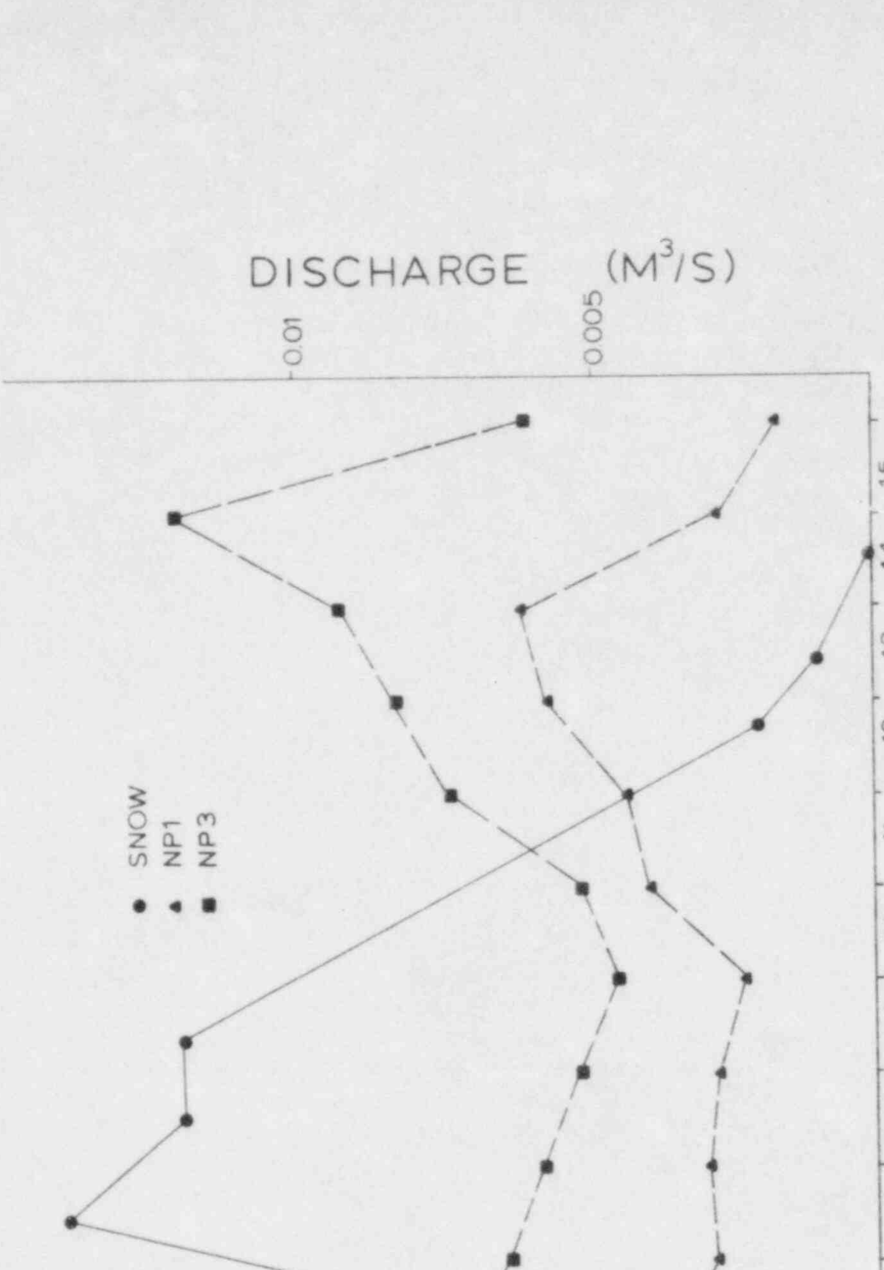


Figure 18. Plot of snowfall and runoff for April 1982 snow survey.

1 and the continuous measurements of snow depth at that location, the water equivalent of the snow was calculated. For the NP1 drainage the average snow depth was equivalent to 0.86 inches (2.2 cm) of rain, and to 0.87 inches (2.2 cm) for the NP3 average snow depth. Using this water equivalent and the total basin area, a total of 24,000 cubic feet (680 cubic meters) of water fell in the NP1 drainage basin and 23,360 cubic feet (660 cubic meters) in the NP3 drainage. To find the total discharge from the two basins for this storm, the total runoff measured at each station was calculated. Between April 9, the date of the lowest discharge for both stations, and April 13, the date of maximum discharge for NP1, the total runoff was calculated by approximating the ares under the discharge curve. For NP1 the total runoff measured was 23,250 cubic feet (660 cubic meters). The same calculations for NP3, for April 9 to 14 , indicates a total of 32,230 cubic feet (910 cubic meters) of runoff as the result of the storm. The calculations for NP1 show a markedly good correlation between total precipitation and total runoff. The calculations for NP3 do not agree as well but indicate a similar relationship.

The agreement between the amounts of precipitation and total runoff prompted a further look into this relationship. To check the validity of these calculations, a similiar set of calculations was performed for the rainfall and runoff that occurred between June 19-23, 1981. This interval was chosen for two reasons: first, it was in the summer when the effects of evapotranspiration should be at a peak, and, second, on June 21 and 22 there was a large storm but no precipitation for the two days before and after. The calculations show that the NP1 basin received approximately 53,290 cubic feet (1500 cubic meters) of water during that storm and, using the USGS gage records, the discharge totalled 18,400 cubic feet (520 cubic meters). For NP3 a similiar difference between rainfall and runoff occurred: approximately 50,600 cubic feet (1430 cubic meters) of water fell and 14,960 cubic feet (420 cubic meters) was recorded as runoff. Examining the income to outgo ratios for the North Plateau as a whole, the summer ratio indicates that approximately one-third of the water that falls in this area runs off, while in the winter the ratio of income to outgo is close to one, indicating that all of the snowmelt runs off through the stream stations. These data sets indicate that the stream monitoring program on the North Plateau provides the capability to quantify the water balance of this area. The seasonal difference in the income to outgo ratios may indicate a low storage capacity for groundwater in the North Plateau or the effect of frozen ground on snowmelt. It could also indicate that evapotranspiration may be a major pathway for water movement away from this area. The investigations of this relationship between water income and runoff will be explored in greater detail as data analysis continues.

## 6.0 GEOMORPHIC STUDIES

### 6.1 Landslide Movement Analysis

Landslides are characterized by relatively rapid downslope movement resulting from shear failure along one or several surfaces (Varnes, 1958). Such slope failures, in the form of slump or rotational shear landslides (Varnes, 1958; Hutchinson, 1967), are actively modifying the land surface at and near the WNYNSC. In order to determine the extent rates of movement, several investigations were conducted. These included the identification and characterization of landslides and of landforms having a potential for landsliding, and measuring of movement on selected landslides by periodic resurveys.

Landslide features at the WNYNSC have been identified from several sources, including: 1) a 1:12,000 scale topographic map, 2) the 1980 series of vertical aerial photographs at an approximate scale of 1:62,000, 3) a 1:24,000 scale surficial geology map (LaFleur, 1979; Plate 7), and 4) field mapping completed in April 1982. Field evidence for landslides includes exposed, near-vertical till faces, surficial mudflow units, transverse cracks, and creep features. More than fifty landslides were thus identified. Most of the landslides are small (less than 1000 square meters (10,760 square feet)), and consist of shallow (2-3 m (6-10 ft)) rotational slumps which occur on the valley walls of first-order drainages such as the East and West Branches of Frank's Creek. Usually a slide is not one individual feature, but rather a series of blocks which are continuous along the valley wall. Scarps (slide scars) and slump blocks are well defined in the most recently active landslides. The morphology of older slides is subtle because degradation has occurred. The material primarily involved in sliding is the fine-grained Lavery till, composed of silt (31 percent), clay (31 percent), sand (18 percent), and gravel (20 percent), with an average density of 1667 kilograms/cubic meter (104 pounds/cubic foot) (Hoffman and others, 1980). Slopes become unstable where valley wall relief exceeds 2 m (6.5 ft) (LaFleur, 1979) or the slope exceeds 8 degrees, which we surmise to be the critical angle of failure.

6.1.1 North Trench Landslide

The North Trench Landslide is typical of landslides at the WNYNSC. This slide has been active throughout the operating history of the site. In 1980, the stream at the base of the slope was diverted to control undercutting and severe sliding threatening the integrity of the NYS-licensed burial trenches. This diversion did aid in alleviating the problem, although surface movement is continuing.

In order to quantify this movement, a stake grid system was established on April 19, 1982, and monitored on a short-term basis. The grid system, marked by 1.5-meter long steel fenceposts, was established to delineate specific features of the slide. Theodolite surveying, accurate to 0.03 m (0.1 ft), was done by Edwards and Moncrieff, P.C., of Springville, New York. Plane table mapping augmented the detail of this data base. A resurvey of all recoverable stakes was conducted on June 19, 1982. A detailed map of the slide was constructed (Figure 19) and the nomenclature used follows that of Varnes (1958).

The volume of moving material and the slide rate for the North Trench landslide were calculated. Constant downslope movement was assumed because no major undercutting of the slide by the West Branch of Frank's Creek occurred during the monitoring time interval. The volume of the actively moving slide is 832 cubic meters (29,400 cubic feet) moving at a rate of 0.22 meters/year (0.7 feet/year). The slope distance from the upper rim of the valley wall to the base of the valley floor is 30.5 m (100 ft). The time required for slide material to move from the top to the stream valley is approximately 140 years, with an average volume of 6 cubic meters/year (206 cubic feet/year) of material delivered to the valley floor each year. Sudden movement related to catastrophic failure would deposit larger volumes of material almost instantaneously. Sudden slope failure, and its effects, have yet to be monitored, although they should be expected where Frank's Creek impinges the base of its valley walls. The North Trench Landslide will be monitored in the future to better refine the understanding of its movement behavior.

Boothroyd, and others (1982), stated that Frank's Creek is actively incising and rapidly downcutting. This

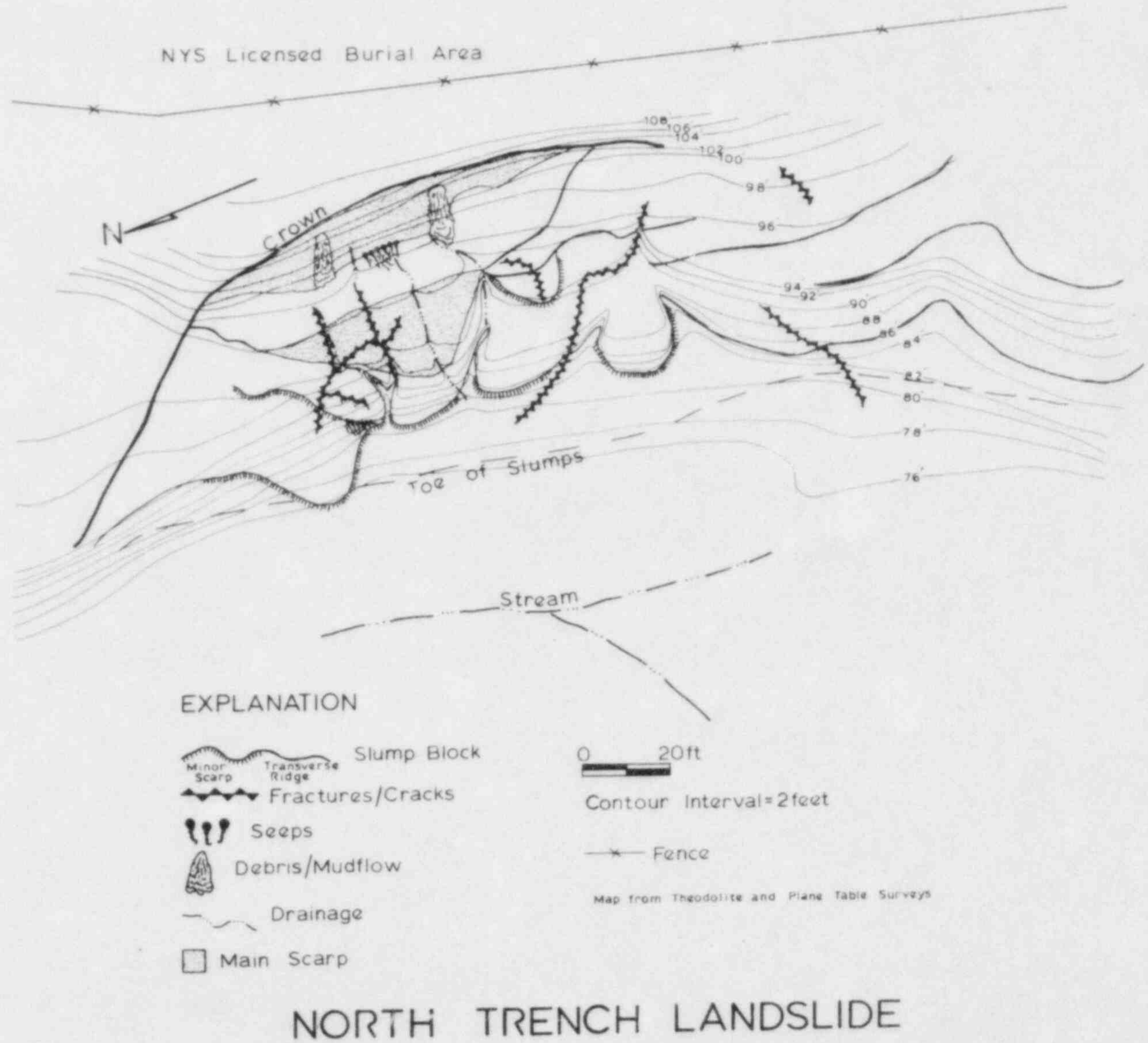


Figure 19. Survey map of the North Trench Landslide.

is indicated by the convex profile of the stream gradient, V-shaped profile, and an approximate 3-5 meters/year (9-15 feet/year) knickpoint retreat on the East Branch of Frank's Creek. The rate of knickpoint retreat on the West Branch of Frank's Creek is assumed to be comparable. Because these knickpoints control the local base level of Frank's Creek, downcutting, valley widening, headward erosion, and incising of the Lavery till eventually will cause landsliding along Frank's Creek in the vicinity of the burial areas unless efforts are made to control this erosion.

### 6.1.2 Connoisarauley Landslide

A second type of landslide, common to the area adjacent to the WNYNSC, is characterized by large, (6,000-36,000 square meters or 64,560-387,360 square feet), slightly deeper (3-4 m or 10-13 ft) complex rotational slumps. These occur where high bluffs are parallel to major drainages and expose the Wisconsinan kame delta sands beneath the silty, clay Lavery till (LaFleur, 1979), or where an active channel undercuts its valley wall (Boothroyd, and others , 1979). Previous work by Boothroyd and others (1979, 1982) has quantified a downslope movement rate for one such landslide on Buttermilk Creek. The average yearly rate of movement was determined to be 1.5 cubic meters/year (53 cubic feet/year), with a volume moved of 150 cubic meters/year (5,297 cubic feet/year). This landslide variety is shown by the Connoisarauley Landslide (Figure 20). A surveyed grid system was established on this landslide in September 1981, using the methods previously described for the North Trench Landslide. It was resurveyed in June, 1982.

The volume and rate of downslope movement for the Connoisarauley Landslide was determined for a nine month period. Constant downslope movement was assumed, as in the case of the North Trench Landslide, because no major undercutting or slope failure occurred. The volume of the actively moving slide is 8,592 cubic meters (306,600 cubic feet) with a rate of downslope movement of 0.24 meters/year (0.8 feet/year). Note that this rate is less than that determined by Boothroyd, and others(1979, 1981), for another large landslide on Buttermilk Creek. This rate corresponds closely with that determined for the North Trench Landslide, indicating similar processes are active on both landslides. The slope distance from the upper rim of the slide scar to the valley floor is 49 m (160 ft). The time required for material to move this slope distance is 200 years. The average volume of material delivered to the valley floor and available for stream transport is 42 cubic meters/year (1518 cubic feet/year). The movement rate and volume determined for

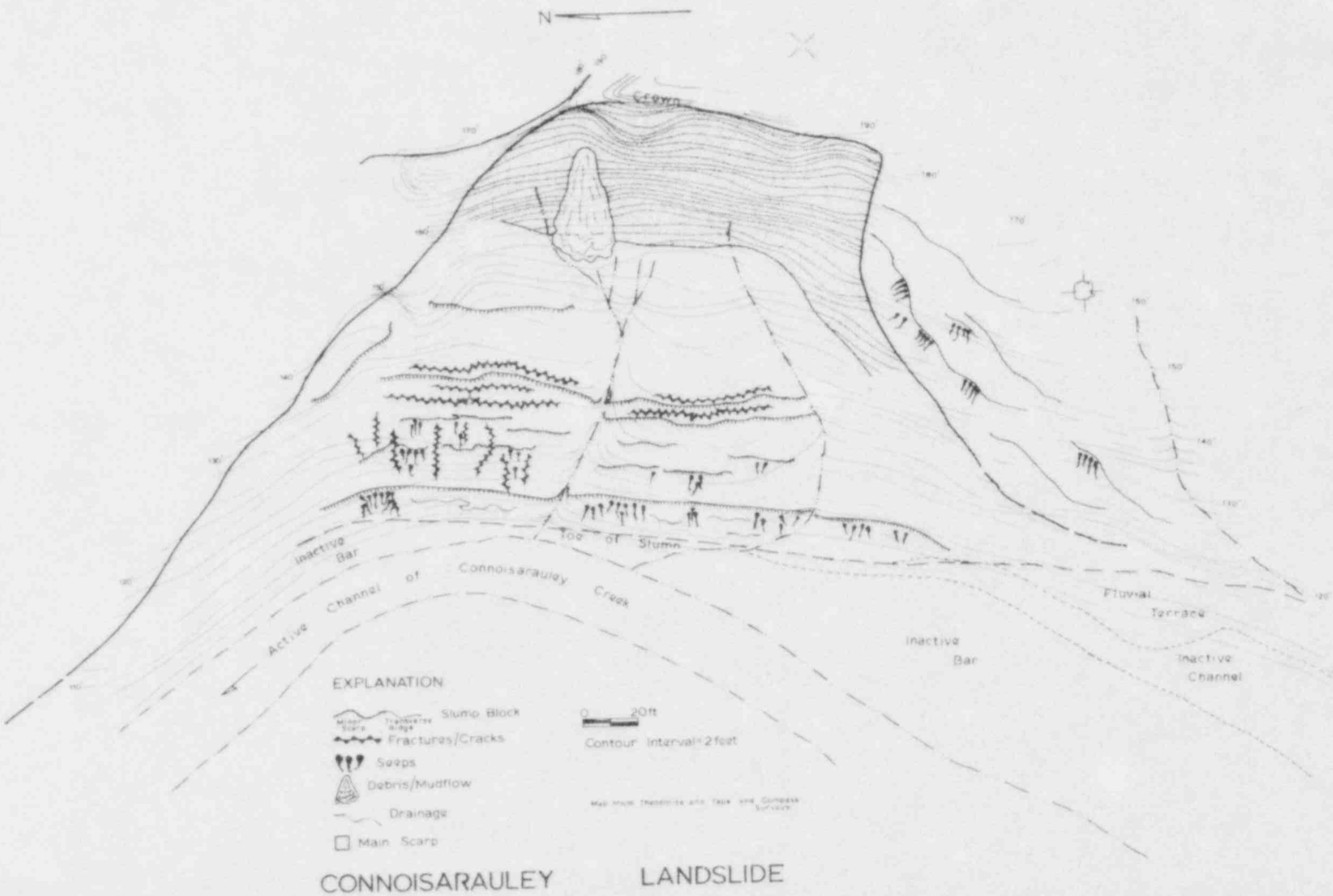


Figure 20. Survey map of the Connoisarauley Landslide.

the Connoisarauley Landslide are less than those determined for the Buttermilk Creek Landslide adjacent to the WNYNSC site (Boothroyd and others, 1982). Further monitoring will continue to more accurately quantify the landslide behavior.

## 6.2 Slope Domains

The surface slope domains of the WNYNSC site are shown on Plate 8. The slope domains were chosen by inspection of topographic contour density and information from the landslide analysis. Five slope domains are identified.

1) SLOPE DOMAIN 1. This domain is characterized by slopes of less than 1 degree where there are active fluvial channel, bar, and terrace systems or where the topography has been modified by landscaping or filling operations (such as the NYS-Licensed burial area). The surface topography is flat and it is underlain by fluvial gravel and sand, silt and clay of the till, or artificial fill of varying composition. Vegetation is moderate and consists of grasses. This domain is not susceptible to landsliding unless immediately adjacent to Slope Domain 4 or if a slope exceeding the critical angle (8 degrees) is created.

2) SLOPE DOMAIN 2. This domain is characterized by slopes from 1 to 2.9 degrees in till (Lavery) or the distal portions of Holocene alluvial fans. The surface topography is hummocky, with poor to moderate drainage, commonly with swamps and ponded water. It is underlain by silt and clay of the till or silty sand of the fan. It is moderately vegetated by swamp grass and shrubs. This domain is generally stable unless modified or immediately adjacent to Slope Domain 4.

3) SLOPE DOMAIN 3. This domain is characterized by slopes from 3 to 8 degrees which are composed of the relatively inactive, medial to proximal surfaces of Holocene alluvial fans. The topography is gentle, with moderate to good drainage, and underlain by gravel with some sand and silt, and well vegetated by grasses and shrubs. This domain is stable, although it is prone to landsliding if adjacent to Slope Domain 4.

4) SLOPE DOMAIN 4. This domain is characterized by surface slopes which exceed 8 degrees. The surface topography is steep and irregular, expressing landslide scars, slump blocks, and flow masses. It is adjacent to active drainages and is most often underlain by silt and clay of the Lavery till. It is poorly to moderately vegetated by forest growth, or unvegetated. Landslides occur exclusively within this domain. It is highly

susceptible to failure, particularly when unvegetated and impinged upon by active stream channels.

5) SLOPE DOMAIN 5. This domain is characterized by slopes greater than 8 degrees which occur along the lower shoulders or flanks of hills, away from well organized, active fluvial systems. The surface topography is gentle with well developed drainage. It is underlain by silts and clay of the Kent till and moderately to well vegetated by grasses, shrubs, and trees. This domain is not prone to failure unless the critical angle is exceeded by cut-and-fill operations or over-steepening.

6.3 Estimating Landslide Potential

Information derived from the landslide mapping, monitoring, and the identified slope domains indicates that an area most susceptible to failure would have the following characteristics:

1) Surface slope exceeding 8 degrees,

2) Slope material composed of silt and clay of the till deposits,

3) An active stream channel impinging upon the foot of slope,

4) Sparse to no vegetative cover.

Specific locations for probable further landslide activity include the areas directly south, east, and north of both the NYS and NRC-Licensed burial areas and east of Lagoons 2 and 3.

6.4 Studies in Progress

6.4.1 Buttermilk Creek Study

The NYSGS has contracted with Earth Surface Research for the completion of the study of the geomorphic processes and evolution of the Buttermilk Valley and some selected tributaries. This study has three major portions: the monitoring of the spring freshet of Buttermilk Creek, the measurement of the movement of pre-selected clasts as the result of the freshet runoff, and the remapping of Bar Complexes 4 through 6 to document changes caused by the freshet flow. These measurements will determine the portion of the yearly suspended sediment and bedload transport that occurs during the annual spring flood. The results of this study will then be integrated with the previous studies of the Buttermilk Creek (Boothroyd and Timson, 1979; Boothroyd and others, 1982) to complete the NYSGS supported studies of this area. Upon completion of this study a separate report will be issued detailing the geomorphology of the Buttermilk Creek.

### 6.4.2 Cattaraugus Creek Erosional History

As part of the investigation of the WNYNSC, the NYSGS has contracted for a study of the post-glacial geomorphic development of the Cattaraugus Creek drainage basin. Cattaraugus Creek serves as the local base level for Buttermilk Creek, and as such controls the rate of downcutting along Buttermilk Creek. To estimate the erosional stability of the WNYNSC site, the rate of change of the base level formed by the Cattaraugus since its inception must be determined. This study is being completed by Dr. R.G. LaFleur, and a separate report of his findings will be produced. The geomorphic history of this drainage will provide a complete regional picture of the erosional processes presently occurring in this area.

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## APPENDIX A. Standardized Well Logs

### A.1 Procedures for Standardization

Standardization of logs focused on factors that could be used to characterize and distinguish lithologic units and to define stratigraphic boundaries. The most important element is the description of the proportions of the grain sizes present. Another important element describes the degree of stratification of the unit, ranging from entirely homogeneous to entirely laminated. Additional information available from some of the logs describes deformation and continuity of layers, roundness of pebbles, composition of large clasts, and color as an indication of oxidation.

Intervals in the original logs were sometimes defined only at lithologic boundaries, but in other cases they represent separate samples. In the standardized logs, interval boundaries from the original logs have been retained, as well as additional depths indicated for any lithologic changes within those intervals. As a result, no interval in the standardized logs contains more than one distinct lithologic unit, but a single unit may continue down through several intervals that represent, for example, successive 2-foot sections of core. All internal boundaries are stated as meters of elevation above mean sea level.

Sub-intervals were used for cases in which the original log indicated the presence of a thin unit of different material at a specific depth or for a very small interval. On the standardized logs such subintervals are indicated by lines indented one space and beginning with "at nnn m". Such subintervals were often used to indicate a distinct layer or change in lithology within a larger lithologic unit above and below. In a few cases, subintervals were used for a thin distinct lithology at the bottom of a larger lithologic unit and above a different, large lithologic unit.

### A.2 Explanation of Standardized Format

#### Line 1

The first line of the description of an interval or subinterval is primarily a description of the grain sizes and volume proportions. In some of the intervals such a description was abbreviated in the original log by using a general genetic term, such as "till". In some cases this was followed by a more specific statement using grain size classes. In many instances, the grain size description stood alone. In the standardized logs, if a general genetic term was used, it appears as the first item in the first line for each interval or subinterval. "Till", "lacustrine", and "alluvium", are the three most common terms used. "Till" implies a homogeneous sediment consisting mainly of clay and silt, with some gravel or pebbles. "Lacustrine" implies layered sediment, primarily composed of clay and silt. "Alluvium" implies a relatively homogeneous material with a markedly higher proportion of gravel or pebbles than in till. Other general genetic terms found in the original logs and used in the standardized logs are "colluvium", "backfill", "organic material/soil", "bedrock", and "fluvial".

The grain size classes used in Line 1 are: "clay", "silt", "sand", "gravel/pebbles", and "angular rock fragments". The modifiers "fine", "medium", and "coarse" are included if they were specified in the original log. If two or more classes occur in approximately equal amounts then the classes are arbitrarily listed in order from fine to coarse. Otherwise, the order of grain size classes and uses of conjunctions indicate decreasing volume proportions. The matrix material is listed first in sediments with subordinate layers in a homogeneous matrix. Next in the list are the size classes making up the subordinate layers. If the sediment is entirely layered then this line begins with "as layers:" and the layers are listed after the colon, in order from fine to coarse.

The following conjunctions are used to indicate proportions in a homogeneous matrix or within an individual layer: "and", "with", "with rare", and "to". The examples below indicate their use for a material with two size classes:

A and B: the two size classes are present in approximately equal amounts, mixed together, and arbitrarily listed from fine to coarse. In some cases this construction may have been used in the original logs without any intention of showing proportions, merely to list the classes present.

A with B: A is the dominant size class, and B is present in lesser amounts, but as more than a mere trace. The two classes are mixed together in the unit. In the original logs a form often used was "silty clay". In the standardized logs this is converted to "clay with silt", in order to place the most abundant class at the start of the list.

A, with rare B: A is by far the dominant size class, with B present only in small amounts. The two classes are mixed together. Equivalent statements in the original logs would be "trace", "very few", or "less than 5 percent".

A to B: part of the unit consists entirely of class A and part purely of B, with a transition from one to the other through all intermediate size classes. The change may be either vertical or lateral, but is most likely to be vertical in order to be seen in a core sample.

The following examples illustrate constructions used for three or more size classes in a homogeneous matrix or within a single layer:

A and B and C: all three are present in approximately equal amounts and mixed together.

A and B, with C: A and B are present in equal amounts and make up most of the sediment. C is present in a significant amount, but less than either A or B.

A and B, with rare C: A and B are present in equal amounts and make up nearly all of the sediment. C is present in only trace amounts. All three classes are mixed together.

A, with B and C: A is dominant, with lesser amounts of B and C, which are equal to each other. B and C are each present in significant amounts. All three classes are mixed together.

A, with rare B and C: A makes up nearly all of the sediment, with trace amounts of B and trace amounts of C. All three classes are mixed together.

A, with B, with C: A is dominant, with a lesser but significant amount of B, and an even lesser amount of C, but still more than a trace. All three classes are mixed together.

A, with B, with rare C: A is dominant, with a lesser but significant amount of B, and with only a trace of C. All three classes are mixed together.

Line 2

The second line of the description for each interval or subinterval concerns color, which can be an indication of the oxidation state in the sediments. Standard Munsell color codes were used in some of the USGS logs, but could not be created for the other logs in which the color description was much less specific. The second line for each interval in the standardized logs uses normal English to describe the colors, and the same constructions used in Line 1 are used to indicate proportions.

Line 3

The third line of the description for each interval or subinterval was reserved for any information that could not be used to characterize or distinguish the units but which did not fit in Line 1 or Line 2. Such information includes descriptions of deformation, continuity, or thickness of layers or blebs; degree of firmness; comments about oxidized or unoxidized portions; presence of fractures; occurrence of calcareous material, large cobbles, or shale fragments; and comments on the type or state of the sample used.

## A.3 Construction of Stratigraphic Columns

Stratigraphic columns were drawn for many of the USGS holes in and near the NYS licensed burial trenches, and for both sets of logs from the 1980-series holes. The columns were derived from the standardized logs discussed in the first section of this chapter.

The heading for each column gives the name of the hole as shown on Plate 1, the company or agency responsible for the drilling, the year of drilling, and the elevation of the surface above sea level in meters and feet.

The center section of each column contains graphic representation of the grain sizes present and their volume proportions. The numbers to the left are depths below the surface in meters, and the vertical scale is 1:50. A scale in feet is shown on the right-hand side of the sheet.

Straight horizontal lines across the column correspond with interval boundaries in the standardized logs. Where the boundaries are so close together that the grain size symbols would not fit in the space, interval boundaries are shown as pairs of line segments at the edges of the column. That same convention is used for subinterval boundaries.

In some of the standardized logs sediments were described only in general genetic terms, without any specific statement of grain sizes present and their proportions. In these cases, the graphic columns contain letters abbreviating the general genetic terms:

till = T

lacustrine = L

alluvium = A

colluvium = C

backfill = b

bedrock = R

fluvial = F

A horizontal squiggle is used for organic material/soil, either alone, as a general genetic term, or in combination with symbols for grain size classes.

The following symbols for grain size classes were used:

clay = dashes

silt = small dots

sand = large dots

gravel/pebbles = open ovals

angular rock fragments = open triangles

For each size class, six patterns of different symbol densities were devised, as shown in Figure 21. Combinations of these thirty patterns represent various proportions, as expressed verbally in the standardized logs. The patterns were superimposed to indicate proportions, rather like combining color correction filters in photography. The examples in Figure 22 show how the patterns were used to translate the standardized logs, using a simple code as an intermediate step. These examples are all homogeneous materials that either occupy an entire interval or a particular layer. Note that for "clay to silt" the graphic form shows the transition as lateral, usually with the fine material on the left. This representation is used when the original log did not specify the direction of the change, which may well be vertical in the hole.

If the standardized log specified a homogeneous matrix with subordinate layers, then the layers are shown at arbitrary positions within the unit. If the log specified "with rare layers", no more than one layer per centimeter is shown. In the logs, subintervals were often used to indicate the precise positions of layers, with homogeneous material above and below. In the graphic form, such layers are bracketed at the sides of the column with horizontal straight line segments. In intervals described in the logs as entirely layered, each type of layer is shown at least once, at arbitrary depths.

The vertical lines on either side of the graphic column supplement the grain size symbols. Colors are indicated on the left under "COL". A blackened circle or thick line segment under "B" indicates that the material is at least partly brown or orange, or some other color suggesting oxidation. A circle or thick line segment under "G" indicates that the material is at least partly gray, indicating a reduced state.

The five lines to the right of the graphic column under "SIZE" show the dominant grain size in each

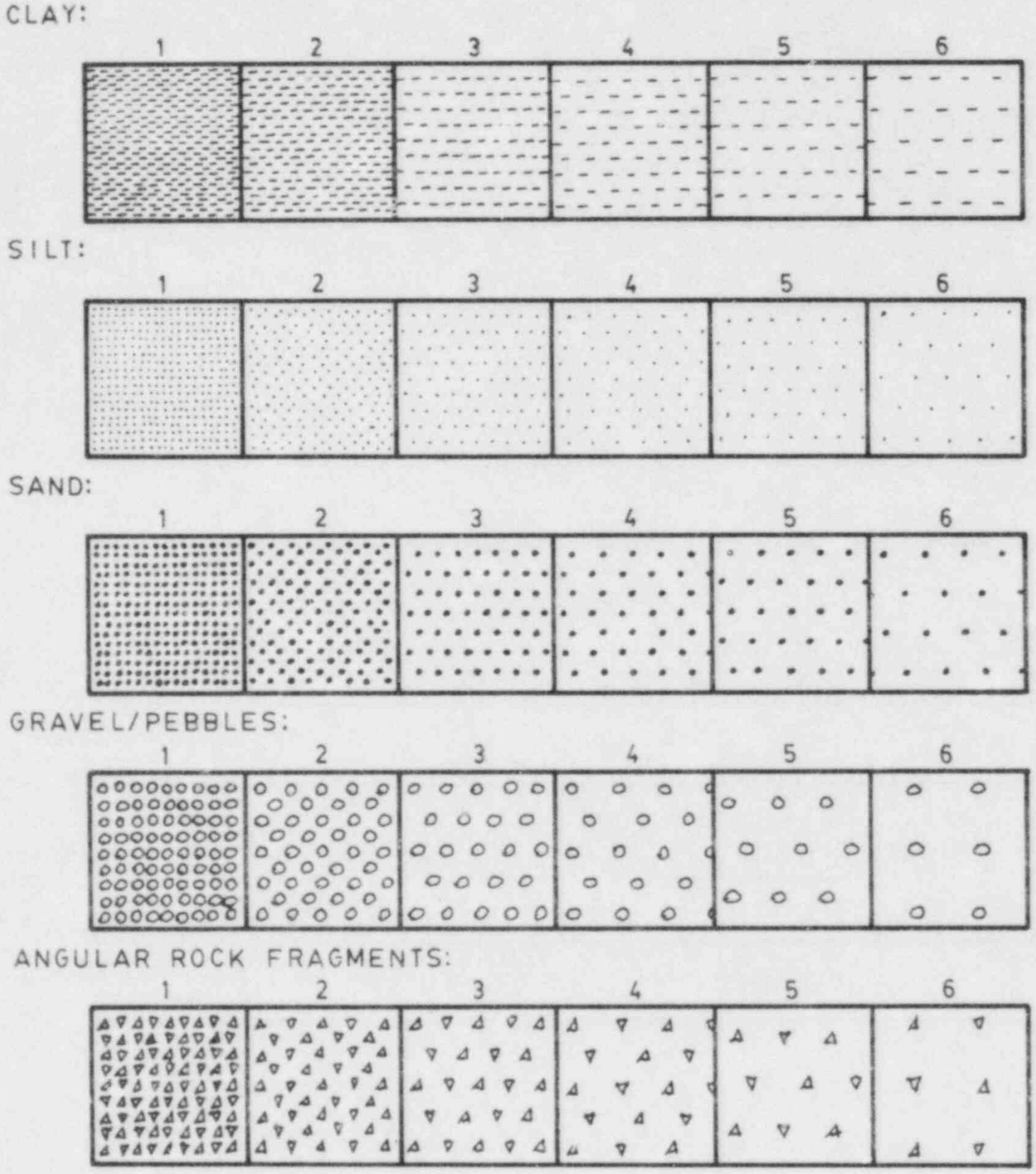



Figure 21. Symbols for graphic columns. Densities represent different proportions of each grain size class, from pure (density 1) to rare (density 6). These are combined to represent various combinations of grain sizes.

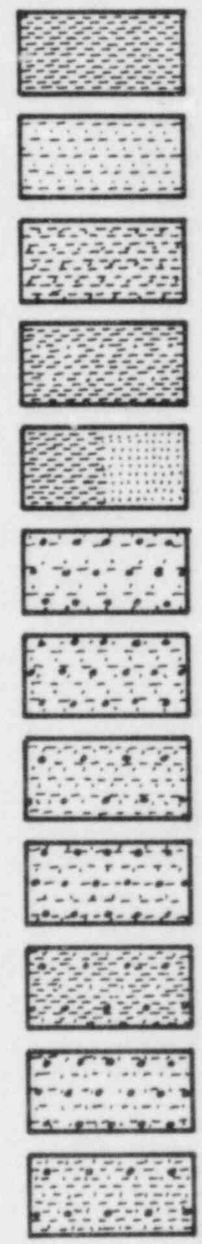
| FROM LOG | CODE | GRAPHIC |
|---|---|---|
| CLAY | C1 |  |
| CLAY AND SILT | C3,L3 | |
| CLAY WITH SILT | C2,L4 | |
| CLAY, WITH RARE SILT | C1,L6 | |
| CLAY TO SILT | C1 → L1 | |
| CLAY AND SILT AND SAND | C5,L5,S5 | |
| CLAY AND SILT, WITH SAND | C4,L4,S5 | |
| CLAY AND SILT, WITH RARE SAND | C3,L3,S6 | |
| CLAY, WITH SILT AND SAND | C3,L5,S5 | |
| CLAY, WITH RARE SILT AND SAND | C1,L6,S6 | |
| CLAY, WITH SILT, WITH SAND | C3,L4,S5 | |
| CLAY, WITH SILT, WITH RARE SAND | C2,L4,S6 | |

Figure 22. Examples of translations from standardized logs, through a simple code, to the form used in the graphic columns.

interval or subinterval: C=clay, L=silt, S=sand, G=gravel/pebbles, R=angular rock fragments.

The three lines under "HOM" describe material that is primarily homogeneous. "L" indicates that the interval contains a significant proportion of layers, blebs, or wisps; "R" indicates only rare layers; and "N" indicates an entirely homogeneous sediment. The line under the large "L" is used to indicate intervals or subintervals that are primarily layered. The pair of lines under "I" and "D" describe the deformation and continuity of layers in either primarily homogeneous or primarily layered sediments. A circle or thick line segment under "I" indicates that the layers are intact, continuous, and horizontal. A circle or thick line under "D" indicates that the layers are deformed or discontinuous, or, at the very least, dipping.

A82-1 (trench)

depth: 3.86 m, 12.67 ft.

surface 416.35 m, 1366.04 ft.
colluvium: clay, with organic
material/soil; with rare
gravel/pebbles
dark grayish brown
moist to touch

416.20
colluvium: clay, with silt and
organic material/soil; with rare
gravel/pebbles
medium yellowish brown, with black
organic smell; moist but does not cohere

416.07
alluvium: clay, with silt and organic
material/soil and gravel/pebbles
medium yellowish brown
root fibres; more silty than above

415.99
alluvium
medium yellowish brown, with brown
many roots; moist but no appreciable yield to hole

415.89
clay, with silt and organic material/soil and
gravel/pebbles
dark grayish brown, with gray and yellowish red
many black roots

415.76
clay, with silt and gravel/pebbles
dark grayish brown, with yellowish red
black root zones

5.64
clay, with silt, with gravel/pebbles
dark grayish brown, with yellowish red
moist, slight yield of water; shale pebbles

415.53
silt, with clay; with rare gravel/pebbles
dark grayish brown
dry to touch but rolls up easily into ball

415.41
clay, with silt; with rare gravel/pebbles;
with rare layers of silt

dark grayish brown, with rare grayish
white and yellowish red
pebbles bigger than above;
silt wisps gray; brachiopod in pebble;
specks of schist(?); sample crumbles

415.23
silt, with clay;with rare gravel/pebbles;
with layers of silt
dark grayish brown, with gray
more gray silt wisps than above

415.11
clay, with silt; with rare gravel/pebbles;
with layers of silt
dark grayish brown, with gray
gray silt wisps; specks of schist on crystals

414.93
clay, with silt; with rare gravel/pebbles
dark grayish brown
saturated in zones

414.72
clay, with silt
dark gray to dark grayish brown, with dark brown
dark brown zones saturated;
sample rolls easily into ball

414.54
clay, with silt; with rare gravel/pebbles
dark gray, with gray
less moist than above;
very plastic and uniform; pebbles lighter gray

414.34
clay, with silt; with rare layers of fine sand
gray to dark gray, with rare yellowish brown
saturated, very plastic; sand in yellowish brown blebs

414.16
clay, with silt; with rare gravel/pebbles
gray
less than 2% pebbles

413.96
clay,with silt; with rare gravel/pebbles
gray
saturated; Lavery?

413.73
clay, with silt and gravel/pebbles;
with rare layers of silt
gray, with rare yellowish brown

some large shale fragments;
saturated; silt bleb is yellowish brown

413.58
clay, with silt and angular rock fragments;
with rare layers of silt
gray,with rare yellowish brown
silt blebs yellowish brown; shale fragments

413.38
silt, with clay and angular rock fragments;
with layers of silt
gray, with yellowish brown
silt blebs yellowish brown; saturated; shale fragments

413.17
gravel/pebbles and angular rock fragments,
with silt, with clay; with rare layers of silt
gray, with rare reddish brown
not as saturated, more silt than above; shale fragments

413.00
clay, with silt and angular rock fragments;
with layers of silt
gray, with yellowish brown
shale fragments large; silt blebs yellowish brown

412.97
clay, with silt and gravel/pebbles; with rare sand;
with rare layers of silt
gray, with rare dark gray and greenish gray
small pebbles weak red;
one zone with dark gray sandy clay matrix, 1-2" thick;
greenish gray silty wisps; drier than above

412.77
clay, with silt, with gravel/pebbles and
angular rock fragments
dark gray
no sand; shale fragments

412.59
clay, with silt and angular rock fragments
dark gray, with rare brown
large shale fragment has brown silt rim

412.54
clay, with silt and angular rock fragments;
with rare gravel/pebbles; with rare layers of silt
dark gray, with greenish gray, pebbles black;
with rare yellowish brown and black
shale fragments greenish gray;
silt blebs small and yellowish brown

412.49 bottom

A82-2 (trench)

depth 2.21 m, 7.25 ft.

surface 414.39 m, 1359.6 ft.

colluvium or soil: clay; with rare gravel/pebbles
and organic material/soil
dark brown
soil damp to touch; roots present

414.24
colluvium: clay, with silt; with rare gravel/pebbles
moderate yellow brown, with black
organic small; black streaks throughout; white roots

414.06
colluvium or alluvium: clay, with silt; with rare gravel/pebbles
brown and orange yellow
streaks of oxidation along roots; organic smell;
moist to touch,some water seeping into hole

413.96
clay, with silt, with gravel/pebbles
moderate brown to olive gray
oxidation along roots

413.80
clay, with silt, with gravel/pebbles;
with rare layers of silt
olive gray
silt partings and blebs;
minor streaks of oxidation along roots

413.68
clay, with silt, with angular rock fragments
gray
moist but does not yield water to hole

413.53
silt, with clay; with rare angular rock fragments;
with rare layers of silt
gray, with rare yellow brown
yields water when squeezed; silt blebs brown; shale fragments

413.38
silt, with clay and gravel/pebbles and angular rock fragments;
with layers of silt
gray, with yellowish brown
shale fragments; partings and blebs of silt;

moist to touch; plastic

413.17
silt, with clay; with rare angular rock fragments; with rare layers of silt
gray, with rare reddish brown and yellow brown
drier than above;
shale fragments; silt partings and blebs

413.02
clay, with silt, with gravel/pebbles; with rare layers of silt
gray, with greenish gray
drier than above; traces of silt partings greenish and wispy

412.87
silt, with clay, with fine gravel/pebbles;
with rare angular rock fragments
gray
shale fragments; moist but does not yield water

412.71
clay, with silt, with gravel/pebbles;
with rare angular rock fragments;
with rare layers of silt
gray
shale fragments;
trace of silt wisps

412.51
clay, with silt, with gravel/pebbles;
with rare layers of silt
gray, with rare yellow brown
moist to touch but does not yield water;
small brown silt blebs around shale clast

412.36
clay, with silt, with gravel/pebbles;
with rare angular rock fragments; with rare layers of silt
gray, with rare greenish gray and black
shale fragments greenish; some small black pebbles;
wispy silt blebs

412.18 bottom

80-1 (from Miller log)

depth: 7.92 m, 26 ft.

surface 433.40 m, 1422 ft.
organic material/soil
brown

433.30
gravel/pebbles, with silt, with sand
olive gray
some cobbles; clasts of shale, siltstone, sandstone

431.88
silt, with sand and gravel/pebbles
layer 0.1m thick

430.81
silt, with gravel/pebbles
iron oxides common

430.36
silt, with gravel/pebbles; with rare clay and sand
gray brown

430.05
coarse gravel/pebbles, with silt

429.75
gravel/pebbles, with silt to silt with gravel/pebbles

429.44
gravel/pebbles, with silt

428.83
coarse gravel/pebbles, with silt

428.53
coarse gravel/pebbles, with silt
olive gray

427.92
gravel/pebbles, with silt

427.46
gravel/pebbles, with silt

427.31
fine gravel/pebbles, with coarse sand, with silt

426.24
till: clay and silt; with rare gravel/pebbles
olive gray

425.48 bottom

80-2 (from Miler log)

depth: 4.88 m, 16ft.

surface 434.32 m, 1425 ft.
organic material/soil
dark brown

434.24
gravel/pebbles, with silt; with rare clay and sand
olive brown

430.66
silt, with gravel/pebbles; with rare clay
olive gray brown

430.05
gravel/pebbles, with silt

429.90
clay and silt, with gravel/pebbles
olive gray

429.44 bottom

80-3 (from Miller log)

depth: 2.44 m, 8 ft.

surface 420.91 m, 1381 ft.
silt, with gravel/pebbles; with rare clay
orange brown

420.22
fine gravel/pebbles, with coarse sand,
with coarse gravel/pebbles; with rare silt
olive brown

419.54
gravel/pebbles, with sand

419.00
till: clay and silt, with gravel/pebbles
orange brown
oxidized

418.85
till: clay and silt, with gravel/pebbles
olive gray
unweathered

418.47 bottom

80-4 (from Miller log)

depth: 4.27 m, 14 ft

surface 420.91 m, 1381 ft
gravel/pebbles, with silt
olive brown

419.99
silt; with rare clay
olive gray
no core sample, cuttings only

419.54
gravel/pebbles, with silt
olive gray

419.38
gravel/pebbles, with silt, with fine sand
olive gray

419.08
fine gravel/pebbles, with fine to coarse sand, with silt
olive brown

418.47
no core

417.86
till: clay and silt, with fine gravel/pebbles
olive brown
"Lavery"; fine pebbles of shale, siltstone

417.25
till: clay and silt, with fine gravel/pebbles;
with layers of gravel/pebbles with sand

417.17
till: clay and silt, with fine gravel/pebbles

416.64 bottom

80-5 (from Miller log)

depth: 4.87 m, 16 ft.

surface approx 401.55 m,1317.8 ft
organic material/soil

401.40
fine to coarse gravel/pebbles, with
fine to coarse sand, with silt
olive brown
poorly sorted

400.64
fine to medium sand; with rare gravel/pebbles
olive brown
well-sorted

400.59
fine to medium gravel/pebbles; with rare sand
olive brown

400.34
fine gravel/pebbles, with coarse sand; with rare silt

399.98
fine to coarse sand, with fine gravel
olive brown

399.73
gravel/pebbles, with sand
olive brown
fair sorting, pebbles mostly siltstone

398.51
fine to medium gravel/pebbles, with sand, with silt
olive gray

397.32
till: silt, with clay, with gravel/ pebbles
olive brown
"Lavery", oxidized

397.29
till: silt, with clay, with gravel/pebbles
olive gray
not oxidized

396.68 bottom

80-6 (from Miller log)
depth: 5.49 m, 18 ft

surface 420.30 m,1379 ft
fine to coarse gravel/pebbles, with sand; with rare silt
brown

419.99
till?: clay and silt, with sand and gravel/pebbles
gray to gray brown to brown
Lavery-like fill

418.17
till?
brown
with green grass and roots; still fill

417.86
till?: silt
olive gray
weathered, not as compact as typical Lavery

416.79
fine to coarse gravel/pebbles, with silt and sand
olive brown

416.64
silt, with sand and gravel/pebbles
olive brown

416.09
fine gravel/pebbles, with coarse sand

416.03
silt, with fine sand
olive brown

415.57
silt; with rare clay
olive brown to olive gray
more gray deeper

415.36

till: clay and silt, with gravel/pebbles
olive gray
Lavery

414.81 bottom

80-7 (from Miller log)

depth: 2.43 m, 8 ft

surface 423.80 m, 1390.5 ft
organic material/soil
grass

423.77
organic material/soil and silt, with clay,
with gravel/pebbles
brown

423.62
silt, with clay, with gravel/pebbles
brown

423.29
silt, with gravel/pebbles; with rare sand
olive brown
some cobbles

423.19
fine to coarse gravel/pebbles, with silt, with sand
olive brown

422.58
sand, with gravel/pebbles; with rare silt
olive brown

422.43
silt, with fine to coarse gravel/pebbles; with rare clay

422.27
sand with gravel/pebbles, with silt
olive brown

422.04
till: clay and silt, with gravel/pebbles
olive brown
Lavery

421.94
till: clay and silt, with gravel/pebbles
olive gray

421.37 bottom

80-8 (from Miller log)

depth: 7.32 m, 24 ft

surface 431.58 m, 1416 ft
organic material/soil

431.55
silt with gravel/pebbles, with sand
dark brown

430.97
coarse sand, with fine to medium gravel/pebbles
olive brown

430.66
silt, with gravel/pebbles
dark brown
some cobbles

430.20
fine to coarse gravel/pebbles with fine
to coarse sand; with rare silt
olive brown

429.75
fine to coarse gravel/pebbles, with fine sand, with silt
olive brown

429.14
fine to medium gravel/pebbles, with silt and sand
brown

428.53
gravel/pebbles, with silt and sand
olive brown

427.92
gravel/pebbles, with sand, with silt
olive brown

427.69
gravel/pebbles, with sand
olive brown

427.61
fine to coarse sand
olive brown

427.38
silt, with clay and sand
olive brown

427.31
silt, with sand and gravel/pebbles
olive brown

427.00
silt, with sand

426.78
coarse sand, with fine gravel/pebbles
grayish brown

426.70
silt, with sand, with gravel/pebbles
olive brown

426.39
fine to coarse gravel/pebbles, with sand; with rare silt

426.01
fine to medium gravel/pebbles, with silt, with sand
olive gray

425.33
sand, with silt

425.18
till: clay and silt, with gravel/pebbles;with rare sand

424.26 bottom

80-9 (from Miller log)

depth: 6.71 m, 22 ft

surface 423.35 m, 1389 ft
organic material/soil: silt with rare gravel/pebbles

423.13
silt, with fine to coarse gravel/pebbles
orange brown and olive brown
mottled

422.89
fine to coarse gravel/pebbles, with silt
mottled

422.74
gravel/pebbles, with silt, with sand

422.43
gravel/pebbles, with clay and silt; with rare sand

422.13
till: silt, with clay, with gravel/pebbles
brown
Lavery

422.03
till: silt, with clay, with gravel/pebbles
olive gray
not weathered

421.76
medium sand

421.70
till: silt, with clay, with fine gravel/pebbles
olive gray

419.84
sand

419.83
till: silt, with clay, with gravel/pebbles
olive gray

416.64 bottom

80-10 (from Miller log)

depth: 12.7 m, 41.7 ft

surface 426.85 m, 1400.5 ft
organic material/soil; clay and silt
dark brown

426.55
gravel/pebbles with silt and sand
orange brown and olive brown
mottled

426.14
till: silt, with clay, with fine to medium gravel/pebbles
olive brown with orange
Lavery, weathered; roots to 425.48

424.72
till: silt, with clay and fine to medium gravel/ pebbles
olive gray
unweathered

423.80
till: silt, with clay and fine to medium gravel/pebbles
olive gray
slightly stonier

421.67
till: silt, with clay, with gravel/pebbles
olive gray

419.54
till: clay and silt, with gravel/pebbles
olive gray
some cobbles

417.81
silt, with gravel/pebbles

417.78
silt, with gravel/pebbles; with rare clay and sand
olive gray

417.40
silt
olive gray

416.82
sand; with rare silt
olive gray

416.79
silt
olive gray

416.49
medium to coarse sand
olive gray

416.34
silt
olive gray

415.88
silt; with rare sand
olive gray

415.73
silt

414.86
till
Lavery?

414.36
gravel/pebbles with silt and sand

414.20
bedrock
olive gray
shale

414.15 bottom

A (trench)

depth: 9.75 m, 32.0 ft

surface 420.63 m, 1380.1 ft
no samples

420.33
Shelby tube sample, not examined

419.72
backfill
brown to gray

418.96
backfill
yellowish brown

418.44
backfill

418.35
organic material/soil
brownish black

418.29
organic material/soil
olive gray and brownish black

418.26
till with organic material/soil
light olive gray to yellowish brown
to yellowish orange
oxidized

417.28
silt, with fine sand
oxidized

416.37
till: silt, with clay and gravel/pebbles
yellowish brown
calcareous

at approx. 416.37
medium gray
fracture plane

at 416.06
medium olive gray

415.61
till: silt, with clay and gravel/pebbles
medium olive gray
unoxidized, calcareous

414.29
lacustrine: silt, with clay; with rare layers of coarse silt to fine sand
medium olive gray
calcareous, unoxidized

at 414.23
coarse gravel/pebbles
one cobble, 80 mm

414.23
no samples, cuttings only

412.40
till

411.49
no samples

410.88 bottom

A2 (trench)
depth: 10.69 m, 35.1 ft

surface 420.63 m, 1380.1 ft
no samples

420.33
Shelby tube sample, not examined

419.72
backfill
dark yellowish brown and medium olive gray

418.53
organic material/soil: clay
grayish black with medium olive gray
and light yellowish brown

418.44
till and organic material/soil: fine silt,
with clay and gravel/pebbles
yellowish gray to medium yellowish brown
vertical fractures oxidized

417.89
fine silt, with clay and gravel/pebbles;
with rare sand, with silt and sand

417.68
fine sand, with silt
medium yellowish brown
vertical fractures oxidized

417.62
fine sand, with silt
medium yellowish brown
subvertical contact with oxidized
till somewhere in this interval

417.31
fine sand, with silt; with rare layers of clay

416.28
sand, with gravel/pebbles

416.25
fine sand, with silt;
with rare layers of clay

416.09
till: silt, with clay and gravel/pebbles
dark yellowish brown to medium olive gray
oxidized, mottled

416.00
till: fine silt, with clay and gravel/pebbles;
with layers of sand, with clay and silt
dark yellowish brown
oxidized

415.82
lacustrine: silt, with fine sand; with rare
gravel/pebbles;
with rare layers of clay
dark yellowish orange

415.73
lacustrine
medium olive gray

415.54
lacustrine: coarse sand, with silt; with layers of clay
brownish gray
dipping layers

415.51
till: silt, with clay and gravel/pebbles
medium olive gray
unoxidized

415.45
lacustrine: fine sand, with silt; with layers of silt
dipping layers

415.42
till: silt, with clay and gravel/pebbles
medium olive gray
subvertical fractures

414.39
till: silt, with clay and gravel/pebbles;
with rare layers of coarse silt

414.29
till: silt, with clay and gravel/pebbles

413.75
till: silt, with clay and gravel/pebbles
with rare layer of coarse silt

413.72
till: silt, with clay and gravel/pebbles

413.29
till: silt, with clay and gravel/pebbles;
with layers of silt with sand

413.17
till: fine silt, with clay and gravel/pebbles
medium olive gray
calcareous, plastic, with vertical fractures

409.94 bottom

B (trench)

depth: 14.17 m, 46.5 ft

surface 418.99 m, 1374.4 ft
backfill
yellowish brown to olive gray

417.46
backfill: silt, with clay and gravel/pebbles;
to silt, with sand and gravel/pebbles
olive gray

417.31
backfill: fine silt, with clay and gravel/pebbles
brownish olive gray

416.92
organic material/soil(?) ana silt;
with rare clay and gravel/pebbles
olive gray and light olive gray and dark yellowish orange

416.76
till(?): silt, with clay and fine sand and gravel/pebbles
dark yellowish brown

at 416.46
with layers of sand and silt
layer is 5 to 10 mm thick

at 416.40
with layers of silt, with sand
single bleb 20 X 10 X 5 mm

416.25
silt, with clay and sand and gravel/pebbles
olive gray with dark yellowish orange

at 416.00
with layers of coarse sand, with silt and gravel/pebbles
layer 25 mm thick

at 415.76 to 415.70
silt; with layers of fine to coarse silt
layers are vertical

415.33
till: fine silt, with clay and gravel/pebbles
medium olive gray
caalcareous; vertical oxidized zones with roots

413.17
till: fine silt, with clay and gravel/pebbles
medium olive gray
calcareous, plastic, with vertical fractures

409.94 bottom

B (trench)

depth: 14.17 m, 46.5 ft

surface 418.99 m, 1374.4 ft
backfill
yellowish brown to olive gray

417.46
backfill: silt, with clay and gravel/pebbles;
to silt, with sand and gravel/pebbles
olive gray

417.31
backfill: fine silt, with clay and gravel/pebbles
brownish olive gray

416.92
organic material/soil(?) and silt;
with rare clay and gravel/pebbles
olive gray and light olive gray and dark yellowish
orange

416.76
till(?): silt, with clay and fine sand and
gravel/pebbles
dark yellowish brown

at 416.46
with layers of sand and silt
layer is 5 to 10 mm thick

at 416.40
with layers of silt, with sand
single bleb 20 X 10 X 5 mm

416.25
silt, with clay and sand and gravel/pebbles
olive gray with dark yellowish orange

at 416.00
with layers of coarse sand, with silt and gravel/pebbles
layer 25 mm thick

at 415.76 to 415.70
silt; with layers of fine to coarse silt
layers are vertical

415.33
till: fine silt, with clay and gravel/pebbles
medium olive gray
caalcareous; vertical oxidized zones with roots

412.74
coarse sand, with silt and gravel/pebbles

412.65
till: fine silt, with clay and gravel/pebbles
medium olive gray

410.30
lacustrine: fine silt, with clay; with rare gravel/pebbles;
with layers of coarse silt
medium olive gray

409.72
till: silt, with clay and gravel/pebbles
medium olive gray

408.83
lacustrine: fine silt, with clay; with rare gravel/pebbles;
with layers of coarse silt
medium olive gray

408.41
till: silt, with clay and gravel/pebbles
medium olive gray

408.02
coarse sand, with silt
medium olive gray to light brown

407.95
till: fine silt, with clay and gravel/pebbles
medium olive gray

404.82 bottom

B2 (trench)

depth: 12.86 m, 42.2 ft

surface 419.62 m, 1376.78 ft
backfill
dry

418.43
backfill(?): clay and silt, with gravel/pebbles
yellow brown to brown to yellow orange
mottled

417.06
till: clay and silt, with gravel/pebbles
dark yellowish brown with medium yellowish brown
oxidized; gray fractures

414.44
till: clay and silt, with gravel/pebbles
gray, with dark yellowish orange

413.83
till: clay and silt, with gravel/pebbles
olive gray

411.45
no core sample

411.24
fine to medium sand; with rare silt

411.21
gravel/pebbles

411.18
gravel/pebbles, with silt

411.12
silt and gravel/pebbles

411.03
no core sample

410.87
gravel/pebbles with silt

410.78
gravel/pebbles, with silt
greenish gray to olive gray

410.72
gravel/pebbles, with silt

410.39
no core sample

410.11
silt and gravel/pebbles

410.02
silt and gravel/pebbles; with layers of silt
may be till; massive silt layer near top

409.90
till: silt, with clay and gravel/pebbles;
with rare layers of coarse silt
olive gray
silt layers wispy

409.81
till: silt, with clay and gravel/pebbles
olive gray

409.75
till: silt, with clay and gravel/pebbles;
with rare layers of coarse silt
olive gray

409.05
till: silt with clay and gravel/pebbles
olive gray

at 406.94
with layers of silt, with sand
reddish gray

406.76 bottom

B3 (trench)

depth: 13.17 m, 43.2 ft

surface 419.67 m, 1376.93 ft
backfill
dry

417.21
organic material/soil
greyish black, to light olive gray and brownish olive gray
old soil zone

417.06
silt, with rare gravel/pebbles

416.99
till: clay and silt, with gravel/pebbles
dark yellowish brown to medium yellow brown
no fractures; oxidized

416.28
fluvial; silt, with clay and sand, to gravel/pebbles, with clay and silt

415.95
till: clay and silt, with gravel/pebbles
brown
oxidized

415.46
till: clay and silt, with gravel/pebbles
olive gray
not oxidized, except on fractures

413.39
till: clay and silt, with gravel/pebbles
olive gray
no oxidized fractures

412.51
till: silt, with clay and gravel/pebbles
olive gray
pebbles of shale or limestone

412.14
no core sample

412.02
gravel/pebbles, with clay and silt

411.78

till: clay, with silt and gravel/pebbles
olive gray

411.53
till: clay, with silt and gravel/pebbles
and angular rock fragments
olive gray to brownish gray

411.23
till: clay, with silt, with gravel/pebbles
olive gray

410.01
till: clay, with silt, with rare gravel/pebbles;
with rare layers of silt
olive gray
"mess bedded"

at approx.409.15
till: clay, with silt, with coarse sand and
gravel/pebbles

409.15
till: clay, with silt, with rare gravel/pebbles;
with rare layers of silt
olive gray
no silty layers

408.19
till: clay with silt, with gravel/pebbles
olive gray
no silty layers

406.50 bottom

C (trench)

depth: 7.62 m, 25 ft

surface at approx. 421.82 m, 1384 ft
backfill

420.91
backfill
dry

420.85
backfill
dry

420.69
backfill
moist

420.39
backfill and organic material/soil

420.18
lacustrine(?): silt, with clay; with rare gravel/pebbles
light olive gray to dark yellowish orange
mottled, grayer at top, oranger at bottom

419.99
till:silt, with clay and gravel/pebbles
dark yellowish brown with light olive gray fractures

419.60
till: silt, with clay and gravel/pebbles
yellowish brown, with light orange

419.32
coarse sand, with silt

419.29
till: silt, with clay and gravel/pebbles
yellowish brown with light gray
fractures light gray

419.81
no core samples

at 416.95
till
not oxidized

414.20 bottom

C2 (trench)

depth: 15.24 m, 50 ft

surface 420.15 m, 1378.5 ft
   no core sample

417.71
   till: silt, with clay; with rare gravel/pebbles
   dark yellowish brown
   shale pebbles

417.53
   fine to medium sand
   dark yellowish brown

417.49
   till: silt, with clay; with rare gravel/pebbles
   dark yellowish brown, with rare dark yellowish orange
   shale chips; possible vertical fractures

417.25
   till: silt, with clay and gravel/pebbles
   dark yellowish brown
   pebbles of shale and vein quartz

416.49
   no core sample

at 415.73
   till
   a few unoxidized cuttings

at 414.66
   till
   all cuttings unoxidized

414.66
   till: silt, with clay and gravel/pebbles
   brownish gray

at 414.51 to 414.36
   with angular rock fragments
   red
   chips of shale

414.05
   till: silt, with clay; with rare gravel/pebles
   brownish gray

413.81
   till: silt and gravel/pebbles, with clay
   very pebbly till

413.78
till:  silt, with clay; with rare gravel/pebbles
brownish gray

413.29
till:  silt, with clay and gravel/pebbles

412.53
till:  silt, with clay; with rare gravel/pebbles

412.37
till:  silt and gravel/pebbles, with clay
very pebbly

412.28
till:  silt, with clay; with rare gravel/pebbles

411.86
till:  silt and sand and gravel/pebbles
very sandy and pebbly; nonplastic

411.80
till:  silt, with clay; with rare gravel/pebbles

411.61
till:  silt, with fine sand and gravel/pebbles
brownish olive gray
many traces of disturbed bedding

411.22
till:  silt, with clay and gravel/pebbles;
with rare fine sand

411.06
till:  silt, with clay and gravel/pebbles;
with rare fine sand;
with rare layers of coarse silt

411.00
till:  silt, with clay and gravel/pebbles;
with rare fine sand

410.79
till:  silt, with clay and gravel/pebbles
some large pebbles of limestone, quartzite,
metamorphic rock

409.17
till:  silt, with clay; with rare gravel/pebbles

at 408.84
with layers of fine sand
actually blebs, not continuous layers

408.72
till: silt, with clay; with rare gravel/pebbles

408.44
till: silt, with sand and gravel/pebbles

408.41
till: silt, with clay; with rare gravel/pebbles

407.80
till: silt, with clay and gravel/pebbles
olive gray

406.43
till: silt, with clay; with rare gravel/pebbles

404.91 bottom

D (trench)

depth: 15.97 m, 52.4 ft

surface 420.97 m, 1381.2 ft
backfill
no core samples

420.05
backfill and organic material/soil

419.66
backfill

419.60
backfill(?)
no core sample

418.53
backfill

418.47
backfill: coarse sand to fine gravel/pebbles;
with silt and clay
dark yellowish brown
saturated, strong odor

418.35
till: silt, with clay and gravel/pebbles
dark yellowish brown
oxidized; fractured

418.07
till(?)
no core sample

417.01
till: silt, with clay and gravel/pebbles
olive gray
unoxidized

415.94
till: silt, with clay and gravel/pebbles
olive gray
more moist and plastic, softer than above

414.48
till: silt, with clay and gravel/pebbles;
with layers of silt and fine sand
olive gray
layers contorted or wispy

413.90

till: silt, with clay and gravel/pebbles;
with rare layers of coarse silt
olive gray

413.47
till: silt, with clay and gravel/pebbles;
with layers of silt and fine sand
medium olive gray and light orange
layers contorted

412.86
till: silt, with clay and gravel/pebbles;
with rare layers of silt
medium olive gray

at 412.44 to 412.28
silt, with sand and gravel/pebbles

411.98
silt, with clay; with rare gravel/pebbles;
with layers of coarse silt, silt with sand
fine sand, fine to coarse sand
olive gray
layers contorted and steeply dipping

at 411.67
fine to medium sand
06 m thick (0.2 ft); saturated

411.37
till: silt, with clay; with rare gravel/pebbles
olive gray

at 411.09
silt, with sand and gravel/pebbles

410.52
no core sample

408.78
till: silt, with clay and fine gravel/pebbles
medium olive gray
pebbles 10-20% of core

408.44
till: silt, with clay and fine gravel/pebbles;
with layers of silt and of silt with sand
medium olive gray, with medium to light olive gray
wispy partings

at 408.32
fine sand, with silt; with rare coarse sand
wavy layer 1 cm thick;
highly calcareous; dry, loose

at 408.08
coarse sand, with clay and silt and gravel/pebbles
as a layer

407.74
till
soft and plastic

407.25
till: silt, with clay; with rare gravel/pebbles
olive gray
soft, very plastic

at 406.71
fine sand, with silt
light gray
discontinuous contorted layer, 2-5 mm thick

406.58
till
soft and plastic, 15-20% pebbles

406.19
till
soft and plastic, 5-10% pebbles

405.73
till
firm and plastic 5-10% pebbles

405.00 bottom

D2

depth: 3.66 m, 12.0 ft
surface 420.91 m, 1381 ft
backfill
brown to gray

419.69
backfill
dark yellowish brown

419.48
till: fine silt, with clay and gravel/pebbles
medium brown
vertical fractures

at 419.29
with layers of gravel
single layer

418.93
till: fine silt, with clay and sand and gravel/pebbles
medium brown
vertical fractures

418.38
no core sample

418.17
till: fine silt, with clay and gravel/pebbles
dark yellowish brown

417.95
till: coarse silt, with clay and gravel/pebbles

417.86
till: silt, with sand and gravel/pebbles
medium olive gray with dark yellowish orange and light yellowish brown

417.74
sand,with clay and silt and gravel/pebbles

417.68
no core sample

417.25 bottom

E

depth: 14.42 m, 47.3 ft
surface 420.82 m, 1380.7 ft
backfill: clay and silt

419.48
backfill: sand

419.38
backfill and organic material/soil: silt and sand

418.65
backfill: gravel/pebbles, with silt and sand

418.59
no core sample

418.07
till: silt, with clay and gravel/pebbles
dark yellowish brown

417.92
till: silt, with clay and gravel/pebbles
branched fracture with iron oxide

417.62
till: silt, with clay and gravel/pebbles
olive gray

417.10
till: silt, with clay and gravel/pebbles
olive gray
steep fracture

415.03
till: silt, with clay and gravel/pebbles
olive gray
very soft

414.39
till: silt, with clay; with rare gravel/pebbles

at 414.36
with layers of coarse silt, with clay and coarse sand

413.78
lacustrine: fine sand

413.75
lacustrine: silt; with layers of fine sand with silt
dipping 20 degrees

413.72
lacustrine: clay, with silt; with layers of coarse silt

413.44
till: silt, with clay and gravel/pebbles; with rare layers of coarse silt
olive gray

413.20
no core sample

411.98
till: silt, with clay and gravel/pebbles

411.28
till: silt, with clay; with rare gravel/pebbles; with rare layers of coarse silt

411.06
till: silt, with clay and gravel/pebbles

410.45
Shelby tube sample, not examined

409.84
till: fine silt, with clay and gravel/pebbles
medium olive gray

408.99
till: silt to fine sand, with clay and gravel/pebbles; with rare layers of silt to sand
medium olive gray

408.96
till: fine silt, with clay and gravel/pebbles
medium olive gray

407.04
coarse sand, with silt, to fine gravel/pebbles, with silt, with clay
dark brownish gray

407.01
till: fine silt, with clay and gravel/pebbles
medium olive gray

406.40 bottom

E2

depth: 3.32 m, 10.9 ft
surface approx 420.60 m, 1380 ft
no core sample

419.45
backfill and organic material/soil

419.14
till: silt, with clay and gravel/pebbles
medium yellowish brown with gray to olive gray
fractures reduced

at 419.11 to 419.05
with olive gray and black
black in fractures

at 418.90
with olive gray and black
black in fractures

418.81
till: silt, with clay and gravel/pebbles
medium yellowish brown
fractures reduced

418.56
till: silt, with clay and gravel/pebbles; with rare layers of fine sand
dark yellowish brown with medium yellowish brown
mottled; discontinuous partings of sand at top

418.47
till: silt, with clay and gravel/pebbles
dark yellowish brown, with gray
fractures reduced, with dark films in cores

418.26
till: clay, with silt and gravel/pebbles
dark yellowish brown, with rare gray
some fractures reduced

417.92
till: clay,with silt and gravel/pebbles
dark yellowish brown to olive gray
decreasing oxidation downward

417.56
till: silt, with clay and gravel/pebbles
olive gray
some oxidation at root tubes

417.28 bottom

F

depth: 16.25 m, 53.3 ft
surface 421.49 m, 1382.9 ft
no core sample

421.18
Shelby tube sample, not examined

420.57
till: fine silt, with clay and gravel/pebbles
dark yellowish brown
fractures dip 45 degrees

419.35
till: fine silt, with clay and gravel/pebbles
dark yellowish brown with medium olive gray

418.47
till: fine silt, with clay and gravel/pebbles; with layers of coarse silt
dark yellowish brown, with dark yellowish orange
layers contorted

418.41
till: fine silt, with clay and gravel/pebbles
medium olive gray
calcareous

at 413.44
with layers of sand
single layer 3 mm thick

413.44
lacustrine: fine silt, with clay; with layers of coarse silt
olive gray

at 413.33
with layers of fine sand
single layer 1 mm thick, deformed

412.89
sand
dips 45 degrees

412.86
till: fine silt, with clay and gravel/pebbles
medium olive gray

411.43
Shelby tube sample, not examined

410.82
till: silt, with clay and gravel/pebbles
medium olive gray

at 410.52
with rare clay

at 410.09
with rare silt to fine sand

410.06
till: silt, with clay and gravel/pebbles
medium olive gray

at 408.17
with rare layers of sand, with silt

408.08
till: silt, with clay and gravel/pebbles
medium olive gray
firm and plastic

407.47
till: silt, with clay and gravel/pebbles; with rare layers of coarse silt
medium olive gray
vertical fractures

406.77
till: silt, with clay and gravel/pebbles
medium olive gray

405.94
till: silt, with clay and gravel/pebbles; with rare layers of coarse silt
medium olive gray

405.24 bottom

G

depth: 13.11 m, 43.0 ft
surface 418.26 m, 1372.3 ft
no core sample

417.95
Shelby tube sample, not examined

417.34
till: fine silt, with clay and gravel/pebbles
medium yellowish brown
fractures not coated

416.58
till: fine silt, with clay and gravel/pebbles
medium yellowish brown to dark yellowish brown
fractures oxidized

416.18
till: fine silt, with clay and gravel/pebbles
dark yellowish brown to brownish gray
fractures oxidized

415.57
till: fine silt, with clay and gravel/pebbles
brownish gray
fewer fractures

414.96
till: fine silt, with clay and gravel/pebbles; with rare layers of coarse silt
brownish gray with pinkish gray
no fractures

414.75
till: fine silt, with clay; with rare gravel/pebbles; with rare layers of coarse silt
brownish gray

414.48
till: fine silt, with clay; with rare gravel/pebbles;with layers of coarse silt
brownish gray with pinkish gray
layers tilted 45 degrees

414.42
till: fine silt, with clay; with rare gravel/pebbles; with layers of sand, with clay and silt and gravel/pebbles
brownish gray
"mess bedded"

414.23
till:  fine silt, with clay; with rare gravel/pebbles; with layers of coarse silt
brownish gray with pinkish gray
layers steeply dipping, wispy, calcareous

414.20
fine silt, with clay; with rare gravel/pebbles
brownish gray to medium olive gray
no silt wisps

413.81
fine silt, with clay; with rare gravel/pebbles; with layers of coarse silt
brownish gray with light gray to pinkish gray

at 413.59 to 413.56
sand with silt; with rare gravel/pebbles, to layers of coarse sand

413.47
till:  fine silt, with clay; with rare gravel/pebbles
medium olive gray

411.67
till:  fine silt, with clay; with rare gravel/pebbles; with rare layers of coarse silt
layers discontinuous, wispy

410.88
till:  fine silt, with clay; with rare gravel/pebbles

410.67
till:  medium sand, with clay and silt and gravel/pebbles
brownish gray

410.61
till:  fine silt, with clay and gravel/pebbles; with layers of sand with silt
medium olive gray with brownish gray

410.39
till:  sand with clay and silt and gravel/pebbles
brownish gray
chunks of underlying till near base

410.24
till:  fine silt with clay; with rare gravel/pebbles
medium olive gray
no apparent bedding

407.89
lacustrine:  clay with silt, to silt with clay; with

layers of coarse silt
medium olive gray
wispy layers

406.55
till: fine silt, with clay; with rare gravel/pebbles
medium olive gray

406.40
till: fine silt, with clay and gravel/pebbles
medium olive gray
not plastic, not "mess bedded"

405.15 bottom

H

depth:  2.69 m, 8.8 ft

surface approx.  418.99m, 1374.71 ft (assume pipe 3 ft high)
till:  silt, with gravel/pebbles
brownish gray

416.85
mottled colors

416.70
olive gray

416.30 bottom

I

depth: 15.60 m, 51.2 ft

surface 412.30 m, 1382.30 ft
no core sample

421.00
Shelby tube sample, not examined

420.39
backfill and organic material/soil
medium olive gray and medium yellowish brown and brownish black
mottled

419.60
till: fine silt, with clay and gravel/pebbles
medium yellowish brown
fractures

419.17
no core sample

418.10
till: fine silt, with clay and gravel/pebbles
medium yellowish brown to medium olive gray

417.65
till, fine silt, with clay and gravel/pebbles
medium olive gray

417.04
no core sample

416.73
till: fine silt, with clay and gravel/pebbles
medium olive gray
no fractures

416.28
till: fine silt, with clay; with rare gravel/pebbles;with layers of coarse silt
medium olive gray
wispy layers

416.03
sand, with clay and silt; with rare gravel/pebbles
light gray

416.00
till: fine silt, with clay; with rare gravel/pebbles; with layers of coarse silt

medium olive gray
layers wispy

415.67
lacustrine:  fine silt, with clay; with rare gravel/pebbles; with layers of coarse silt to fine sand
medium olive gray
layers 40 to 50% of sample

415.51
till:  silt, with clay and gravel/pebbles
medium olive gray
no bedding

415.21
till silt, with clay; with rare gravel/pebbles
medium olive gray

414.14
no core sample

413.99
till:  silt, with clay; with rare gravel/pebbles; with rare layers of coarse silt
medium olive gray with light gray
wispy layers

413.17
till:  silt, with clay and sand and gravel/pebbles
medium olive gray

413.01
till:  silt, with clay; with rare gravel/pebbles;with layers of coarse silt
medium olive gray with light gray wispy layers

412.47
no core sample

410.55
lacustrine:  as layers:  clay to clay with silt; silt; coarse silt to fine sand; fine sand, with silt
all layers

410.36
lacustrine(?):  clay with silt; with rare coarse sand and gravel/pebbles; with rare layers of coarse silt to fine sand

410.09
till:  silt, with clay and gravel/pebbles
olive gray to brownish olive gray

at 408.50

clay
gray

408.11
till: silt, with clay and gravel/pebbles
crudely stratified, contorted

407.95
till: silt, with clay and gravel/pebbles; with rare layers of coarse silt

407.80
till: silt, with clay and gravel/pebbles

407.35
till: silt, with clay and gravel/pebbles

at 407.28
with layers of coarse silt to fine sand

407.13
till: silt, with clay and gravel/pebbles; with layers of silt, with gravel/pebbles, and of fine sand
olive gray

406.67
till: silt, with clay and gravel/pebbles

406.37
till: silt, with clay and gravel/pebbles; with layers of coarse silt to fine sand

405.70 bottom

I2

depth: 11.58 m, 38 ft

surface 421.30 m, 1382.30 ft
   no core sample

412.16
   till: silt, with clay and gravel/pebbles
   olive gray

411.55
   till: silt, with clay; with rare gravel/pebbles
   light brown

at 411.31
   with layers of fine sand with silt
   light brown
   layers contorted

at 411.94
   with layers of silt, with sand
   at 410.88
   with layers of fine sand, with silt
   light brown
   layers contorted

410.85
   till: silt, with clay; with rare gravel/pebbles; with
   layers of coarse silt
   olive gray with light gray
   coarse silt blebs and deformed lenses

410.73
   till: silt, with clay; with rare gravel/pebbles; with
   rare layers of coarse silt
   olive gray

at 410.64
   with layers of fine sand

at 410.61
   with layers of silt and coarse sand
   lenses

at 410.39
   with layers of coarse silt
   single mass

410.18
   till: silt, with clay and gravel/pebbles
   olive gray

409.72 bottom

I3

depth: 7.84 m, 25.7 ft
surface 421.46 m, 1382.8 ft
no core sample

419.93
backfill and organic material/soil

419.81
lacustrine: silt to silt, with clay
light olive gray to yellowish gray to yellow to brownish black

419.75
silt
strongly oxidized

419.72
gravel/pebbles, with silt and sand
grayish red to greenish gray

at 419.51
with layers of clay, with silt
dark yellowish brown
single layer, dips

419.48
till: silt, with clay and gravel/pebbles
medium yellowish brown
calcareous

419.32
till: silt, with clay and sand and gravel/pebbles

419.23
till: silt, with clay and gravel/pebbles

418.93
till: silt, with clay and gravel/pebbles
fractures oxidized

at 418.71 to 418.68
fractures not oxidized

418.20
till: silt, with clay and gravel/pebbles
medium yellowish brown and olive gray
mottled

417.95
till: silt, with clay and gravel/pebbles
olive gray with medium yellowish brown

417.04
till: silt, with clay and gravel/pebbles
olive gray
no oxidation

416.89
no core sample

415.18
till: silt, with clay; with rare gravel/pebbles
olive gray

414.90
till: silt, with clay; with rare gravel/pebbles; with rare layers of coarse silt to silt with sand

414.54
lacustrine: clay, with silt; with rare gravel/pebbles; with layers of coarse silt to silt with fine sand

414.42
lacustrine: as layers: silt, with clay; coarse silt; fine sand, with silt; fine sand
all layers

414.23
lacustrine: silt with clay; with rare layers of silt

414.19
as layers: silt; silt, with clay; coarse silt; fine sand
all wispy lenses

413.99
lacustrine: clay with silt; with layers of silt

at 413.84
vertical contact with till

at 413.81
clay
dark gray

at 413.75
with layers of coarse silt
single layer, dips 45 degrees

at 413.72
with rare gravel/pebbles

413.72
till: silt, with clay; with rare gravel/pebbles

413.62 bottom

I4

depth: 3.35 m, 11.0 ft
surface approx 421.06 m, 1381.5 ft
backfill

420.00
organic material/soil(?)

419.69
till
oxidized

418.17
till: silt, with clay; with rare gravel/pebbles
medium yellowish brown to brownish gray, with light gray

at 418.01 and 417.86
horizontal fractures filled with calcite

417.71 bottom

J

depth: 39.62 m, 130 ft
surface 419.32 m, 1375.8 ft
till: fine silt, with clay and gravel/pebbles
medium yellowish brown with brownish gray
microjoints

at 418.07
with layers of sand
single layer 12 mm thick

417.19
till: fine silt, with clay and gravel/pebbles
medium olive gray
highly calcareous

416.95
till: fine silt, with clay and gravel/pebbles; with layers of coarse silt
medium olive gray with medium yellowish brown coarse silt in "mess beds" and oxidized

416.79
till: fine silt, with clay and gravel/pebbles
medium olive gray
no bedding or oxidation

411.09
no core samples

at 409.88 to 409.57, and 400.57 to 408.66, found water; implies sand

404.39
till: fine silt with clay; with rare gravel/pebbles
medium olive gray

401.13
fine sand with gravel/pebbles

401.07
till: fine silt with clay; with rare gravel/pebbles
medium olive gray

396.46
no core sample

394.94
till: fine silt, with clay; with rare gravel/pebbles
medium olive gray
more clay than above

389.76
till: fine silt, with clay and gravel/pebbles
medium olive gray

387.93
sand with gravel/pebbles

387.32
fine to medium sand, with silt and gravel/pebbles

381.53
till: fine silt, with clay and gravel/pebbles
medium olive gray
many large cobbles

379.70 bottom

J2

depth: 5.67 m, 18.6 ft
surface approx 418.95 m, 1374.58 ft
alluvium
gray
muck

418.64
till: clay and silt, with gravel/pebbles
yellowish orange

417.73
till: clay and silt, with gravel/pebbles
medium yellowish brown with light gray
gray fractures

416.96
till: clay and silt, with gravel/pebbles
brownish gray

415.90
till: clay and silt, with gravel/pebbles
olive gray
unoxidized

413.76
till: clay and silt, with gravel/pebbles
olive gray

413.64
till: clay and silt, with gravel/pebbles; with layers of fine sand
olive gray with grayish red
thin partings of red sand

413.34
till: clay and silt, with gravel/pebbles

413.28 bottom

J3

depth: 1.73 m, 5.7 ft
surface 419.32 m, 1375.8 ft
no core sample

418.10
till
dark yellowish orange and grayish brown

417.71
till
oxidized; films on fractures

417.59 bottom

J4

depth: 3.03 m 10 ft
surface approx 419.56 m, 1376.58 ft
alluvium
mottled

419.10
till: silt, with clay and gravel/pebbles
medium yellowish brown
fractures oxidized

417.52
till: silt, with clay and gravel/pebbles
brownish gray

416.51 bottom

J5

depth: 1.58 m, 5.2 ft
surface 419.32 m, 1375.8 ft
alluvium(?): silt, with clay; with rare gravel/pebbles
orange to medium brown to dark brown
chunks 2 mm wide

418.80
alluvium(?): clay, with silt; with rare gravel/pebbles
dark brown flecks of iron oxide; gray on fractures

418.74
alluvium(?): fine sand, with rare gravel/pebbles; with layers of clay, with silt
dark brown
iron stain

418.70
alluvium(?): gravel/pebbles, with silt to sand, with silt
soft

418.45
till: silt and clay; with rare gravel/pebbles
brown, with orange and gray
gray rims on fractures and root tubes

417.74 bottom

K

depth: 15.24 m, 50.0 ft
surface 422.40 m, 1385.9 ft
till: fine silt, with gravel/pebbles
light yellowish brown, and brownish gray to greenish gray
pebbles of limestone and shale

421.18
till: fine silt, with gravel/pebbles
light yellowish brown with brownish gray to gray
gray fractures

420.27
till: fine silt, with gravel/pebbles
gray with light yellowish brown
visible joints

419.90
till: fine silt, with gravel/pebbles
gray with rare dark yellowish orange

419.35
no core sample

417.83
till: silt, with gravel/pebbles
gray
pebbles of shale

416.28
medium to coarse sand, with gravel/pebbles

416.25
lacustrine: fine to medium silt, with fine to medium sand
olive gray to yellowish gray
beds torn and deformed

416.06
till: fine silt, with gravel/pebbles
olive gray

415.91
fine silt; with layers of silt
olive gray
layers are wispy blebs

415.54
no core sample

415.39

till: silt, with coarse sand and gravel/pebbles
from cuttings, not core

414.78
till: fine silt, with gravel/pebbles
olive gray
no bedding

414.02
no core sample

412.50
till: fine silt, with gravel/pebbles
olive gray
no bedding

412.34
till: fine silt, with gravel/pebbles; with layers of
coarse silt
olive gray
layers deformed, wispy

411.73
till: fine silt, with sand and gravel/pebbles
olive gray
no coarse beds

411.58
till: fine silt, with sand and gravel/pebbles; with
layers of silt, fine sand
olive gray
more sand and gravel/pebbles than typical

411.45
silt, with clay
lens without pebbles

411.28
till: fine silt, with gravel/pebbles
olive gray
may be a sandy layer at base

410.97
no core sample

410.21
till: fine silt, with gravel/pebbles
olive gray

at 409.91
with coarse gravel/pebbles
one cobble

407.16 bottom

L

depth: 13.86 m, 45.5 ft
surface 420.60 m, 1380.0 ft
till: silt, with gravel/pebbles
medium yellowish brown
from cuttings; no core

419.23
till: silt, with clay and gravel/pebbles
dark yellowish brown and olive gray
mottled

419.14
till: silt, with clay and gravel/pebbles
olive gray
oxidized on fractures and root tubes

418.41
till: silt, with clay and gravel/pebbles; with rare layers of sand
olive gray
sand layers are thin partings

418.23
till: silt, with clay and gravel/pebbles
olive gray

417.92
till: silt, with clay and gravel/pebbles
gray
from cuttings; no core

416.61
lacustrine: silt, with clay, to silt; with rare gravel/pebbles
olive gray
layered

416.43
lacustrine: coarse silt, with coarse sand; with rare fine sand
bedding highly deformed

at 416.34
with layers of till
lens of till dips 75 degrees

416.12
lacustrine: as layers: fine silt; silt, with clay; coarse silt; silt, with coarse sand; silt, with clay and

gravel/pebbles
all layered; silt at base dips 45 degrees

415.64
till: fine silt with clay; with rare gravel/pebbles
olive gray

415.51
lacustrine: as layers: fine silt; silt with clay; coarse silt, with fine sand; with rare gravel/pebbles
olive gray with light yellowish gray
layered, highly deformed

415.27
no core sample

414.51
till: fine silt, with clay and gravel/pebbles
olive gray

at 412.22
with layers of coarse silt
single deformed layer, dips 15 degrees

412.22
no core sample

411.46
till: fine silt, with clay and gravel/pebbles
olive gray

411.16
till: silt, with clay and gravel/pebbles
from cuttings; no core

409.17
till: silt, with clay and gravel/pebbles
olive gray
"slightly clayey"

408.75
till: silt, with clay and gravel/pebbles
brownish olive gray

408.56
no core sample

408.26
till: silt, with clay and gravel/pebbles; with rare layers of silt
brownish olive gray
layers deformed

408.05

till: silt, with clay and gravel/pebbles
brownish olive gray

406.95
lacustrine: clay, with silt, to coarse silt
deformed

406.89
till: silt, with clay and gravel/pebbles
brownish olive gray

406.74 bottom

M

depth: 15.95 m, 52.3 ft
surface 422.53 m, 1386.3 ft
no core sample

420.09
till
oxidized; from cuttings; no core

419.48
till: fine silt, with clay and gravel/pebbles
dark yellowish brown
many fractures

419.23
till: fine silt, with clay and gravel/pebbles
medium olive gray
fractures oxidized

approx 418.26
till: fine silt, with clay and gravel/pebbles
medium olive gray
fractures not oxidized

417.77
no core sample

415.51
till: fine silt, with clay and gravel/pebbles
medium olive gray
no fractures or bedding

415.12
till: fine silt, with clay and gravel/pebbles; with layers of silt with sand, to sand with silt
medium olive gray with light gray
layers distorted and wispy

415.06
till: fine silt, with clay and gravel/pebbles
medium olive gray
no bedding

412.47
till: fine silt, with clay and gravel/pebbles; with rare layers of silt
medium olive gray
1 mm beds wispy

412.22
no core sample

411.70
till: fine silt, with clay and gravel/pebbles; with rare layers of silt
medium olive gray
1 mm beds wispy

411.55
till: fine silt, with clay and gravel/pebbles
medium olive gray
no bedding

411.25
till: fine silt, with clay and gravel/pebbles; with rare layers of silt
medium olive gray, with medium gray
1 mm beds wispy

410.67
till: fine silt, with clay and gravel/pebbles; with layers of silt
medium olive gray with medium gray
wispy beds

410.42
no core sample

410.12
lacustrine: silt; with layers of fine silt with clay; rare gravel/pebbles
light to medium gray
silt in wispy beds; other layers may be till

410.03
till: fine silt, with clay; with rare gravel/pebbles
medium olive gray
no bedding

409.34
till: fine silt, with clay; with rare gravel/pebbles; with rare layers of silt, to sand with silt
medium olive gray, with rare light gray

409.14
till: fine silt, with clay; with rare gravel/pebbles
medium olive gray
no bedding

409.02
till: fine silt, with clay; with rare gravel/pebbles; with layers of silt

at 408.84
with layers of silt, with sand
medium olive gray with light gray

408.84
till: fine silt, with clay; with rare gravel/pebbles
medium olive gray

408.41
till: fine silt, with clay; with rare gravel/pebbles;
with layers of silt
medium olive gray with light gray

408.20
till: fine silt, with clay; with rare gravel/pebbles;
with rare layers of silt
medium olive gray, with rare light gray

408.11
till: fine silt, with clay; with rare gravel/pebbles
medium olive gray
no bedding

407.35
till: fine silt, with clay; with rare gravel/pebbles;
with layers of: silt; silt, with sand; sand, with silt
medium olive gray with light gray
pebbles common in wispy beds

407.16
fine to medium sand, with silt; with layers of fine silt
with clay; with rare gravel/pebbles, to sand with
gravel/pebbles
medium reddish brown with medium olive gray
interbedded with till

407.10
till: fine silt, with clay and gravel/pebbles; with
rare layers of silt
medium olive gray, with rare light gray

406.89
Shelby tube sample, not examined

406.58 bottom

N

depth: 14.63 m, 48 ft
surface 422.65 m, 1386.7 ft
no core sample

422.49
Shelby tube sample, not examined

421.98
no core sample

421.12
backfill and organic material/soil
mottled

419.93
backfill and gravel/pebbles

419.87
no core sample

419.66
till: fine silt, with clay; with rare gravel/pebbles
medium yellowish brown, with rare medium gray
gray fractures

418.74
till: fine silt, with clay; with rare gravel/pebbles
dark yellowish orange and medium gray
root tubes gray in center, oxidized beyond

418.50
till: fine silt, with clay; with rare gravel/pebbles
olive gray, and medium yellowish brown to brownish gray
fractures and root tubes oxidized

418.01
till: fine silt, with clay; with rare gravel/pebbles
medium olive gray
oxidation rims decrease with depth

at 417.46
white
blebs

416.40
till: fine silt, with clay; with rare gravel/pebbles
medium olive gray
no bedding or fractures

414.32
no core sample

413.50
   till:  silt, with clay, with gravel/pebbles
   brownish olive gray

at 413.35 and 413.17
   with layers of silt, with clay, to coarse silt

411.22
   till:  silt, with clay and gravel/pebbles
   brownish olive gray

408.02 bottom

O

depth: 3.40 m, 11.16 ft
surface 415.82 m, 1364.31 ft
backfill
dry

415.52
colluvium(?) and organic material/soil

415.02
till: clay and silt, with gravel/pebbles
yellowish brown with yellowish orange
orange stain and manganese oxides on fractures

414.92
till: clay and silt, with gravel/pebbles; with layers of coarse silt

414.87
till: clay and silt, with gravel/pebbles; with layers of silt; with rare layers of clay
unoxidized except at root tubes and fractures

414.57
till: clay and silt, with gravel/pebbles

414.12
till: clay and silt and gravel/pebbles
relatively stoney

413.77
till: clay and silt, with gravel/pebbles; with layers of silt; with rare layers of clay

413.62
lacustrine and till: clay, with silt and gravel/pebbles; with layers of fine to coarse silt

at approx. 413.27
with clay, with silt
red

413.27
till: clay and silt, with coarse sand and gravel/pebbles
unoxidized

412.42 bottom

P

depth: 14.41 m, 47.3 ft
surface 422.43 m, 1386.0 ft
no core sample

421.43
backfill
dark yellowish brown with medium yellowish brown

420.88
backfill
olive gray with yellowish brown

420.51
till: fine silt, with clay and gravel/pebbles
medium yellowish brown with olive gray

419.11
till: fine silt, with clay and gravel/pebbles
olive gray with medium yellowish brown
mottled

418.99
till: fine silt, with clay and gravel/pebbles
medium olive gray, with rare light brown

at 418.77
with layers of coarse sand
1 to 2 mm thick

at 418.74
with layers of coarse silt
1 mm or less thick

418.17
till: fine silt, with clay and gravel/pebbles
medium olive gray
no more oxidation

417.46
till: fine silt, with clay and gravel/pebbles

at 417.25
with layers of medium sand

at 413.90
with layers of fine sand
dips 15 degrees

413.29
till: fine silt, with clay and gravel/pebbles; with rare layers of silt

medium olive gray, with rare light gray
layers wispy

412.89
no core sample

412.13
till: fine silt, with clay and gravel/pebbles
medium olive gray

411.86
lacustrine: silt, with clay; with rare gravel/pebbles;
with rare layers of fine silt
medium olive gray
wispy streaks of fine silt

411.37
no core sample

410.55
lacustrine: silt, with clay and gravel/pebbles; with
rare layers of fine silt
medium olive gray
wispy streaks of fine silt

409.78
no core sample

409.17
till: fine silt, with clay and gravel/pebbles
medium olive gray

408.02 bottom

Q

depth: 7.62 m, 25.0 ft
surface 420.27 m, 1378.9 ft
no core sample
brown
probably till

417.53
till: silt, with clay and gravel/pebbles
unoxidized

416.73
till: silt, with clay and gravel/pebbles; with layers of coarse silt to fine sand
gray
layers highly deformed

at 416.67
with layers of coarse silt
single layer 10 mm thick, dips 45

416.55
till: silt, with clay and gravel/pebbles
gray

416.00
no core sample

414.17
till: silt, with clay; with rare gravel/pebbles
olive gray

413.87
till: silt, with clay; with rare gravel/pebbles; with rare layers of coarse silt
olive gray

412.65 bottom

R

depth: 7.68 m, 25.2 ft
surface 419.75 m, 1377.2 ft
no core sample

418.23
clay, to clay, with silt
gray to olive gray to olive black
roots and white root hairs; swamp deposit

418.07
clay, to clay, with silt
gray to light olive gray
some compressed roots or stems

417.92
lacustrine: clay, with silt
yellowish olive brown, with gray, with rare brownish black and olive gray

at 417.77
with rare gravel/pebbles

417.74
till: silt and gravel/pebbles, with clay
mottled

at approx 417.62
with layers of coarse silt
red

417.62
lacustrine: coarse silt
gray, with yellowish olive brown

417.46
lacustrine: coarse silt, to silt and fine sand
light olive gray, to gray and dark yellowish brown

at 417.31
with gravel/pebbles

at 417.10
with layers of silt to fine sand

417.04
till: clay, with silt and gravel/pebbles
dark yellowish brown

at 416.93 to 416.90
with layers of coarse silt, with clay

at 416.89
with layers of fine sand

at 416.82
with fine sand and till

416.64
till: silt, with sand and gravel/pebbles
brown to olive gray

416.46
till: silt, with clay and gravel/pebbles
brown to olive gray

415.85
till: silt, with clay and gravel/pebbles
brown to olive gray, with gray to dark gray
unoxidized with darker blocks

415.64
till: silt, with clay and gravel/pebbles
gray to dark brown, with dark yellowish orange
fractures oxidized to orange

415.39
till: silt, with clay and gravel/pebbles
olive gray
no fractures

415.00
till: silt, with gravel/pebbles; with silt, with clay
and gravel/pebbles
olive gray
inclusions of pebbly silt in matrix of till as above

414.90
till: silt, with clay and gravel/pebbles
olive gray

412.07 bottom

S1

depth: 4.45 m, 14.6 ft

surface approx 410.04 m, 1345.33 ft
alluvium: silt with clay

409.12
alluvium: silt, with clay and gravel/pebbles

408.60
alluvium: gravel/pebbles, with silt and sand

408.51
colluvium or till: clsy with silt; with rare gravel/pebbles
unoxidized

406.99
till: clay, with silt and gravel/pebbles
unoxidized

405.59 bottom

S2

depth: 1.71 m, 5.6 ft

surface approx. 410.01 m, 1345.25 ft
alluvium: silt, with clay
light brown to dark brown, with rare black
black flecks to 1 cm

408.93
alluvium: clay with silt; with rare organic
material/soil; with layers of sand with gravel/pebbles
oxidized

408.75
alluvium: clay, with silt, with rare organic
material/soil; with layers of sand and gravel/pebbles
unoxidized

408.69
alluvium: clay, with silt and gravel/pebbles
oxidized

408.59
alluvium: clay, with rare gravel/pebbles; with layers
of sand
sand layers near base

408.41
medium to coarse sand, with gravel/pebbles
dark gray
unoxidized

408.29 bottom

T

depth: 2.26 m, 7.42 ft

surface 414.72 m, 1360.68ft
colluvium to organic material/soil: silt
dry

414.52
colluvium to organic material/soil: silt with gravel/pebbles
dry

414.32
till: silt, with clay and gravel/pebbles
dry, mottled

413.97
till: silt and gravel/pebbles, with clay
dry, mottled

413.92
till: clay and silt, with coarse sand to fine gravel/pebbles
oxidized

413.67
till: clay and silt, with coarse sand to fine gravel/pebbles
variably mottled, strong oxidation on root tubes

413.27
till and/or lacustrine: clay and silt; with layers of sand and fine gravel/pebbles
disturbed bedding(?), mainly unoxidized

412.90
till: clay and silt, with coarse sand to fine gravel/pebbles
unoxidized

412.46 bottom

U

depth:  3.08 m, 10.1 ft

surface 420.94 m, 1381.12 ft
   till
   brown to tan
   stony at base

419.41
   till
   mostly unoxidized

417.86 bottom

V

depth: 45.72 m, 150.00 ft

surface 422.40 m, 1385.90 ft
till: clay and silt, with coarse sand to gravel/pebbles
oxidized

417.83
till: clay and silt, with rare coarse sand to gravel/pebbles
grading to unoxidized

411.73
till: clay and silt, with coarse sand to gravel/pebbles
unoxidized

410.21
till: clay and silt, with coarse sand to gravel/pebbles; with layers of coarse silt
unoxidized

408.99
lacustrine: as layers: clay; clay with rare layers of silt and gravel/pebbles; silt; coarse silt; fine to coarse sand
all layered

407.47
till: clay and silt; with rare coarse sand to gravel/pebbles, with layers of clay to silt, with layers of silt
relatively clayey; silt in partings

406.25
till: clay and silt, with coarse sand to gravel/pebbles; with layers of clay to silt, with layers of silt
silt in partings

401.37
till: clay and silt, with coarse sand to gravel/pebbles

399.54
till: clay and silt, with gravel/pebbles
possibly relatively pebbly

398.63
till: clay and silt, with coarse sand to gravel/pebbles
may be unsaturated near base; unoxidized

397.10

fine gravel/pebbles and angular rock fragments, with fine to coarse sand; with rare silt
oxidized

393.75
fine sand with coarse sand; with rare silt; with rare layers of clay with coarse sand
unsaturated, oxidized

392.23
fine gravel/pebbles

392.08
fine sand with layers of silt
unsaturated, oxidized

390.86
clay to silt, to clay with layers of silt; with rare layers of silt to fine sand
at least lower part is lacustrine; clay to silt is upper part;
boundary not given; only sand is oxidized

389.79
coarse silt; with layers of fine silt with clay; with rare layers of coarse silt; silt and sand oxidized; some deformation

at 386.86
with layers of fine sand

386.44
lacustrine: fine silt to silt with clay; with rare coarse sand gravel/pebbles; with layers of clay; with rare layers of coarse silt
gray to olive gray
disturbed; good layering alternates with contorted layers and possible till

383.08
lacustrine: fine to medium silt; with rare layers of clay
olive gray
regular beds of silt, disturbed in some zones

381.56
lacustrine: fine to medium silt; with rare layers of clay
graded bedding in silt layers

380.34
fine to medium silt; with rare layers of clay, coarse silt
coarse silt in partings

377.90
fine to medium silt; with rare coarse sand and gravel/pebbles; with rare layers of clay, coarse silt coarse silt in partings; coarse sand and pebbles scattered

376.99
fine to medium silt; with layers of coarse silt; with rare layers of clay
coarse silt in beds

376.68 bottom

W

depth: 42.06 m, 138 ft
surface approx 421.43 m, 1382.7 ft
till: clay and silt, with coarse sand and fine gravel/pebbles
all oxidized

418.99
till: clay and silt, with coarse sand and fine gravel/pebbles
oxidized on fractures and root tubes only

418.23
till: clay and silt, with coarse sand and fine gravel/pebbles
not oxidized

417.77
till: clay and silt, with coarse sand and fine gravel/pebbles; with rare layers of clay to silt with clay

412.29
till: clay and silt, with coarse sand and fine gravel/pebbles; with layers of clay to silt, with clay, with fine gravel/pebbles

411.68
till: clay and silt, with coarse sand and fine gravel/pebbles

399.79
till: clay and silt and coarse sand and gravel/pebbles
unusually stoney

396.74
till: clay and silt and coarse sand and gravel/pebbles; with rare layers of silt to silt with clay
unusually stoney

395.83
till: clay and silt, with coarse sand and gravel/pebbles; with rare layers of silt to silt with clay

393.69
silt, with clay and fine sand; with layers of silt with gravel/pebbles
with layers of various combinations of fine and coarse

393.09
silt, with clay and fine sand; with layers of silt with

gravel/pebbles, and of fine sand, and of silt

392.46
silt, with clay and fine sand; with layers of silt with gravel/pebbles, and of clay, with silt and gravel/pebbles

388.82
clay, with silt, with coarse gravel/pebbles, with layers of coarse silt
dark brownish gray
partings of silt

388.51
silt; with layers of fine silt, silt with clay, coarse silt; with rare layers of coarse sand to fine gravel/pebbles

387.29
silt; with layers of fine silt, silt with clay, coarse silt

383.03
silt; with rare coarse silt to sand; with layers of fine silt, silt with clay, coarse silt; with rare layers of coarse sand to fine gravel/pebbles

382.72
silt; with layers of fine silt, silt with clay, coarse silt

380.28
silt; with layers of fine silt, silt with clay, coarse silt; with rare layers of coarse sand to fine gravel/pebbles

379.98
coarse silt, with layers of fine silt
very disturbed and convoluted

379.37 bottom

X

depth: 2.90 m, 9.52 ft
surface 411.80 m, 1351.12 ft
organic material/soil

411.65
till: silt, with gravel/pebbles
mottled, oxidized

411.10
till(?): fine silt, with clay; with layers of coarse silt; with rare layers of gravel/pebbles
olive brown, to tan, to light gray
weakly oxidized; may be lacustrine

at 410.60
with layers of sand, with silt
actually blebs

410.60
till: silt, with clay; with rare sand and fine gravel/pebbles; with rare layers of coarse silt
medium brown to olive gray

410.45
till: silt, with clay; with rare sand and fine gravel/pebbles
medium brown to olive gray

409.30
till: silt, with clay, with sand and fine gravel/pebbles
unoxidized

409.05
till: silt, with clay; with rare sand and fine gravel/pebbles
unoxidized

408.90 bottom

Y

depth: 2.02 m, 6.63 ft
surface 410.94 m, 1348.29 ft
organic material/soil; silt
dark brown

410.79
till: silt, with clay, with sand and gravel/pebbles
maybe displaced downslope; fractured, thoroughly
oxidized

410.39
till: silt, with clay, with sand and gravel/pebbles
grayish brown, with yellowish orange
weaker oxidation; maybe displaced downslope

409.99
till: silt, with clay; with rare sand and
gravel/pebbles
grayish brown, with yellowish orange
weaker oxidation; maybe displaced downslope

409.89
till: silt, with clay, with sand and gravel/pebbles
thoroughly oxidized, fresh roots

at 409.79
with layers of silt

409.54
till: silt, with clay, with sand and gravel/pebbles
fractures and root tubes reduced

409.09
till: silt, with clay, with sand and gravel/pebbles
olive brown and olive gray
mottled, traces of roots

408.92 bottom

Z6

depth: 2.90 m, 9.5 ft
surface 409.54 m, 1343.7 ft
silt to silt, with clay
brown
numerous roots

409.30
silt, with clay
brownish gray, with dark yellowish orange to red brown
many roots; oxidized near roots and fractures

at 409.04
with layers of sand to gravel/pebbles
streaks of sand or pebbles

408.84
clay, with silt; with rare sand
light gray, with yellowish orange
oxidation along root tubes

408.67
silt, with gravel/pebbles
mottled

408.47
silt, with clay and sand; with layers of silt with clay

408.35
silt, with clay and sand; with layers of silt with clay,
with organic material/soil
abundant leaves and twigs

408.26
coarse sand, with silt; with rare gravel/pebbles

408.23
till: clay and silt, with sand and gravel/pebbles

at 407.71
with rare layers of silt
wispy silt beds

406.64 bottom

EB-1

depth: 2.70 m, 8.86 ft
surface 413.33 m, 1356.14 ft
organic material/soil; clay and silt
dark brown

413.21
till: clay and silt, with coarse sand and
gravel/pebbles
light brown and light grayish brown, with yellowish
orange

413.00
till: clay and silt, with coarse sand and
gravel/pebbles
light brown and light grayish brown, with reddish brown
and brownish black

412.14
gravel/pebbles, with clay and silt
light to medium brown

412.05
till: clay and silt, with coarse sand and
gravel/pebbles
brown and brownish gray, with rare dark yellow orange
oxidized, mottled

411.87
till: clay and silt, with coarse sand and
gravel/pebbles
olive brown, with rare light gray

411.56
till: clay, with silt, with coarse sand and
gravel/pebbles
olive gray

411.20
till: clay, with silt; with rare coarse sand and
gravel/pebbles; with rare layers of coarse silt
olive gray, with rare light gray
silt partings

411.14
till: clay, with silt, with coarse sand and
gravel/pebbles
olive gray

410.63 bottom

EB-2

depth: 2.05 m, 6.73 ft
surface 412.63 m, 1353.85 ft
organic material/soil
dark grayish brown

412.33
till: clay and silt, with coarse sand and gravel/pebbles
light to medium grayish brown, with yellowish orange
many fresh roots

411.73
till: clay and silt, with coarse sand and gravel/pebbles
light to medium grayish brown, with gray

411.33
till: clay and silt, with coarse sand and gravel/pebbles
mottled

at 410.73
with layers of silt and fine sand
wisps of silt and sand

410.73
till
unoxidized

410.58 bottom

EB-3

depth: 4.57 m, 15.0 ft
surface 413.45 m, 1356.54 ft
colluvium and organic material/soil: clay, with silt
dark brown

413.13
colluvium and organic material/soil: clay, with silt; with rare gravel/pebbles
medium yellow brown

413.04
alluvium: clay, with silt, with sand and gravel/pebbles
yellow brown, with yellow orange and dark reddish brown

412.94
alluvium: gravel/pebbles, with clay and silt and sand
medium yellow brown, with yellow orange and dark reddish brown

412.81
till: clay, with silt, with gravel/pebbles; with rare layers of silt
medium brown
silt blebs

412.72
till: clay, with silt, with gravel/pebbles
olive gray, with rare yellow brown

412.33
till: clay, with silt, with gravel/pebbles
olive gray
no oxidation

410.53
till: clay, with silt, with gravel/pebbles; with layers of silt
olive gray, with gray
streaks and blebs of gray silt

408.97
till: clay, with silt, with gravel/pebbles
olive gray
hint of bedding

408.88 bottom

EB-4

depth: 1.74 m, 5.7 ft
surface 413.04 m, 1355.19 ft
organic material/soil: clay
dark brown

412.74
organic material/soil: clay
light to medium yellow brown

412.49
alluvium: gravel/pebbles, with clay and silt
yellow brown

412.43
till: clay, with silt, with gravel/pebbles
medium yellow brown, with yellow orange to yellow brown,
with rare gray

412.01
till: clay, with silt, with gravel/pebbles; with rare
layers of silt
olive gray
oxidation on fractures and root fibers; blebs and
streaks of silt

411.94
till: clay, with silt, with gravel/pebbles
olive gray

at 411.88
with layers of coarse silt
single layer, very thin

411.30 bottom

EB-5

depth: 3.14 m, 10.3 ft
surface 413.19 m, 1355.68 ft
organic material/soil: clay
dark brown

412.89
organic material/soil: clay
yellow brown, with yellow orange and dark gray to black
floodplain?

412.46
alluvium: gravel/pebbles, with clay and silt
yellow brown

412.34
till: clay, with silt, with gravel/pebbles
medium brown, with yellow orange
oxidation along root fibers

412.19
till: clay, with silt, with gravel/pebbles
olive gray

411.67
till: clay, with silt, with gravel/pebbles; with layers of silt
olive gray, with gray and brownish red
wisps and blebs of gray and red silt throughout

410.05 bottom

EB-6

depth: 1.08 m, 3.5 ft
surface 413.21 m, 1355.73 ft
organic material/soil: clay
dark brown

412.90
organic material/soil(?): clay
yellow brown
streaks of oxidation

412.44
alluvium: gravel/pebbles, with silt
brown

412.13 bottom

EB-7

depth: 4.54 m, 14.9 ft
surface 415.08 m, 1361.88 ft
colluvium(?) and organic material/soil
dark grayish brown

414.93
colluvium(?) and/or till: silt, with clay; with rare gravel/pebbles
oxidized; gray film on fractures

414.72
alluvium: silt, with fine sand
dark yellowish orange to dark brown
mottled

414.56
alluvium: gravel/pebbles, with silt
oxidized

414.32
till: clay and silt, with gravel/pebbles
broad areas of weak oxidation

414.17
till: clay and silt, with gravel/pebbles
no oxidation

412.28
till: clay and silt, with gravel/pebbles; with rare layers of silt
silt wisps

412.12
lacustrine: fine sand, with silt

412.03
lacustrine; clay and silt
layered; stones near base

411.79
lacustrine(?): silt, with clay and fine sand, with gravel/pebbles; with layers of silt
disturbed lake beds?; silt partings, randomly oriented

411.61
lacustrine: coarse silt and fine sand
unoxidized; massive lake beds

411.30
lacustrine: clay, with silt; with rare gravel/pebbles; with layers of silt

dark gray, with light gray
bedding random near top, improves some near base;
disturbed lake beds

410.78
lacustrine: silt, with clay, with coarse sand to
gravel/pebbles; with layers of silt
disturbed lake beds; sand and gravel in same proportions
as in till above

410.54 bottom

EB-8

depth: 4.81 m, 15.8 ft
surface 414.32 m, 1359.39 ft
organic material/soil
dark brown

414.14
till: clay, with silt, with coarse sand and gravel/pebbles
strong oxidation on fractures and root tubes

413.80
till
mottled along root tubes and fracture(?)

413.10
till: with rare layers of silt
randomly oriented fragments of silt partings

412.25
till(?): clay, with silt, with coarse sand and gravel/pebbles; with rare layers of silt
unoxidized; distorted thin lenses and partings of silt ([ 5% of sample)

411.27
till(?): clay, with silt, with coarse sand and gravel/pebbles; with layers of silt
unoxidized; distorted thin lenses and partings of silt (5-10% of sample)

at 410.36
with rare layers of coarse sand, with silt
a few streaks 3 mm thick

410.05
till(?): clay, with silt, with coarse sand and gravel/pebbles; with rare layers of silt
unoxidized; lenses or streaks up to 1 cm thick

4:9.51 bottom

EB-9

depth: 4.57 m, 15.0 ft
surface 414.08 m, 1358.6 ft
organic material/soil; clay, with silt
dark brown to black

413.93
colluvium or alluvium: clay, with silt
light tan
roots common

413.87
colluvium or alluvium: clay, with silt
yellow brown
roots common

413.81
colluvium or alluvium: silt, with clay
yellow brown, with yellow orange and reddish brown
roots common

at 413.53
with gravel/pebbles

413.53
alluvium: silt, with clay and gravel/pebbles
brown to yellowish brown
mottled, oxidation along roots

413.41
colluvium or alluvium: clay, with silt and gravel/pebbles
medium yellow brown
resembles oxidized till

413.35
alluvium: gravel/pebbles, with clay and silt
grayish brown

413.23
till: clay, with silt, with gravel/pebbles
olive gray
mainly not oxidized, some oxidation along roots

412.95
till: clay, with silt, with gravel/pebbles
olive gray
no oxidation at all

at 412.80
coarse silt to fine sand
medium gray

layer approx 5 mm thick

412.80
till: clay, with silt, with gravel/pebbles; with layers of coarse silt to fine sand
olive gray
partings, wisps and blebs of silt to sand

412.40
till: clay, with silt, with gravel/pebbles
olive gray

411.64
till: clay, with silt, with gravel/pebbles; with rare layers of silt
olive gray
silt partings, wisps, blebs

411.34
till: clay, with silt, with gravel/pebbles
olive gray

410.27
till: clay, with silt, with gravel/pebbles; with rare layers of silt
olive gray
silt partings

410.12
till: clay, with silt, with gravel/pebbles
olive gray

409.51 bottom

EB-10

depth: 4.30 m, 14.1 ft
414.51 m surface, 1360 ft
organic material/soil: clay, with silt; with rare gravel/pebbles
dark brown

414.36
colluvium or alluvium: silt, with clay; with rare gravel/pebbles and angular rock fragments
light tan, with gray and brown and orange

414.02
alluvium: sand, with silt and gravel/pebbles
gray and brown and yellowish orange and red

413.99
till: clay, with silt, with gravel/pebbles
medium brown
oxidation along roots, less oxidation near bottom

413.87
till: clay, with silt, with gravel/pebbles
olive gray
minor oxidation along root fibers

413.75
till: clay, with silt, with gravel/pebbles
olive gray
no oxidation at all

412.98
till: clay, with silt, with gravel/pebbles; with rare layers of silt
olive gray
partings and blebs of silt

411.76
till: clay, with silt, with gravel/pebbles; with layers of gravel/pebbles with sand
olive gray
gravel layer approx 5 mm thick

411.67
till: clay, with silt, with gravel/pebbles; with layers of silt to fine sand
olive gray
distorted partings

411.46
till: clay, with silt, with gravel/pebbles; with rare layers of silt

olive gray
wispy silt partings

410.85
till: clay, with silt, with gravel/pebbles
olive gray

410.55
till: clay, with silt, with gravel/pebbles; with rare layers of silt
wispy silt partings

410.39
till: clay, with silt, with gravel/pebbles

410.21 bottom

HA1

depth: 1.53 m, 5.0 ft
surface 417.85 m, 1370.96 ft
till
olive gray, with brownish gray and dark yellowish orange
reworked till, mostly unoxidized

417.36
till
reworked, oxidized and disrupted

416.87
alluvium: silt, with organic material/soil and gravel/pebbles
medium to dark brown
grass and weed stems at top

416.81
alluvium: gravel/pebbles, with sand; with rare silt

416.74
till
oxidized

416.32 bottom

HA2

depth: 1.77 m, 5.8 ft
surface 418.07 m, 1371.68 ft
till
olive gray
reworked, mainly unoxidized

417.61
till
reworked, mixed oxidized and unoxidized

417.21
till
reworked, mainly unoxidized

417.00
alluvium: silt
oxidation along root tubes; grass and stems at top

416.94
alluvium: silt
oxidation strong along close-spaced fractures

416.88
alluvium: silt, with sand, with gravel/pebbles; with rare layers of coarse silt to fine sand
small streaks and blebs of silt to sand; oxidized, but decreasing downward

416.57
alluvium: gravel/pebbles, with silt and sand; with layers of fine sand
sand streaks strongly oxidized

416.48
till
oxidized, gray on fractures

416.30 bottom

4-4A

depth: 12.12 m, 39.77 ft
surface 423.1 m, 1388.19 ft
no samples

413.48
fine to medium sand

413.45
silt; with rare layers of fine sand
single layer of sand, 4 mm thick, dips 45 degrees

413.41
clay to clay, with silt; with layers of coarse silt
olive gray
silt zones dip 35 degrees

413.22
fine to coarse sand, with gravel/pebbles

413.19
fine to coarse silt; with rare layers of coarse silt, with silt and gravel/pebbles
one layer, 15 mm thick, dips 45 degrees

413.10
coarse silt
dipping, incoherent

413.06
silt, with clay; with rare gravel/pebbles; with layers of coarse silt
dark olive gray
silt layers discontinuous, subhorizontal

412.86
silt, with clay; with layers of coarse silt
dark olive gray
more silt than above, irregular attitudes

412.65
coarse silt
nearly incoherent

412.61
fine to coarse silt
massive

412.57
clay, with silt, with gravel/pebbles; with layers of coarse silt
5-10% pebbles

412.39
   till: clay and silt, with gravel/pebbles

at 411.91
   with rare sand

at 411.82
   with rare sand

411.50
   till: clay and silt, with gravel/pebbles
   more pebbles than above, approx 15%

411.14
   till: clay and silt, with gravel/pebbles
   more normal proportion of pebbles

410.98 bottom

5-2D

depth: 11.96 m, 39.24 ft
surface 422.22 m, 1385.30 ft
no samples

413.62
till: clay and silt, with gravel/pebbles
olive gray

at 413.57
with layers of coarse silt to fine sand
lens approx 3 mm thick, dips less than 30 degrees

413.41
coarse silt

413.38
silt, with clay; with rare coarse sand and gravel/pebbles
wedge, upper and lower surfaces have different dips

413.35
fine to coarse sand; with rare silt

413.32
coarse silt; with layers of silt with clay
"mess bedded"

413.30
lacustrine: clay and silt and sand
from cuttings

413.20
coarse sand, with silt; with layers of clay with silt; with rare gravel/pebbles
may be disturbed

413.15
coarse silt to fine sand; with layers of clay to fine silt; with rare gravel/pebbles
layers dip approx 20 degrees

413.02
clay, with silt, to fine silt; with rare sand and gravel/pebbles
beds dip approx 20 degrees

412.91
till: clay and silt; with rare to some gravel/pebbles; with layers of silt
pebble content increases downward; silt in wisps

412.71
till: clay and silt, with gravel

at 412.62
with layers of sand

at 412.16
with rare coarse silt

412.01
till: clay and silt, with gravel/pebbles
more pebbles than above, some microlaminations

410.26 bottom

5-2E

depth: 9.19 m, 30.15 ft
surface 422.25 m, 1385.40 ft
no samples

414.05
till
disturbed, soft

413.75
till: clay, with silt, with coarse sand and gravel/pebbles; with layers of coarse silt; with rare fine to medium sand
olive gray
fine to medium sand in one pod

413.67
lacustrine: coarse silt to fine sand; with layers of silt, with clay
light to dark gray
dips substantial

413.55
not cored, may be lake beds

413.35
lacustrine: fine silt, with clay; with layers of coarse silt
distorted layers

413.20
coarse silt to fine sand; with rare layers of silt, with clay

413.11
fine silt, with clay; with layers of coarse silt to sand

413.06 bottom

8-1C

depth: 12.54 m, 41.14 ft
surface 423.18 m, 1388.45 ft
no samples

413.09
till: clay and silt, with gravel/pebbles
olive gray

412.66
till: clay and silt; with rare gravel/pebbles; with rare layers of silt
olive gray, with rare light gray
wisps of silt, less gravel

412.55
coarse silt; with layers of fine sand; clay
gray, with gray to tan and olive gray

412.21
coarse silt, with clay and silt
layering lost, mottled, blobby

at 412.16
with layers of fine sand
brownish gray
dips 25 degrees

412.16
coarse silt
gray

411.37
clay; with layers of coarse silt
olive gray
silt in wisps

410.68
clay; with layers of coarse silt; with rare layers of coarse silt to fine sand
olive gray, with rare brown

410.64 bottom

8-2A

depth: 11.89 m, 39.01 ft
surface 423.18 m, 1388.45 ft
no samples

413.22
till: clay, with silt, with coarse sand and gravel/pebbles
olive gray
no bedding

at 412.94
with layers of fine sand
brownish gray
layer is 1 cm thick

412.94
clay with sand; with rare gravel/pebbles; with layers of coarse silt; with rare layers of fine sand

412.84
till: clay, with silt, with coarse sand and gravel/pebbles; with rare layers of silt
olive gray with rare light gray
silt in tiny blebs, maybe only near top

411.51
till: clay, with silt; with rare gravel/pebbles; with rare layers of coarse silt
olive gray, with rare light gray
silt in wisps and blebs, increases slightly downwards

411.29 bottom

1 (from Giardina)

depth: 15.54 m, 51 ft
no surface elevation given

1.22
clay, with silt; with rare fine gravel/pebbles
brown

1.83
no sample

2.74
clay, with silt; with rare fine gravel/pebbles
brownish gray

3.35
no sample

4.27
clay, with silt; with rare fine gravel/pebbles
gray

4.88
no sample

5.79
silt, with clay; with rare gravel/pebbles
gray

6.40
no sample

7.31
silt, with clay; with rare fine gravel/pebbles
gray

7.92
no sample

8.84
clay, with silt; with rare fine gravel/pebbles
gray

9.45
no sample

10.36
silt, with clay; with rare gravel/pebbles
gray

10.97
no sample

11.89
silt, with clay; with rare gravel/pebbles
gray

12.50
no sample

13.41
silt, with clay; with rare gravel/pebbles
gray

14.02
no sample

14.93
silt, with clay; with rare fine gravel/pebbles
gray

15.54 bottom

2 (from Giardina)

depth: 15.54 m, 51 ft
no surface elevation given

1.22
clay, with silt; with rare fine gravel/pebbles
brown

1.83
no sample

2.74
clay, with silt; with rare fine gravel/pebbles
brown

3.35
no sample

4.27
clay, with silt; with rare fine to medium gravel/pebbles
gray brown

4.88
no sample

5.79
clay, with silt; with rare fine gravel/pebbles
dark gray

6.40
no sample

7.31
silt, with clay; with rare gravel/pebbles
gray

7.92
no sample

8.84
silt, with clay; with rare gravel/pebbles
gray

9.45
no sample

10.36
silt, with clay; with rare fine gravel/pebbles
gray

10.97
no sample

11.89
silt, with clay; with rare gravel/pebbles
gray

12.50
no sample

13.41
silt, with clay; with rare gravel/pebbles
gray
moist

14.02
no sample

14.93
silt, with clay; with rare gravel/pebbles
gray

15.54 bottom

2B

depth:4.88 m, 16.01 ft
no surface elevation given

1.22
? with fine gravel/pebbles
brown gray

1.83
no samples

2.44
clay, with fine gravel/pebbles
brown

3.05
no samples

4.27
clay; with rare gravel/pebbles
gray and brown

4.88 bottom

2C

depth: 4.88 m, 16.01 ft
no surface elevation given

1.22
?; with rare fine gravel/pebbles
gray to brown

1.83
no samples

2.44
clay, with gravel/pebbles
brown

3.05
no samples

4.27
?; with rare gravel/pebbles
gray with rare brown

4.88 bottom

2D

depth: 4.88 m, 16.01 ft
no surface elevation given

1.22
?; with rare gravel/pebbles
brownish gray

1.83
no samples

2.44
?; with gravel/pebbles and angular rock fragments
brown
"looks like fill gravel"

3.05
no samples

4.27
clay; with rare gravel/pebbles
brownish gray

4.88 bottom

3 (from Giardina)

depth: 15.54 m, 51 ft
no surface elevation given

1.22
clay, with silt, with fine gravel/pebbles
brownish gray

1.83
no sample

2.74
clay, with silt, with fine gravel/pebbles
brownish gray

3.35
no sample

4.27
clay, with fine gravel/pebbles
gray
moist

4.88
no sample

5.79
clay, with silt; with rare fine gravel/pebbles
gray

6.40
no sample

7.31
clay, with silt; with rare fine gravel/pebbles
gray
moist

7.92
no sample

8.84
clay, with silt, with fine gravel/pebbles
gray
very moist

9.45
no sample

10.36
clay, with silt; with rare fine gravel/pebbles
gray

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10.97
no sample

11.89
gravel/pebbles, with clay, with silt; with layers of silt
gray
silt lenses

12.50
no sample

13.41
clay, with silt; with rare fine gravel/pebbles
gray

14.02
no sample

14.93
clay, with silt; with rare fine gravel/pebbles
gray

15.54 bottom

4 (from Giardina)

depth:15.54 m, 51 ft
no surface elevation given

1.22
clay, with silt, with fine gravel/pebbles
brownish gray

1.83
no sample

2.74
clay, with silt; with rare fine gravel/pebbles
brown

3.35
no sample

4.27
silt, with clay, with fine gravel/pebbles
brown

4.88
no sample

5.79
clay, with silt; with rare fine gravel/pebbles
gray

6.40
no sample

7.31
clay, with silt; with rare fine gravel/pebbles
gray
moist

7.92
no sample

8.84
gravel/pebbles, with clay, with silt
gray
moist

9.45
no sample

10.36
clay, with silt; with rare fine gravel/pebbles
gray

10.97
no sample

11.89
clay, with silt; with rare fine gravel/pebbles
gray

12.50
no sample

13.41
clay, with silt
gray

at 13.87
with layers of sand

14.02
no sample

14.93
clay, with silt; with rare fine gravel/pebbles
gray

15.54 bottom

6 (from Giardina)

depth: 15.54 m, 51 ft
no surface elevation given

1.22
clay, with silt; with rare fine gravel/pebbles
brown

1.83
no sample

2.74
2.74
clay, with silt; with rare fine gravel/pebbles
brown

3.35
no sample

4.27
clay, with silt; with rare fine gravel/pebbles
gray
moist

4.88
no sample

5.79
silt, with clay; with rare fine gravel/pebbles
gray

6.40
no sample

7.31
silt, with clay, with fine gravel/pebbles
gray
moist

7.92
no sample

8.84
clay, with silt, with fine gravel/pebbles
gray

10.67
no sample

11.89
silt, with clay; with rare fine gravel/pebbles
gray

12.50
no sample

13.41
clay, with silt; with rare fine gravel/pebbles
gray

14.02
no sample

14.93
silt, with clay; with rare fine gravel/pebbles
gray

15.54 bottom

6 (from Giardina)

depth: 15.54 m, 51 ft
no surface elevation given

1.22
clay, with silt; with rare fine gravel/pebbles
brown

1.83
no sample

2.74
2.74
clay, with silt; with rare fine gravel/pebbles
brown

3.35
no sample

4.27
clay, with silt; with rare fine gravel/pebbles
gray
moist

4.88
no sample

5.79
silt, with clay; with rare fine gravel/pebbles
gray

6.40
no sample

7.31
silt, with clay, with fine gravel/pebbles
gray
moist

7.92
no sample

8.84
clay, with silt, with fine gravel/pebbles
gray

10.67
no sample

11.89
silt, with clay; with rare fine gravel/pebbles
gray

12.50
no sample

13.41
clay, with silt; with rare fine gravel/pebbles
gray

14.02
no sample

14.93
silt, with clay; with rare fine gravel/pebbles
gray

15.54 bottom

7B (from Giardina)

depth: 15.54 m, 51 ft
no surface elevation given

1.22
clay, with silt; with rare fine gravel/pebbles
brown

1.83
no sample

2.74
clay, with silt; with rare fine gravel/pebbles
brown

3.35
no sample

4.27
clay, with silt; with rare fine gravel/pebbles
gray

4.88
no sample

5.79
clay, with silt; with rare fine gravel/pebbles
gray
moist

6.40
no sample

10.36
silt, with clay; with rare fine gravel/pebbles
gray
moist

10.97
no sample

11.89
silt, with clay; with rare fine gravel/pebbles
gray
moist

12.50
no sample

13.41
silt, with clay; with rare fine gravel/pebbles
gray

moist

14.02
no sample

14.93
silt, with clay; with rare fine gravel/pebbles
gray
moist

15.54 bottom

8 (from Giardina)

depth: 15.54 m, 51 ft
no surface elevation given

1.22
clay, with silt; with rare fine gravel/pebbles
brown

1.83
no sample

2.74
clay, with silt; with rare fine gravel/pebbles
brown

3.35
no sample

4.27
clay, with silt; with rare fine gravel/pebbles
grayish brown

4.88
no sample

5.79
clay, with silt; with rare fine gravel/pebbles
gray

6.40
no sample

7.31
clay, with silt; with rare fine gravel/pebbles
gray

7.92
no sample

8.84
silt, with clay; with rare fine gravel/pebbles
gray

9.45
no sample

10.36
silt, with clay; with rare fine gravel/pebbles
gray

10.97
no sample

11.89
silt, with clay; with rare fine gravel/pebbles
gray

12.50
no sample

13.41
silt, with clay; with rare fine gravel/pebbles
gray

14.02
no sample

14.93
silt, with clay; with rare fine gravel/pebbles
gray

15.54 bottom

9 (from Giardina)

depth: 15.54 m, 51 ft
no surface elevation given

1.22
clay, with silt, with fine gravel/pebbles
brown

1.83
no sample

2.74
clay, with silt, with fine gravel/pebbles
brown
moist

3.35
no sample

4.27
clay, with silt, with fine gravel/pebbles
gray
moist

4.88
no sample

5.79
silt, with clay; with rare fine gravel/pebbles
gray
moist

6.40
no sample

7.31
silt, with clay, with fine gravel/pebbles
gray
moist

7.92
no sample

8.84
silt, with clay, with fine gravel/pebbles
gray
moist

10.67
no sample

11.89

clay, with silt; with rare fine gravel/pebbles
gray
moist

12.50
no sample

13.41
silt, with clay, with fine gravel/pebbles
gray
moist

14.02
no sample

14.93
silt, with clay, with fine gravel/pebbles
gray
moist

15.54 bottom

9B

depth: 4.88 m, 16 ft
no surface elevation given

2.44
?, with gravel/pebbles
brownish gray

3.05
no samples

3.66
?, with fine gravel/pebbles
gray

4.27
?, with fine gravel/pebbles
gray

4.88 bottom

9C

depth: 4.88 m, 16 ft
no surface elevation given

2.44
?; with rare gravel/pebbles
brownish gray

3.05
no samples

3.66
?, with fine gravel/pebbles
gray

4.27
clay; with rare gravel/pebbles
gray

4.88 bottom

9D

depth: 4.88 m, 16 ft
no surface elevation given

2.44
?; with rare gravel/pebbles
brown

3.05
no samples

3.66
clay; with rare gravel/pebbles
gray

4.27
clay; with rare gravel/pebbles
gray

at 4.42
with layers of sand

4.88 bottom

10 (from Giardina)

depth: 15.54 m, 51 ft
no surface elevation given

1.22
clay, with silt; with rare fine gravel/pebbles
brown

1.83
no sample

2.74
clay, with silt; with rare fine gravel/pebbles
brown

3.35
no sample

4.27
silt, with clay; with rare fine gravel/pebbles
gray
moist

4.88
no sample

5.79
clay, with gravel/pebbles,
with silt
gray
moist

6.40
no sample

7.31
gravel/pebbles, with silt, with clay
gray
moist

7.92
no sample

8.84
silt, with clay; with rare fine gravel/pebbles
gray
moist

9.45
no sample

10.36

silt, with clay; with rare fine gravel/pebbles
gray
moist

10.97
no sample

11.89
silt, with clay, with fine gravel/pebbles
gray
moist

12.50
no sample

13.41
silt, with clay; with rare fine gravel/pebbles
gray
moist

14.02
no sample

14.93
clay, with fine gravel/pebbles, with silt
gray
moist

15.54 bottom

12

depth:7.92 m, 26 ft
no surface elevation given

3.05
clay, with gravel/pebbles
brown

3.66
no samples

4.27
?; with rare fine gravel/pebbles
gray

4.88
no samples

5.49
?, with gravel/pebbles
brown gray

5.73
no samples

6.71
clay; with rare gravel/pebbles
gray

7.31
clay; with rare gravel/pebbles
gray

7.92 bottom

13

depth: 14.63 m, 48 ft
no surface elevation given

3.66
?, with fine gravel/pebbles
brownish gray

4.27
no samples

5.49
clay; with rare gravel/pebbles
gray

6.10
no samples

7.31
clay; with rare gravel/pebbles
gray

7.92
no sample

9.75
clay; with rare sand
gray

10.36
no sample

14.00
clay
gray

14.63 bottom

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2A (core log by Davis)

depth: 7.32 m, 24 ft
surface 419.52 m, 1376.43 ft
organic material/soil

419.42
clay and silt
gray and brown
mottled; disturbed fill

at 418.14
with layers of silt

417.74
organic material/soil
with roots, green and black layers; developed soil layer

416.77
clay, with silt; with rare gravel/pebbles
brown
weathered; tough and homogeneous

at 416.16
signs of thin layers, material not specified

415.10
clay; with rare gravel/pebbles
gray
unweathered

at 414.18
with layers of fine sand

412.20 bottom

9A (core log by Davis)

depth: 7.01 m, 23 ft
no surface elevation given

0.15
clay, with silt
gray and brown
disturbed fill

at 1.98
with layers of silt
silty partings

2.74
clay, with silt, with gravel/pebbles
brown
weathered

3.81
clay, with silt, with gravel/pebbles
brown to gray
transition

4.27
clay, with silt, with gravel/pebbles
gray
unweathered

at 5.18
with layers of gravel/pebbles
single layer of pebbles

5.94
silt and fine sand, with clay and gravel/pebbles

at 6.25
one root hair

6.40
clay
soft

6.55
clay with silt and coarse sand

6.86
clay

at 6.92
with layers of coarse sand
red
gritty parting

7.01 bottom

1 (from log of samples by Bailey)

depth:  15.54 m, 51 ft
no surface elevation given; top and bottom of sample not specified

at approx 6.10 m
silt; with rare fine to coarse sand and gravel/pebbles
light to medium olive gray
no bedding

at approx 9.14
as above

at approx 10.67
as above

at approx 12.19
as above

at approx 13.72
as above

at approx 15.24
as above

2 (from log of samples by Bailey)

depth: 15.54 m, 51 ft
no surface elevation given; top and bottom of sample not specified

at approx 1.52 m
silt; with rare fine to coarse sand and gravel/pebbles
light olive gray with dark yellowish orange
sand and pebbles randomly distributed

at approx 4.57
as above
light olive gray with dark yellowish orange and light orange
then light olive gray with medium gray
then light olive gray

at approx 6.10
olive gray
then olive gray with dark yellowish orange and medium brown

at approx 7.62
silt; with rare fine to coarse sand and gravel/pebbles
olive black to olive gray to light olive gray
color depends on dampness of sample; no bedding

at approx 9.14
as above

at approx 10.67
as above

at approx 12.19
as above

at approx 13.72
as above

at approx 1[illegible]
as abov[illegible]

2A (from log of samples by Bailey)

depth: 7.31 m, 24 ft
no surface elevation given

0.09 m
silt, with fine sand and gravel/pebbles
olive gray
possible faint contorted banding

0.46
silt, with fine sand and gravel/pebbles
olive gray, with rare dark yellowish orange
orange on partings

0.91
silt; with rare gravel/pebbles
light to medium olive gray, with rare dark yellowish orange
orange oxidation bands and films

1.37
silt, with sand; with layers of organic material/soil
olive black and yellow
organic material black, in contorted layers

1.83
silt; with rare fine sand and gravel/pebbles
dark yellowish brown, with grayish orange
mottled

2.29
silt; with rare fine sand and gravel/pebbles
dark yellowish brown
more pebble than immediately above

2.74
silt; with rare fine to medium sand and gravel/pebbles
dark yellowish brown, with rare medium gray
mottled

3.20
silt; with rare fine sand and gravel/pebbles
dark yellowish brown

3.66
silt; with rare fine sand and gravel/pebbles
dark yellowish brown

4.11
silt; with rare fine to coarse sand and gravel/pebbles
yellowish brown

4.57
silt; with rare fine sand and gravel/pebbles
yellowish brown

5.03
silt; with rare fine sand and gravel/pebbles
yellowish brown

5.49
silt; with rare fine sand and gravel/pebbles
yellowish brown

5.94
silt; with rare fine sand and gravel/pebbles
yellowish brown

6.40
silt; with rare fine sand and gravel/pebbles
yellowish brown

6.86
silt; with rare fine sand and gravel/pebbles
yellowish brown

7.31 bottom

2B (from log of samples by Bailey)

depth: 4.88 m, 16 ft
no surface elevation given; top and bottom of sample not specified

at approx 1.52 m
silt; with rare fine to coarse sand and gravel/pebbles
light to dark yellowish brown

at approx 2.74
light olive gray, with light yellowish gray

at approx 4.27
yellowish gray, to light olive gray

at approx 4.88
light olive gray with grayish orange

2C (from log of samples by Bailey)

depth: 4.88 m, 16 ft
no surface elevation given; top and bottom of sample not specified

1.22 m
silt; with rare silt and fine to coarse sand and gravel/pebbles
light olive gray

1.83 bottom

2D (from log of samples by Bailey)

depth: 4.88 m, 16 ft
no surface elevation given; top and bottom of sample not specified

1.22 m
silt, with fine sand; with rare gravel/pebbles
light olive gray, with rare grayish orange and dark yellowish orange
mottled

1.83
no sample

2.44
gravel/pebbles, with silt; with rare fine sand
yellowish gray and dark yellowish orange
mottled

3.05
no sample

3.66
silt; with rare fine sand and gravel/pebbles
light olive gray, with dark yellowish orange
mottled

4.27
silt; with rare fine sand and gravel/pebbles
light yellowish brown

4.88 bottom

3 (from log of samples by Bailey)

depth: 15.54 m, 51 ft
no surface elevation given; top and bottom of samples not specified

at approx 1.52
silt; with rare fine to coarse sand and gravel/pebbles
light olive gray
one rootlet

at approx 3.05
light olive gray, with grayish orange

at approx 4.57
olive gray
then dark yellowish orange
then olive gray and dark yellowish orange
chaotically mottled

at approx 6.10
silt; with rare fine to coarse sand and gravel/pebbles
olive black, to olive gray, to light olive gray
color depends on dampness; no bedding

at approx 7.62
as above

at approx 9.14
as above

at approx 10.67
as above

at approx 12.19
fine sand, with silt; with rare gravel/pebbles
light brown, with light olive gray
poor porosity and permeability; no bedding

at approx 13.72
as above at 6.10

at approx 15.24
as above

4 (from log of samples by Bailey)

depth: 15.54 m, 51 ft
no surface elevation given; top and bottom of samples not specified

at approx 3.05 m
silt; with rare fine to coarse sand and gravel/pebbles
dark grayish orange

at approx 4.57
light grayish orange
then light olive gray

at approx 6.10
silt; with rare fine to coarse sand and gravel/pebbles
light olive gray
pebbles and sand randomly distributed; no bedding

at approx 7.62
as above

at approx 9.14
as above

at approx 10.67
as above

at approx 12.19
as above

at approx 15.24
silt,with fine sand
fair porosity and permability,
approx. 40% sand; no bedding

5 (from log of samples by Bailey)

depth: 15.54 m, 51 ft

no surface elevation given; top and bottom of samples not specified

at approx. 1.52 m
silt, with gravel/pebbles
yellowish gray, with yellowish orange
up to 40% pebbles

at approx. 3.05
silt; with rare fine to coarse sand and gravel/pebbles
grayish orange to medium yellowish brown,
with light olive gray then light gray

at approx. 4.57
light olive gray
then yellowish gray to light olive gray

at approx. 6.10
light olive gray, with rare yellowish gray

at approx. 7.62
as above

at approx. 9.14
as above

at approx. 10.67
fine sand, with silt
light olive gray
porosity and permability fair, sand 50%, no bedding

at approx. 13.72
light olive gray, with rare yellowish gray

at 15.24
surface material may be mixed in

6 (from log of samples by Bailey)

depth: 15.54 m, 51 ft

no surface elevation given; top and bottom of samples not specified

at approx. 1.52 m
silt; with rare fine to coarse sand and gravel/pebbles
grayish orange, with light gray

at approx. 3.05
yellowish gray

at 4.57
olive black with light gray, then
olive gray, with grayish orange, then
light olive gray, then light olive gray,
with rare dark yellowish orange

at approx. 6.10
light olive gray to light gray

at approx. 7.62
as above

at approx. 12.19
as above

at approx. 13.72
as above

at approx. 15.24
as above

7b (from log of samples by Bailey)

depth: 15.54 m, 51 ft.
no surface elevation given; top and bottom of samples
not specified

at approx. 1.52
gravel/pebbles, with silt and sand
light to dark yellowish brown, with dark yellowish
orange
chaotic

at approx. 3.05
silt; with rare fine to coarse sand and gravel/pebbles
yellowish gray with light gray
then grayish orange with yellowish brown to medium brown
then grayish orange to yellowish brown
mottled

at approx. 4.57
dark yellowish brown
then light olive gray

at approx. 6.10
olive black to light olive gray

at approx. 7.62
medium to coarse sand; with rare gravel/pebbles
olive gray to olive black
good porosity and permability; no bedding

at approx. 9.14
silt; with rare fine to coarse sand and gravel/pebbles
light to medium olive gray, to olive black
sand and pebbles randomly distributed; no bedding

at approx. 10.67
as above

at approx. 12.19
as above

at approx. 13.72
as above

at approx. 15.24
as above

8 (from log of samples by Bailey)

depth: 15.54 m, 51 ft

no surface elevation given; top and bottom of samples not specified

at approx. 3.05
silt; with rare fine to coarse sand and gravel/pebbles
yellowish gray, with grayish orange

at approx. 4.57
light gray, then light olive gray

at approx. 6.10
silt; with rare fine to coarse sand and gravel/pebbles
light to medium olive gray
sand and gravel randomly distributed; no bedding

at approx. 7.62
as above

at approx. 10.67
as above

at approx. 12.19
as above

at approx. 13.72
as above

at approx. 15.24
as above

9 (from log of samples by Bailey)

depth: 15.54 m, 51 ft

no surface elevation given; top and bottom of samples not specified

at approx. 1.52
silt; with rare fine to coarse sand and gravel/pebbles
dark yellowish brown, with light yellowish
orange and medium reddish brown
roots or stems present

at approx. 3.05
light olive gray, with grayish orange
then yellowish gray, with grayish brown
pinpoint mottling

at approx. 4.57
light olive gray, with grayish orange
then olive gray

at approx. 6.10
silt; with rare fine to coarse sand and gravel/pebbles
light to medium olive gray
pebbles and sand randomly distributed; no bedding

at approx. 7.62
as above

at approx. 12.19
as above

at approx. 13.72
as above

at approx. 15.24
as above

9A (from log of samples by Bailey)

depth: 7.01 m, 23 ft

no surface elevation given; top and bottom of sample not
specified

0.15
silt; with organic material/soil and gravel/pebbles
olive gray

0.61
silt; with rare fine sand and gravel/pebbles
medium olive gray

1.07
silt; with rare organic material/soil and fine sand
olive gray, with black
irregular black layers or films

1.52
silt; with rare fine sand and gravel/pebbles;
with layers of clay
medium olive gray, with yellow
yellow areas of clay, not really layers

1.98
silt; with rare fine sand and gravel/pebbles
dark to medium yellowish brown

2.44
silt; with rare coarse sand and gravel/pebbles;
with rare layers of fine sand
dark yellowish brown, with light olive brown to grayis
yellow
partings of fine sand in one end of sample

2.90
silt; with rare fine to coarse sand and gravel/pebbles
dark yellowish brown

3.35
silt, with fine sand;
with rare gravel/pebbles
dark yellowish brown

3.81
silt; with rare clay and fine sand and gravel/pebbles
dark yellowish brown
clays in irregular areas

4.27
silt, with fine sand;

with rare coarse sand and gravel/pebbles
medium olive gray

4.72
silt; with rare gravel/pebbles
medium olive gray

5.18
silt, with fine sand;
with rare coarse sand and gravel/pebbles
light to medium olive gray

5.64
silt
medium olive gray

6.10 bottom

9B (from log of samples by Bailey)

depth: 4.88 m, 16 ft

no surface elevation given; top and bottom of samples not specified

at approx. 2.74
silt; with rare fine to coarse sand and gravel/pebbles
medium yellowish brown, with light olive gray

at approx 3.05
light olive gray, with dark yellowish orange

at approx. 4.57
dark yellowish brown, with rare light gray

9C (from log of samples by Bailey)

depth 4.88 m, 16 ft

no surface elevation given; top and bottom of samples not specified

at approx. 2.74
silt; with rare fine to coarse sand and gravel/pebbles
light to medium olive gray
then light to medium olive gray, with dark yellowish orange

at approx. 4.27
light olive gray, with dark yellowish orange and light brown

at approx. 4.88
silt; with rare fine to coarse sand and gravel/pebbles
light to medium olive gray
pebbles and sand randomly distributed;
no bedding

9D (from log of samples by Bailey)

depth: 4.88 m, 16 ft

no surface elevation given; top and bottom of samples not specified

2.44
silt; with rare fine sand and gravel/pebbles
yellowish gray, with rare yellow
yellow partings

3.05
no sample

3.66
silt; with rare fine to coarse sand and gravel/pebble
light olive gray

4.27
clay, with silt and fine sand;
with rare coarse sand and gravel/pebbles
light olive gray
gritty; no bedding

4.88 bottom

10 (from log of samples by Bailey)

depth: 15.54 m, 51 ft

no surface elevations given; top and bottom of samples not specified

at approx. 1.52
silt; with rare fine to coarse sand and gravel/pebbles
yellowish gray, with light yellowish orange

at approx. 3.05
yellowish gray, with light orange and grayish orange

at approx. 4.57
yellowish gray, then light olive gray

at approx. 6.10
light to medium olive gray
sand and pebbles randomly distributed; no bedding

at approx. 7.62
as above

at approx. 9.14
as above

at approx. 10.67
as above

at approx. 12.19
as above

at approx. 13.72
as above

at approx. 15.24
as above

12 (from log of samples by Bailey)

depth: 7.92 m, 26 ft

no surface elevations given; top and bottom of samples not
specified

at approx. 3.35
silt; with rare fine to coarse sand and gravel/pebbles
light olive gray, with grayish orange
to dark yellowish orange
mottled areas same texture as main;
pebbles and sand randomly distributed; no bedding

at approx. 4.57
light to medium olive gray

at approx 5.64
light olive gray, with yellowish gray

at approx. 6.71
light olive gray

13 (from log of samples by Bailey)
depth: 14.63 m, 48 ft

no surface elevation given; top and bottom of samples not specified

at approx. 3.66
silt; with rare fine to coarse sand and gravel/pebbles

yellowish gray, with light gray, and rare dark yellowish orange

at approx. 5.79
olive gray

at approx. 6.40
light to medium olive gray

at approx. 7.01
as above

at approx. 9.45
with layers of fine sand
bleb of sand 15 X 25 X 40 mm on edge of sample

at approx. 10.06
silt; with rare fine sand and coarse sand
olive gray with light gray
then light yellowish brown
silt; with rare gravel/pebbles;
with layers of fine sand
olive gray, with rare light gray
bleb of sand 20 X 20 X 35 mm

at ?
silt; with rare gravel/pebbles;
with layers of fine sand
olive gray
irregular bleb of sand 10 mm
thick at one end of sample

at ?
silt; with rare gravel/pebbles;
with layers of fine sand
olive gray
irregular bleb of sand 20 X 20 X 40 mm

at approx. 14.02
silt; with rare fine to coarse sand and gravel/pebbles
olive gray, with light gray

B-1 (N of trench)

depth 46.33 m, 151.5 ft

surface 408.8 m, 1341.40 ft
fine to coarse gravel/pebbles, with clay, with silt
brownish gray
some cobbles

407.01
clay, with silt; with rare fine to coarse gravel/pebb
gray

389.03
silt, with clay; with rare fine sand
gray

382.63
gravel/pebbles
no core samples

382.02
silt, with clay; with rare fine sand
gray

381.10
clay, with silt
dark gray

378.21
silt, with clay
gray

377.90
clay, with silt, with fine gravel/pebbles
gray

375.16
fine to coarse gravel/pebbles,
with fine to coarse sand and, with rare clay
gray

374.25
clay, with silt
gray

368.00
silt, with clay
dark gray

362.82
clay, with silt
dark gray

362.51 bottom

B-2 (N of trench)

depth: 30.94 m, 101.5 ft

surface 407.24 m, 1336.14 ft
organic material/soil and clay, with silt
brownish gray

406.78
clay, with silt; with rare fine gravel/pebbles;
with rare layers of fine sand
gray

406.71
fine to medium sand; with rare fine gravel/pebbles
dark gray

404.49
clay, with silt; with rare fine to coarse gravel/pebbles
gray
some cobbles

389.71
fine sand; with rare silt
brownish gray

385.75
fine to medium sand; with rare silt
brownish gray

385.44
fine gravel/pebbles, with fine to medium sand
brownish gray

384.68
silt, with clay
gray

380.11
fine to coarse gravel/pebbles, with clay;
with rare silt and fine to coarse sand
gray

378.59
clay, with silt; with rare fine to coarse gravel/pebbles
gray

376.30 bottom

B-3 (N of trench)

depth: 30.63 m, 100.5 ft

surface 404.78 m, 1328.08 ft
clay, with silt; with rare fine gravel/pebbles
and organic material/soil
gray

402.95
coarse gravel/pebbles
no core sample

402.04
clay, with silt, with fine to medium gravel/pebbles
gray

381.92
fine sand, with silt
brownish gray

376.12
fine to coarse angular rock fragments, with silt;
with rare clay and fine to coarse sand
gray

374.15 bottom

B-4 (N of trench)

depth: 30.78 m, 101.5 ft

surface 415.18 m, 1362.2 ft
fine to coarse gravel/pebbles, with clay;
with rare fine to coarse sand
brownish gray

414.26
clay, with silt; with rare fine to medium gravel/pebbles
gray

404.51
fine to coarse gravel/pebbles, with clay, with silt;
with rare fine to medium sand
gray

404.05
clay, with silt; with rare fine to medium gravel/pebbles
gray

402.68
fine sand, with silt
gray

402.22
clay, with silt, with fine to medium gravel/pebbles
gray

394.15
fine to medium sand, with clay; with rare fine
gravel/pebbles
gray

393.39
clay, with fine silt; with rare fine gravel/pebbles;
with rare layers of fine sand
gray

at 384.40
fine sand, with silt
brownish gray

384.40 bottom

B-5 (N of trench)

depth: 31.09 m, 102.0 ft

surface 414.48 m, 1359.9 ft
   clay, with silt; with rare fine to coarse gravel/pebb
   gray
   some cobbles

384.61
   fine sand, with silt; with rare gravel/pebbles
   brownish gray

383.39 bottom

B-6 (N of trench)

depth: 30.94 m, 101.5 ft

surface 392.20 m, 1286.8 ft
clay,with silt, with rare fine sand and gravel/pebbles
brownish gray

391.74
clay, with silt; with rare fine gravel/pebbles
gray

at 390.37
with layers of sand

376.96
clay, with silt; with rare fine gravel/pebbles;
with rare layers of fine sand
gray
sand lenses

374.82
silt, with clay; with rare fine sand
gray

at 368.12
gravel/pebbles
no core sample; pocket of gravel

366.29
clay, with silt; with rare fine gravel/pebbles
gray

361.26 bottom

B-7 (N of trench)

depth: 21.94 m, 72 ft

surface 421.45 m, 1382.78 ft
fine to coarse gravel/pebbles, with fine to medium sa
with rare silt
brownish gray

420.99
silt, with clay; with rare sand and fine to coarse gravel/pebbles
brown

419.93
clay, with silt, with fine to medium gravel/pebbles
gray

414.14
clay, with silt, with gravel/pebbles
gray

406.21
clay, with silt, with coarse gravel/pebbles
gray
some cobbles

403.47
clay, withsilt, with rare gravel/pebbles

at 401.03
gravel/pebbles
no core sample; pocket of gravel

400.42
silt, with clay; with rare fine sand
gray

399.51 bottom

TP-1 (N of trench)

depth: 3.66m, 12 ft

surface 414.51 m, 1360 ft
organic material/soil and clay, with silt;
with rare fine to coarse gravel/pebbles
brownish gray
many roots and fibers

at 410.85
brownish gry and gray brown, with rare orange brown
some cobbles

410.85 bottom

TP-2 (N of trench)

depth: 2.74 m, 9 ft

surface 416.03 m, 1365 ft
clay, with silt, with sand; with rare fine to coarse gravel/pebbles
brownish gray
some roots; cobbles at 415.42 m

414.96
clay, with silt, with fine gravel/pebbles
brownish gray
some roots

413.29 bottom

TP-3 (N of trench)

depth: 2.74m, 9 ft

surface 420.60 m, 1380 ft
clay, with silt; with rare sand
yellowish brown to brown

419.69
clay, with silt; with rare fine to coarse gravel/pebbles
brownish gray

417.86 bottom

TP-4 (N of trench)

depth: 2.59 m, 8.5 ft

surface 416.03 m, 1365 ft
clay, with silt; with rare fine to coarse gravel/pebbl
brownish gray
some brown staining

413.44 bottom

TP-5 (N of trench)

depth: 2.43 m, 8 ft

surface 412.98 m, 1355 ft
clay, with silt, with rare sand and gravel/pebbles
brown
some roots

412.37
clay, with silt; with rare fine to coarse gravel/pebbles
brownish gray

410.55 bottom

TP-6 (N of trench)

depth: 2.74 m, 9 ft

surface 416.03m, 1365 ft
clay, with silt, with coarse gravel/pebbles;
with rare sand
brown
much gravel and cobbles

415.73
clay, with silt, with sand and fine gravel/pebbles
brown

415.27
clay, with silt; with rare fine to coarse gravel/pebb
brownish gray

413.29 bottom

TP-7 (N of trench)

depth: 2.81 m, 9 ft

surface approx. 426.70 m, 1400 ft
fine to coarse gravel/pebbles, with clay, with silt
brown
with cobbles and boulders

423.96 bottom

DM 1 (plant)

depth: 18.90 m, 62.0 ft

surface 423.28 m, 1388.77 ft
surface 423.2ay, with organic silt, with clay, with organic material/soil
brown and gray
mottled, with roots

422.22
gravel/pebbles, with sand
gray

421.30
clay,with silt, with gravel/pebbles
brownish gray

413.23
gravel/pebbles, with sand
grayish brown

412.86
clay, with silt and sand, with gravel/pebbles
brownish gray

at 409.87
grading to less silt and sand

404.38 bottom

DM 2 (plant)

depth: 23.47 m, 77.0 ft

surface 423.77 m, 1390.38 ft
clay, with organic material/soil
brown

423.46
gravel/pebbles, with sand
brownisn gray

420.41
clay, with silt, with gravel/pebbles; brownish gray

408.53
clay, with silt;
with gravel/pebbles; with rare sand
brownish gray

407.31
gravel/pebbles, with sand

407.00
clay, with silt, with gravel/pebbles
brownish gray

400.30 bottom

DM 3 (plant)

depth: 8.23 m, 27.0 ft

surface 422.46 m, 1386.10 ft
   silt and sand and gravel/pebbles
   brown and gray
   mottled

421.55
   clay, with silt, with gravel/pebbles
   brownish gray

414.23 bottom

DM 4 (plant)

depth: 8.23 m, 27.0 ft

surface 422.46 m, 1386.10 ft
silt and sand and gravel/pebbles
brown and gray
mottled

420.02
clay, with silt, with gravel/pebbles
brownish gray

414.23 bottom

DM 5 (plant)

depth:  12.80 m, 42.0 ft

surface 424.86 m, 1393.97 ft
silt and sand and gravel/pebbles
tan and brown
mottled

422.42
clay, with silt, with gravel/pebbles
brownish gray

415.72
silt and sand
gray

415.41
gravel/pebbles,with sand

414.96
clay, with silt, with gravel/pebbles
brownish gray

412.06 bottom

DM 6 (plant)

depth: 12.80 m, 42.0 ft

surface 423.82m, 1390.56 ft
organic material/soil

423.52
clay and silt and gravel/pebbles
brown

422.07
clay, with silt, with gravel/pebbles
and angular rock fragments
brownish gray

417.73
clay, with silt, with gravel/pebbles and angular
rock fragments;
with rare sand

416.20
clay, with silt, with gravel/pebbles and angular rock
fragments

411.02 bottom

DM 7 (plant)

depth 50.29 m, 165 ft

surface 424.88 m, 1394.03 ft
clay, with silt, with organic material/soil
and gravel/pebbles

424.27
clay and silt and sand and gravel/pebbles
and angular rock fragments
tan and gray
mottled

421.22
clay, with silt; with rare gravel/pebbles
brownish gray

418.17
clay, with silt

412.69
clay,with silt; with rare gravel/pebbles

400.50
silt and sand, with gravel/pebbles
and angular rock fragments
dark gray

396.23
fine sand, with silt; with rare layers of clay
dark grayish brown
clay layers are lenses

393.79
silt, with clay
dark gray

385.26
silt; with rare clay

376.72
silt; with rare clay and gravel/pebbles

374.59 bottom

DM 8 (plant)

depth 12.80 m, 42 ft

depth 12.80 m, 4, 1396.99 ft
surface 425.69 m, 1396.99 ft
silt and sand and gravel/pebbles
and angular rock fragments
brown

422.34
clay, with silt, with gravel/pebbles

412.89 bottom

DM 9 (plant)

depth 7.32 m, 24 ft

surface 424.79m, 1393.73 ft
clay and silt and sand and gravel/pebbles
brown

420.83
clay, with silt; with rare gravel/pebbles
gray

417.47 bottom

DM 10 (plant)

depth 8.24 m, 27 ft

surface 424.79 m, 1393.73 ft
silt and sandand gravel/pebbles
and angular rock fragments
brown

421.13
clay, with silt, with gravel/pebbles
brownish gray

416.55 bottom

DM 12 (plant)

depth: 24.99 m, 82 ft

surface 423.61 m, 1389.88 ft
organic material/soil and clay, with silt
grayish brown

422.55
clay and silt and sand, with gravel/pebbles
brown

416.28
clay, with silt, with gravel/pebbles
and angular rock fragments
brownish gray

414.17
clay, with silt; with rare gravel/pebbles
and angular rock fragments

398.62 bottom

DM 15 (plant)

depth : 8.22 m, 27 ft

surface 420.05 m, 1378.2 ft
organic material/soil and silt with clay;
with rare gravel/pebbles
brown

419.83
silt, with clay; with rare gravel/pebbles
brown

417.92
clay, with silt; with rare gravel/pebbles
grayish brown

411.83 bottom

DM 16(plant)

depth 18.90 m, 62 ft

surface 429.50 m, 1409.18 ft
organic material/soil and silt, with clay,
with gravel/pebbles
brown

429.45
silt, with clay, with gravel/pebbles
brown

428.58
clay and silt and sand, with gravel/pebbles
and angular rock fragments
tan and gray
mottled

421.42
clay, with silt
brown

421.14
clay and silt and sand and gravel/pebbles
brown

417.61
clay, with silt, with gravel/pebbles
and angular rock fragments
brownish gray

410.60 bottom

DM 17 (plant)

depth: 12.80 m, 42 ft

surface 428.73 m, 1406.67 ft
organic material/soil and silt, with clay, with gravel/pebbles
brown

428.63
silt, with clay, with gravel/pebbles
brown

427.82
clay and silt and sand and gravel/pebbles and angular rock fragments
brown

423.70
clay, with silt; with layers of gravel/pebbles
brownish gray

421.42
clay and silt and sand and gravel/pebbles
brown

419.13
clay, with silt; with layers of gravel/pebbles
brownish gray

15.93 bottom

DM 18 (plant)

depth: 20.42 m, 67 ft

surface 430.87 m, 1413.69 ft
organic material/soil and silt, with clay
brown

430.80
silt, with clay
brown

429.96
clay and silt and sand, with gravel/pebbles
brown

424.32
clay, with silt, with gravel/pebbles
and angular rock fragments
brownish gray

423.25
clay, with silt; with rare gravel/pebbles
brownish gray

418.38
clay, with silt, with gravel/pebbles;
with rare fine sand
brownish gray

411.67
clay and silt and sand and angular rock fragments
green

410.45 bottom

DM 19 (plant)

depth: 15.84 m, 52 ft

surface 431.51 m, 1415.8 ft
organic material/soil and silt, with clay
brown

431.36
silt, with clay
brown

430.91
clay and silt and sand and gravel/pebbles
and angular rock fragments
brown

427.71
clay, with silt, with rare sand
brownish gray

420.39
clay and silt and sand and gravel/pebbles
gray

419.32
clay, with silt, with gravel/pebbles
gray

418.56
clay and silt and sand and gravel/pebbles
gray

415.67 bottom

DM 20 (plant)

depth 24.99 m, 82 ft

surface 430.83 m, 1413.56 ft
organic material/soil and silt and sand and gravel/pebbles and angular rock fragments
brown

430.76
silt and sand and gravel/pebbles and angular rock fragments
brown

429.31
gravel/pebbles and angular rock fragments, with silt
sand
brown

424.28
sand; with rare fine gravel/pebbles
brown

423.67
clay, with silt; with rare sand and fine gravel/pebb
brownish gray

420.16
clay, with silt; with rare sand and fine gravel/pebbles; with rare layers of fine sand
brownish gray

418.95
clay, with silt; with rare sand and fine gravel/pebb
brownish gray

416.81
silt and sand and gravel/pebbles, with clay
brownish gray

415.59
silt and gravel/pebbles, with clay
brownish gray

413.15
clay and silt and sand and gravel/pebbles and angular rock fragments
greenish gray

409.19
clay and silt and sand and fine gravel/pebbles, with angular rock fragments
greenish gray

405.84 bottom

DM 21 (plant)

depth 24.38 m, 80 ft

surface 432.03m, 1417.5 ft
organic material/soil and silt and fine sand;
with rare gravel/pebbles and angular rock fragments
dark brown

431.88
silt and fine sand; with rare gravel/pebbles
and angular rock fragments
dark brown

431.73
clay and silt and sand and gravel/pebbles
and angular rock fragments
brown

430.20
gravel/pebbles and angular rock fragments,
with clay and silt and sand
brown

425.63
clay, with silt; with layers of gravel/pebbles
brownish gray

423.19
clay, with silt; with layers of fine sand with silt;
with rare fine gravel/pebbles
brownish gray

421.67
clay, with silt; with rare fine gravel/pebbles
brownish gray

420.15
clay, with silt
brownish gray

417.10
clay, with silt; with rare fine gravel/pebbles
brownish gray

415.57
clay, with silt, with gravel/pebbles
brownish gray

414.36
clay and silt and sand and gravel/pebbles
and angular rock fragments
greenish gray

408.56
bedrock

407.65 bottom

DM 22 (plant)

depth: 22.55 m, 74 ft

surface 430.34 m, 1411.96 ft
organic material/soil and silt and fine sand; with rare gravel/pebbles
dark brown

430.19
silt and fine sand; with rare gravel/pebbles
dark brown

429.89
clay and silt and sand and gravel/pebbles and angular rock fragments
brown

423.03
clay, with silt, with gravel/pebbles
brownish gray

421.20
clay and gravel/pebbles, with silt
brownish gray

419.98
clay, with silt, with gravel/pebbles
brownish gray

418.85
418.85
clay, with silt; with rare gravel/pebbles
brownish gray

413.88
clay, with silt, with gravel/pebbles
brownish gray

410.23
clay and silt and sand and gravel/pebbles and angular rock fragments
greenish gray

408.40
bedrock

407.79 bottom

DM 23 (plant)

depth: 23.62 m, 77.5 ft

surface 427.77 m, 1403.5 ft
organic material/soil and clay and silt and sand and gravel/pebbles and angular rock fragments
brown

427.67
clay and silt and sand and gravel/pebbles and angular rock fragments
brown

424.41
clay, with silt
brownish gray

423.19
clay, with silt; with rare gravel/pebbles
brownish gray

421.37
clay, with silt; with rare gravel/pebbles; with layers of sand with silt
brownish gray

413.75
clay, with silt and gravel/pebbles
brownish gray

412.22
gravel/pebbles and angular rock fragments, with clay silt
brownish gray

408.56
clay, with silt, with gravel/pebbles and angular rock fragments
brownish gray

404.91
clay and gravel/pebbles, with silt
brownish gray

404.90
clay and silt and sand and gravel/pebbles and angular rock fragments
greenish gray

404.15 bottom

DM 24 (plant)

depth: 12.80 m, 42 ft

surface 429.83 m, 1410.28 ft
silt and fine sand and fine gravel/pebbles
and angular rock fragments
brown

429.07
gravel/pebbles, with silt and fine sand and angular rock
fragments
brown

426.78
angular rock fragments, with silt and fine sand and
gravel/pebbles
brown

426.17
clay, with silt, with rare fine gravel/pebbles
brownish gray

424.65
clay and silt; with rare fine gravel/pebbles
brownish gray

423.58
sand; with rare fine gravel/pebbles
brown

422.21
clay, with silt, with gravel/pebbles
gray

420.99
clay and gravel/pebbles, with silt
gray

419.92
clay, with silt, with gravel/pebbles
gray

419.47
clay, with silt
gray

417.95
clay, with silt, with gravel/pebbles
gray

417.03 bottom

DM 25 (plant)

depth: 22.55 m, 73.5 ft

surface 430.52m, 1412.55 ft
organic material/soil and clay and silt and fine sand
with rare gravel/pebbles
dark brown

430.45
clay and silt and fine sand; with rare gravel/pebbles
dark brown

430.37
clay and silt and sand and gravel/pebbles
and angular rock fragments
brown

428.24
gravel/pebbles and angular rock fragments,
with clay and silt and sand
brown

405.65
clay and silt and sand
brown

425.04
clay, with silt; with rare fine gravel/pebbles
brownish gray

424.23
fine sand, with clay
brown

423.36
clay, with silt, with fine gravel/pebbles
brownish gray

423.21
clay, with silt and sand and gravel/pebbles
brownish gray

420.62
clay, with silt, with sand and gravel/pebbles
brownish gray

415.29
clay and gravel/pebbles, with silt and sand
brownish gray

414.98
clay and silt and sand and gravel/pebbles

and angular rock fragments
greenish gray

408.12
bedrock?

407.97 bottom

DM 26 (plant)

depth 23.01 m, 75.5 ft

surface 430.05? m, 1411 ft
gravel/pebbles, with silt and sand
grayish brown

423.96
clay, with silt; with rare fine sand and gravel/pebb
gray

422.74
fine to coarse sand and gravel/pebbles, with clay
gray

420.30
clay, with silt; with rare fine sand and gravel/pebb
gray

at 414.81
with layers of sand
sand in pockets

412.68
till; fine to medium sand, with silt, with coarse san
and gravel/pebbles
gray

407.04 bottom

DM 28 (plant)

depth 10.06 m,33 ft

surface 431.88 m, 1417 ft
silt; with rare organic material/soil
and sand and gravel/pebbles
brown

430.20
silt, with sand, with gravel/pebbles
dark brown

427.92
bedrock
light gray
weathered shale

425.78
bedrock
gray
less weathered shale

421.82 bottom

DM 29

depth: 12.81 m, 42 ft
424.57 m surface, 1393 ft
organic material/soil and silt, with sand
dark brown

424.26
silt
light brown

420.60
clay, with silt
brown

421.82
clay, with silt
gray

421.06
clay, with silt, with sand and gravel/pebbles
gray

415.42
clay, with silt, with sand and gravel/pebbles and
angular rock fragments
gray

411.76 bottom

DM 30

depth:  38.10 m, 125 ft

surface 426.09 m, 1398 ft
silt, with sand, with organic material/soil and gravel/pebbles
brown to brown and gray

424.87
clay, with silt
brown and gray

423.65
fine to coarse sand and gravel/pebbles, with clay
brown

421.82
fine to coarse sand and gravel/pebbles, with clay, with silt
brown

421.21
clay, with silt
gray

415.73
silt, with clay, with fine to coarse sand and gravel/pebbles
dark gray

405.67
fine to medium sand; with rare silt
dark gray

403.84
silt, with clay, with fine to coarse sand and gravel/pebbles
dark gray

398.66
silt and sand, with gravel/pebbles
dark gray

395.31
silt, with angular rock fragments
dark gray

390.89
bedrock
gray
shale

387.99 bottom

DM 31

depth: 12.80 m, 42 ft
surface 427.92 m, 1404 ft
silt, with sand and gravel/pebbles
brown

425.78
silt, with clay and sand and gravel/pebbles
brown

425.63
fine to coarse sand and gravel/pebbles, with silt
brown and gray

421.06
clay, with silt; with rare layers of silt
dark gray

417.25
clay, with silt, with sand and gravel/pebbles
dark gray

415.12 bottom

DM 32

depth: 65.53 m, 215 ft

surface 420.00 m, 1378 ft
silt
light brown

419.09
fine to coarse sand, with silt, with gravel/pebbles
brown

417.87
clay, with silt; with rare fine gravel/pebbles
gray

415.42
clay, with silt; with layers of fine to medium silt, with sand; with rare fine gravel/pebbles
gray

413.59
clay, with silt; with rare fine gravel/pebbles
gray
stiff

at 409.10
with layers of fine sand, with silt
layer is 0.15 m thick

397.75
clay, with silt; with rare fine gravel/pebbles
gray
medium stiff

394.09
silt; with layers of silt, with clay
grayish brown

392.87
silt; with layers of silt, with clay
gray

391.95
silt
gray

385.25
fine to coarse sand, with clay
gray

384.64
till: clay, with silt; with rare coarse sand and fine

gravel/pebbles
dark gray

379.46
till: silt, with clay; with rare sand and fine
gravel/pebbles
dark gray

377.32
till: silt, with rare sand and fine gravel/pebbles
dark gray

360.57
silt, with sand, with gravel/pebbles
gray
some cobbles

357.21
bedrock
gray
shale

354.47 bottom

DM 33

depth: 20.88 m, 68.5 ft

surface 432.67 m, 1419.58 ft
silt, with clay and fine to coarse sand, with fine to coarse gravel/pebbles
brown

428.10
clay with silt; with rare fine to coarse sand
gray

419.26
clay, with silt and fine to coarse sand, with fine gravel/pebbles
gray
some cobbles

416.67
clay, with silt, with fine to medium sand and gravel/pebbles
gray

412.86
clay, with silt; with rare sand and gravel/pebbles
gray

411.94
bedrock
gray
shale

411.79 bottom

DM 34

depth: 24.54 m, 81 ft
surface 434.11 m, 1424.8 ft
silt, with clay and fine to coarse sand, with fine t
coarse gravel/pebbles
brown

427.40
clay, with silt; with rare sand and fine gravel/pebb
gray

420.39
clay, with silt, with fine to coarse sand, with fine
gravel/pebbles
gray

414.29
clay, with silt, with fine to coarse sand; with rare
fine gravel/pebbles and angular rock fragments
gray

411.40
bedrock
gray with light blue gray
shale, with dolomitic limestone

409.57 bottom

DM 35

depth: 22.86 m, 75 ft

surface 432.46 m, 1418.9 ft
silt, with clay and fine to coarse sand, with fine to coarse gravel/pebbles
brown

427.28
clay, with silt and fine to coarse sand, with fine to coarse gravel/pebbles
gray

423.77
clay, with silt, with fine to coarse sand; with rare fine gravel/pebbles
gray

417.68
silt, with clay and fine to coarse gravel/pebbles, with fine to coarse sand
gray
some cobbles

412.19
bedrock
gray, with rare light blue gray
shale with some dolomitic limestone

409.60 bottom

DM 36

depth: 29.87 m, 98 ft

surface 432.46 m, 1418.9 ft
fine to coarse gravel/pebbles, with fine to coarse sa
with rare silt, with clay
brown

424.84
fine to coarse sand, with clay, with silt, with rare
fine gravel/pebbles
gray

422.40
fine to coarse gravel/pebbles, with fine to coarse sa
with rare clay, with silt
gray

416.92
fine to coarse gravel/pebbles, with fine to coarse sa
with rare clay, with silt
gray
some cobbles

414.17
clay, with silt; with rare fine to coarse sand and
gravel/pebbles
gray

412.95
clay, with silt; with rare fine to coarse sand and
coarse gravel/pebbles
gray
frequent cobbles

411.73
bedrock
gray, with light gray
weathered shale with little dolomitic limestone

410.21
bedrock
gray, with light blue gray
shale with many layers of dolomitic limestone

402.59 bottom

DM 37

depth: 25.75 m, 84.5 ft

surface433.19 m, 1421.3 ft
fine to coarse gravel/pebbles, with fine to coarse sand; with rare silt, with clay
brown

422.68
clay, with silt; with rare fine to coarse sand
gray

417.04
silt, with clay, with angular rock fragments
gray
fragments of weathered shale

415.51
bedrock
gray and light blue gray
shale and dolomitic limestone

407.44 bottom

DM 38

depth:  6.25 m, 20.  ft

surface 437.06 m, 1434.0 ft
   silt, with clay and fine to coarse gravel/pebbles; wi
   rare fine to coarse sand
   brown

434.62
   fine to coarse sand and gravel/pebbles, with clay, wi
   silt
   gray

430.81 bottom

DM 39

depth: 21.49 m, 70.5 ft

surface 431.30 m, 1415.1 ft
silt, with clay and fine to coarse gravel/pebbles; with rare fine to coarse sand
brown

426.88
clay, with silt, with rare fine to coarse sand and fine gravel/pebbles
gray

425.21
fine to coarse sand, with silt, with clay, with fine to coarse gravel/pebbles
brown

423.68
fine to coarse sand, with silt, with clay; with rare gravel/pebbles
brown

422.62
clay, with silt, with fine to coarse sand; with rare fine to coarse gravel/pebbles
gray

414.84
fine to coarse sand, with silt, with clay; with rare gravel/pebbles
gray

413.47
clay, with silt and fine to coarse gravel/pebbles; with rare fine to coarse sand
gray

411.19
silt, with clay and fine to coarse gravel/pebbles; with rare fine to coarse sand and angular rock fragments
gray
with weathered shale

409.97
bedrock
gray
weathered shale

409.81 bottom

393.17

clay, with silt and fine to coarse sand; with rare f
to coarse gravel/pebbles
gray
some cobbles

392.41

silt, with clay and sand and fine to coarse
gravel/pebbles, with angular rock fragments
gray
shale fragments

390.89

bedrock
gray and light blue gray
shale and dolomitic limestone

388.60 bottom

DM 40

depth: 41.15 m, 135 ft
surface 429.75 m, 1410.0 ft
silt, with clay and fine to coarse sand, with fine to coarse gravel/pebbles
brown

422.13
clay, with silt; with rare fine to coarse sand and gravel/pebbles
gray

420.30
clay, with silt and fine to coarse sand; with rare fine to coarse gravel/pebbles
gray

419.23
clay, with silt; with rare fine to coarse sand and gravel/pebbles
gray

414.51
clay, with silt and sand and gravel/pebbles
gray

410.55
silt, with clay and fine to coarse gravel/pebbles, with fine to coarse sand
gray
some cobbles

408.72
silt, with clay and fine to coarse gravel/pebbles, with fine to coarse sand and angular rock fragments
gray
shale fragments

401.19
clay, with silt; with rare sand and gravel/pebbles
gray

396.22
clay, with silt and sand and gravel/pebbles
gray

395.31
clay, with silt and fine to coarse sand; with rare fine gravel/pebbles
gray

DM 41

depth: 11.12 m, 36.5 ft

surface 436.57 m, 1432.4 ft
silt, with clay and fine to coarse gravel/pebbles, w
fine to coarse sand
brown

433.53
clay, with silt; with rare fine to coarse sand and
gravel/pebbles
gray

432.15
silt, with clay;
with sand and fine to coarse gravel/pebbles
gray

430.17
bedrock
gray
shale, some limestone

425.45 bottom

DM 42

depth: 20.73 m, 68.0 ft

surface 434.87 m, 1426.8 ft
silt, with clay and fine to coarse gravel/pebbles, with fine to coarse sand
brown

429.99
clay, with silt; with rare to some fine to coarse sand and gravel/pebbles
gray

427.55
clay, with silt, with fine to coarse sand
gray

419.63
silt, with clay, with angular rock fragments
gray
shale fragments

418.87
bedrock
gray and light blue gray
shale and dolomitic limestone

414.14 bottom

DM 43

depth: 16.46 m, 4.0 ft

surface 437.52 m, 1435.5 ft
silt, with clay; and fine to coarse gravel/pebbles,
fine to coarse sand
brown

432.95
clay, with silt; with rare fine to coarse sand and
gravel/pebbles
gray

428.83
silt and fine coarse sand; with rare fine gravel/pe
gray

425.33
silt and fine to coarse sand; with rare fine
gravel/pebbles and angular rock fragments
gray
shale fragments

422.89
angular rock fragments
gray
shale and limestone

421.06 bottom

DH-3

depth: 22.12 m, 72.58 ft

surface426.21 m, 1398.40 ft
angular rock fragments, with silt and sand
yellow brown
wet, compact

423.16
angular rock fragments, with silt and sand
gray

422.25
silt; with rare clay and gravel/pebbles
gray
dry, hard .

417.68
fine gravel/pebbles, with silt; with rare clay and coarse sand
gray
wet, compact

412.19
silt; with rare clay and sand and fine gravel/pebbles
gray
wet, medium

410.06
fine gravel/pebbles; with rare to some clay and silt and coarse sand
gray
wet, compact

408.99
sand, with silt; with rare to some gravel/pebbles
gray
wet, firm

407.31
gravel/pebbles and angular rock fragments, with silt; with rare clay
compact

406.45
bedrock

404.09 bottom

DH-4

depth: 36.83 m, 120.83 ft

surface 430.78 m, 1413.39 ft
silt; with rare to some gravel/pebbles
red brown
loose

430.17
silt; with rare to some clay and coarse sand and gravel/pebbles brown
medium

426.21
silt; with layers of fine sand
red brown
medium

425.60
silt, with sand and gravel/pebbles; with rare clay ar
angular rock fragments
brown
hard

419.20
silt, with clay; with rare fine gravel/pebbles
gray
medium to hard

412.49
gravel/pebbles and angular rock fragments
very hard

411.88
sand, with silt and gravel/pebbles
gray
very compact

407.31
silt; with rare to some sand and gravel/pebbles
gray
very hard

398.78
silt, with clay and sand; with rare angular rock fragments
gray
very hard

395.55
bedrock

393.95 bottom

DH-7
depth: 55.32 m, 181.50 ft

surface 422.18 m, 1385.17 ft
silt; with rare clay
medium brown gray
hard

419.74
silt with clay; with rare gravel/pebbles
gray
medium and plastic

at 408.46
soft and plastic

397.80
silt, with sand and angular rock fragments
very hard

396.27
sand, with silt and gravel/pebbles
brown
very compact

390.18
silt with fine sand; with rare fine gravel/pebbles
brown
very hard

381.95
silt with clay; with rare gravel/pebbles
gray
medium and plastic

at 370.37
hard

366.86 bottom

DH-13

depth: 9.60 m, 31.50 ft

surface 418.06 m, 1371.66 ft
sand; with rare silt and fine gravel/pebbles
brown
firm

415.32
silt; with rare clay and fine gravel/pebbles
gray
hard

412.58
silt, with sand and fine gravel/pebbles; with rare
gray
medium

411.36
silt; with rare to some clay and fine gravel/pebble
gray
medium

410.44
fine gravel/pebbles, with silt and sand; with rare
gray
firm

408.46 bottom

PAH-3

depth: 8.07 m, 26.45 ft

surface 422.22 m, 1385.32 ft
silt; with rare clay and sand and gravel/pebbles
yellow brown
compact

at 419.18
with layers of gravel
single layer 0.05 m thick

417.65
silt; with rare to some clay
gray
medium, plastic

416.13
silt; with rare clay and sand and gravel/pebbles and angular rock fragments
gray
medium

414.61
sand; with rare silt
gray
compact

414.15 bottom

PAH-4

depth: 8.07 m, 26.50 ft

surface 421.06 m, 1381.51 ft
silt; with rare clay and fine gravel
yellow brown
hard, mottled

418.63
silt, with clay; with rare fine gravel
gray
medium, plastic

414.36
silt; with rare clay; with rare layers of fine sand
gray
medium

412.99 bottom

PAH-5

depth: 9.60 m, 31.50 ft

surface 422.27 m, 1385.48 ft
silt; with rare clay and gravel/pebbles
yellow brown
dry, medium stiffness

420.44
silt and fine sand; with rare clay
yellow brown
medium moisture and stiffness

419.23
silt; with rare clay and fine gravel/pebbles
gray
medium moisture and stiffness

416.18
silt, with sand
gray
wet, medium to firm

414.65
silt, with clay; with rare fine gravel
gray
wet, medium and plastic

413.74
silt, with fine sand; with rare clay and angular rock fragments
gray
wet, medium stiffness

412.67 bottom

FAH-13

depth: 6.55 m, 21.50 ft

surface 417.17 m, 1371.83 ft
sand, with angular rock fragments; with rarc silt
brown
compact

411.38
silt; with rare clay and fine gravel/pebbles
gray
hard

410.62 bottom

PAH-16

depth:  3.50 m, 11.50 ft

surface 418.11 m, 1371.83 ft
   sand, with fine gravel/pebbles; with rare silt
   brown
   wet, firm

415.68
   silt; with rare clay and fine gravel/pebbles
   gray
   medium moisture

414.61 bottom

PAH-18

depth: 12.74 m, 41.80 ft

surface 421.94 m, 1384.38 ft
silt; with rare clay and fine gravel/pebbles
brown
hard, mottled

417.98
silt, with clay; with rare fine gravel/pebbles
gray
medium and plastic

409.20 bottom

PAH-19

depth: 12.65 m, 41.50 ft

surface 420.24 m, 1378.81 ft
silt; with rare clay and fine gravel/pebbles
yellow brown
hard

416.28
silt, with clay; with rare fine gravel/pebbles
gray
medium and plastic

414.15
silt, with clay; with rare fine gravel/pebbles; with rare layers of sand
gray
medium

412.62
silt, with clay; with rare fine gravel/pebbles
gray
medium and plastic

407.59 bottom

PAH-23

depth: 9.60 m, 32.50 ft

surface 434.32 m, 1425.01 ft
silt, with sand and gravel/pebbles
brown
loose

433.71
silt; with rare clay and sand and gravel/pebbles
brown
medium

430.97
silt; with layers of sand and angular rock fragment
gray brown
medium to hard

428.23
silt; with rare clay and sand and fine gravel/pebbl
gray
medium

424.72 bottom

PAH-29

depth:  11.13 m, 36.50 ft

surface 422.25 m, 1385.39 ft
   silt; with rare gravel/pebbles
   brown

420.72
   silt; with rare clay and fine gravel/pebbles
   gray brown

419.20
   silt; with rare clay and fine gravel/pebbles
   gray

411.12 bottom

PAH-30

depth 11.13 m, 36.50 ft

surface 421.65 m, 1383.43 ft
silt; with rare clay and silt; with rare clay and gravel/pebbles
yellow brown
medium to hard

at approx 419.21
gray brown

418.30
silt; with rare to some clay and fine gravel/pebbles
gray
medium and plastic

at approx 412.51
firm and plastic

410.52 bottom

PAH-32

depth: 9.60 m, 31.50 ft

surface 426.30 m, 1398.68 ft
organic material/soil

426.14
silt; with rare clay and fine gravel/pebbles
yellow brown
medium

423.86
silt; with rare clay and fine gravel/pebbles
gray
medium and plastic

416.70 bottom

PAH-34

depth: 9.60 m, 31.50 ft

surface 418.20 m, 1372.13 ft
organic material/soil

418.10
silt; with rare clay and fine sand and fine gravel/pebbles
yellow brown
medium

at 415.16
brown gray

414.24 silt; with rare clay and fine gravel/pebbles
gray
medium and plastic

at 409.67
soft and plastic

408.60 bottom

PAH-35

depth:  10.21 m, 33.50 ft

surface 425.47 m, 1395.97 ft
fine gravel/pebbles, with silt and coarse sand
yellow brown
compact

422.12
silt; with rare to some clay and gravel/pebbles
gray
medium and plastic

415.26 bottom

PAH-37

depth: 9.60 m, 31.50 ft

surface 421.23 m, 1382.07 ft
silt; with rare clay and sand and fine gravel/pebble
brown
medium to hard

418.80
silt, with clay; with rare fine gravel/pebbles
gray
hard

at 415.75
becoming soft and plastic

411.63 bottom

PAH-39

depth: 9.61 m, 31.50 ft

surface 426.14 m, 1398.15 ft
silt; with rare to some clay and gravel/pebbles
brown gray
medium

at 423.70
gray

421.56
silt, with clay and gravel/pebbles
gray
medium and plastic

416.53 bottom

PAH-40

depth: 6.55 m, 21.50 ft

surface 419.17 m, 1375.29 ft
silt, with fine gravel/pebbles; with rare clay and s
brown yellow
medium

417.03
silt, with clay; with rare to some gravel/pebbles
gray
hard

at 415.51
becoming medium and plastic

412.62 bottom

FAH-42

depth: 9.60 m, 31.50 ft

surface 428.86 m, 1407.08 ft
silt; with rare layers of clay and fine sand
brown yellow gray
medium

425.20
silt, with clay; with rare fine gravel/pebbles
gray
medium and plastic

419.26 bottom

PAH-44

depth: 9.60 m, 31.50 ft

surface 421.39 m, 1382.57 ft
sand, with silt and gravel/pebbles
yellow brown

420.47
sand, with silt and gravel/pebbles
gray

418.34
silt, with clay
gray

411.79 bottom

PAH-61

depth:  12.19 m, 40.00 ft

surface 428.88 m, 1407.17 ft
silt, with sand and gravel/pebbles
brown

426.75
silt; with rare sand
brown

425.53
silt; with rare to some clay, with rare angular rock fragments
gray

423.70
sand and gravel/pebbles
brown

422.79
silt, with clay; with rare gravel/pebbles
gray

416.69 bottom

PAH-71

depth: 11.12 m, 36.50 ft

surface 433.56 m, 1422.52 ft
   silt, with sand and gravel/pebbles
   brown
   hard

428.38
   silt, with rare clay and gravel/pebbles
   gray
   medium and plastic

426.55
   silt and sand
   gray
   loose

425.03
   silt; with rare to some clay, with rare fine sand and
   gravel/pebbles
   gray
   medium and plastic

422.44 bottom

PAH-74

depth: 6.40 m, 21.00 ft

surface 440.90 m, 1446.59 ft
silt; with rare sand and gravel/pebbles
yellow brown
hard

438.44
silt; with rare to some angular rock fragments
gray brown
very hard

435.72
silt; with rare to some clay and angular rock fragments
brown
very hard

434.50
bedrock
bottom

PAH-84

depth: 13.71 m, 45.00 ft

surface 420.91 m, 1381.01 ft
silt; with rare clay
brown

419.39
silt; with rare clay and fine angular rock fragments
gray

416.34
silt, with clay
gray

407.20 bottom

PAH-85

depth: 3.66 m, 12.00 ft

surface 440.870 m, 1446.25 ft
silt; with rare clay
brown

438.36
silt; with rare angular rock fragments
brown gray

437.14 bottom

APPENDIX B. Gravel Grainsize Analyses

Gravel Samples

| | Analysis Number | Analysed by | Geological Unit |
|---|---|---|---|
| 1. | 80-1-F | NYSGS | Holocene Alluvial Fan Gravel |
| 2. | 80-2-E | NYSGS | Holocene Alluvial Fan Gravel |
| 3. | 80-2-F | NYSGS | Holocene Alluvial Fan Gravel |
| 4. | 80-5-B | NYSGS | Wisconsinan Fluvial Gravel |
| 5. | 80-5-C | NYSGS | Wisconsinan Fluvial Gravel |
| 6. | 80-5-F-A | NYSGS | Wisconsinan Fluvial Gravel |
| 7. | 80-8-B | NYSGS | Holocene Alluvial Fan Gravel |
| 8. | 80-8-C | NYSGS | Holocene Alluvial Fan Gravel |
| 9. | 80-8-G-A | NYSGS | Holocene Alluvial Fan Gravel |
| 10. | 80-8-J | NYSGS | Holocene Alluvial Fan Gravel |
| 11. | 80-8-G-B | NYSGS | Holocene Alluvial Fan Silt |
| 12. | GS2 | B, T, & D | Holocene Fluvial Terrace Gravel |
| 13. | GS3 | B, T, & D | Holocene Floodplain (Lacustrine) Mud |
| 14. | GS4 | B, T, & D | Holocene Fluvial Bar Gravel |

| | | | |
|---|---|---|---|
| 15. | GS5 | B, T, & D | Holocene Fluvial Bar Gravel |
| 16. | GS6 | B, T, & D | Holocene Fluvial Bar Gravel |
| 17. | GS7 | B, T, & D | Holocene Fluvial Bar Gravel |
| 18. | GS8 | B, T, & D | Holocene Fluvial Bar Gravel |
| 19. | GS9 | B, T, & D | Holocene Fluvial Bar Gravel |
| 20. | GS10 | B, T, & D | Holocene Fluvial Terrace Gravel |

* B, T, & D refers to Boothroyd and others (1982).

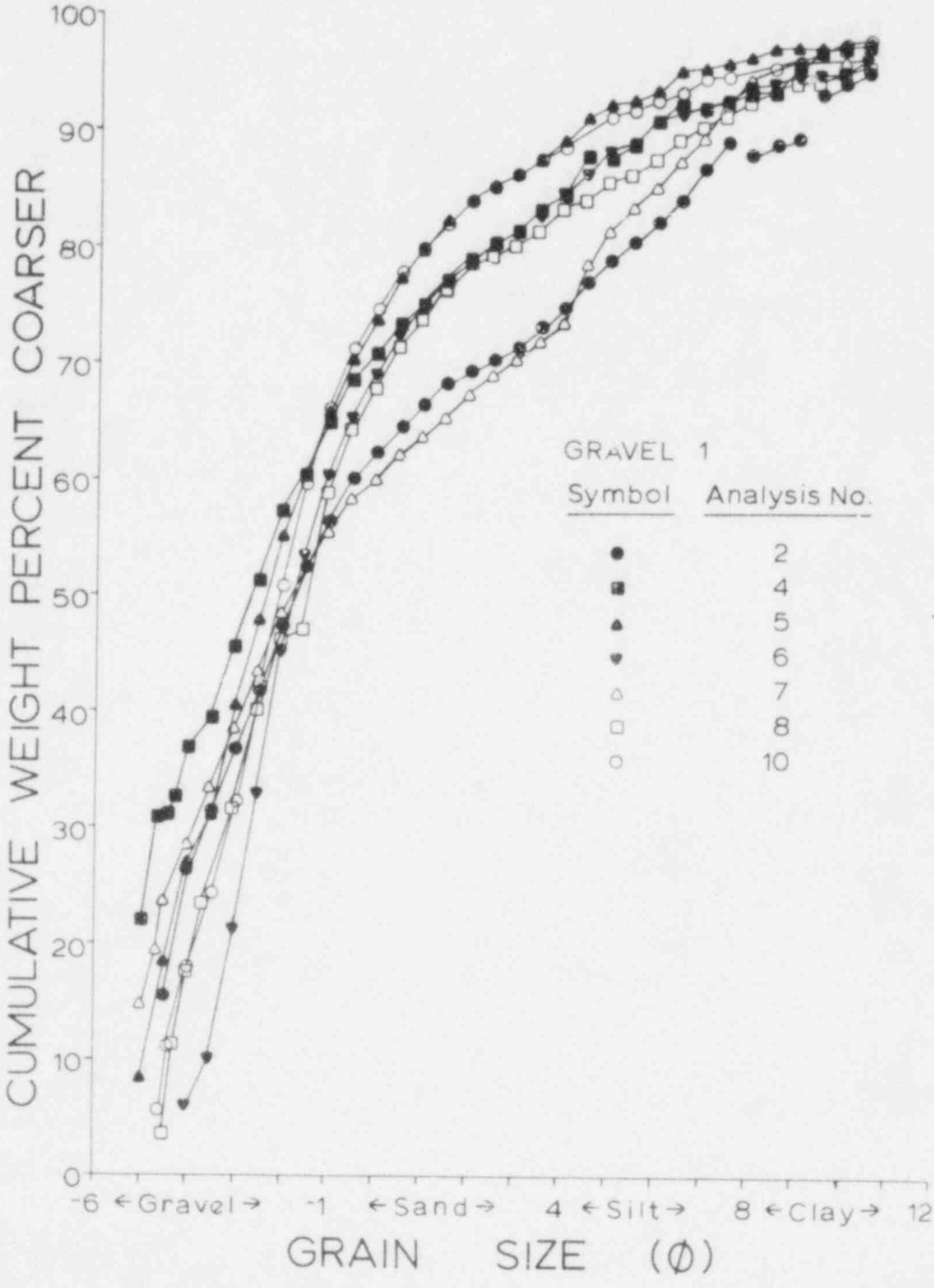



Figure 23. Graph of grain size distributions for Group 1 of the surficial gravel samples.

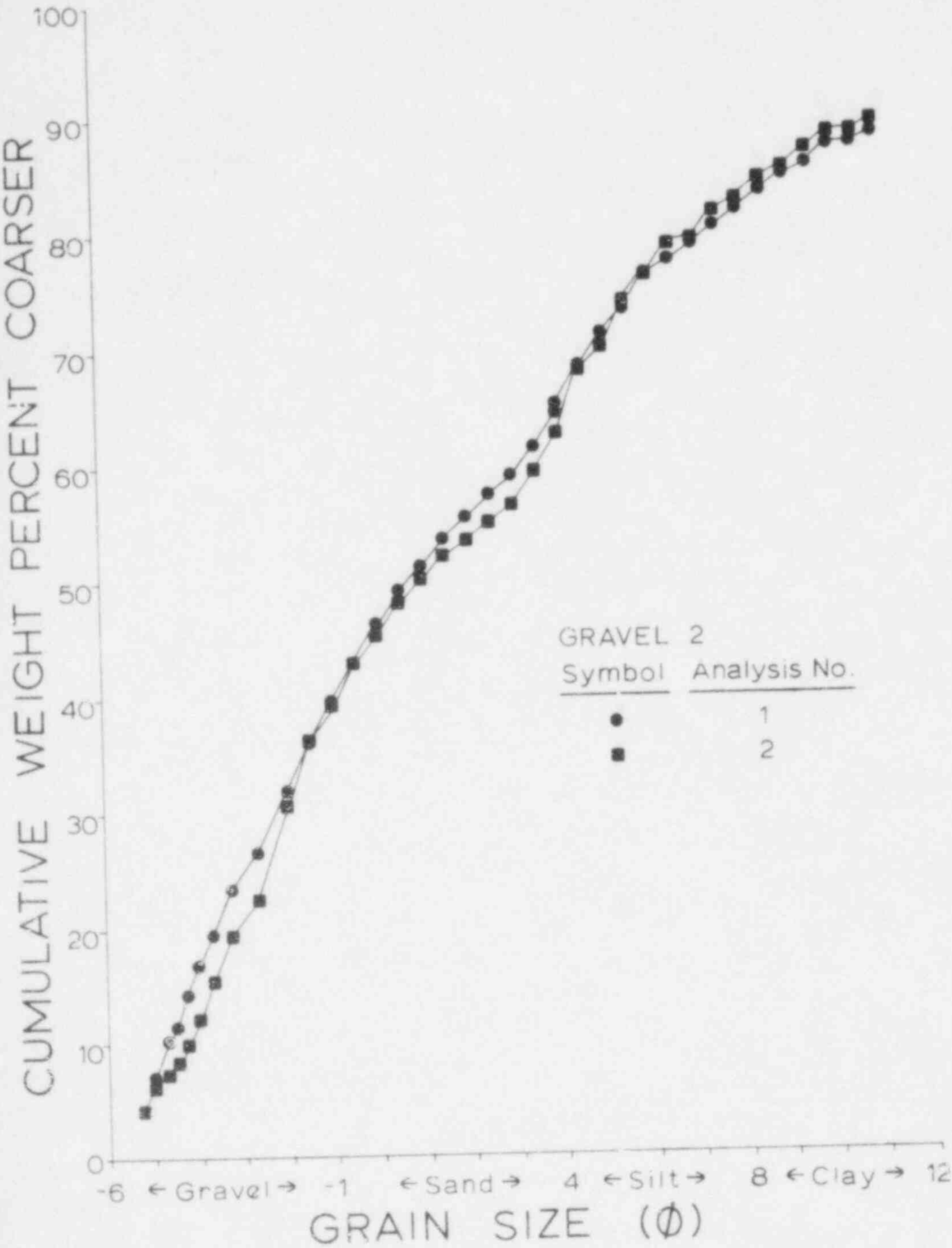



Figure 24. Graph of the grain size distributions for Group 2 of the surficial gravel samples.

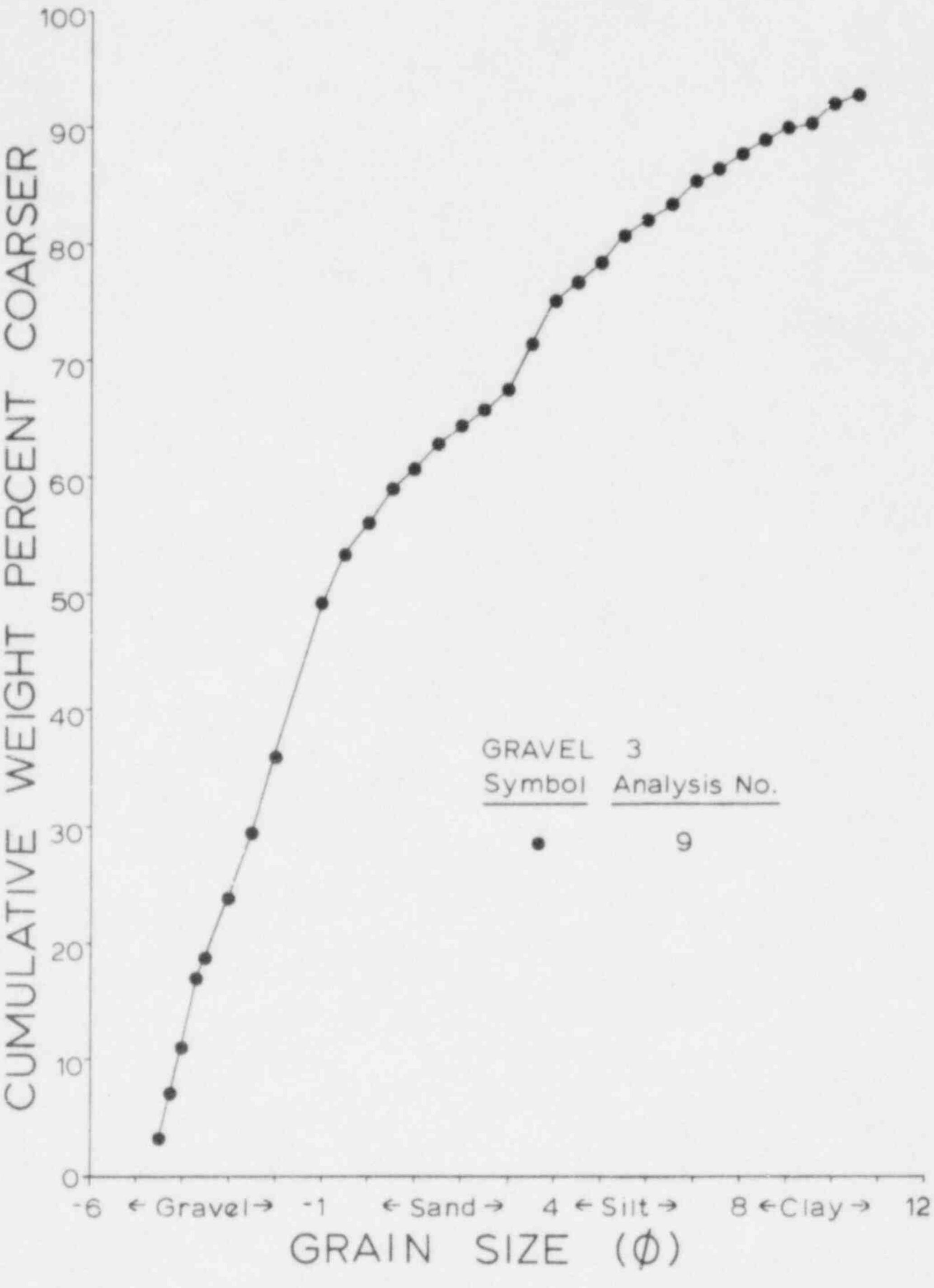



Figure 25. Graph of the grain size distributions for Group 3 of the surficial gravel samples.

APPENDIX C. Till Grainsize Analyses

Till Samples

| Analysis Number | | Analysed by | Geological Unit |
|---|---|---|---|
| 1. | Snake Run Road | NYSGS | Kent Till |
| 2. | GS1 | B, T, & D | Kent Till |
| 3. | GS11 | B, T, & D | Kent Till |
| 4. | Connoisarauley Creek Road A | NYSGS | Lavery Till |
| 5. | Connoisarauley Creek Road B | NYSGS | Lavery Till |
| 6. | Connoisarauley Road | NYSGS | Lavery Till |
| 7. | West Townline Road A | NYSGS | Lavery Till |
| 8. | West Townline Road B | NYSGS | Lavery Till |
| 9. | 80-5-F-B | NYSGS | Lavery Till |
| 10. | 80-8-L | NYSGS | Lavery Till |
| 11. | 80-10-E-2 | NYSGS | Lavery Till |
| 12. | 80-10-F | NYSGS | Lavery Till |
| 13. | 80-10-I-A | NYSGS | Lavery Till |
| 14. | 80-10-P-A | NYSGS | Lavery Till |
| 15. | 80-10-P-B | NYSGS | Lavery Till (Interbedded Silt-Clay) |
| 16. | 80-10-Q-A | NYSGS | Lavery Till (Interbedded Sand) |
| 17. | 80-10-Q-B | NYSGS | Lavery Till (Interbedded Silt) |
| 18. | 80-10-R-A | NYSGS | Lavery Till (Interbedded Sand) |

| | | | |
|---|---|---|---|
| 19. | 80-10-S-A | NYSGS | Lavery Till (Inte bedded Silt) |
| 20. | 80-10-S-B | NYSGS | Lavery Till (Inte bedded Silt) |
| 21. | 80-10-T-A | NYSGS | Lavery Till |
| 22. | B 33.5-34.0 ft | USGS | Lavery Till (Inte bedded Silt) |
| 23. | C2 32.5-33 ft | USGS | Lavery Till |
| 24. | D 14.5-15.0 ft | USGS | Lavery Till |
| 25. | D 30.8-31.3 ft | USGS | Lavery Till (Inte bedded Clay) |
| 26. | E 34-36 ft | USGS | Lavery Till |
| 27. | F 35-35.5 ft | USGS | Lavery Till |
| 28. | F 45-45.5 ft | USGS | Lavery Till |
| 29. | G 25.2-25.6 ft | USGS | Lavery Till |
| 30. | G 30.5-31.4 ft | USGS | Lavery Till |
| 31. | G 36.3-36.8 ft | USGS | Lavery Till (Inter bedded Clay) |
| 32. | I 19-19.5 ft | USGS | Lavery Till |
| 33. | I 38.3-38.8 ft | USGS | Lavery Till |
| 34. | I 48.3-48.8 ft | USGS | Lavery Till |
| 35. | I2 32.5-33.0 ft | USGS | Lavery Till |
| 36. | L 4.7-5.2 ft | USGS | Lavery Till |
| 37. | L 15.8-16.3 ft | USGS | Lavery Till (Inter bedded Silt) |
| 38. | M 51.3-52.3 ft | USGS | Lavery Till |
| 39. | R 23-23.5 ft | USGS | Lavery Till |
| 40. | EB-7 | USGS | Lavery Till (Inter bedded Sand) |

* B, T, and D refers to Boothroyd and others (1982).

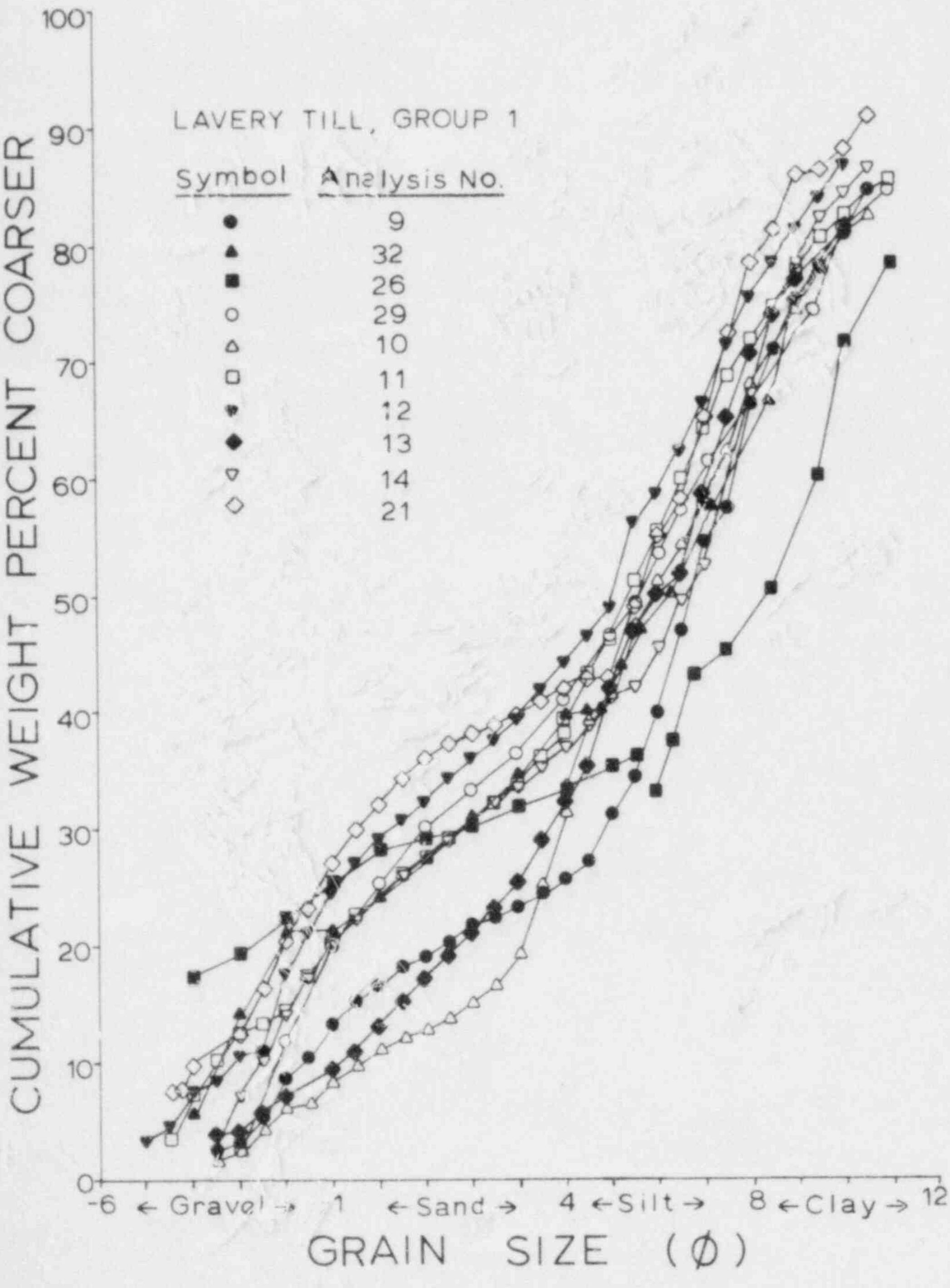



Figure 26. Graph of grain size distributions for Group 1 of the Lavery Till samples.

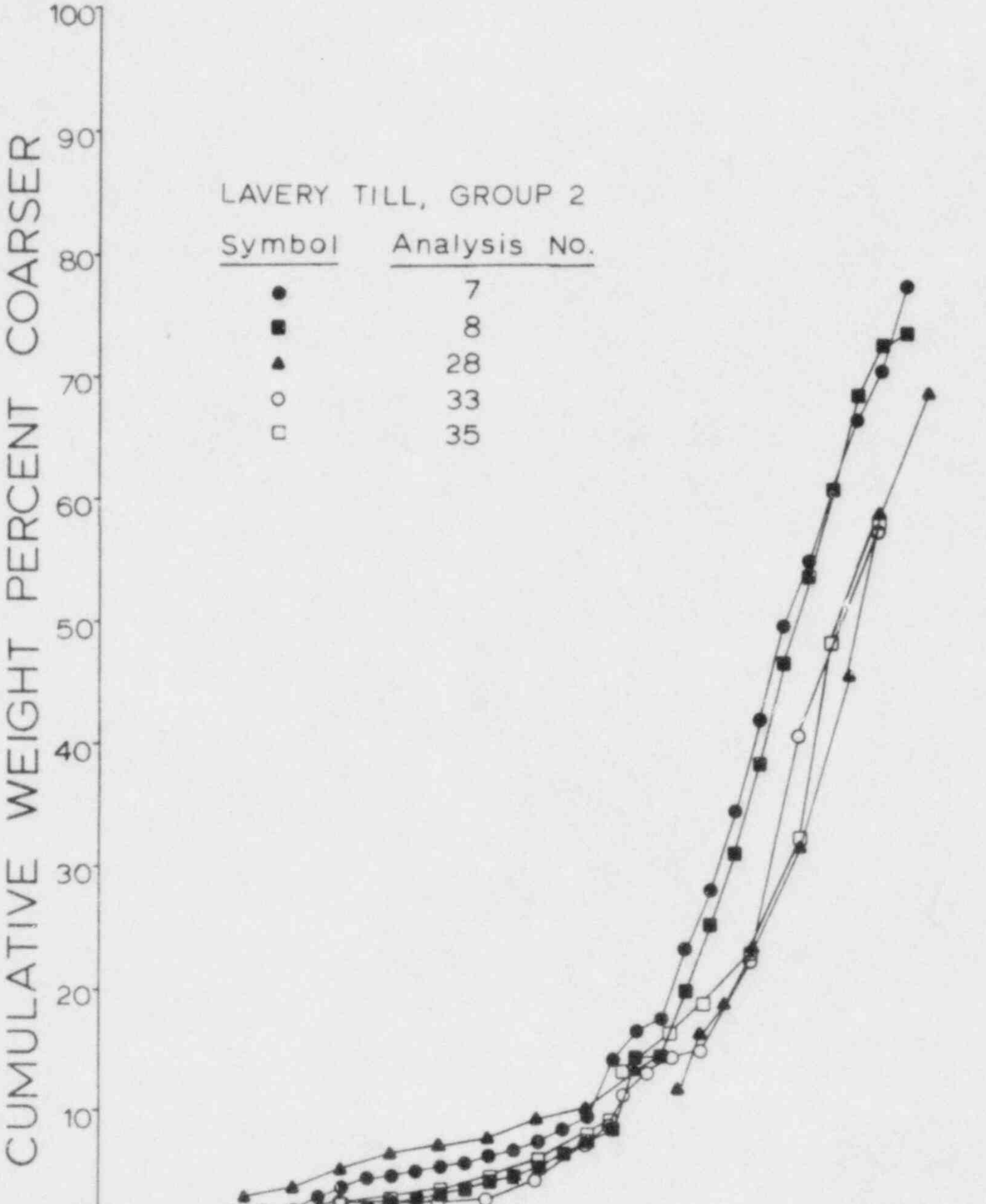



Figure 27. Graph of grain size distributions for Group 2 of the Lavery Till samples.

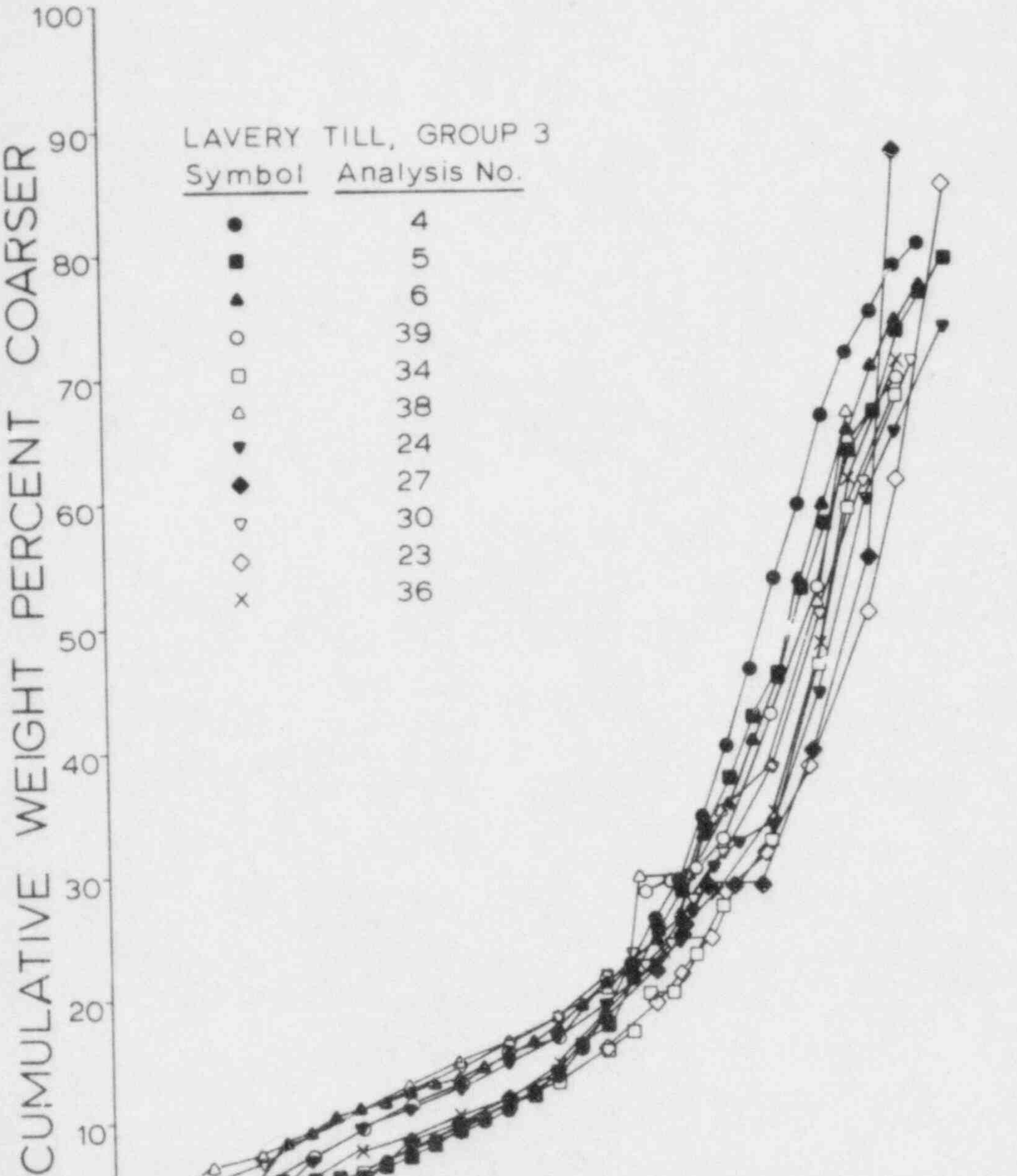



Figure 28. Graph of the grain size distributions for Group 3 of the Lavery Till samples.

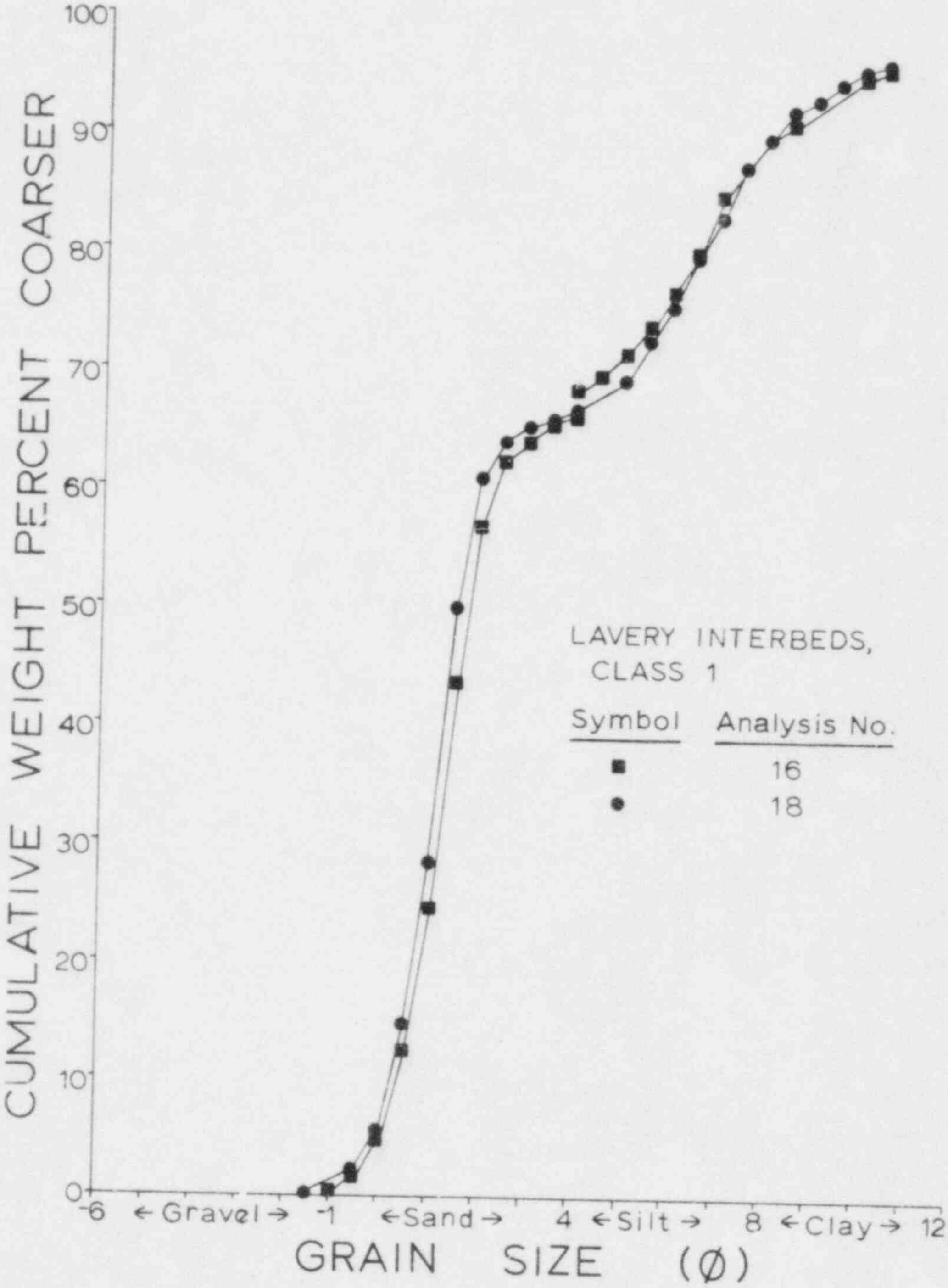



Figure 29. Graph of the grain size distributions for Class 1 interbeds in Lavery Till.

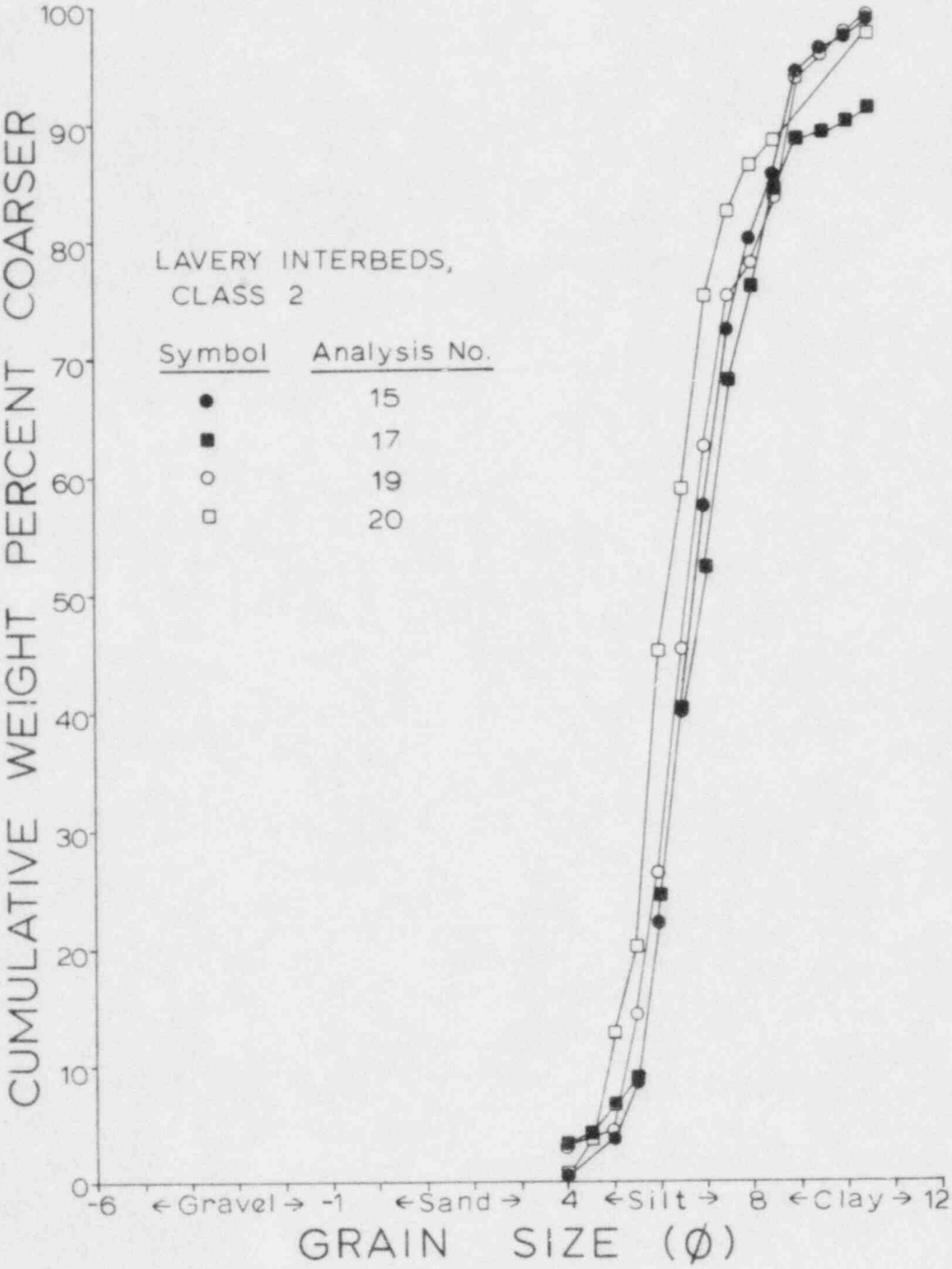



Figure 30. Graph of the grain size distributions for Class 2 interbeds in Lavery Till.

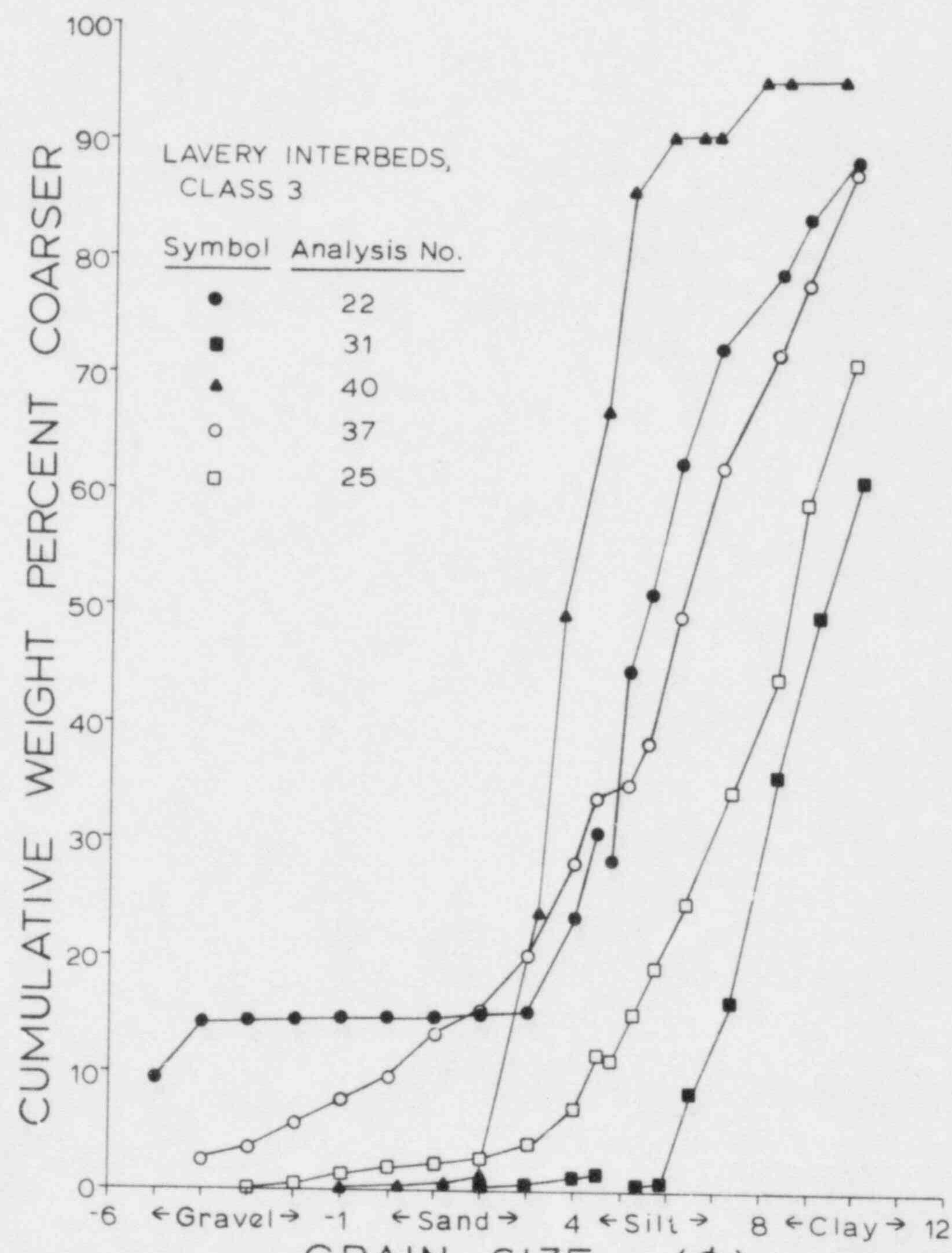



Figure 31. Graph of the grain size distributiors for Class 3 interbeds in Lavery Till.

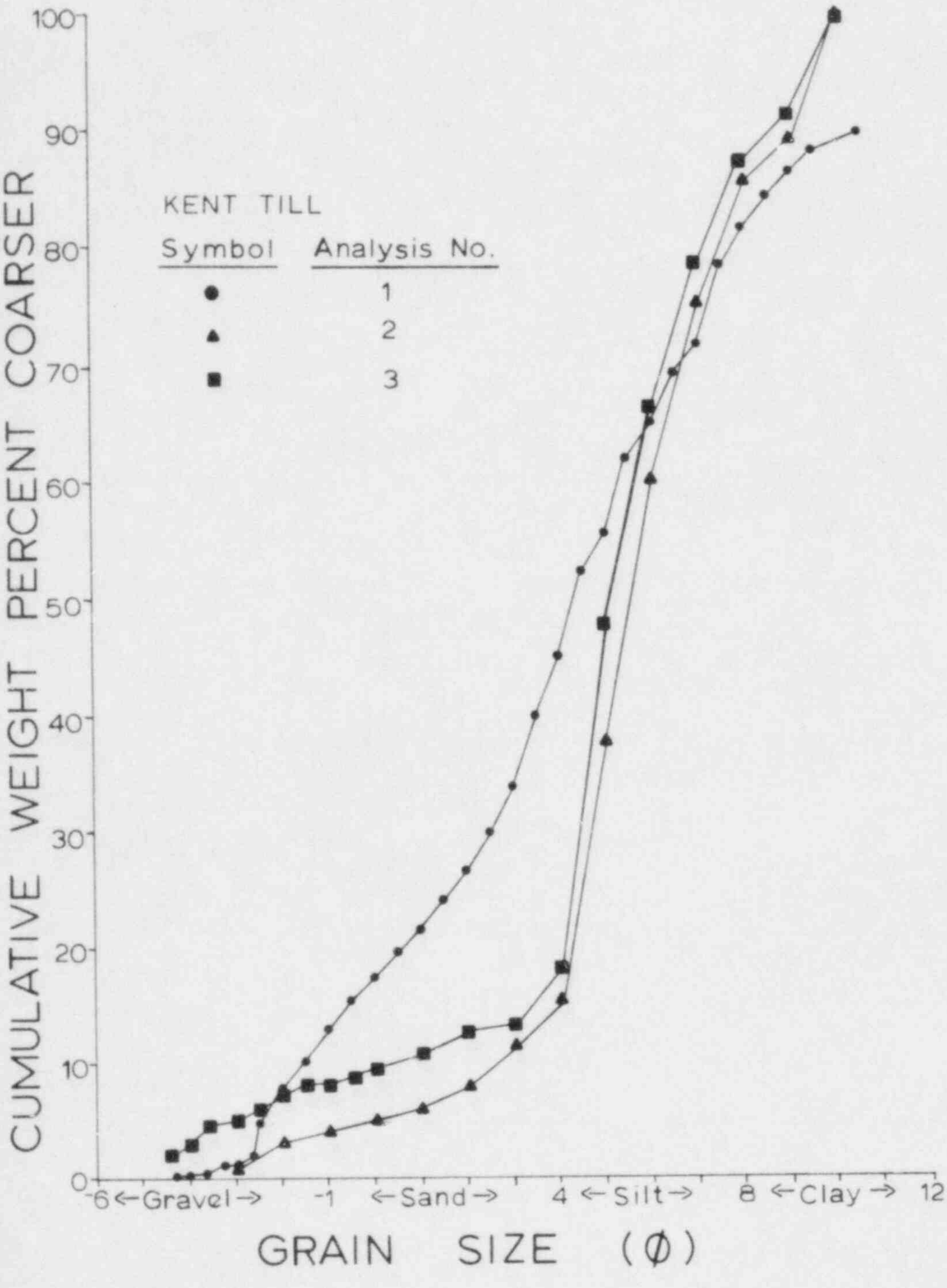
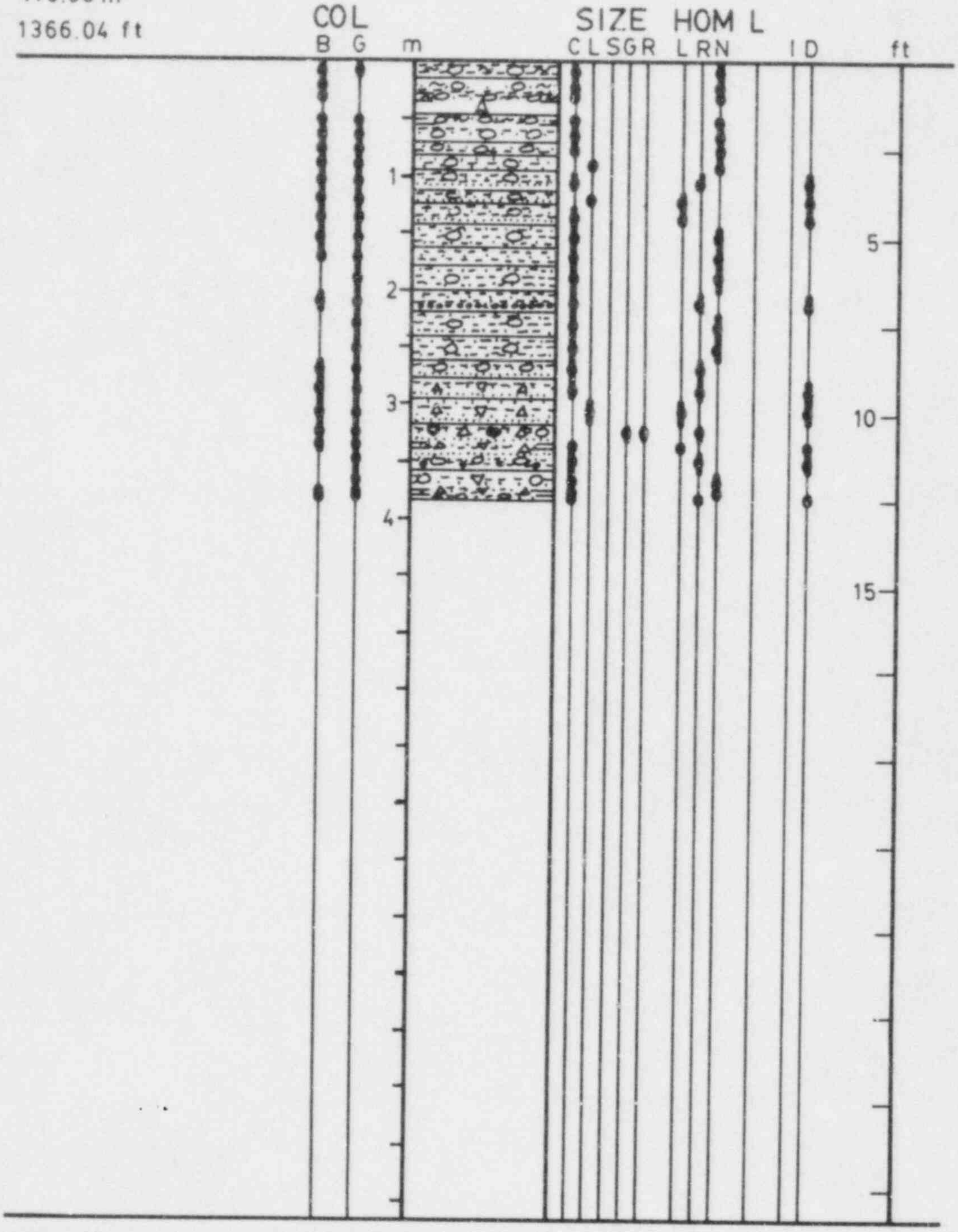
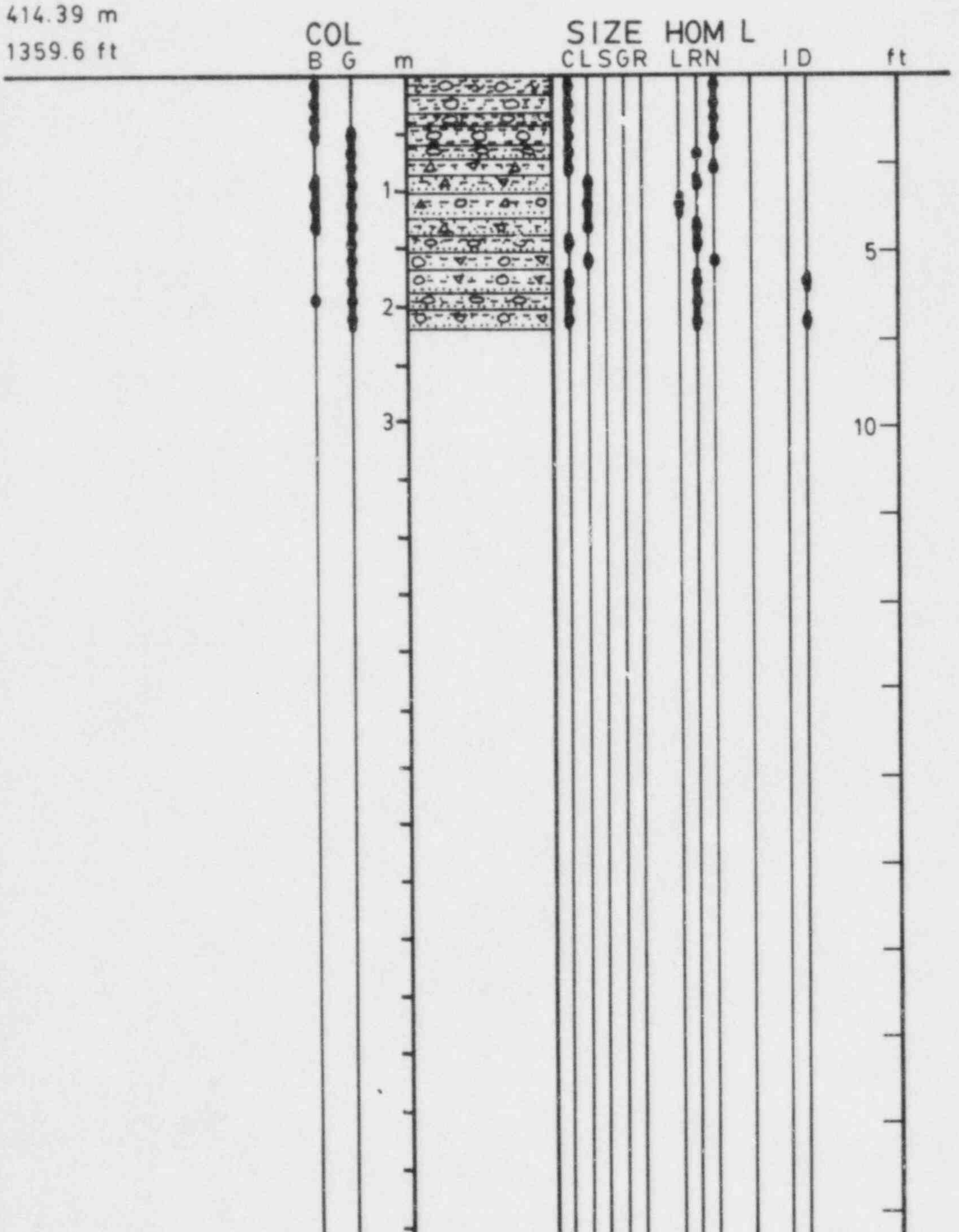


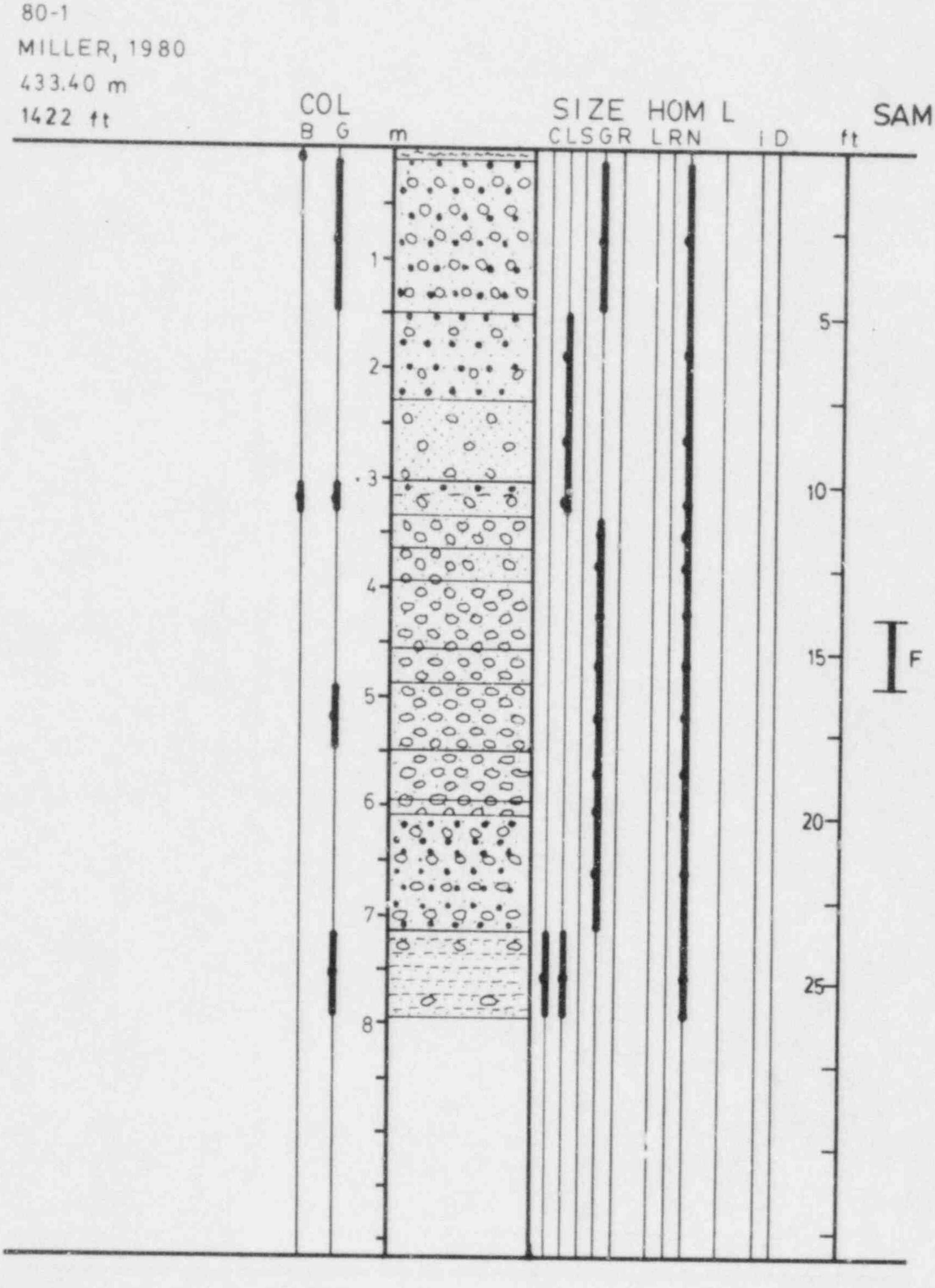

Figure 32. Graph of the grain size distributions for Kent Till samples.

A82-1
NYSGS, 1982
416.35 m
1366.04 ft

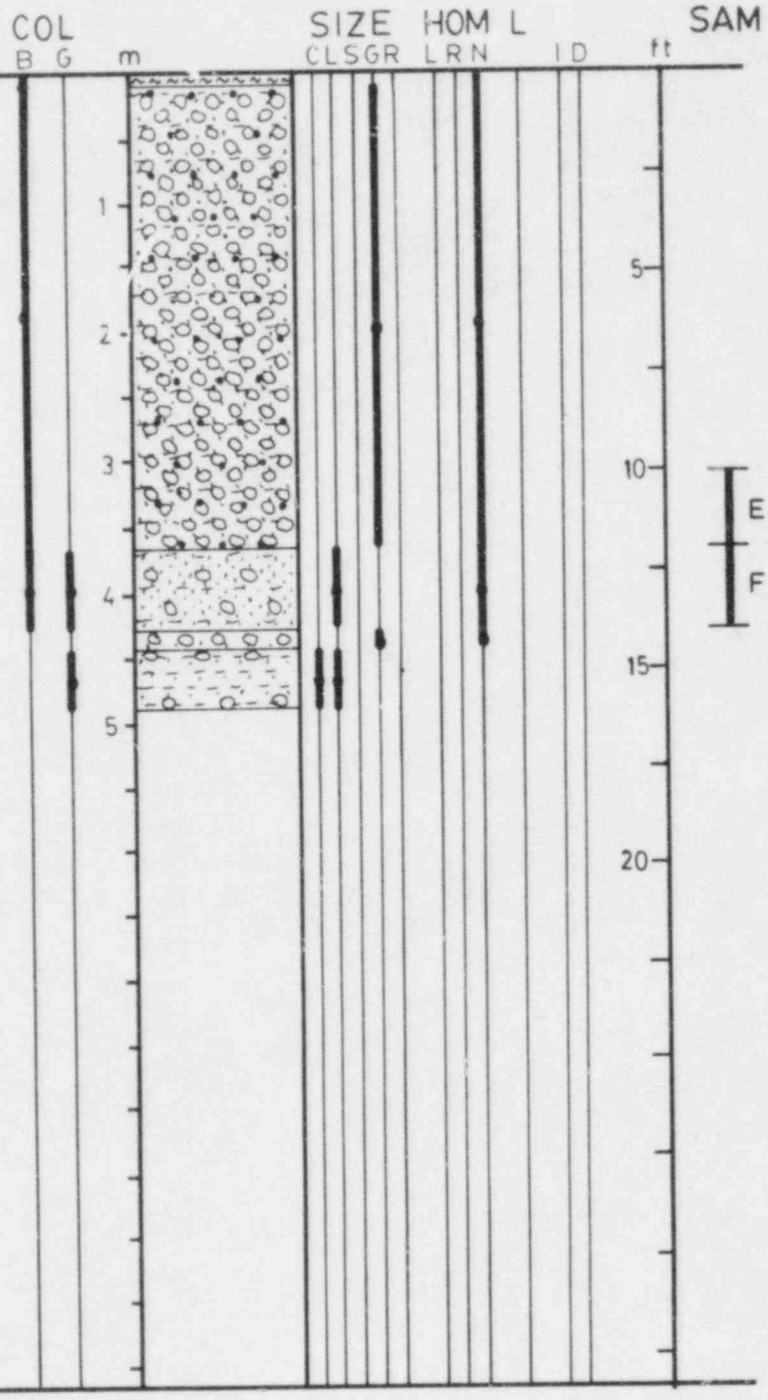


A82-2
NYSGS, 1982
414.39 m
1359.6 ft

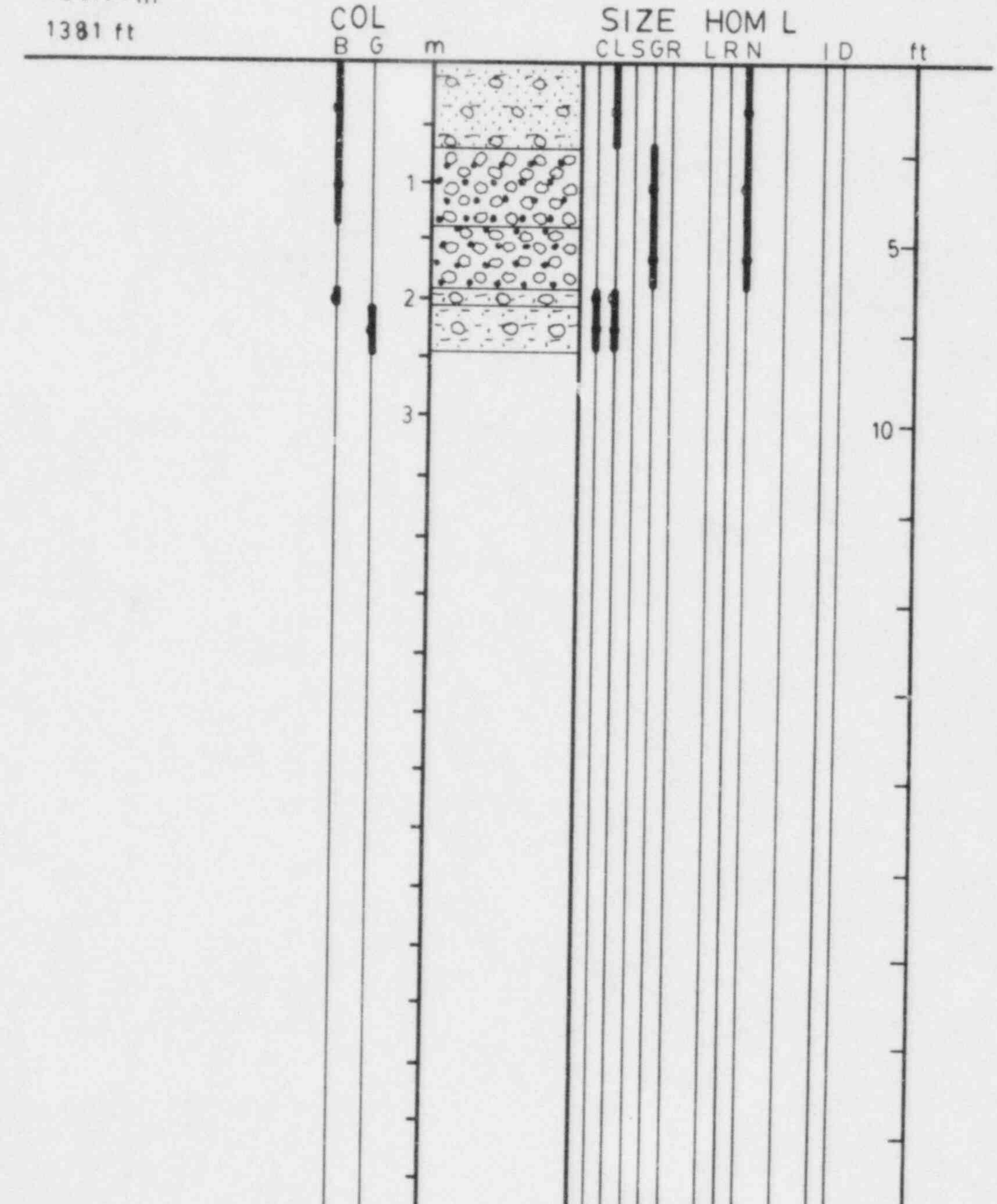



80-1
MILLER, 1980
433.40 m
1422 ft
COL
B G
m
SIZE HOM L
CLSGR LRN
i D
ft
SAM
1
2
3
4
5
6
7
8
5
10
15
20
25
F

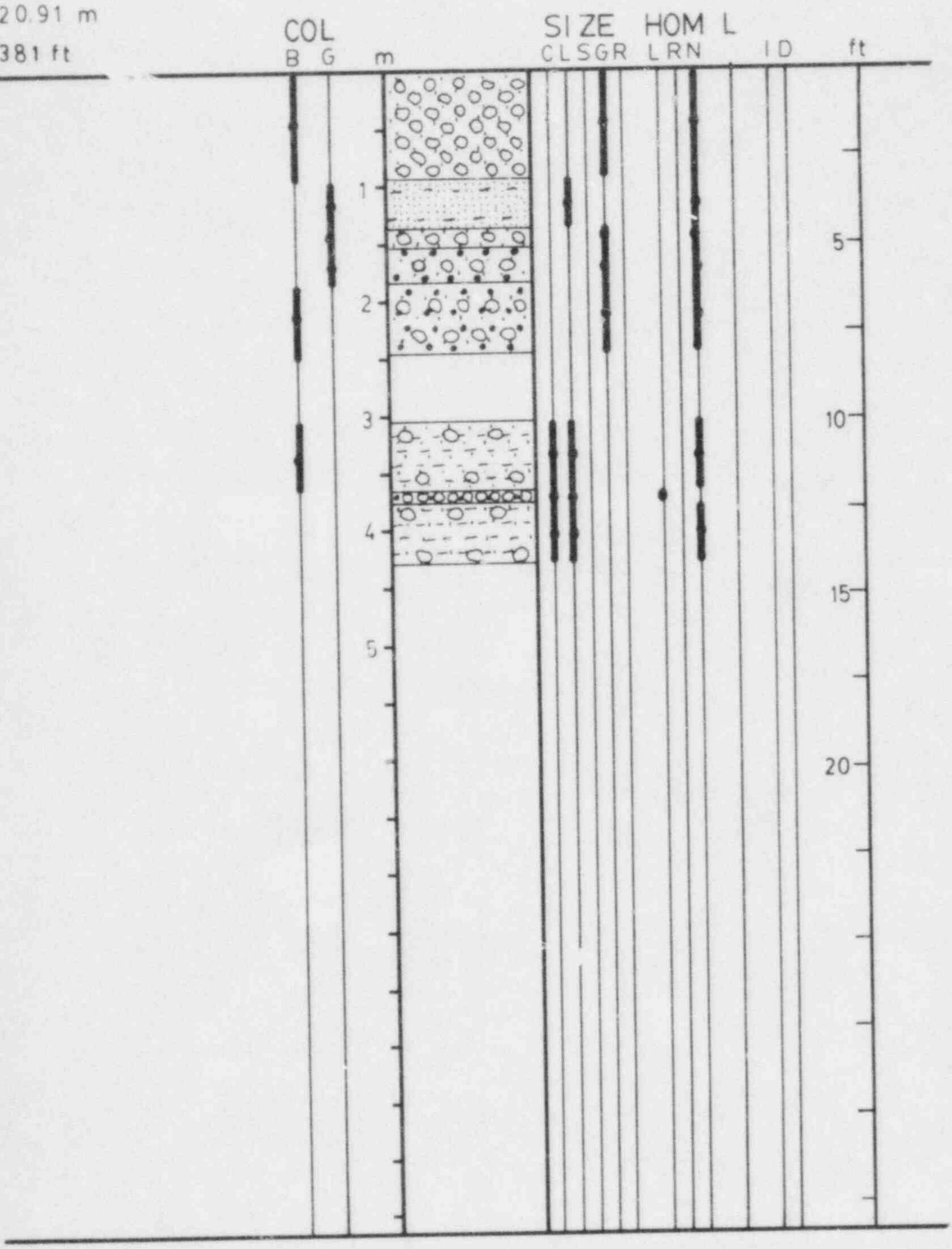
80-2
MILLER, 1980
434.32 m
1425 ft



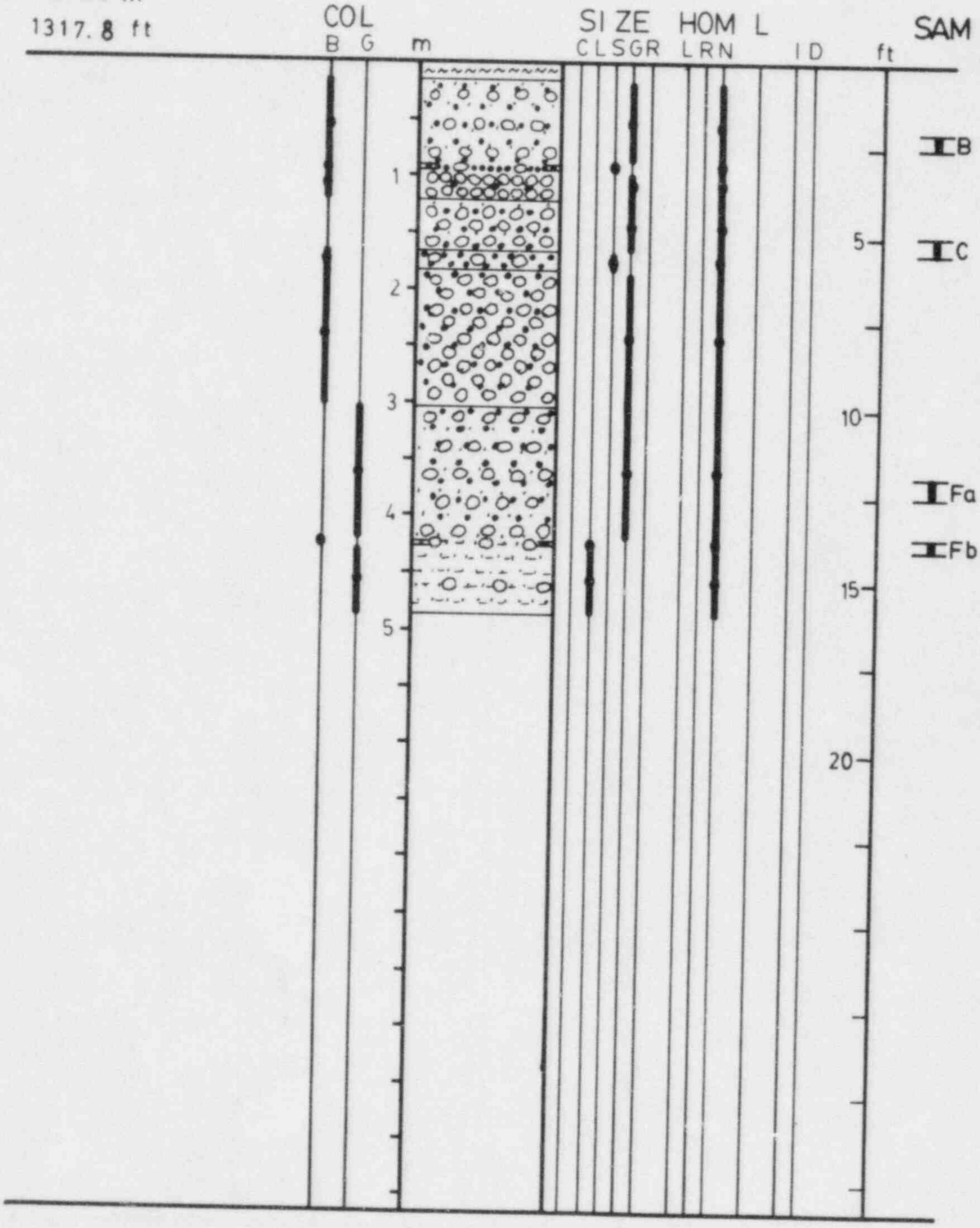
80-3
MILLER, 1980
420.91 m
1381 ft



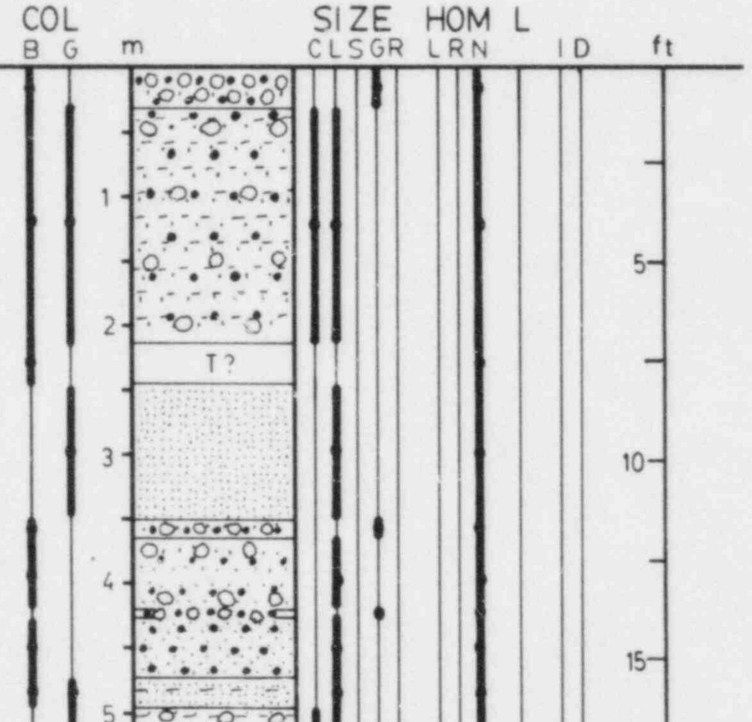
80-4
MILLER, 1980
420.91 m
1381 ft



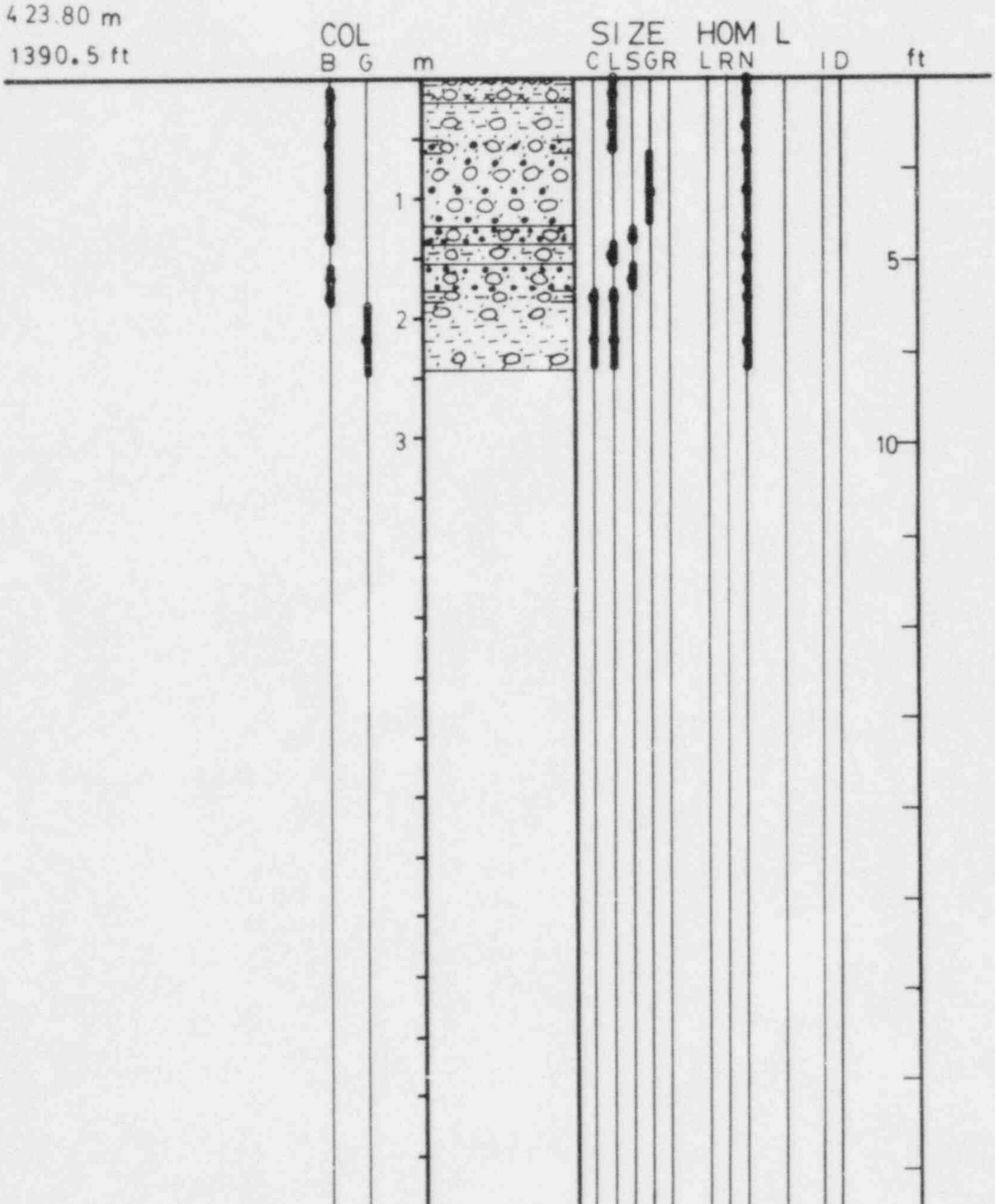
80-5
MILLER, 1980
401.55 m
1317.8 ft

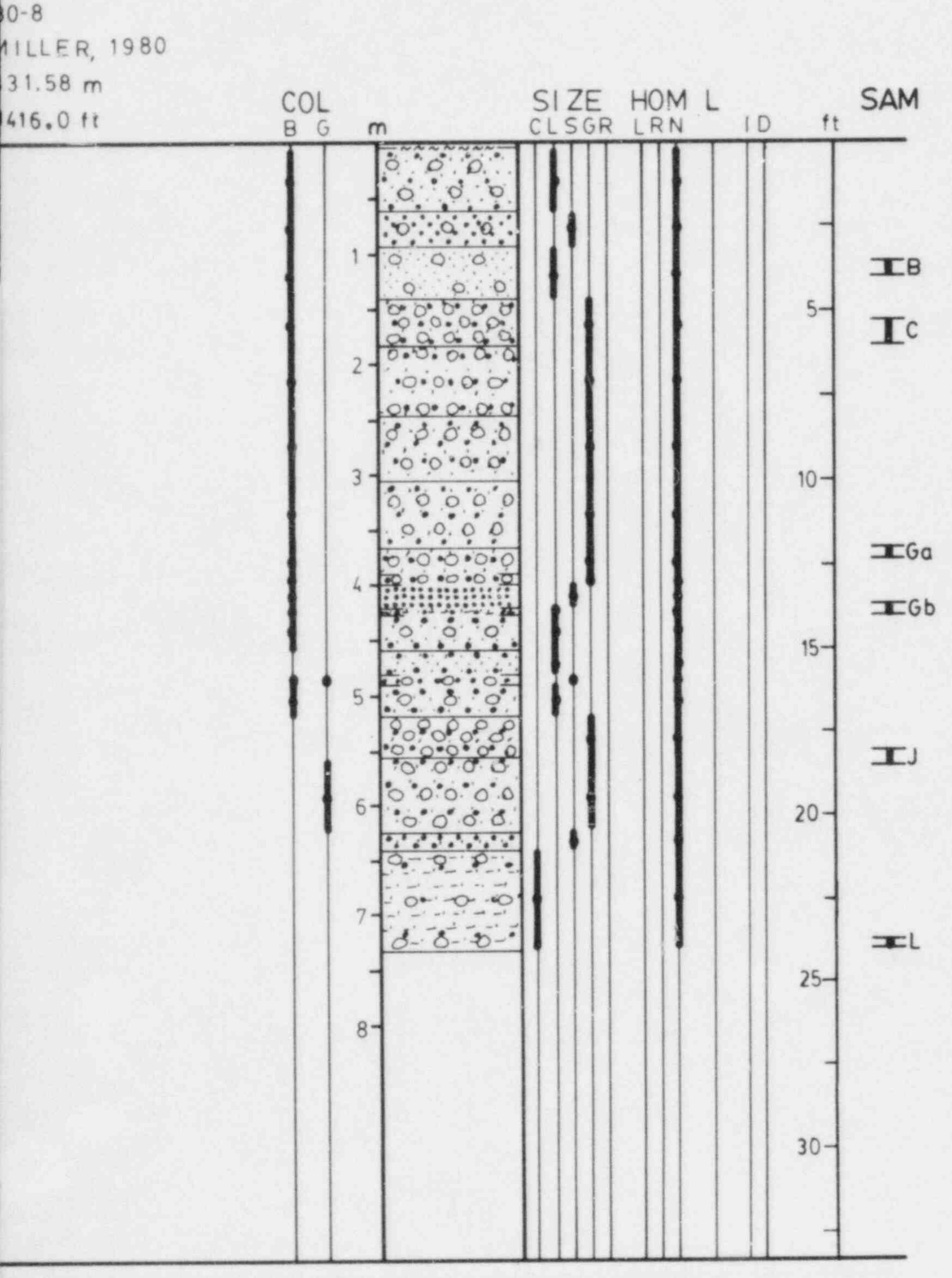


80-6
MILLER, 1980
420.30 m
1379 ft



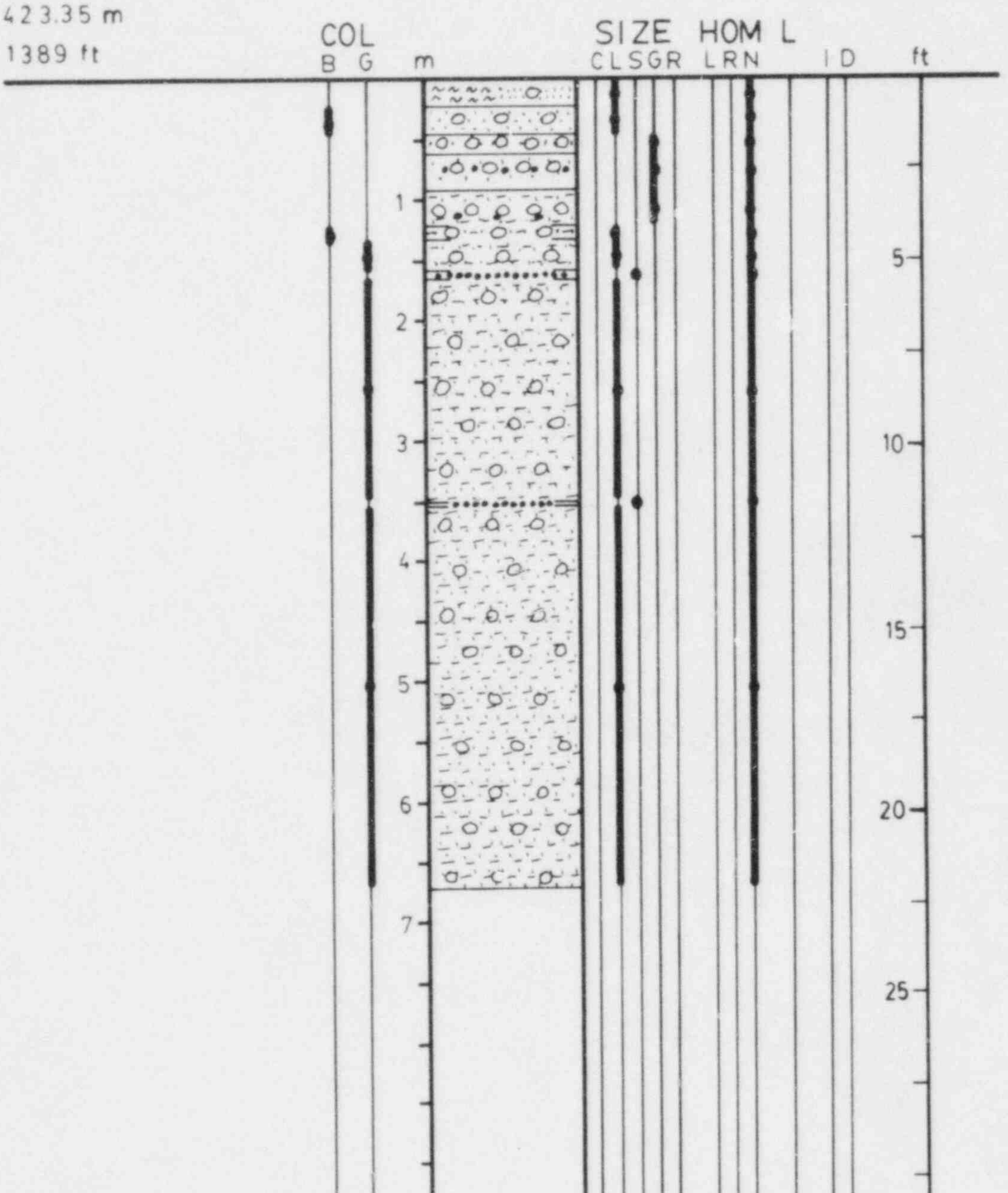
80-7
MILLER, 1980
423.80 m
1390.5 ft



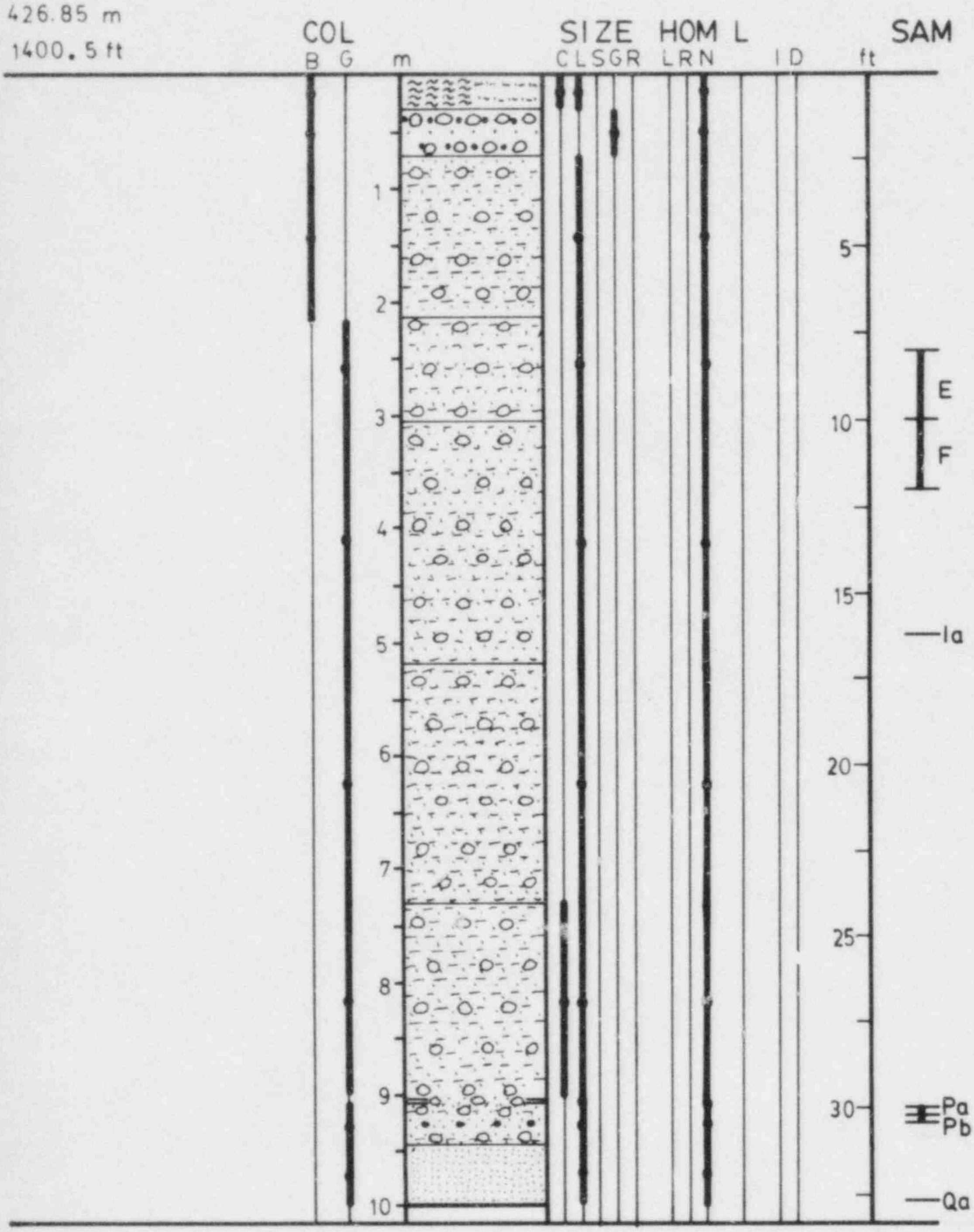


0-8
ILLER, 1980
31.58 m
416.0 ft
COL
B G
m
SIZE
CL S G R
HOM
L R N
L
I D
ft
SAM
B
C
Ga
Gb
J
L

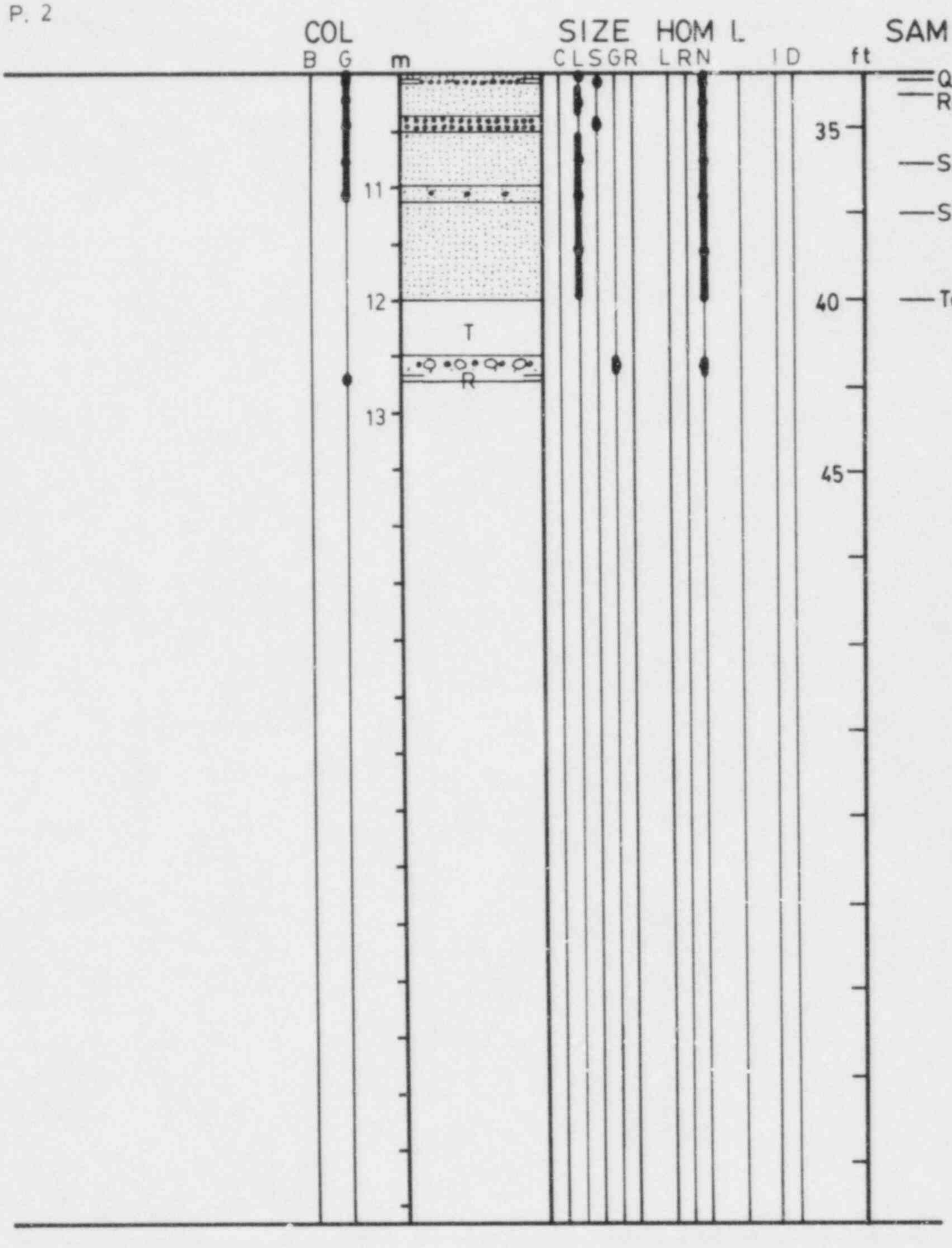
80-9
MILLER, 1980
423.35 m
1389 ft



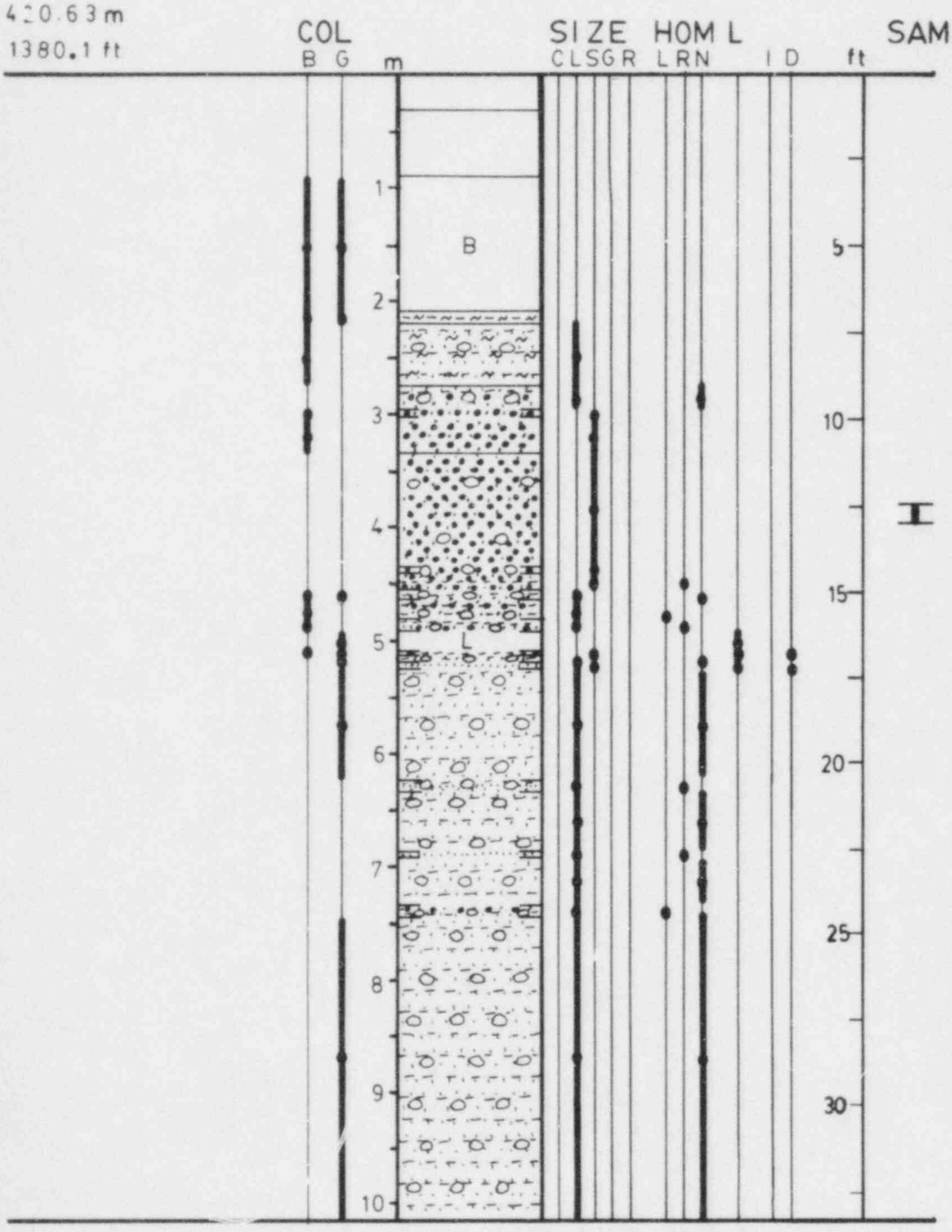
80-10
MILLER, 1980
426.85 m
1400.5 ft

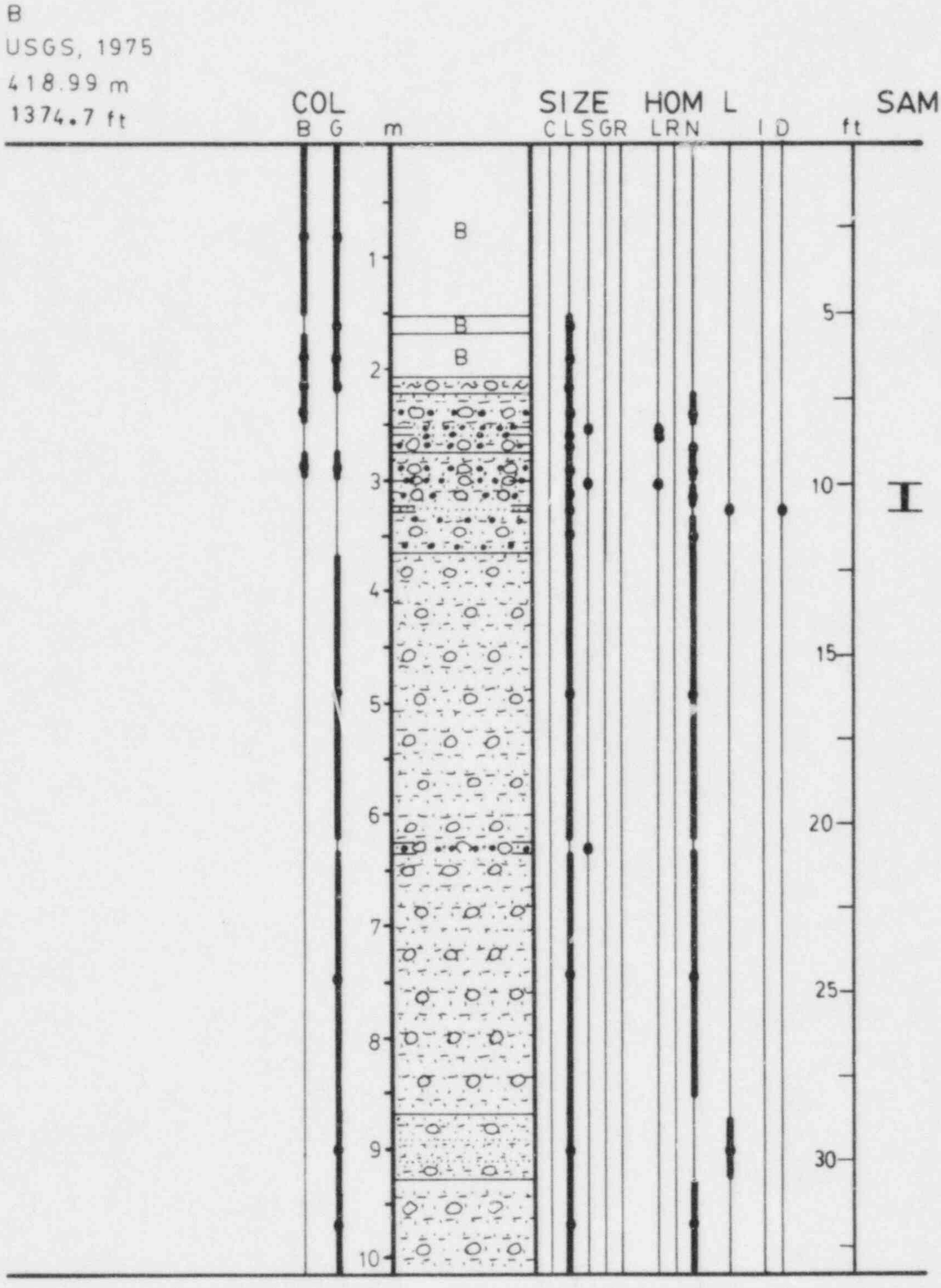


80-10
MILLER, 1980
P. 2

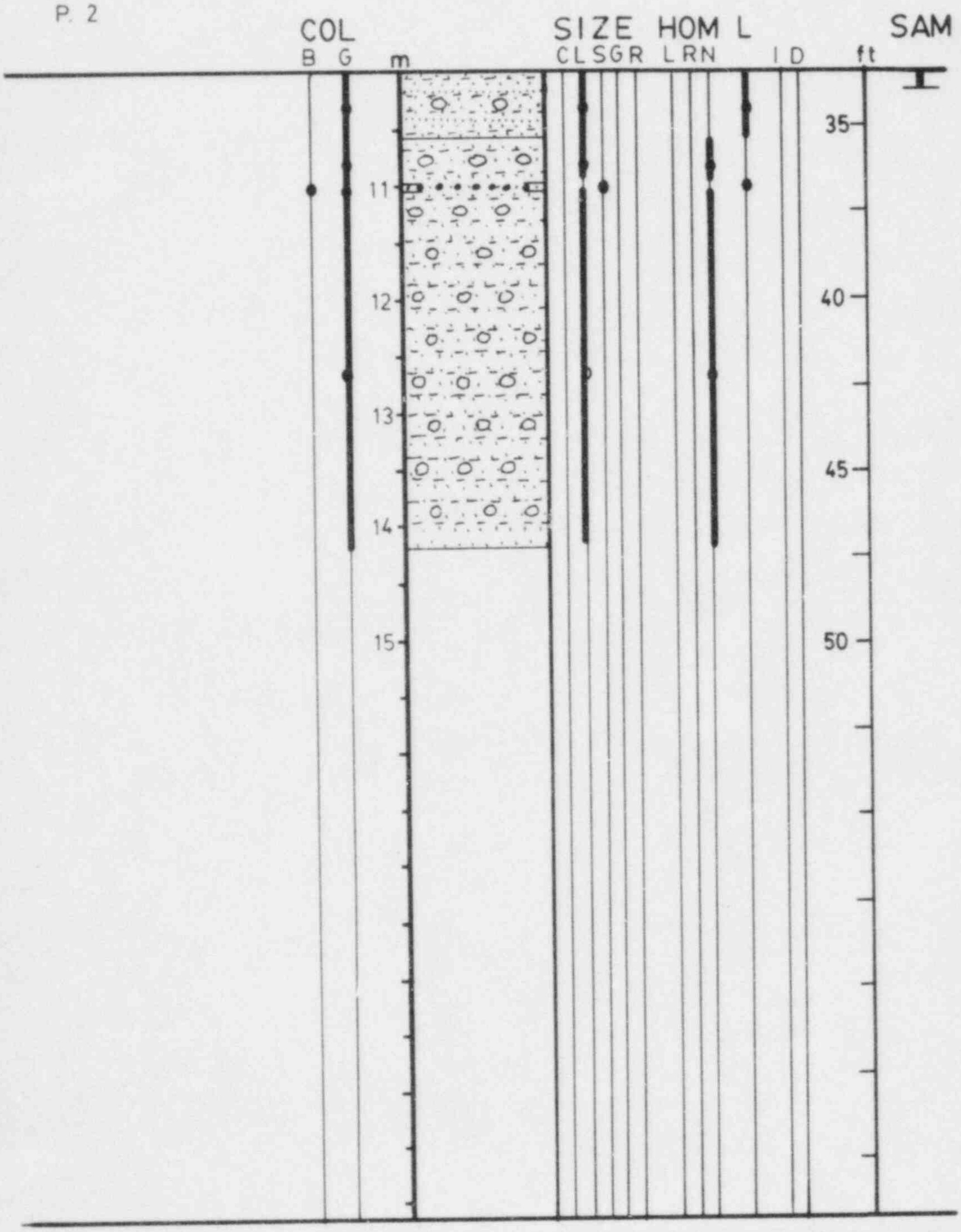


A2
USGS, 1975
420.63 m
1380.1 ft

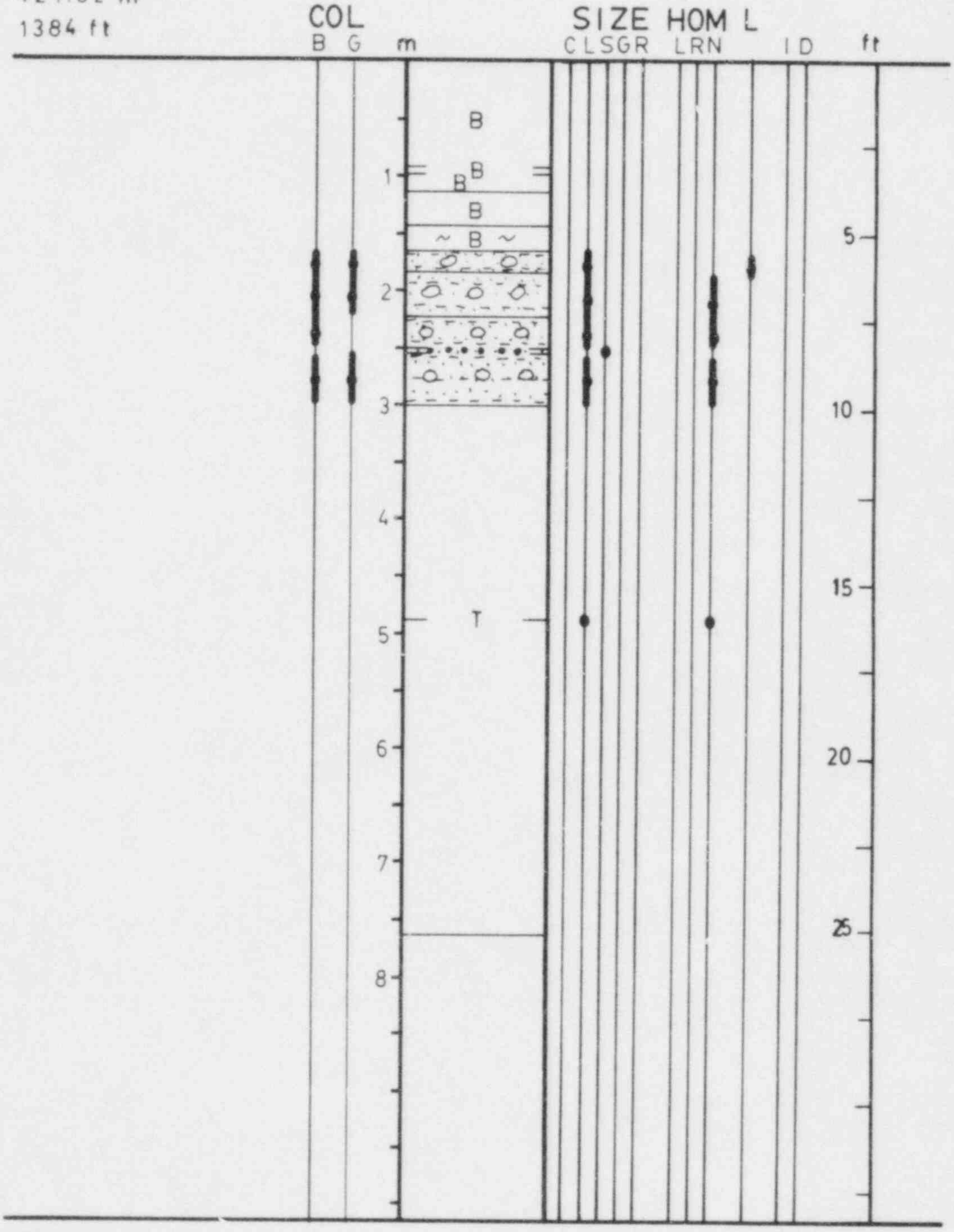



B
USGS, 1975
418.99 m
1374.7 ft
COL
B G
m
SIZE
C L S G R
HOM
L R N
L
I D
ft
SAM
B
B
B
1
2
3
4
5
6
7
8
9
10
5
10
15
20
25
30
I

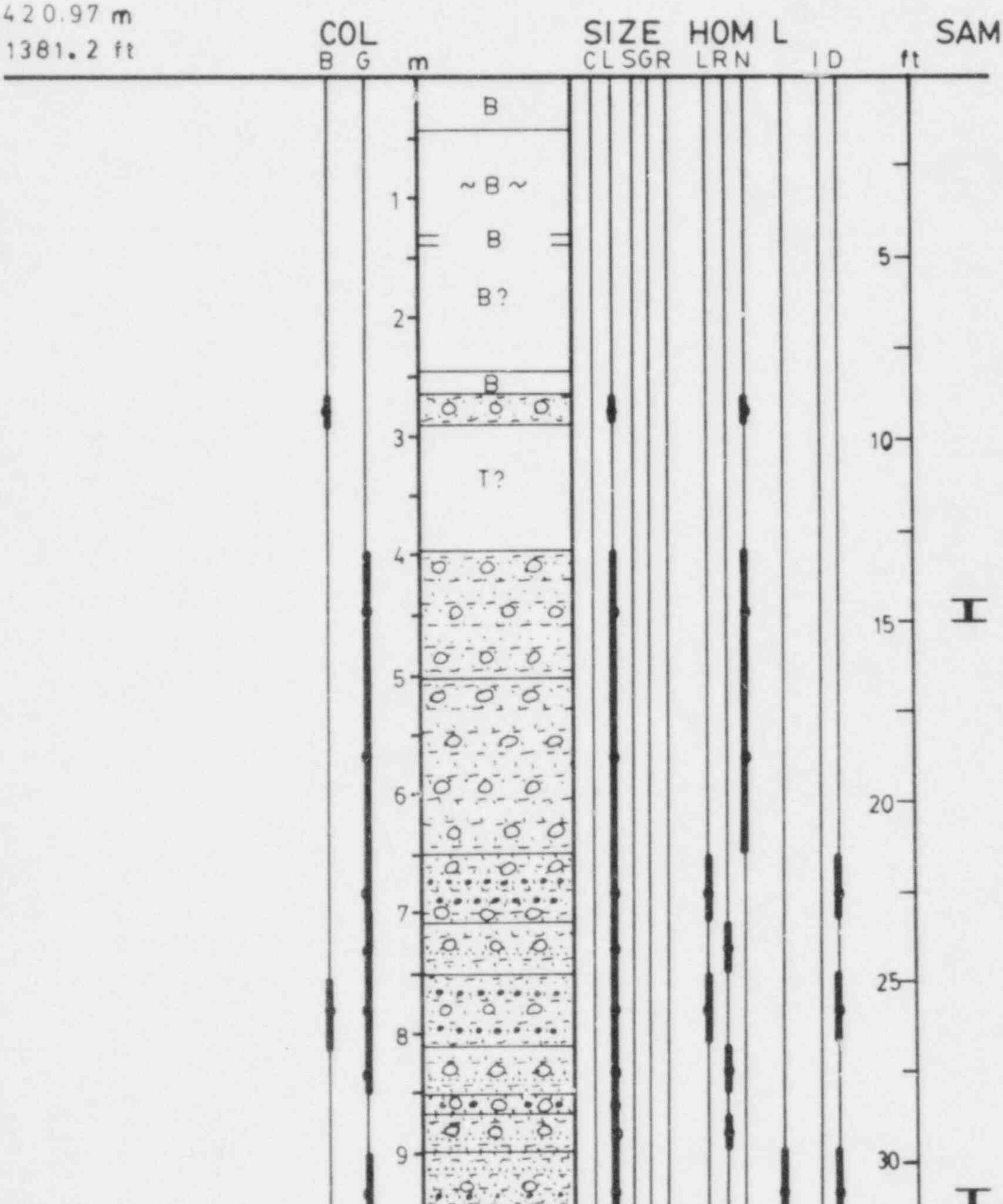
B
USGS, 1975
P. 2



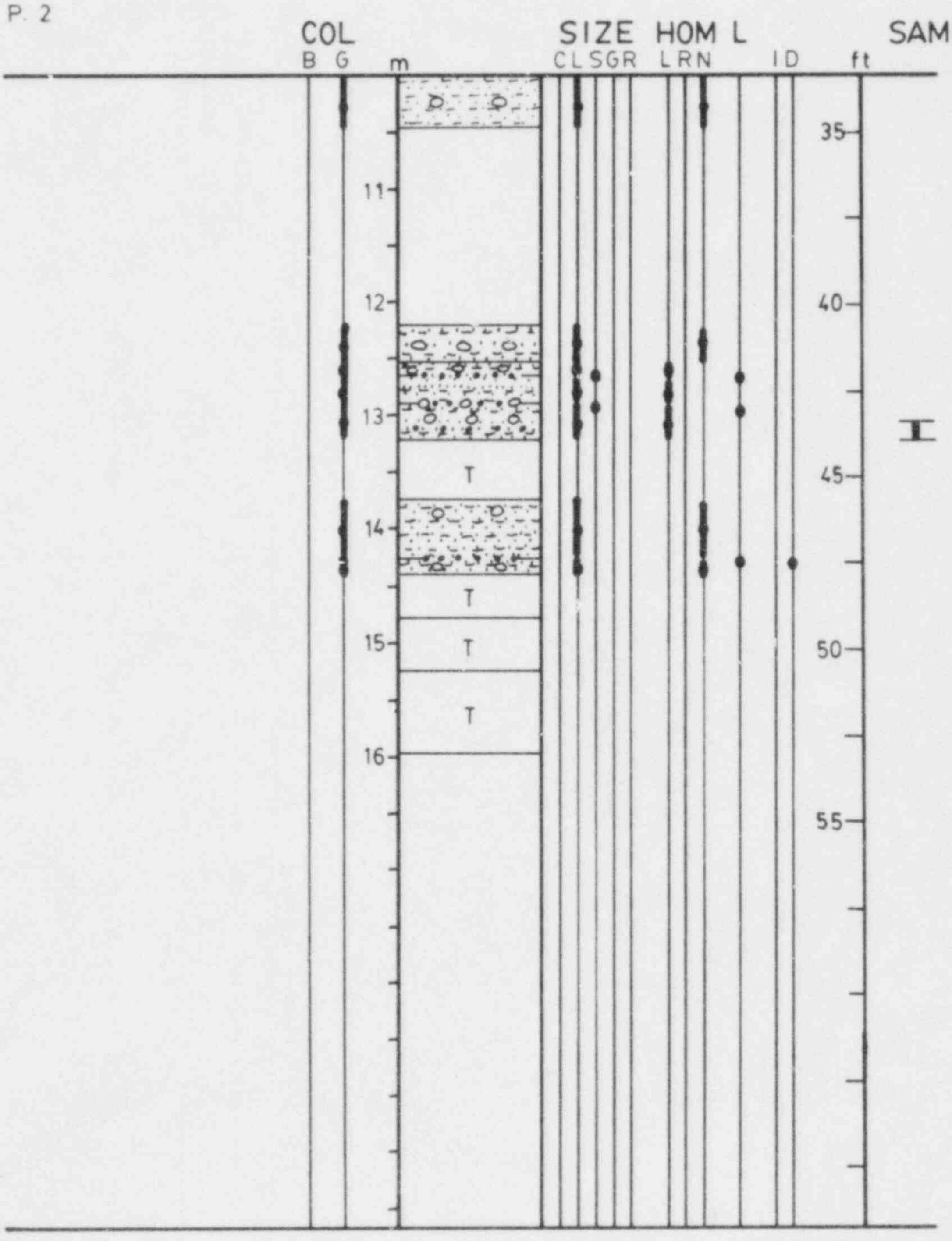
C
USGS, 1975
421.82 m
1384 ft



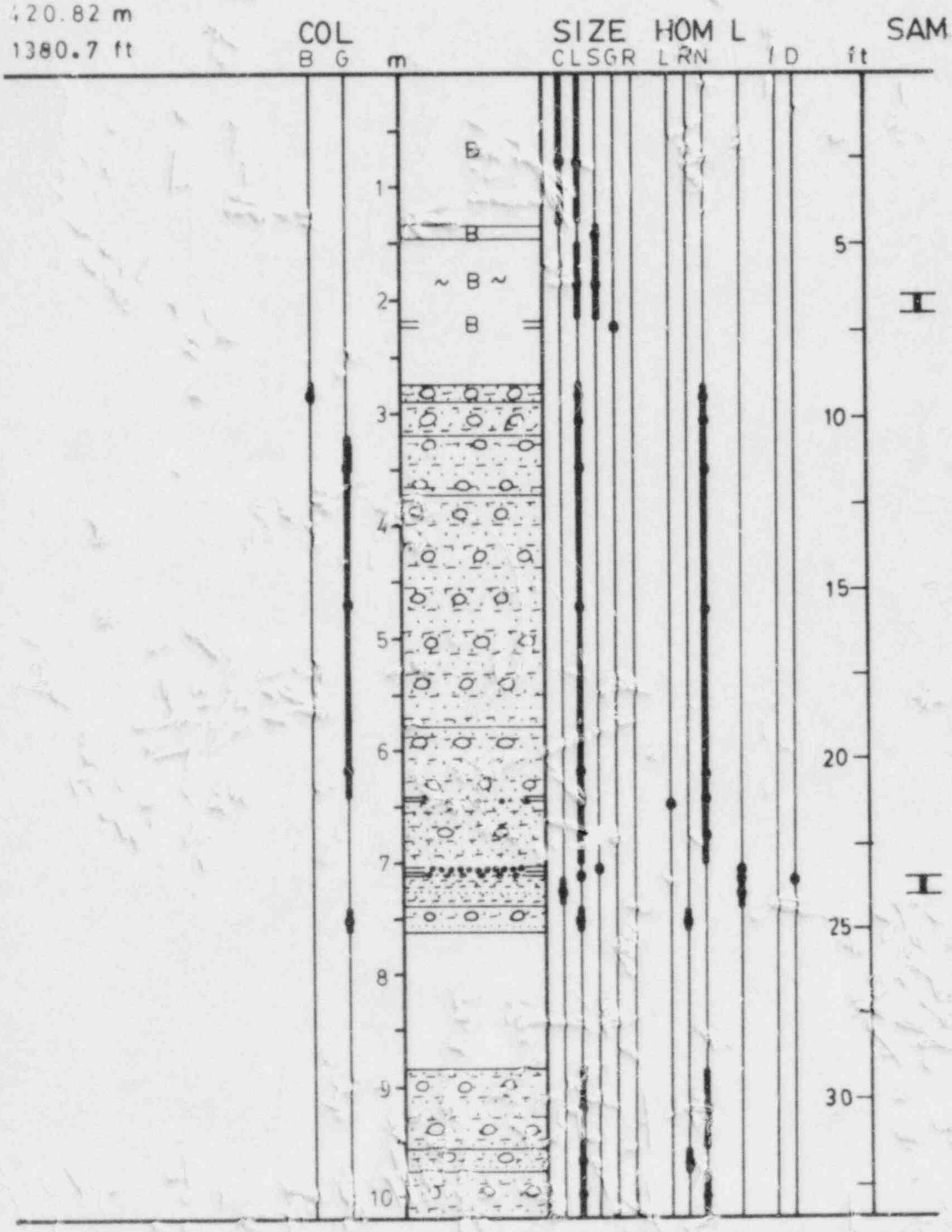
D
USGS, 1975
420.97 m
1381.2 ft



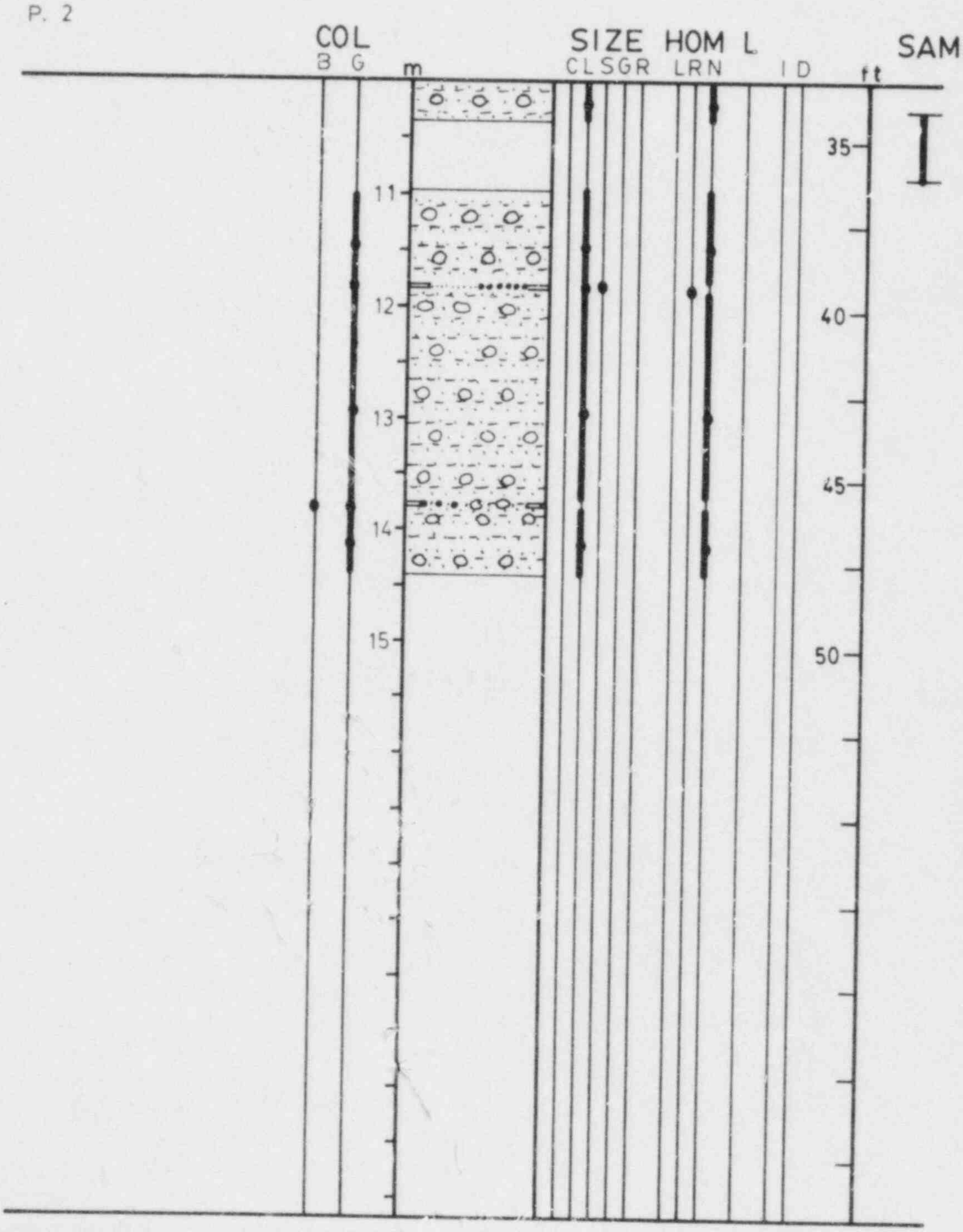
D
USGS, 1975
P. 2



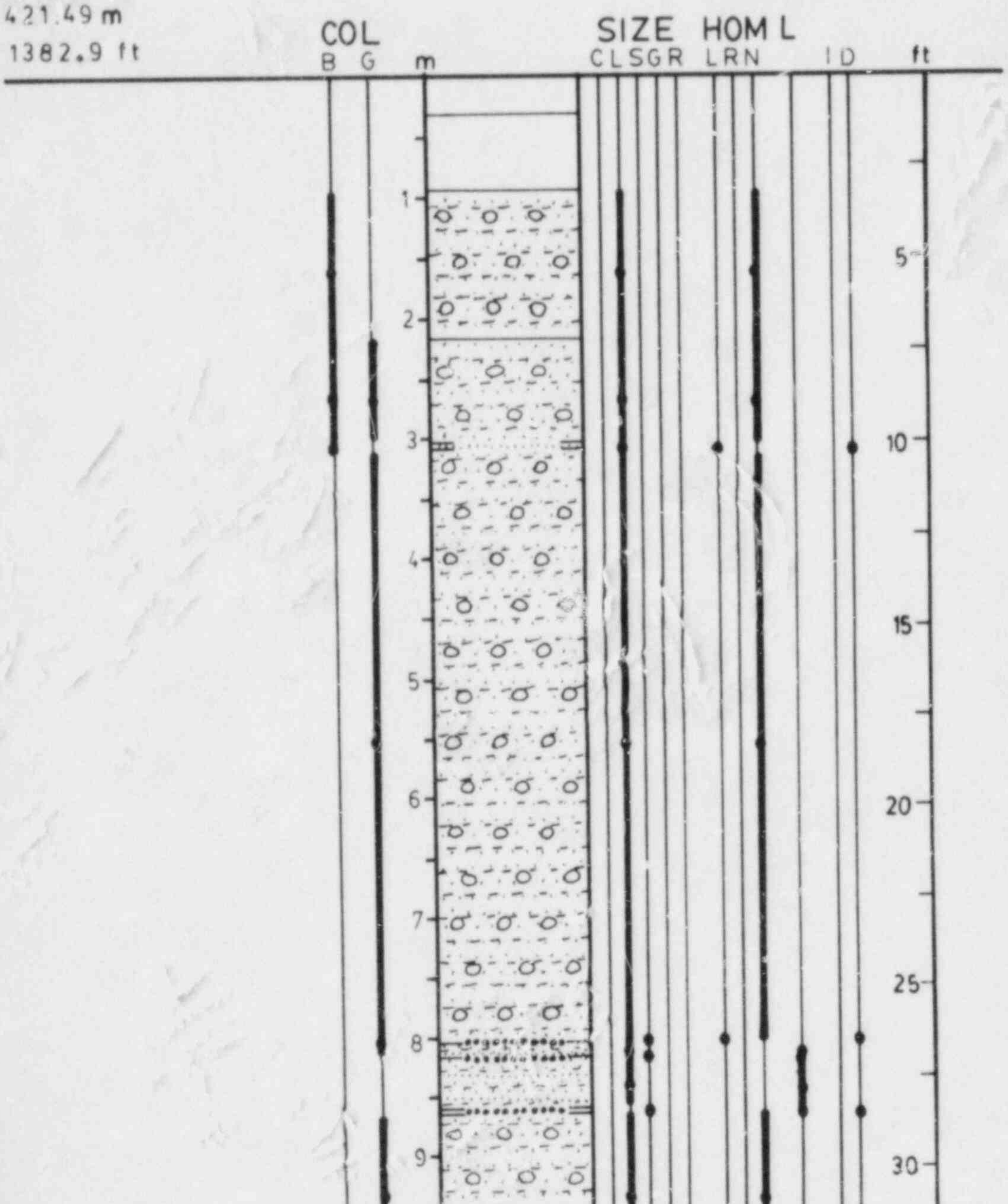
E
USGS, 1975
420.82 m
1380.7 ft



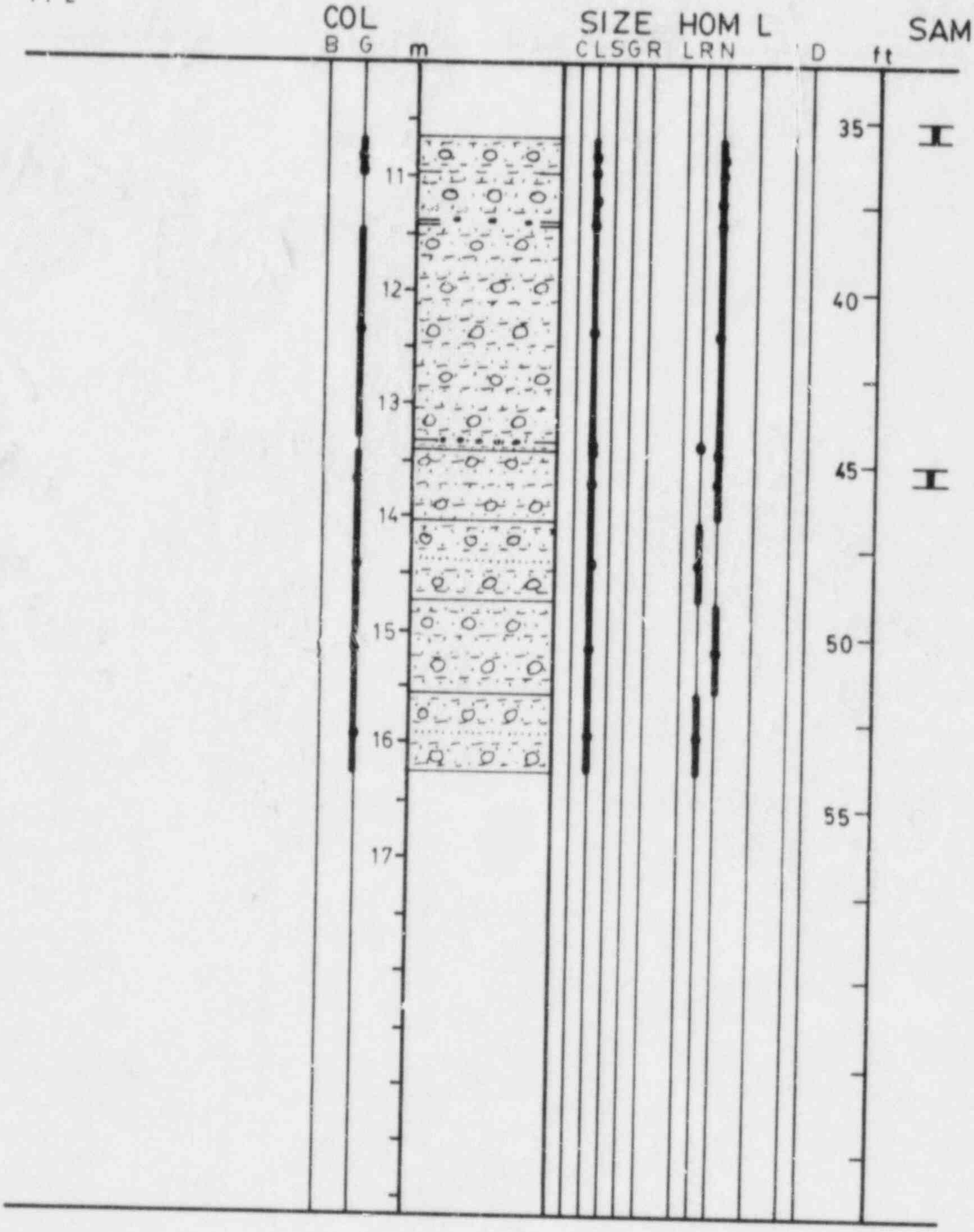
E
USGS, 1975
P. 2

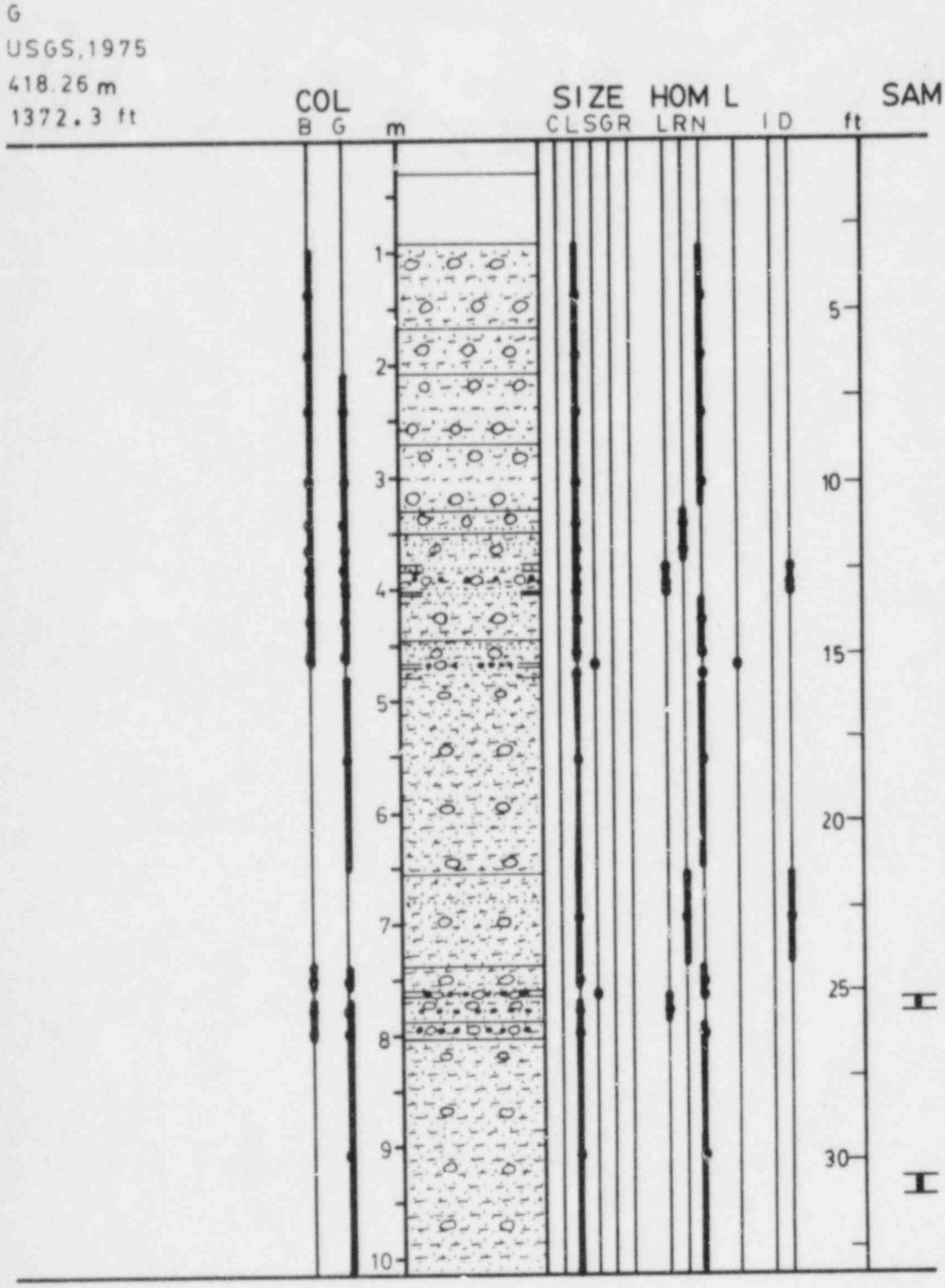


F
USGS 1975
421.49 m
1382.9 ft



F
USGS, 1975
P. 2

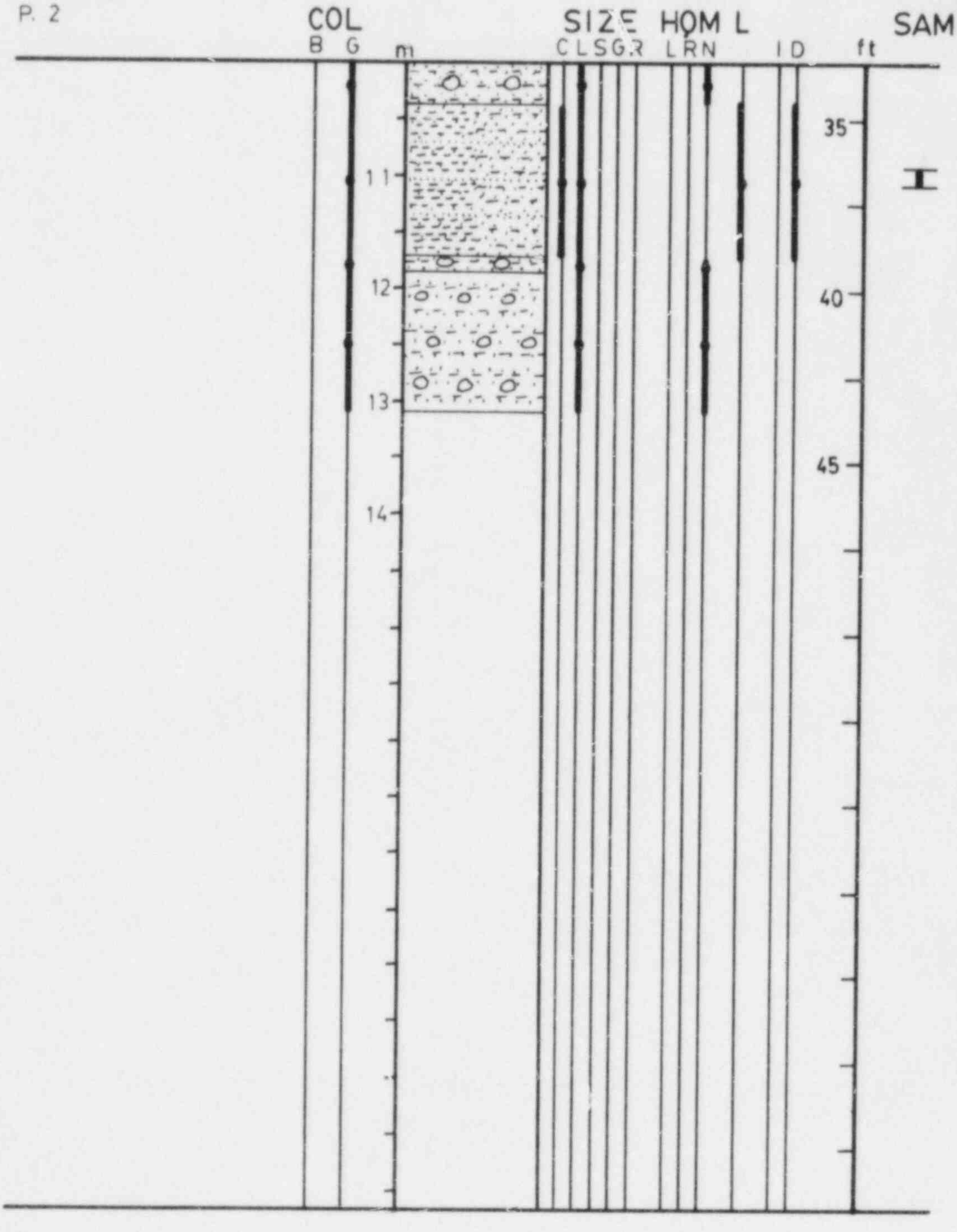



G
USGS,1975
418.26 m
1372.3 ft
COL
B G
m
SIZE
CLSGR
HOM
LRN
L
I D
ft
SAM
1
2
3
4
5
6
7
8
9
10
5
10
15
20
25
30

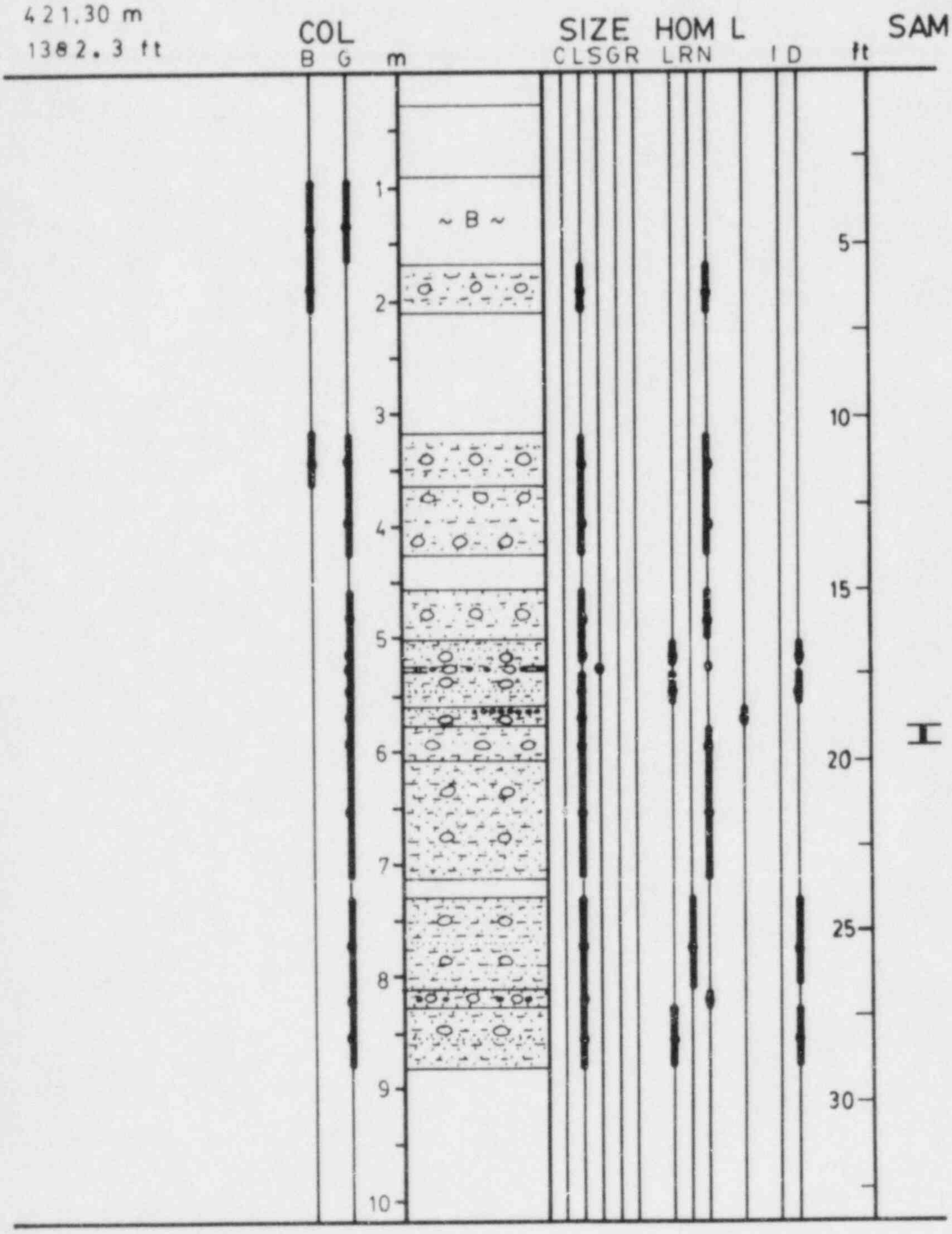
G

USGS, 1975

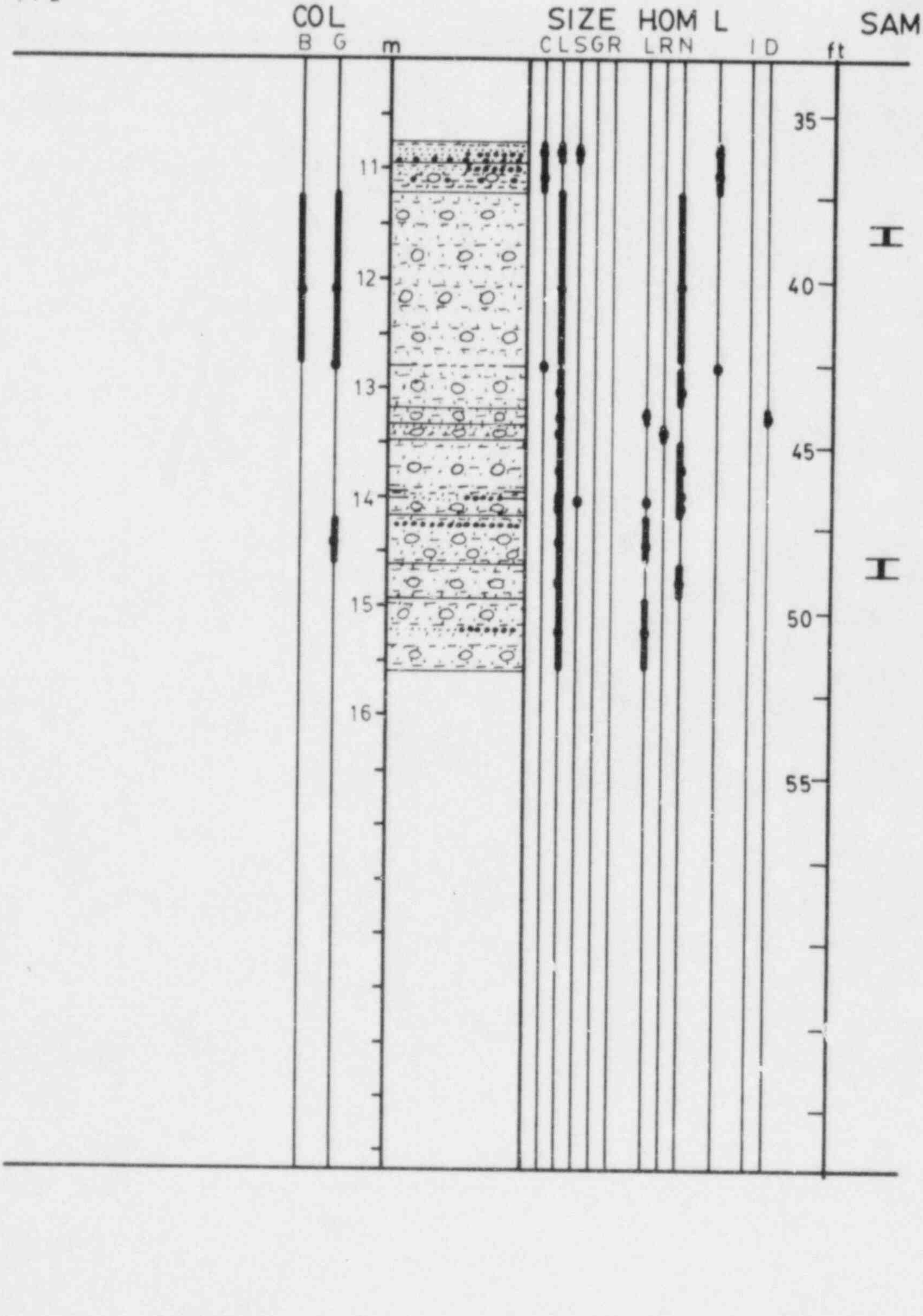
P. 2

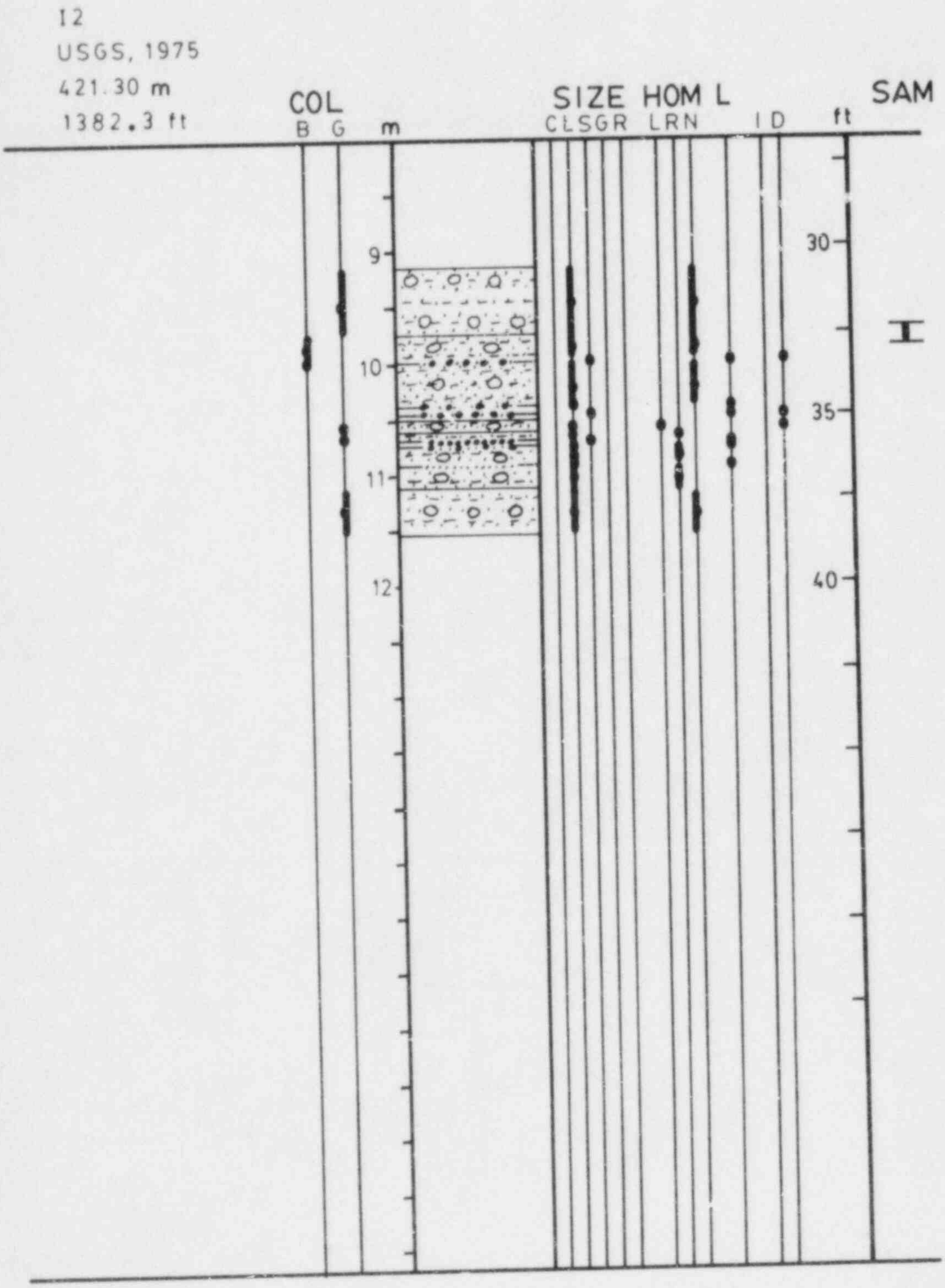


I
USGS, 1975
421.30 m
1382.3 ft



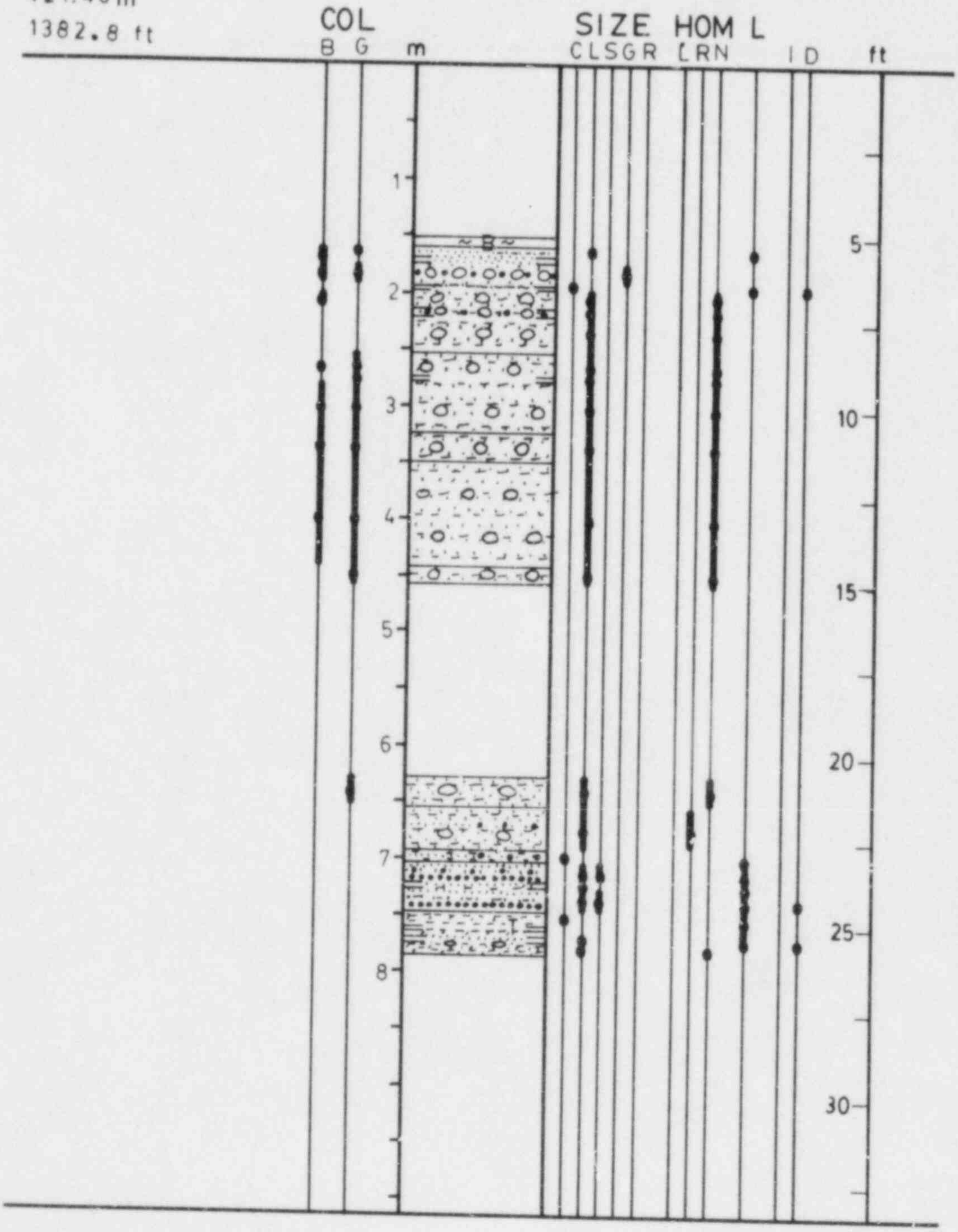
I
USGS, 1975
P. 2



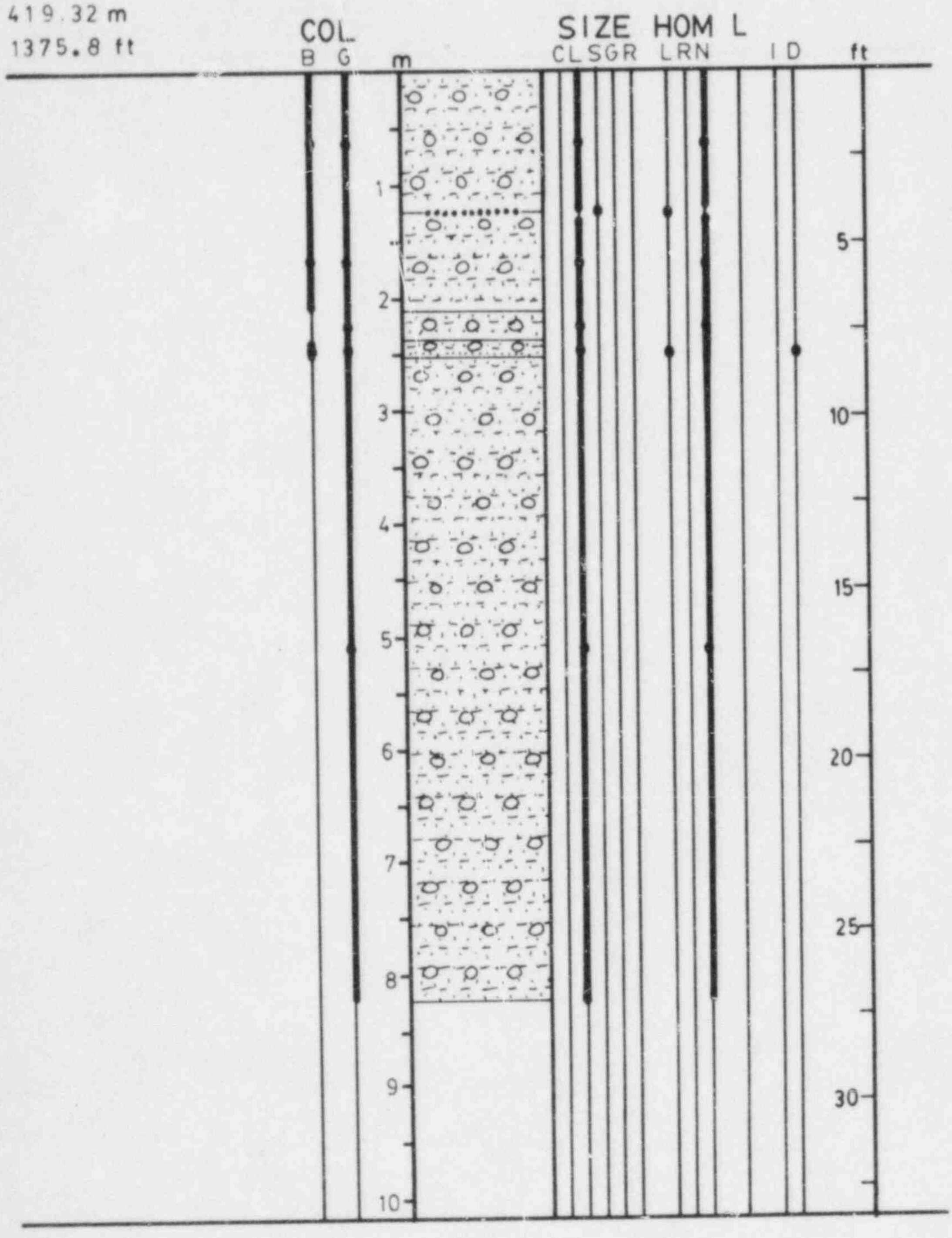


I2
USGS, 1975
421.30 m
1382.3 ft
COL
B G
m
SIZE HOM L
CLSGR LRN
I D
ft
SAM
9
10
11
12
30
35
40

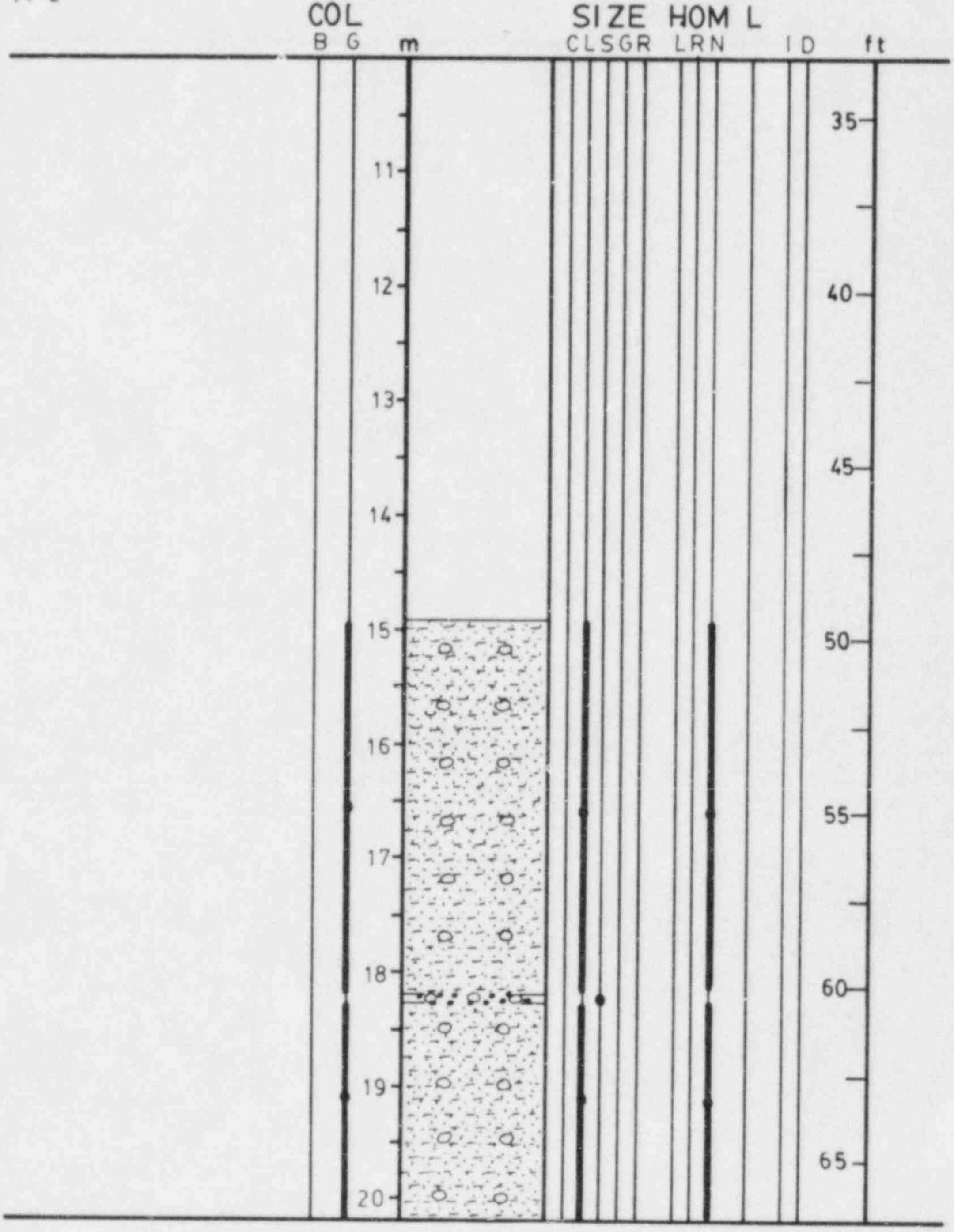
I 3
USGS, 1975
421.46 m
1382.8 ft



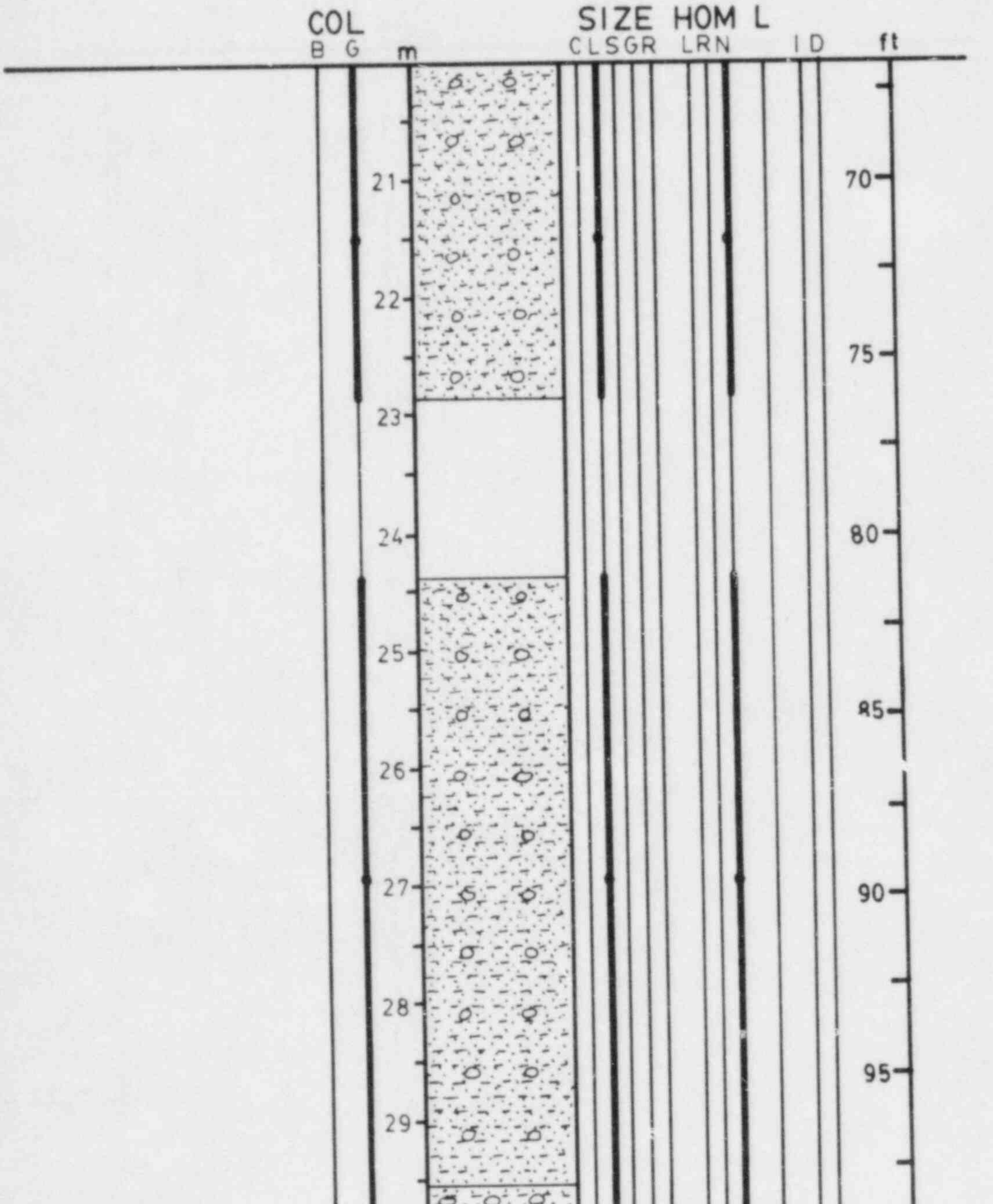
J
USGS, 1975
419.32 m
1375.8 ft



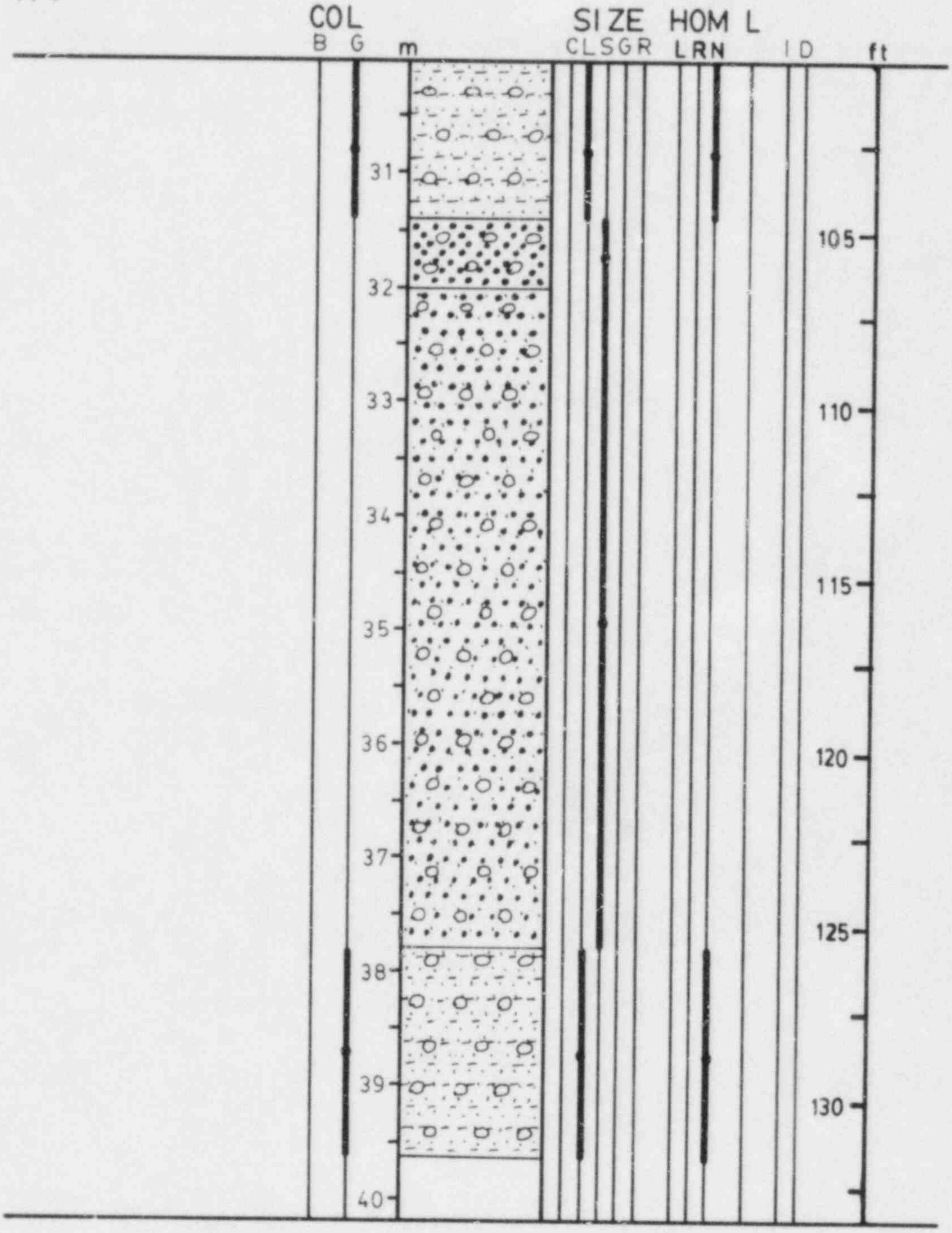
J
USGS, 1975
P. 2



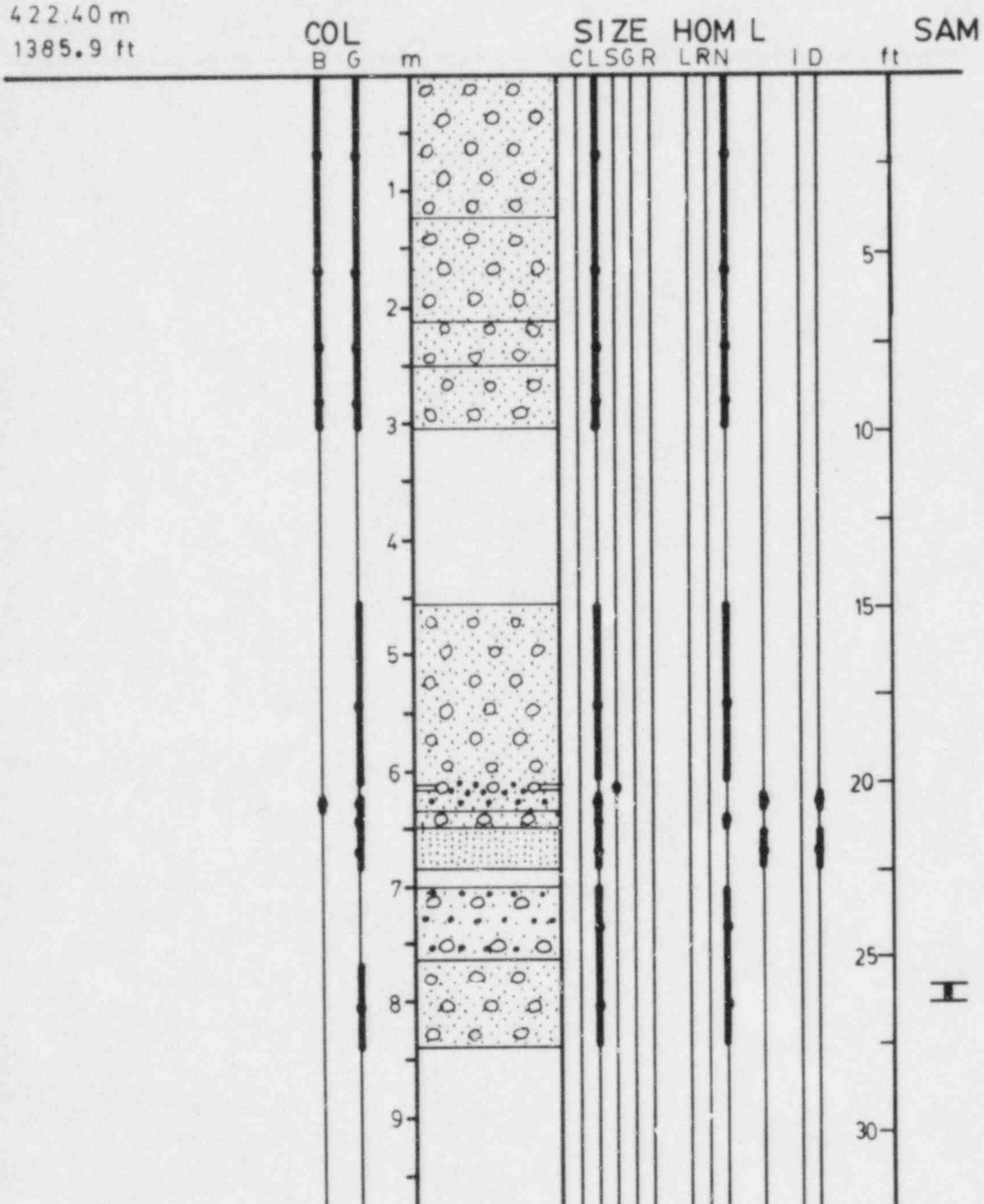
J
USGS, 1975
P. 3



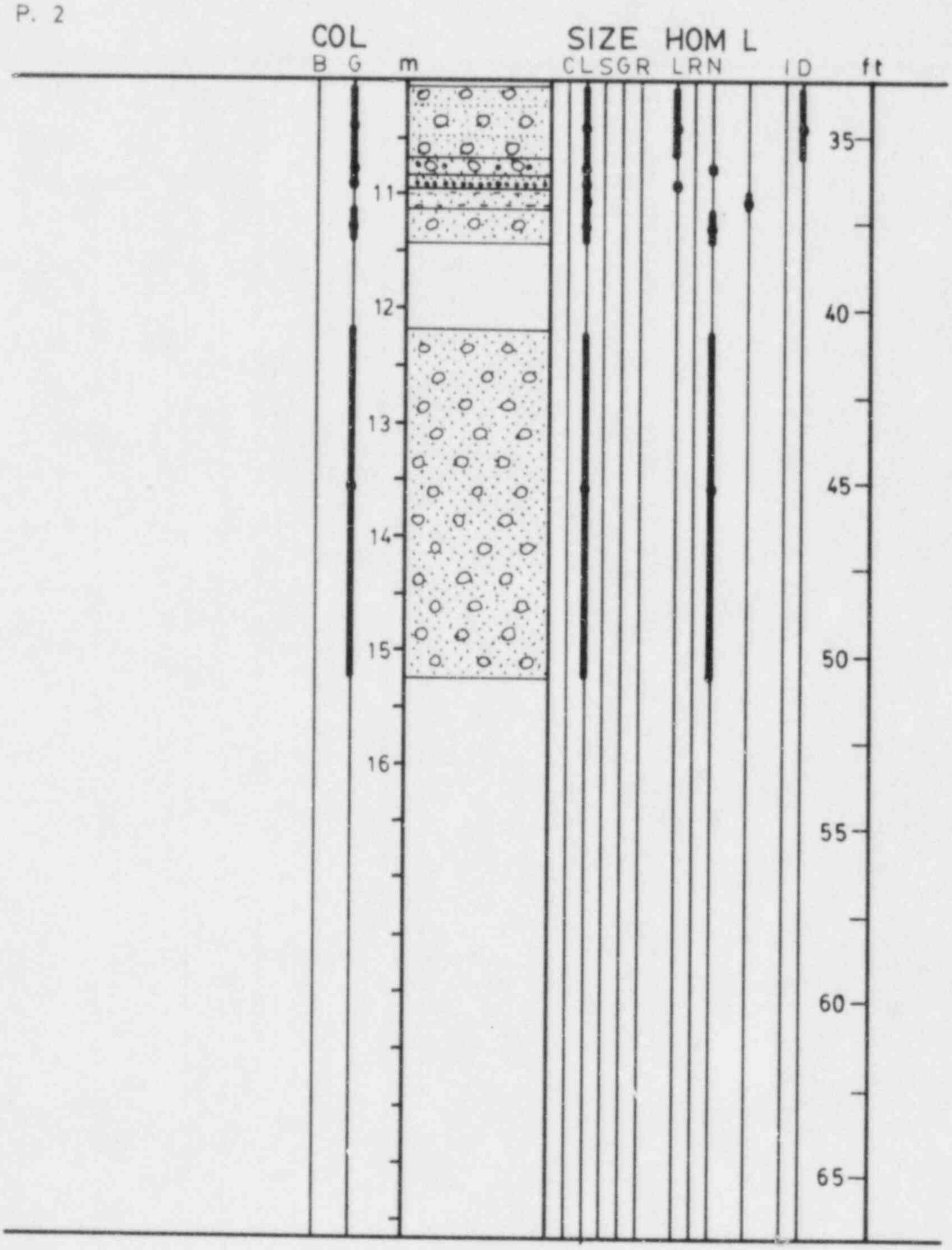
J
USGS, 1975
P. 4



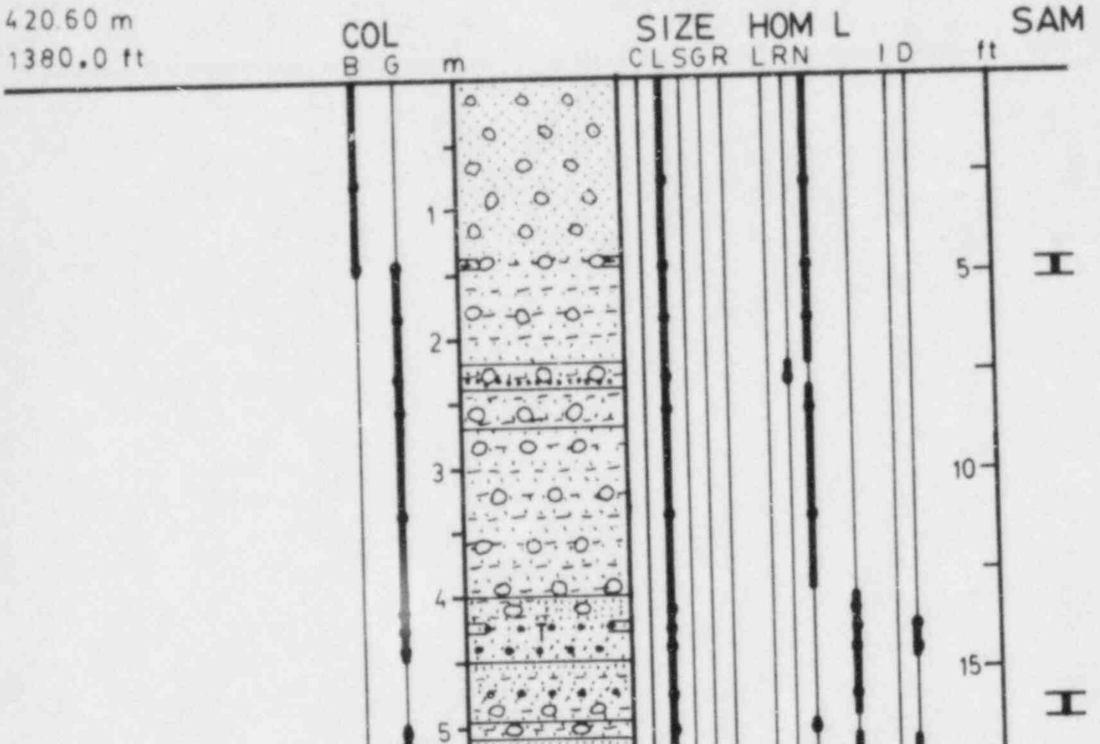
K
USGS, 1975
422.40 m
1385.9 ft



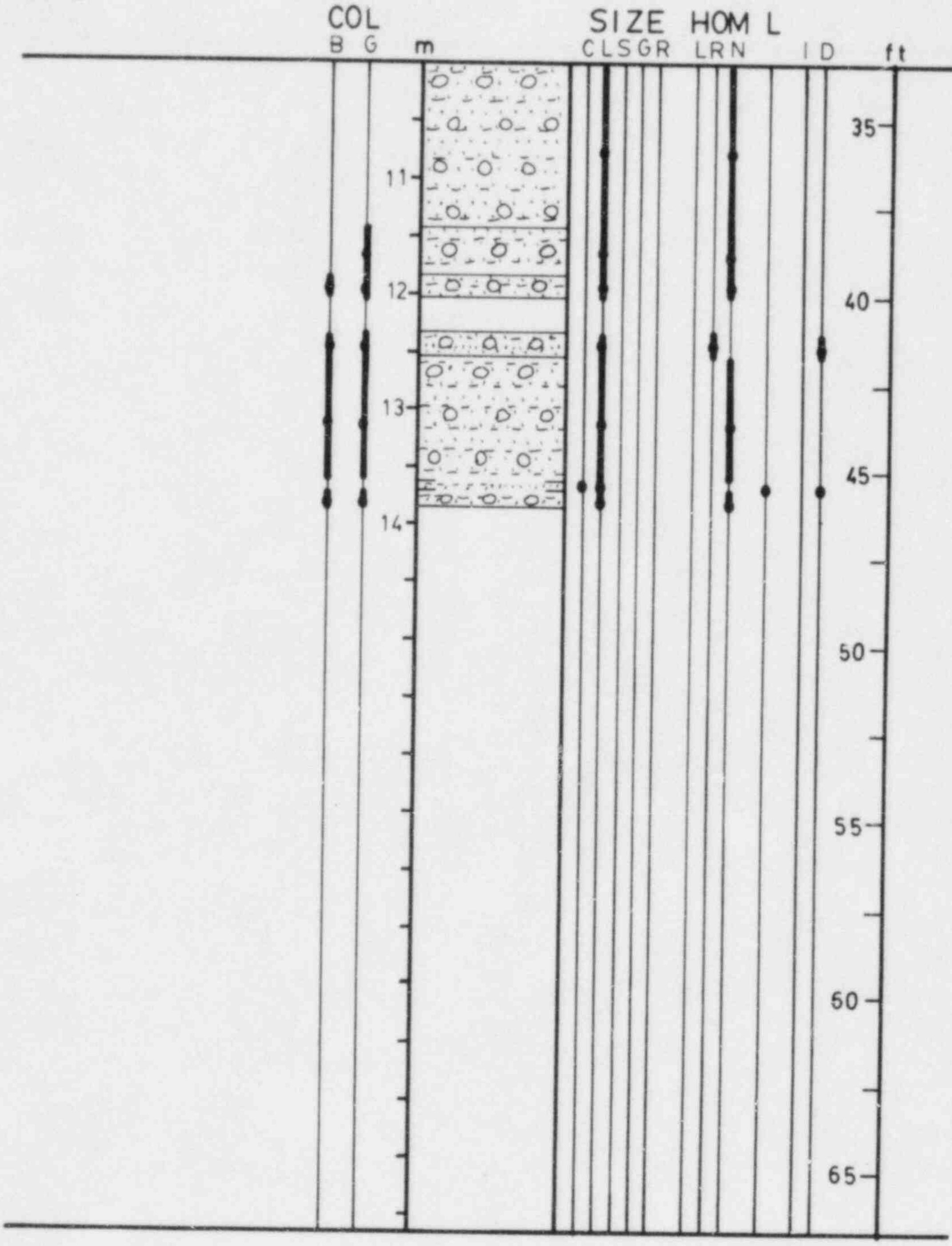
USGS, 1975
P. 2


COL
B G
m
SIZE
CL S G R
HOM
L R N
L
I D
ft
11
12
13
14
15
16
35
40
45
50
55
60
65

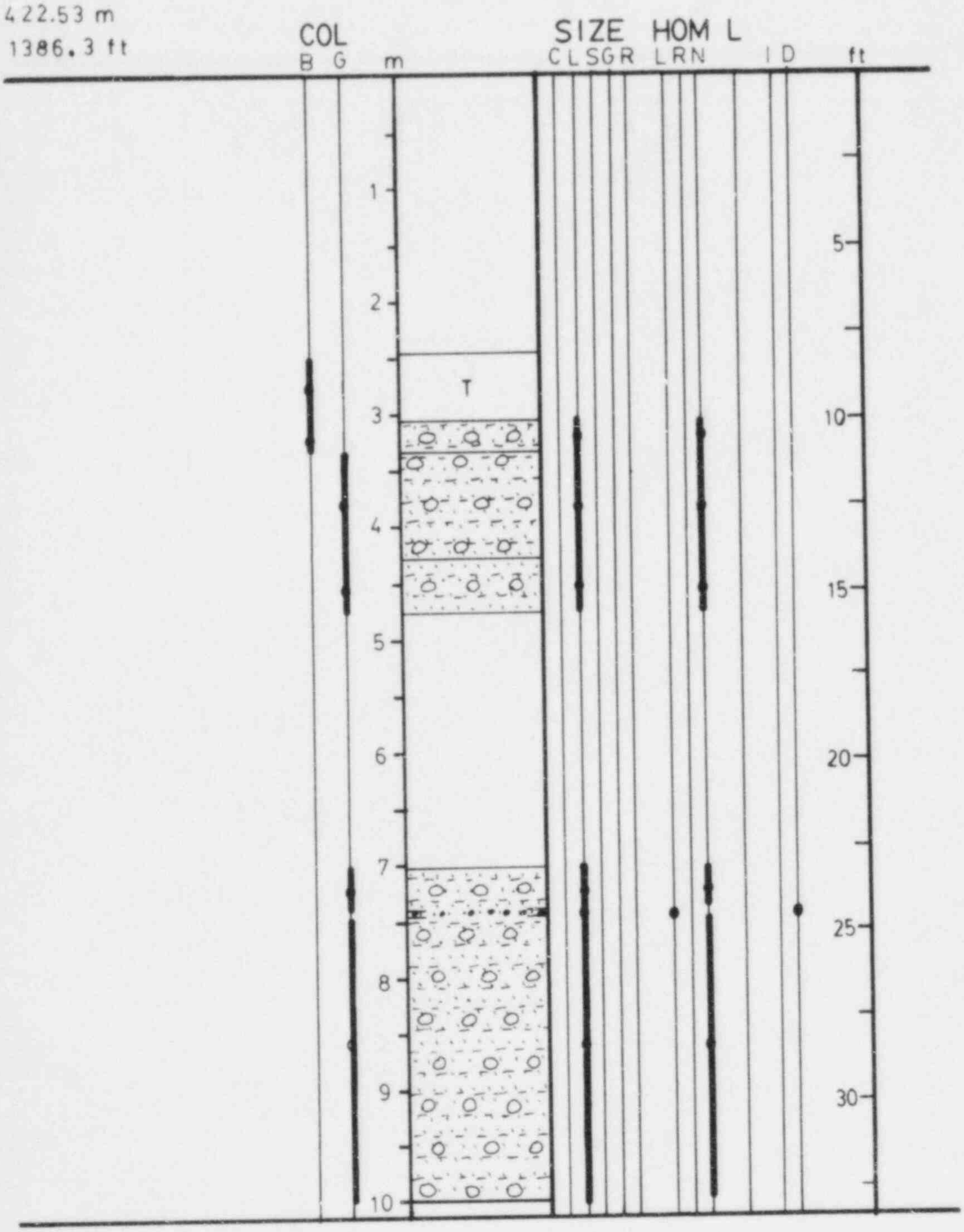
L
USGS, 1975
420.60 m
1380.0 ft



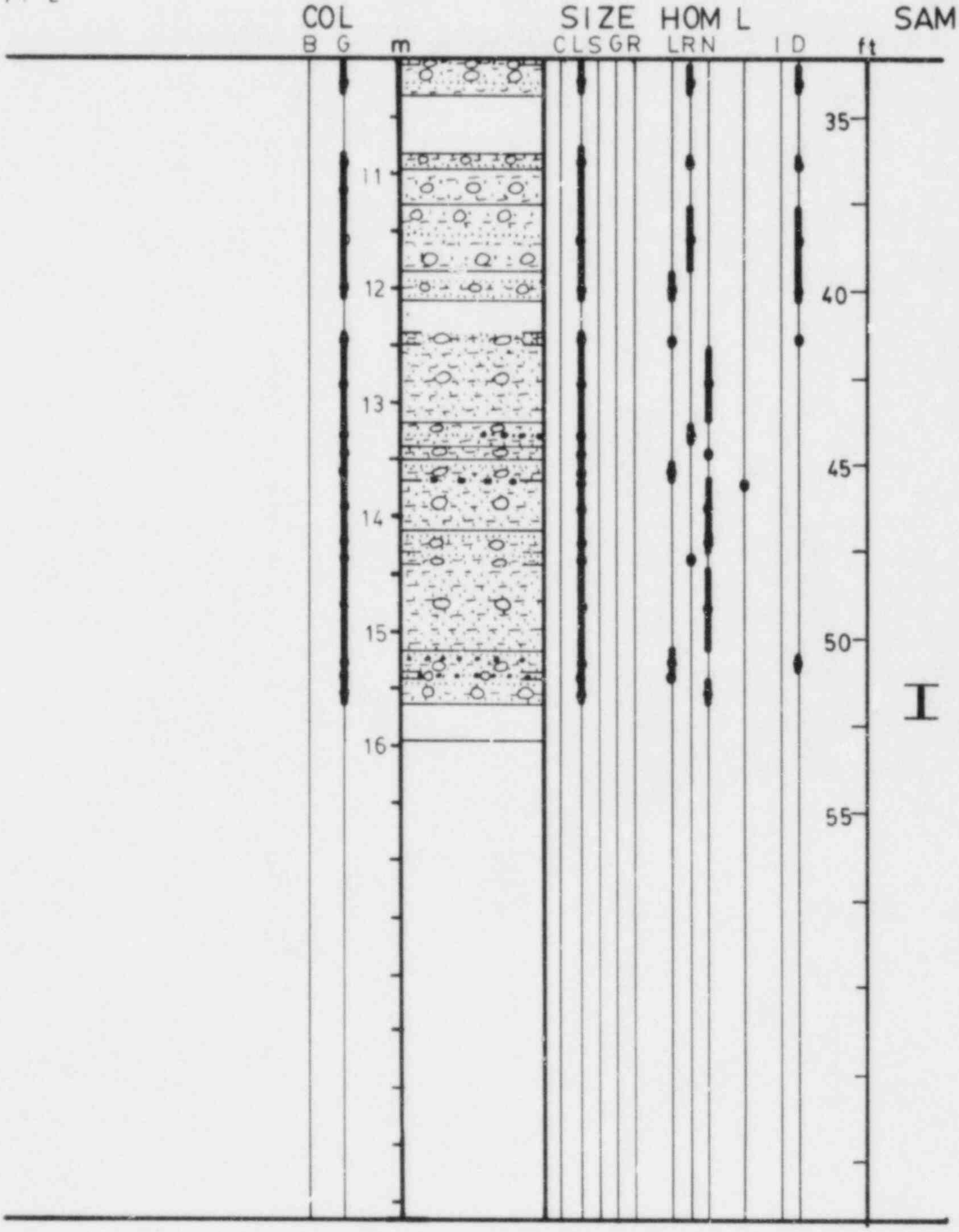
L
USGS, 1975
P. 2

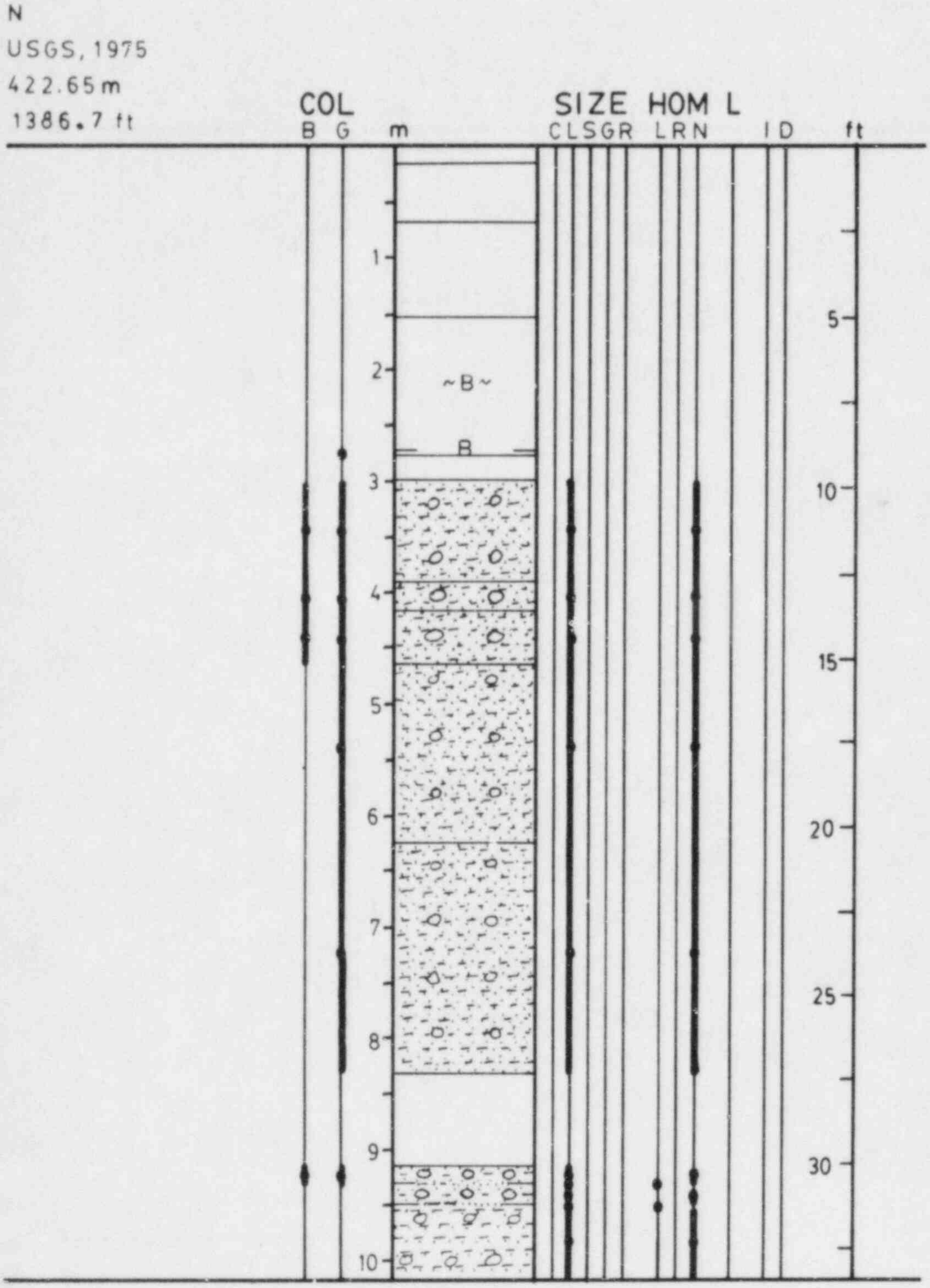


M
USGS, 1975
422.53 m
1386.3 ft



M
USGS, 1975
P. 2




N
USGS, 1975
422.65m
1386.7 ft
COL
B G
m
SIZE HOM L
CLSGR LRN
I D
ft
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B
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25
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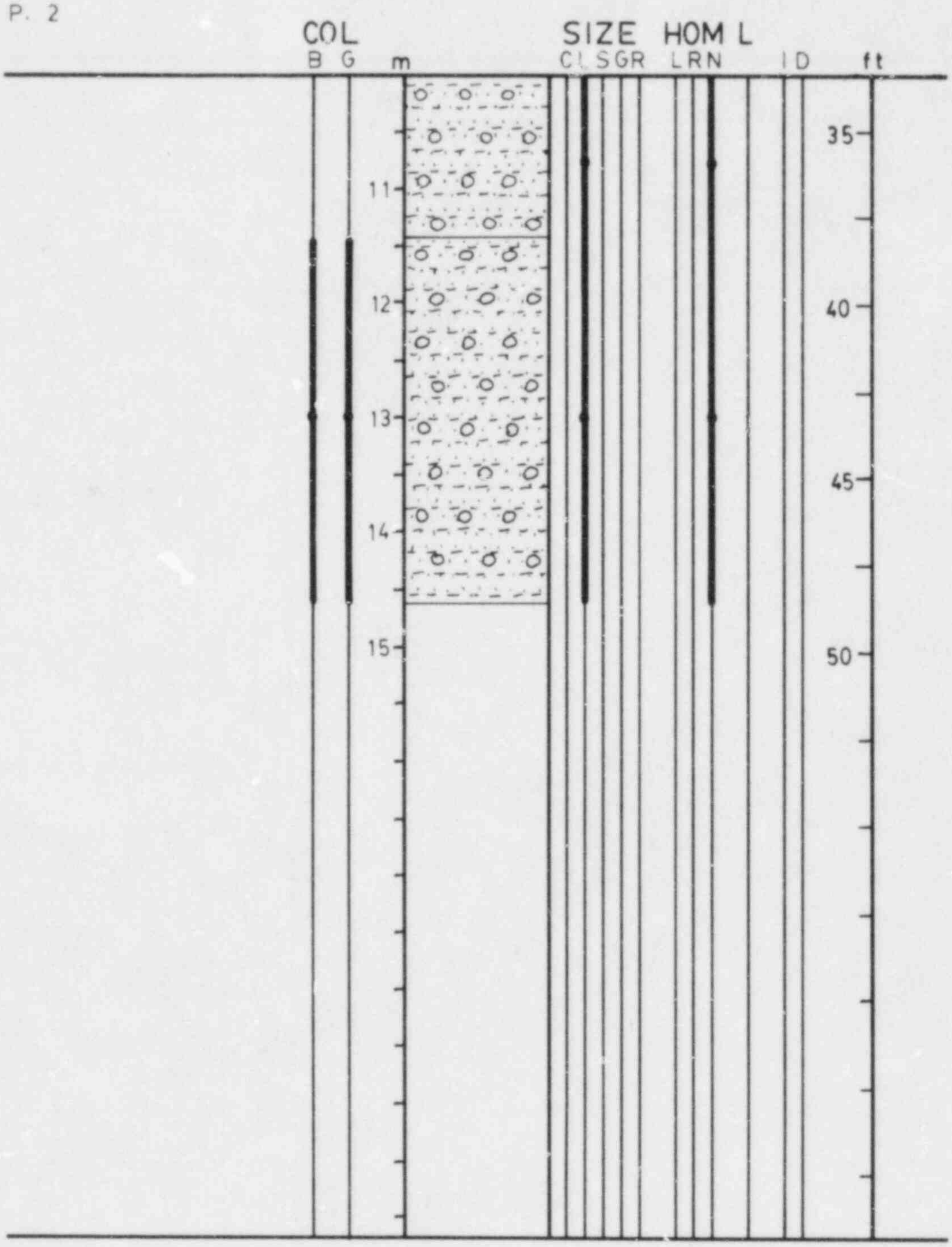
N
USGS, 1975
P. 2



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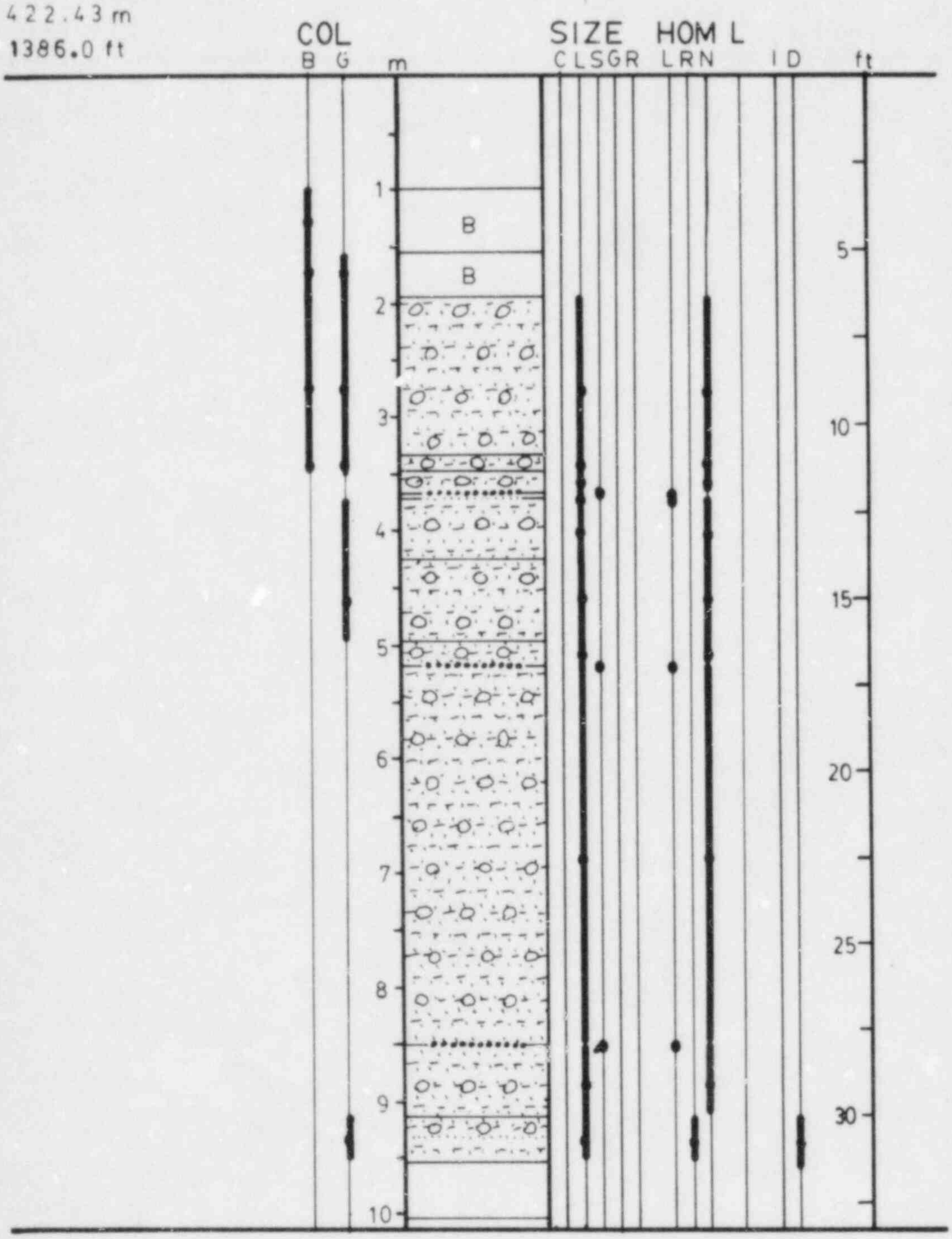
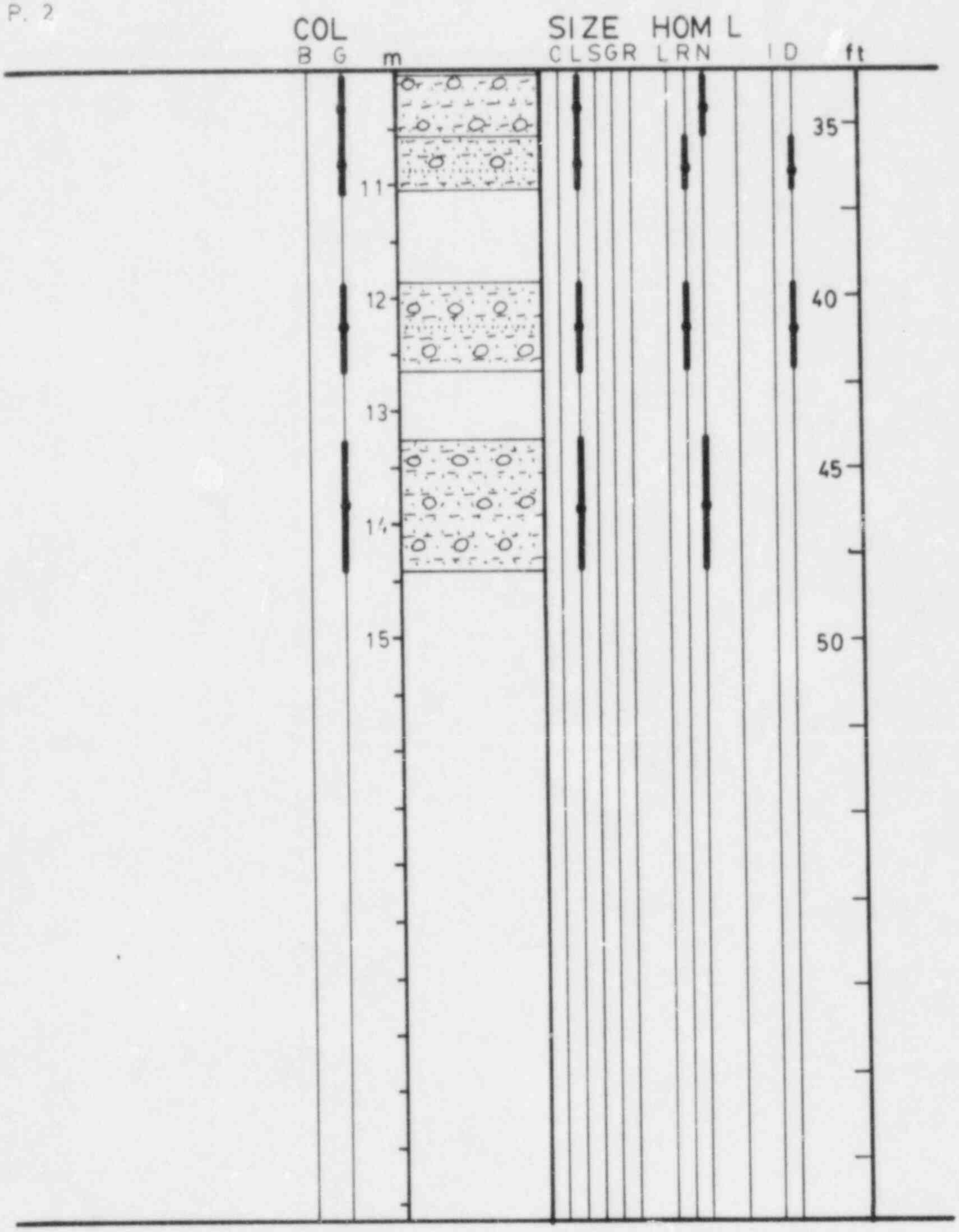
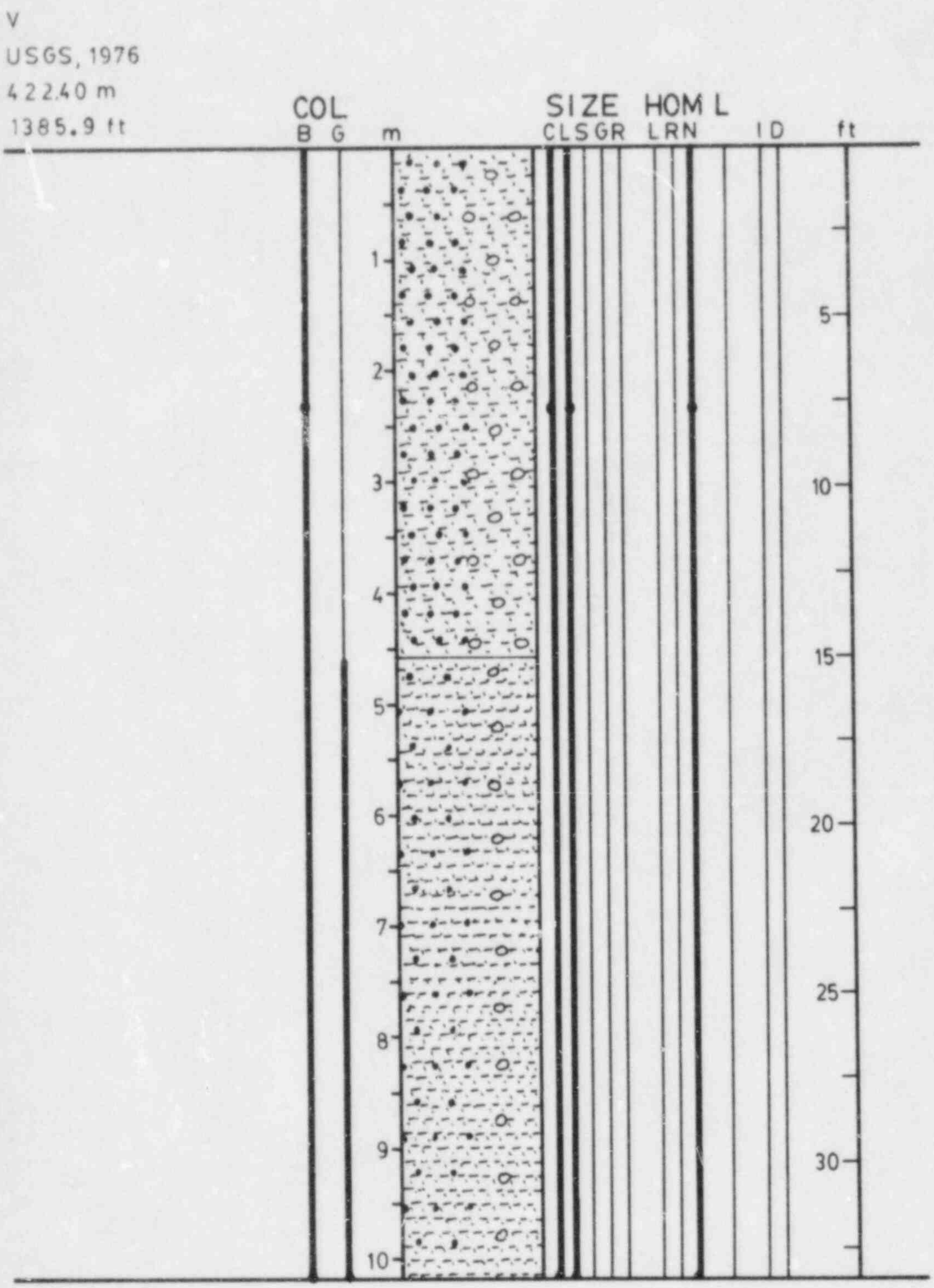
USGS, 1975
422.43 m
1386.0 ft



P
USGS, 1975
P. 2




V
USGS, 1976
422.40 m
1385.9 ft
COL
B G
m
SIZE HOM L
CLSGR LRN ID
ft
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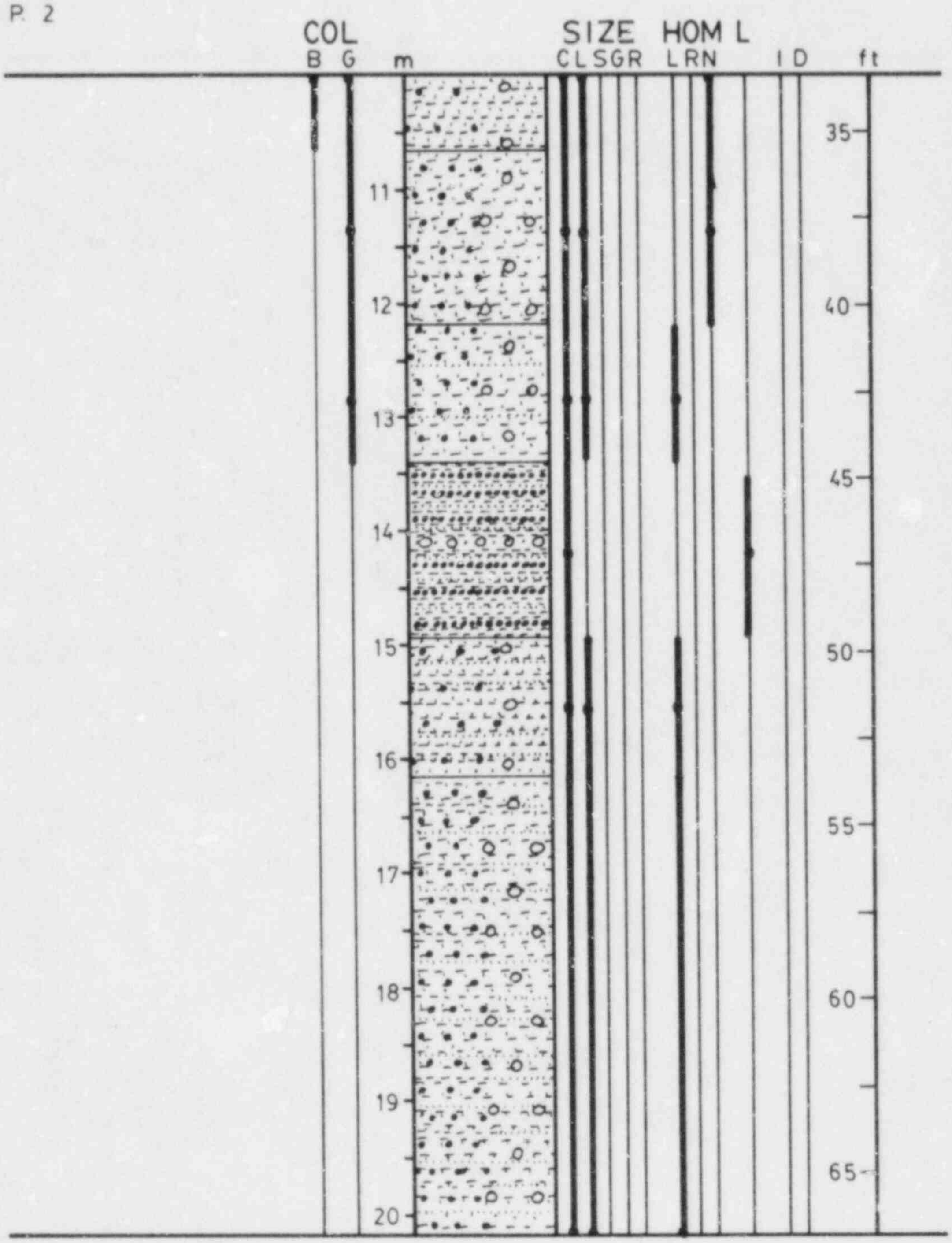
V
USGS, 1976
P. 2



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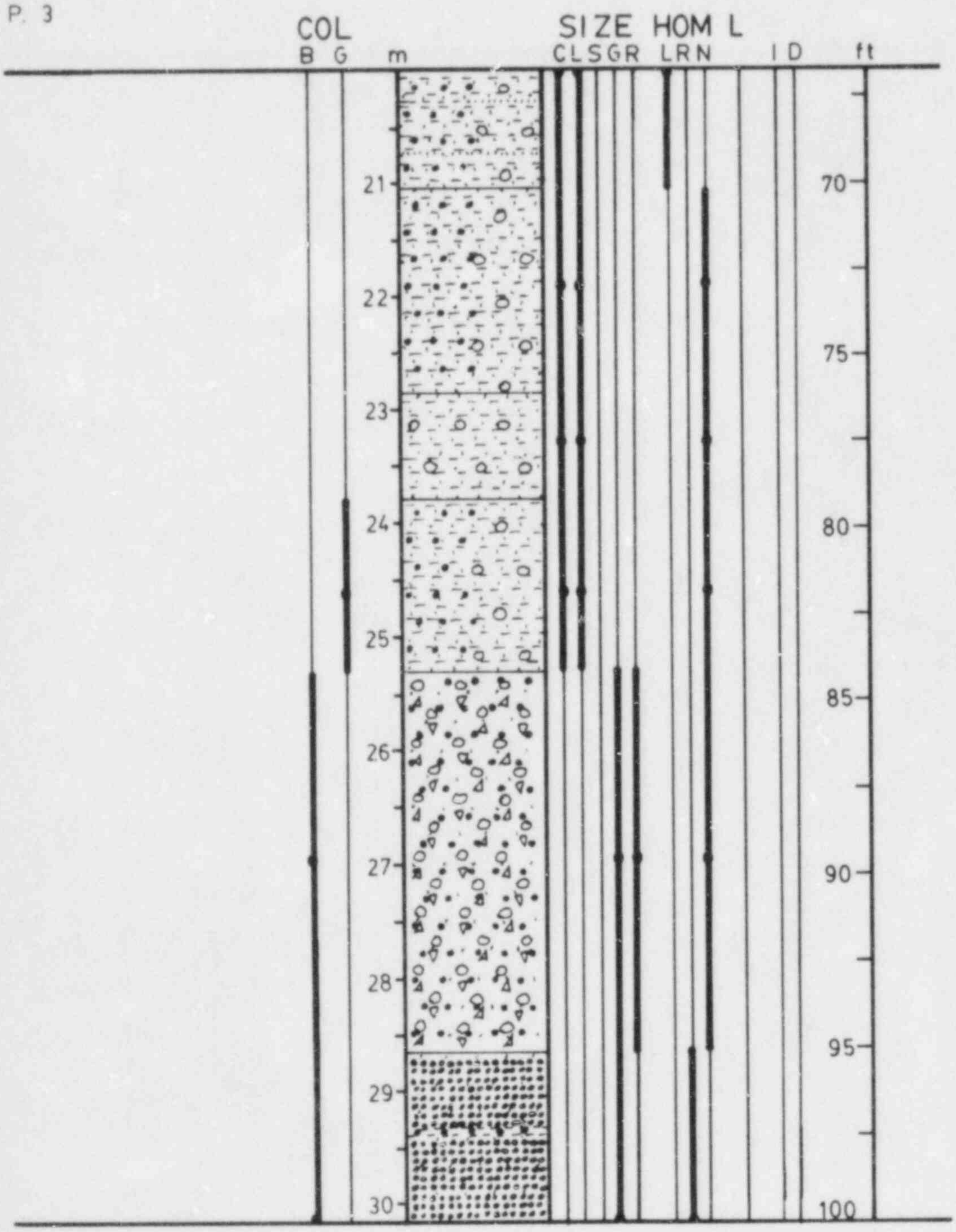
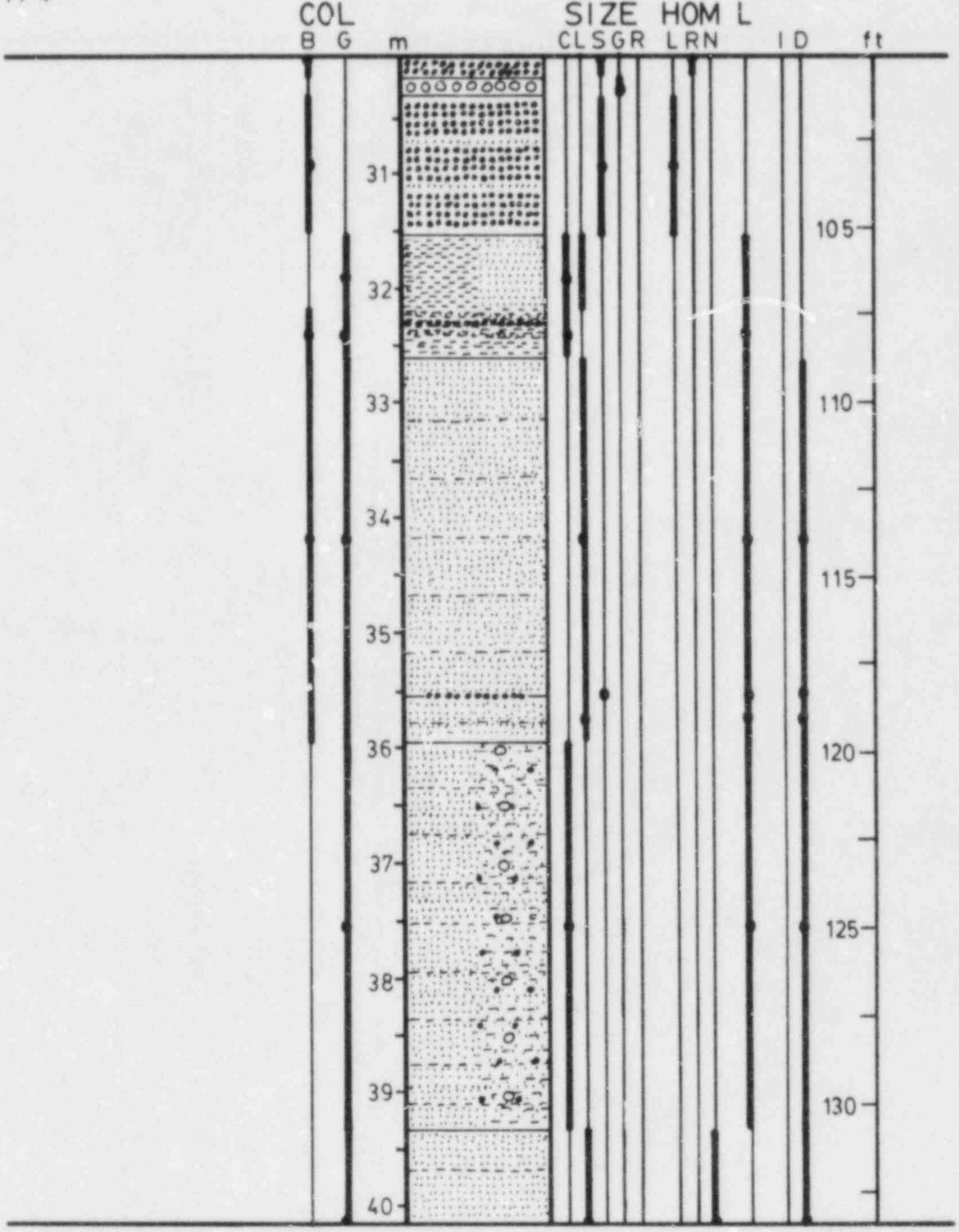
USGS, 1976
P. 3



V
USGS, 1976
P. 4



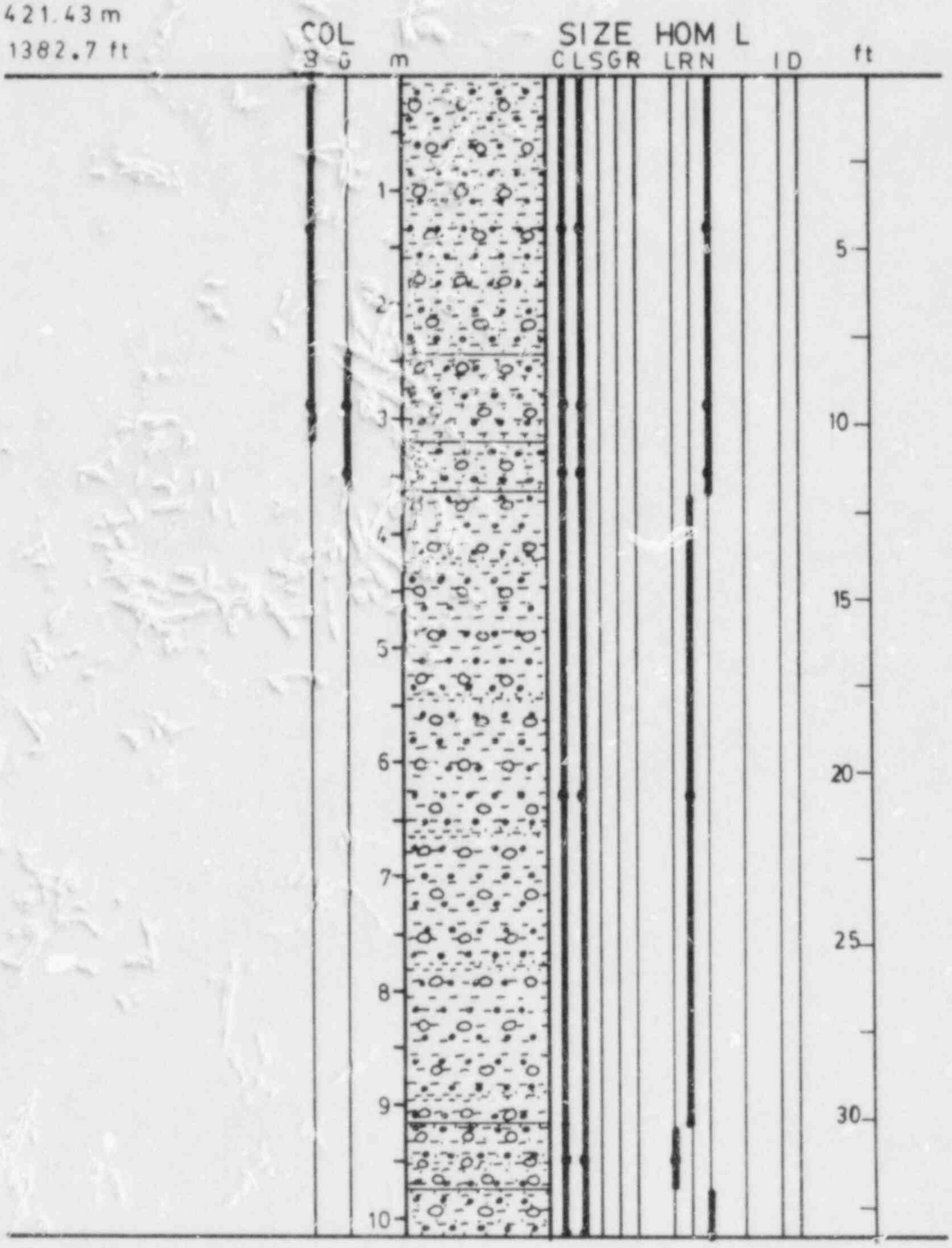
V
USGS, 1976
P. 5

W

USGS, 1976

421.43 m

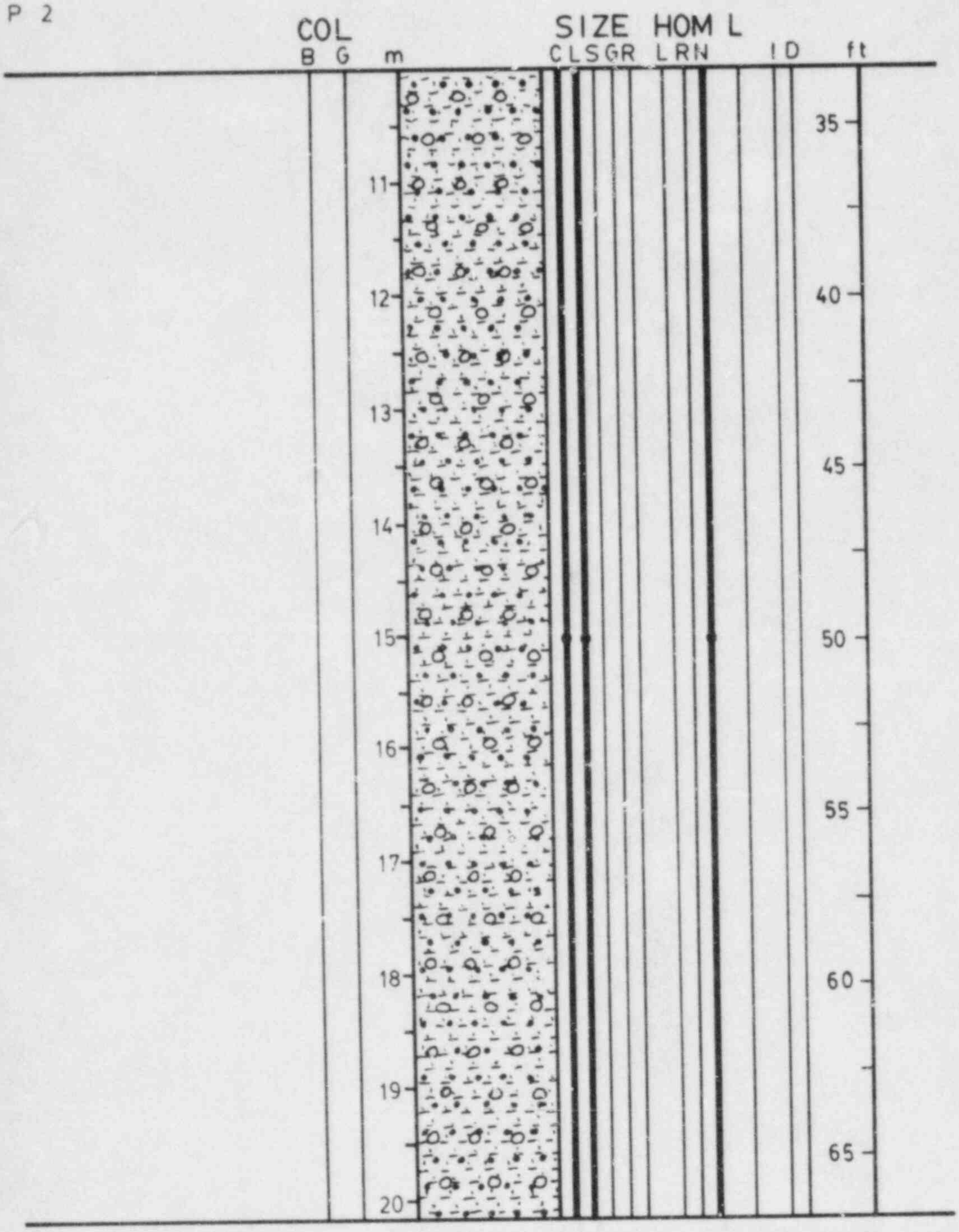
1382.7 ft



W

USGS, 1976

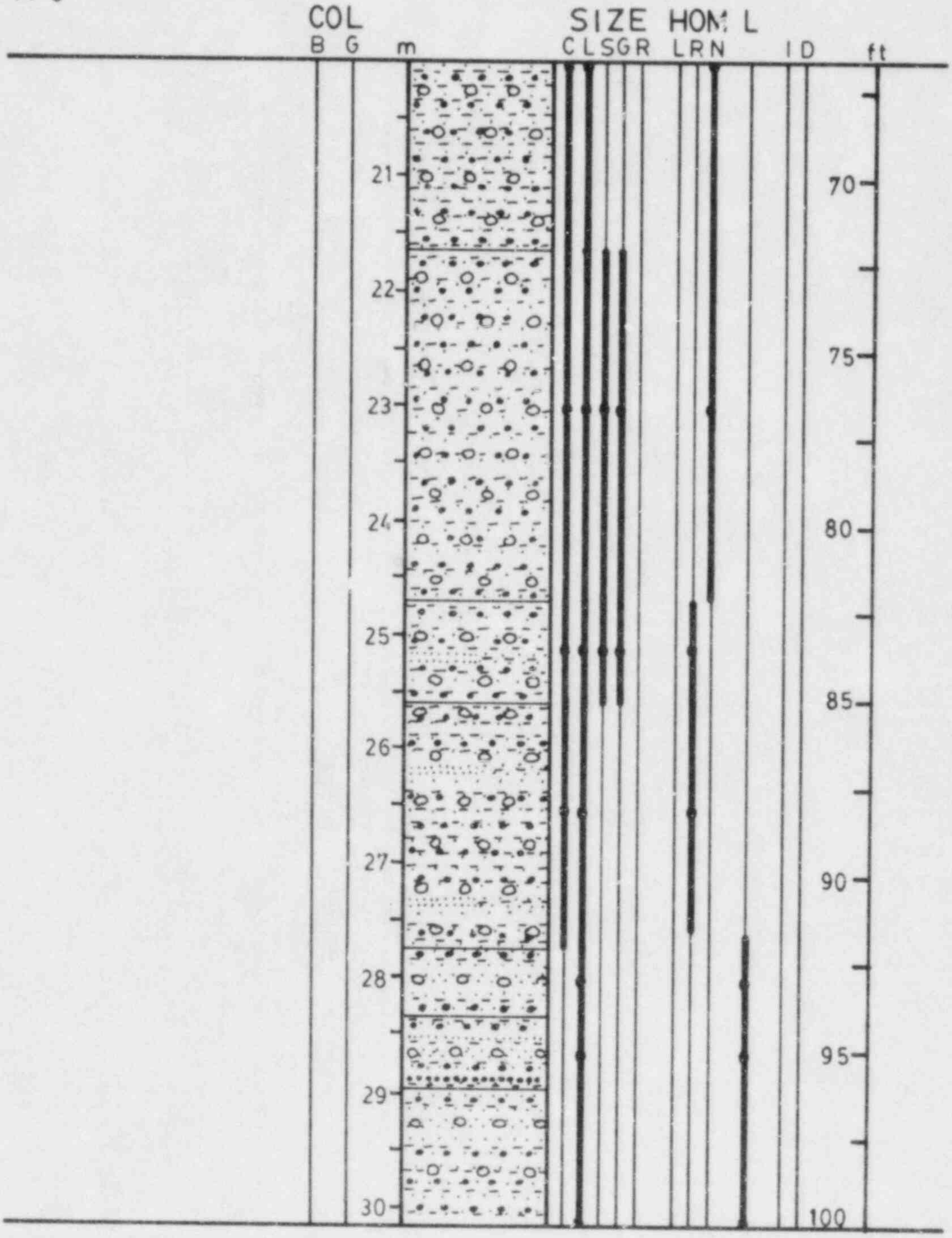
P 2



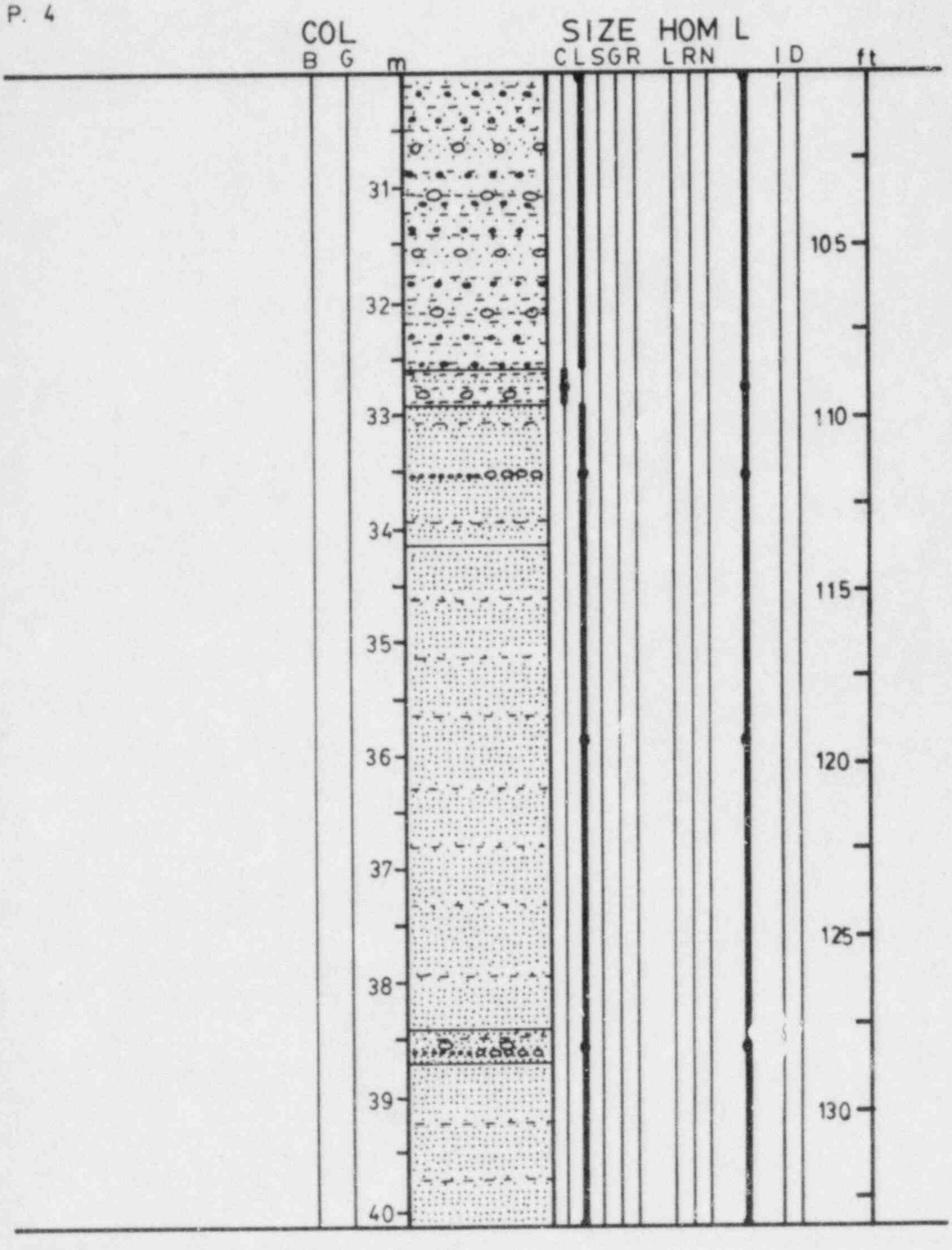
W

USGS, 1976

P. 3



W
USGS, 1976
P. 4



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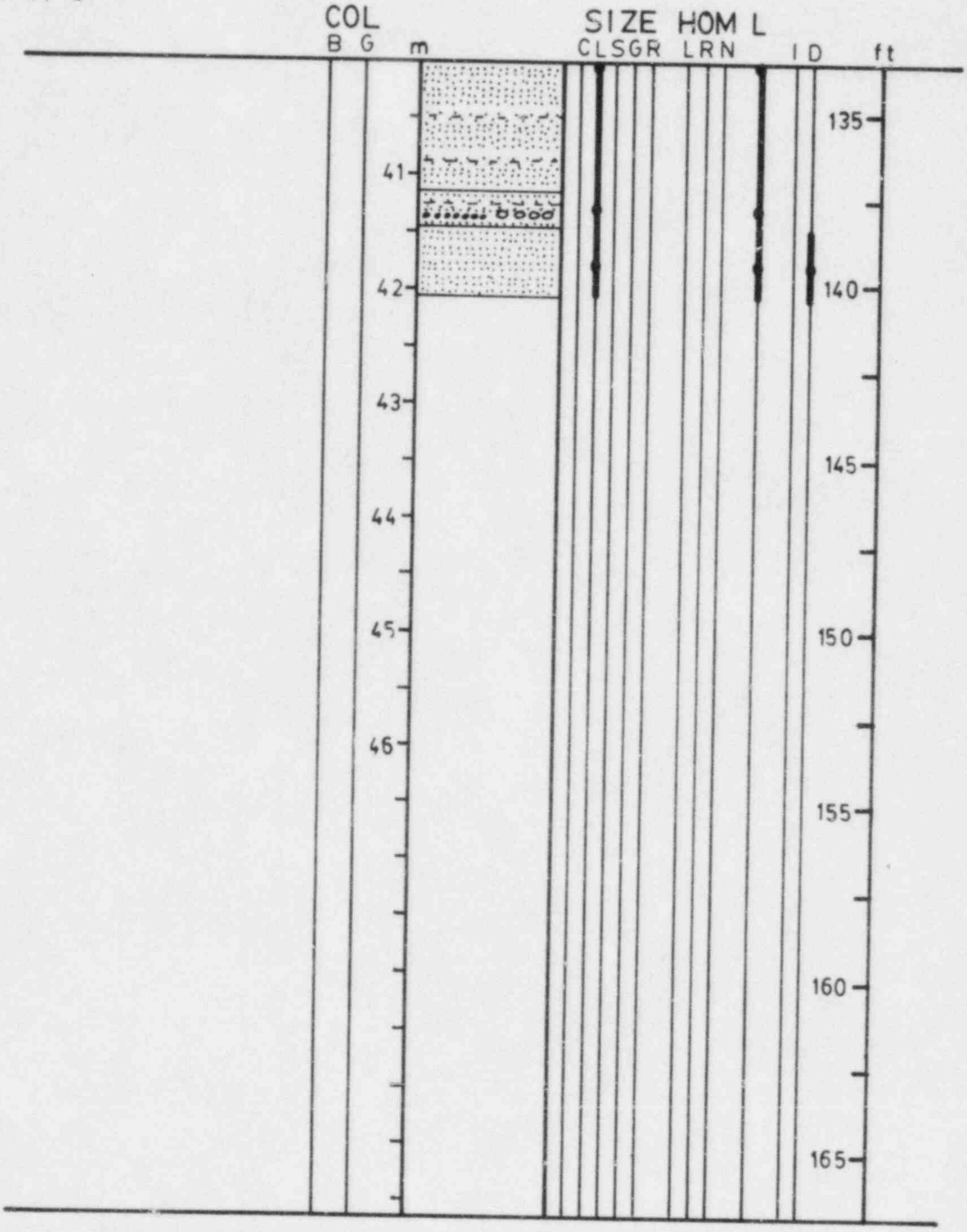
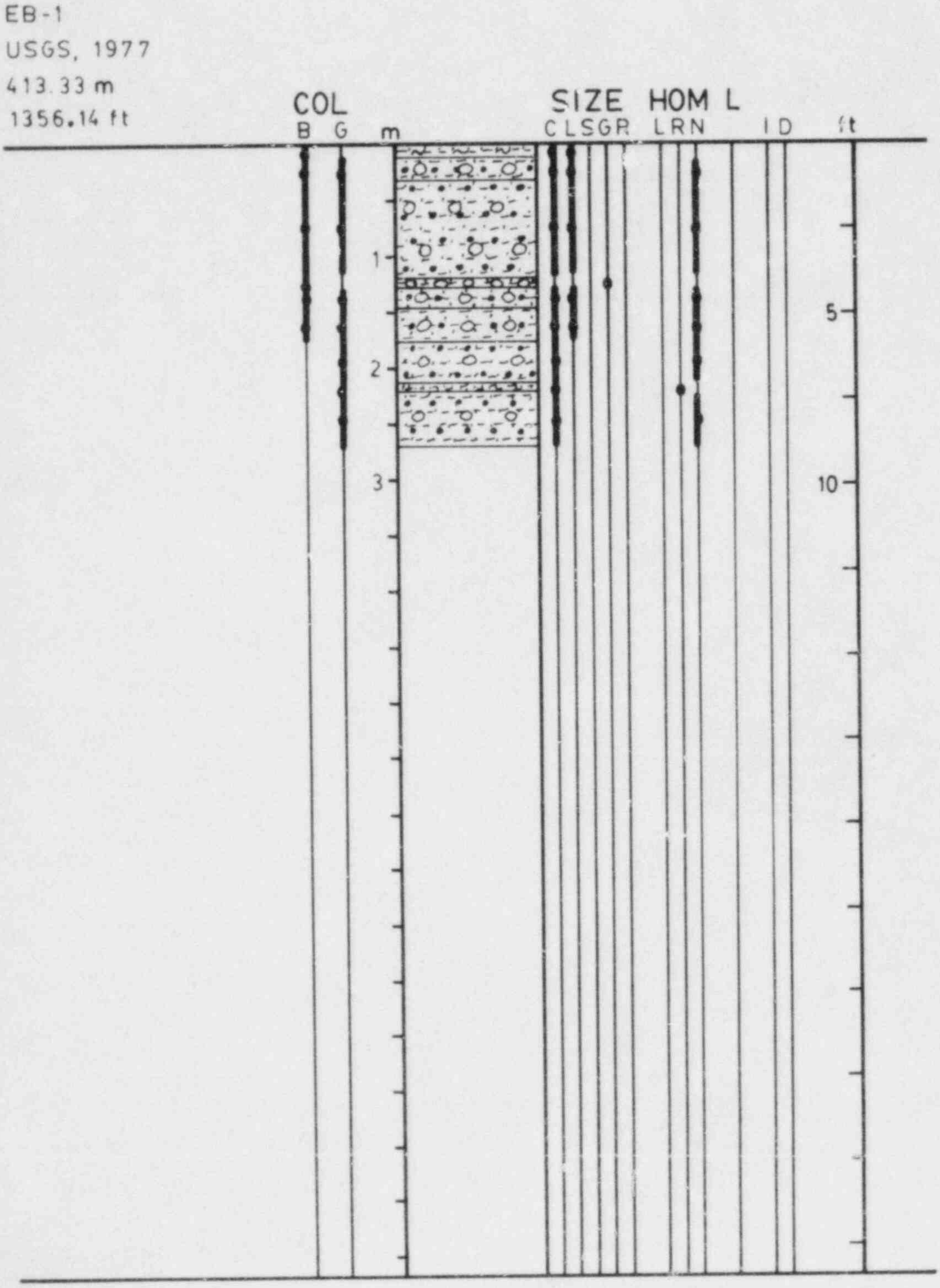
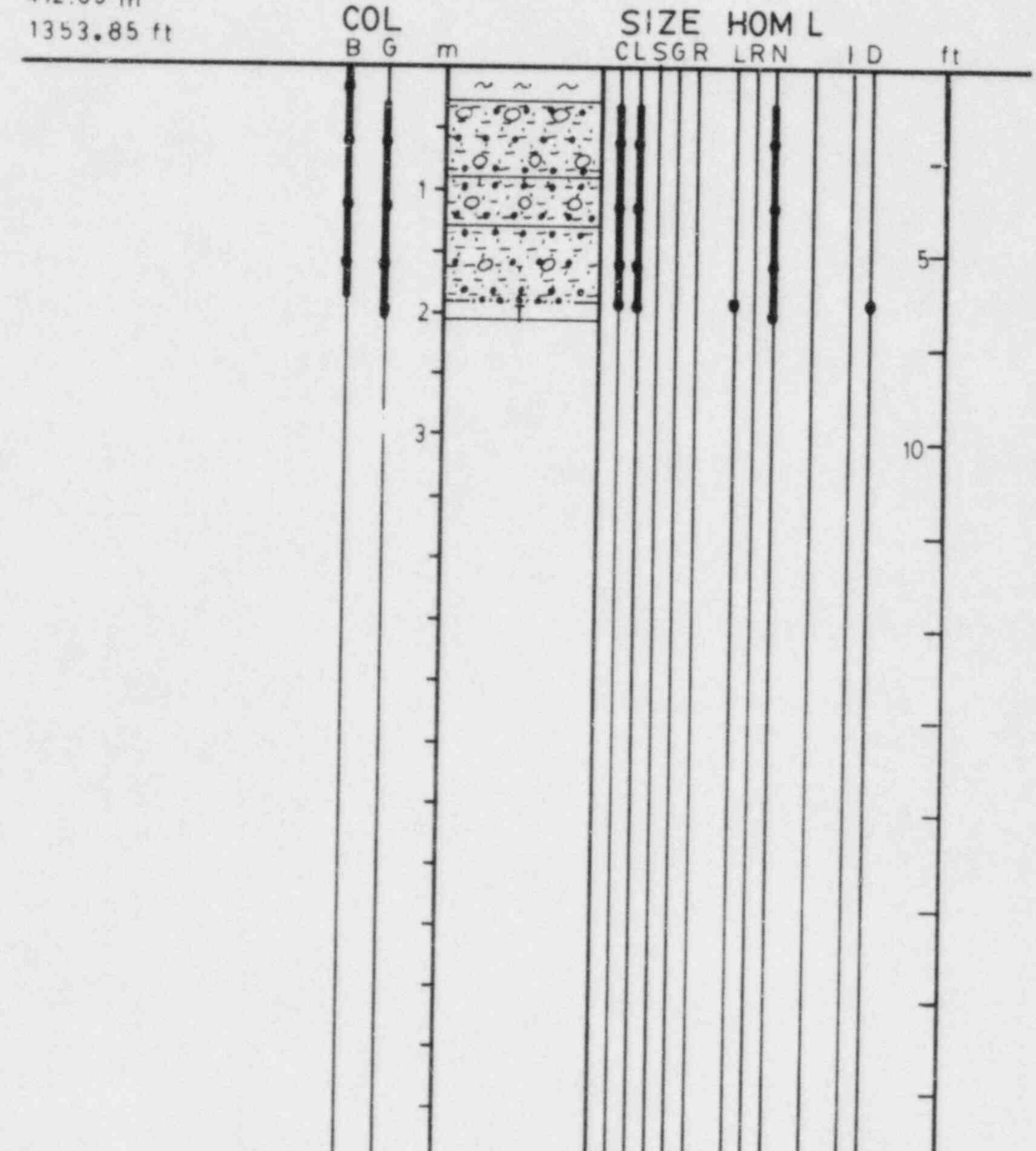
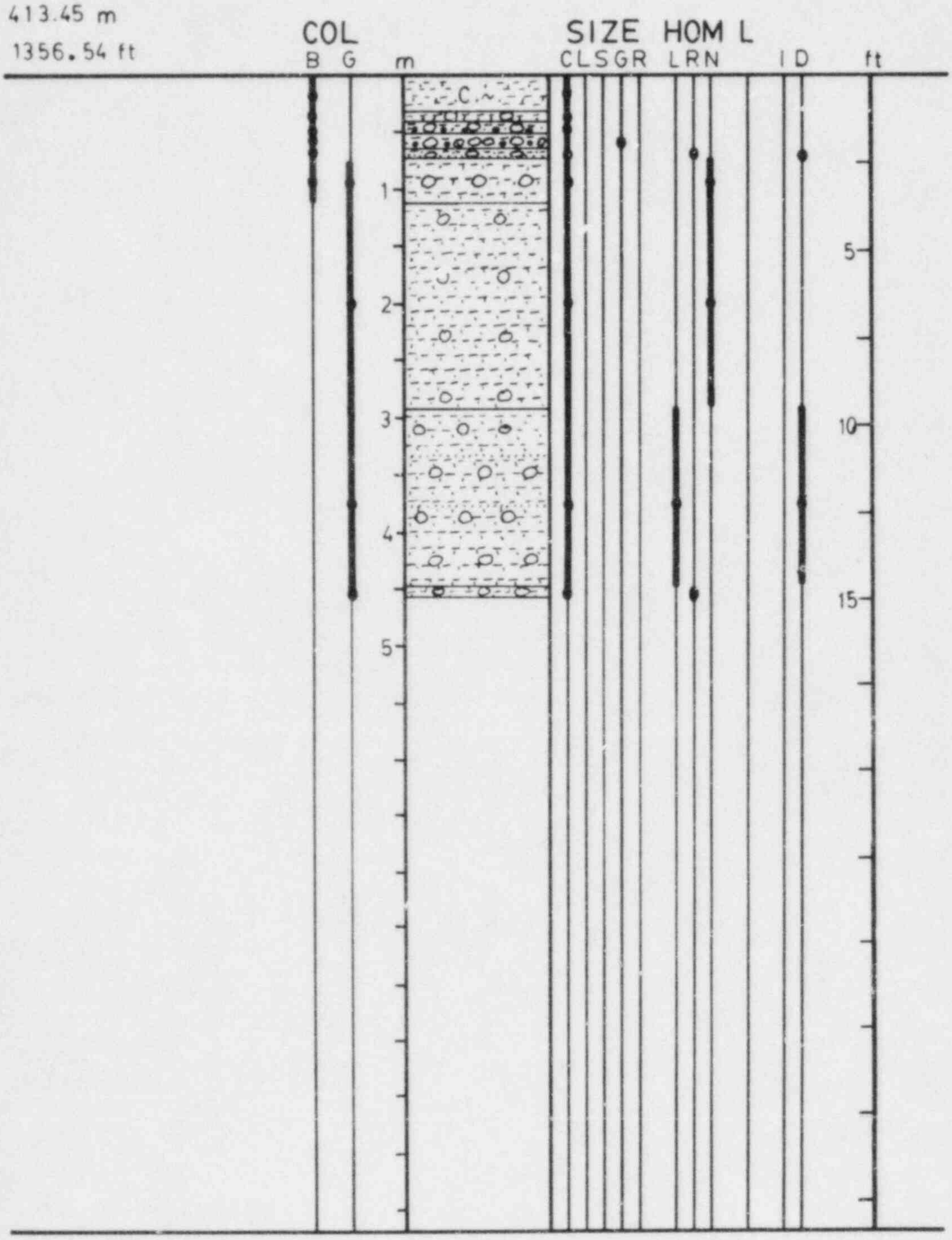



EB-1
USGS, 1977
413.33 m
1356.14 ft
COL
B G
m
SIZE HOM L
C L S G R L R N I D
ft
1
2
3
5
10

EB-2
USGS, 1978
412.63 m
1353.85 ft



EB-3
USGS, 1979
413.45 m
1356.54 ft



EB-4
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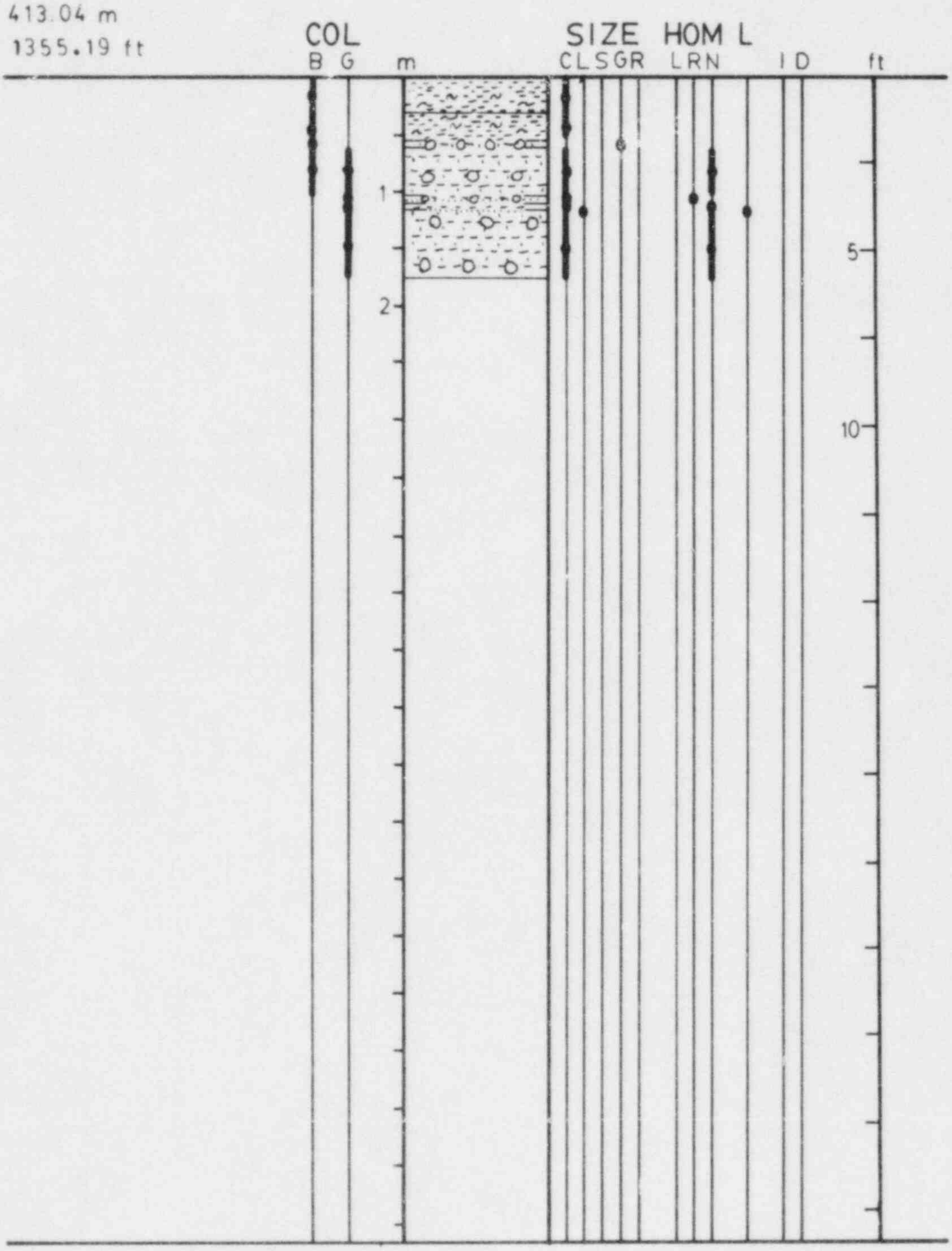
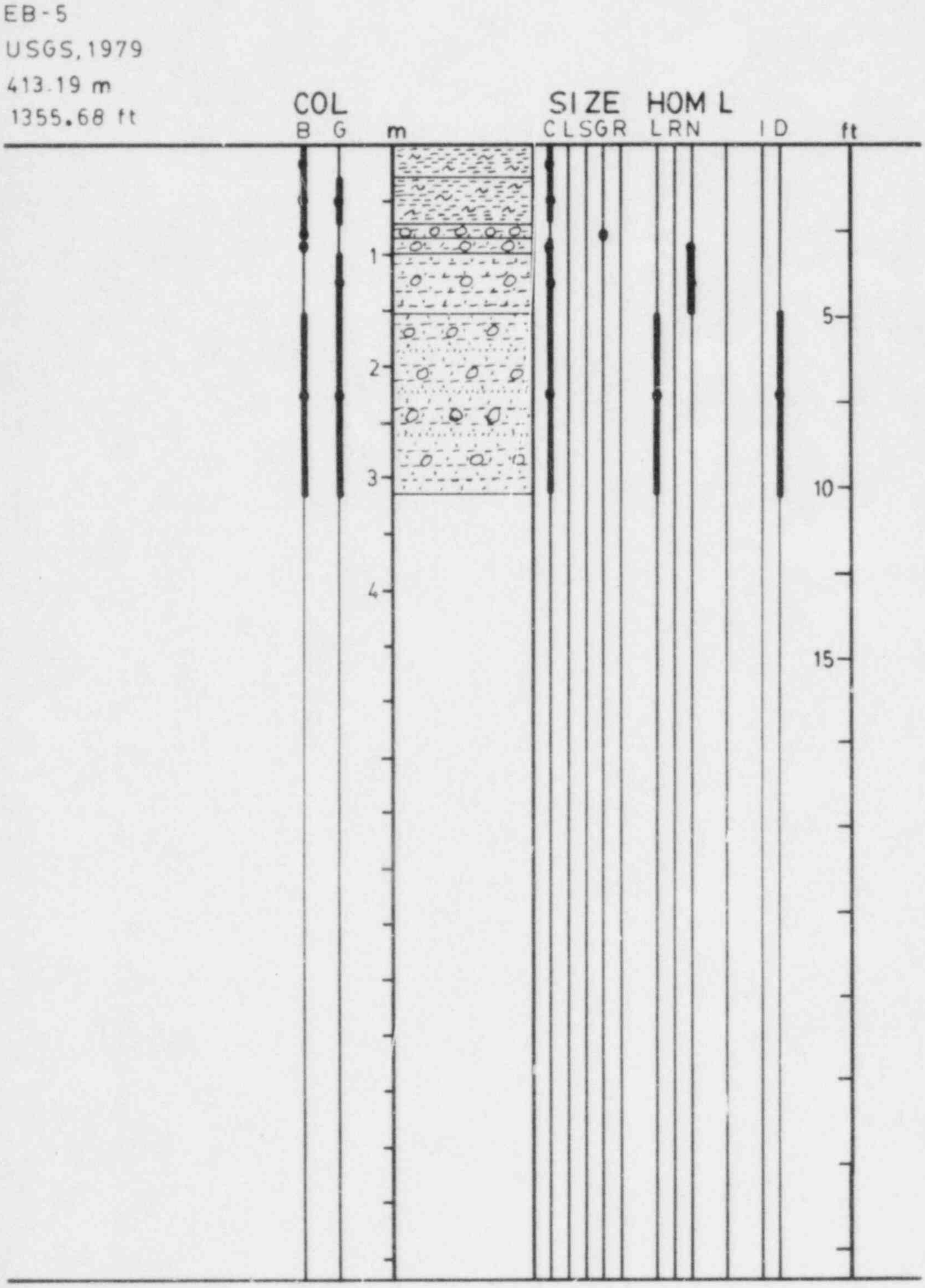
413.04 m
1355.19 ft




EB-5
USGS, 1979
413.19 m
1355.68 ft
COL
B G
m
SIZE HOM L
C L S G R L R N I D
ft
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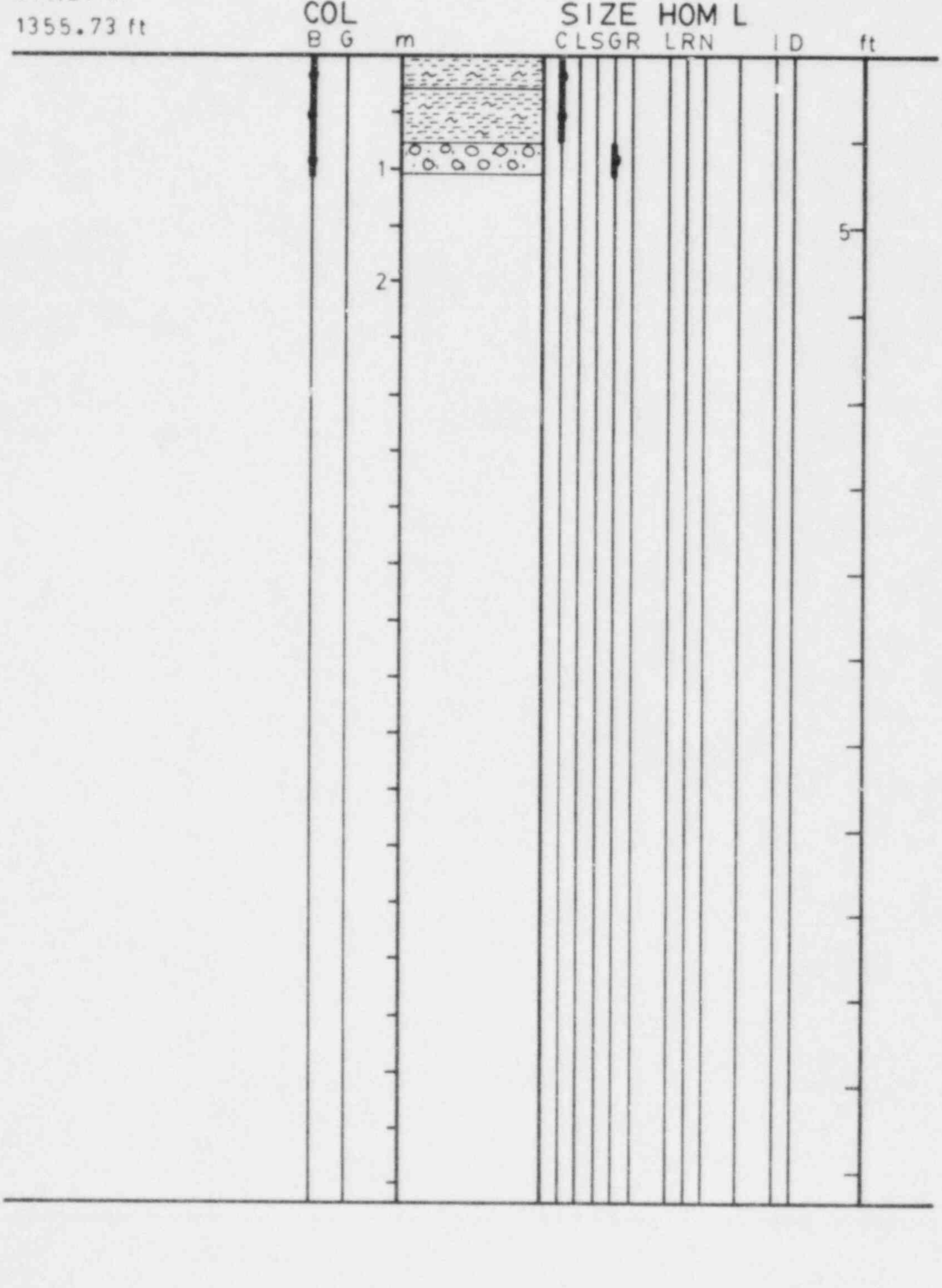
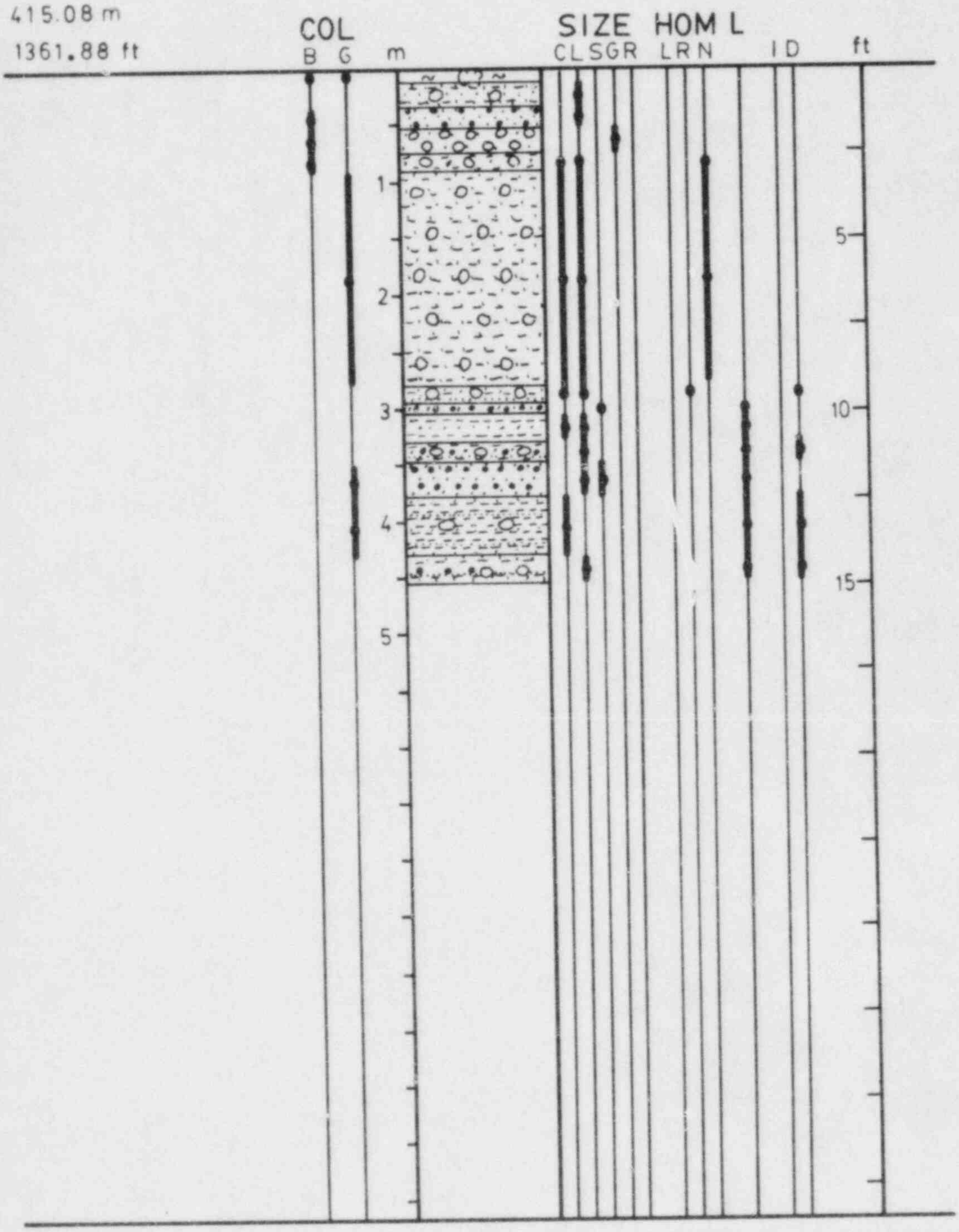
EB-6
USGS, 1979
413.21 m
1355.73 ft



EB-7
USGS, 1979
415.08 m
1361.88 ft



EB-8
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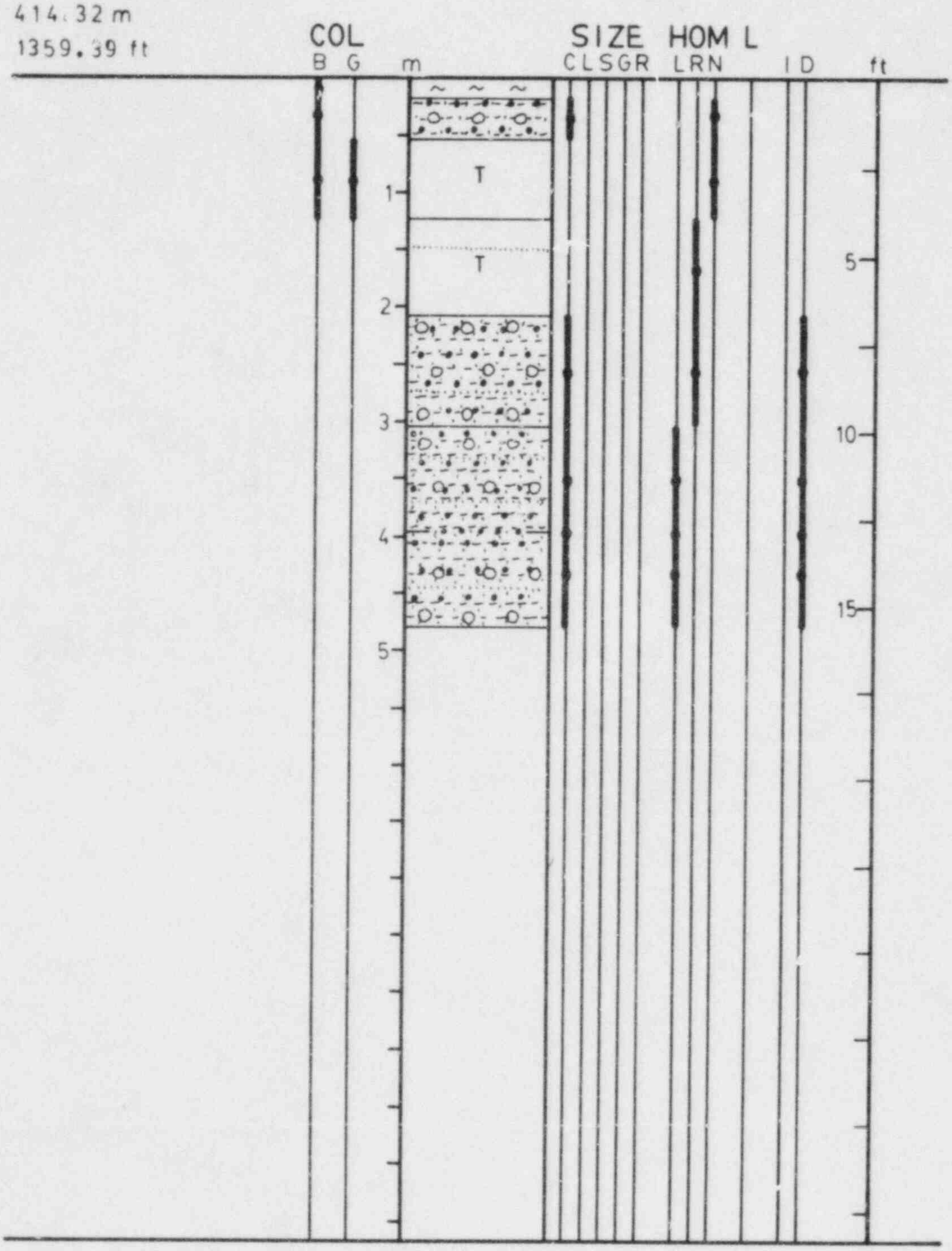
414.32 m
1359.39 ft



EB-9
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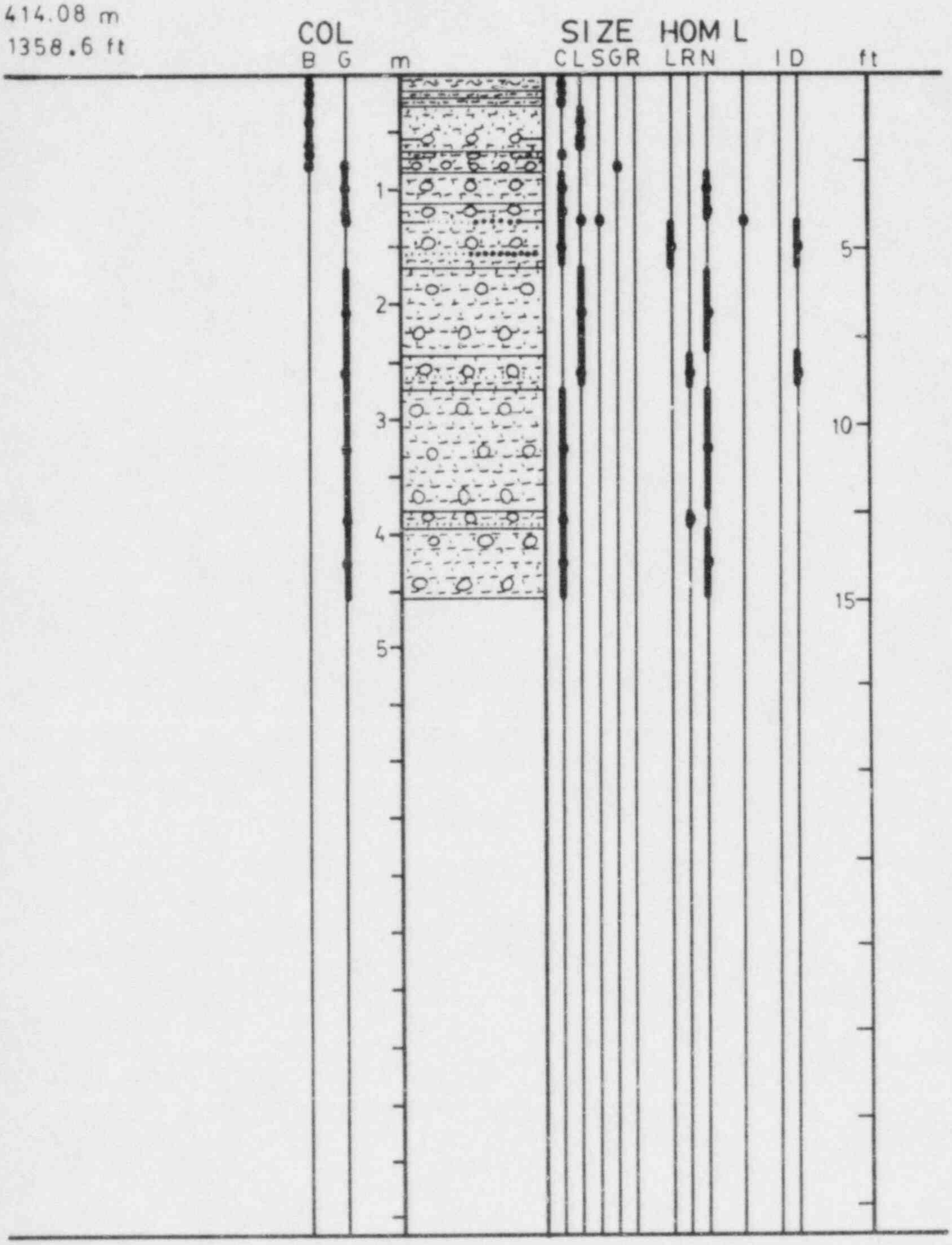
1358.6 ft



EB-10
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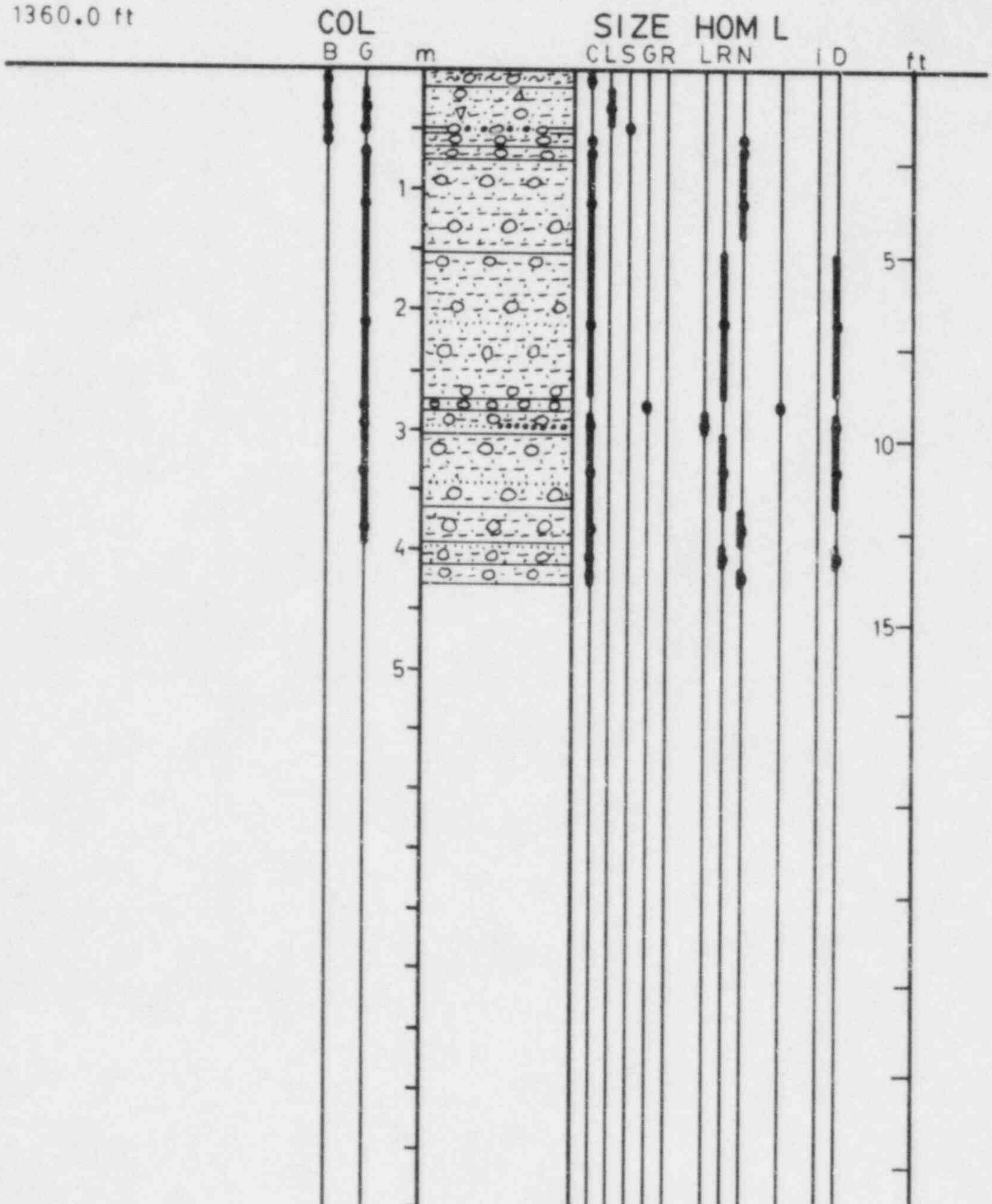
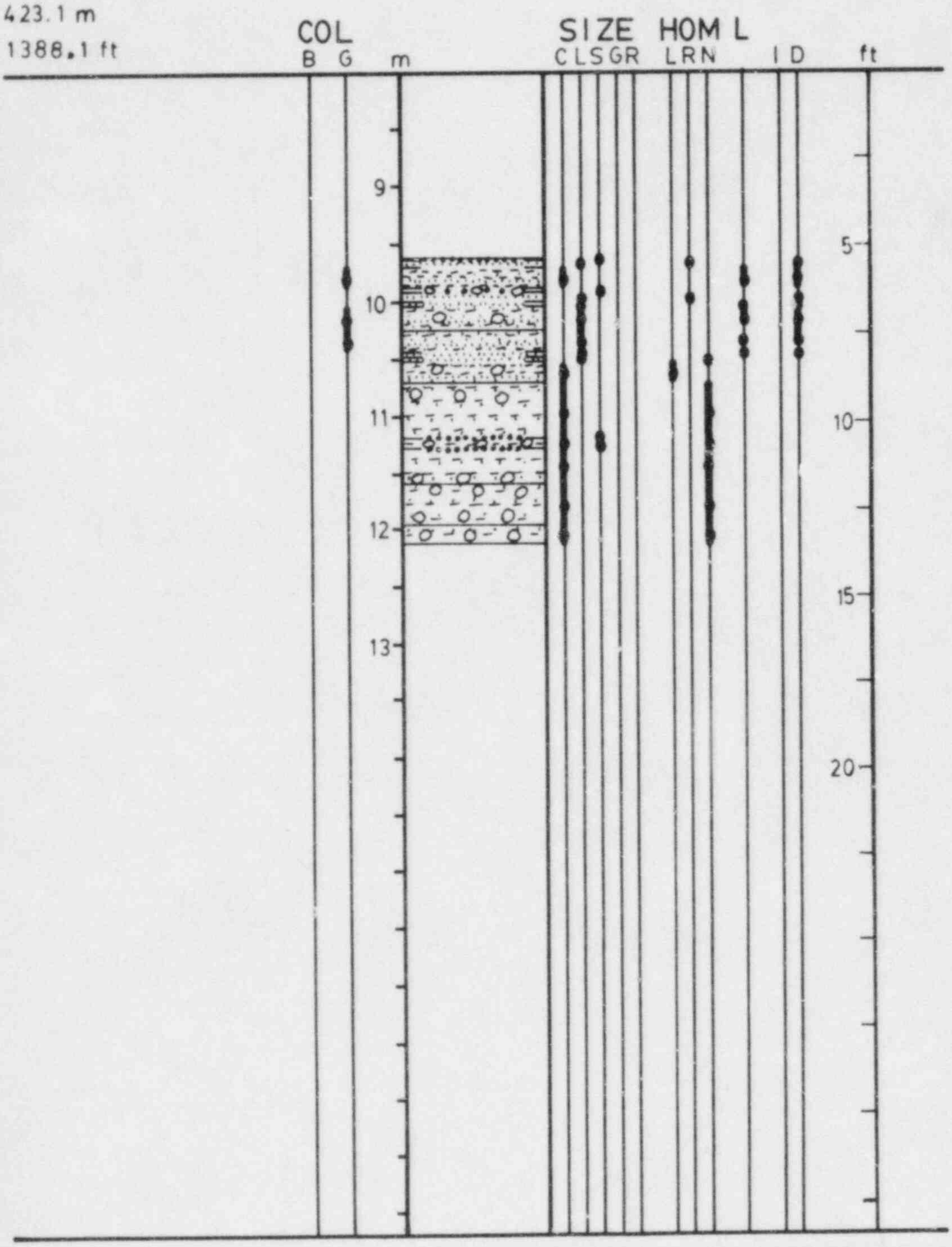


4-4A
USGS, 1977
423.1 m
1388.1 ft



5-2D
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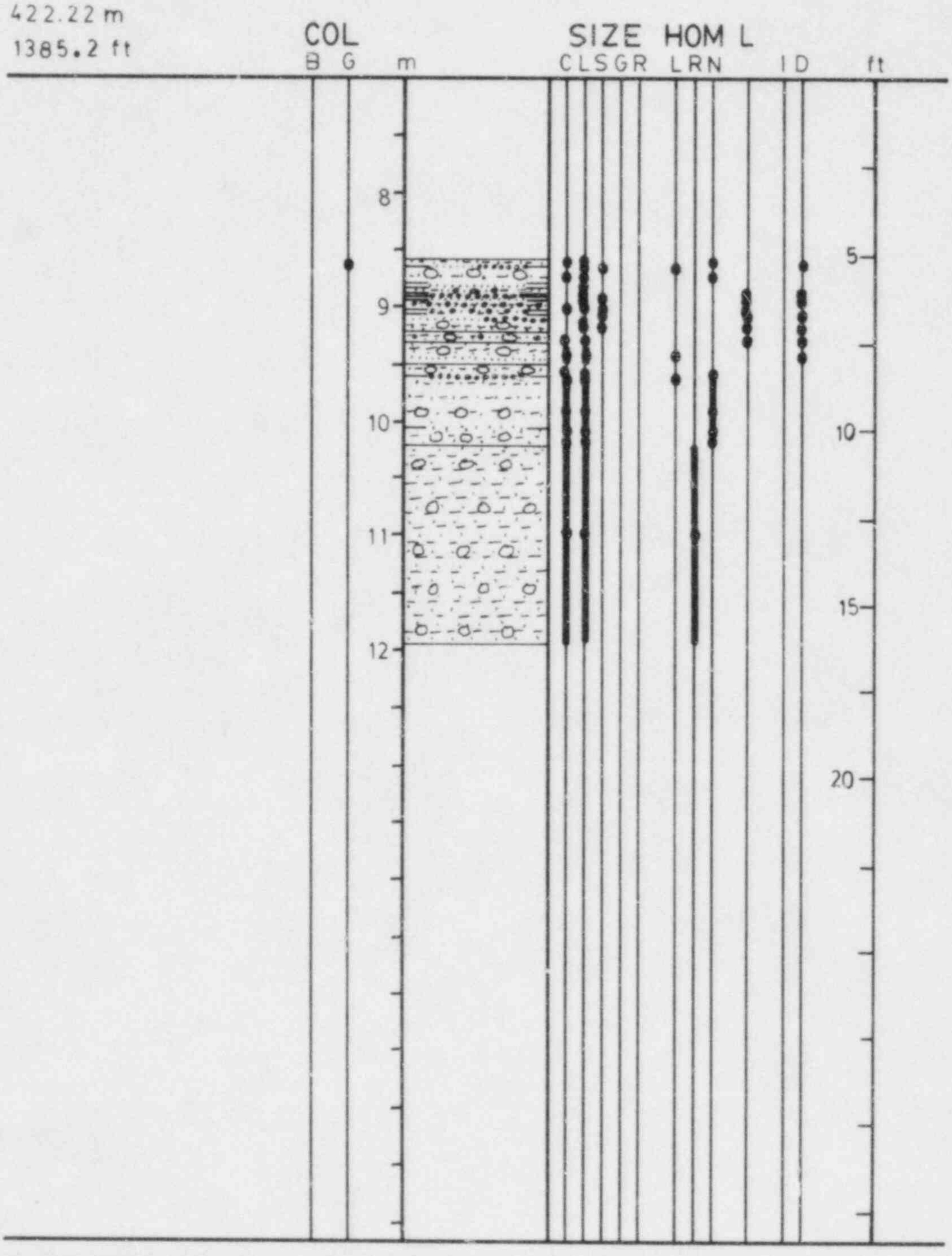
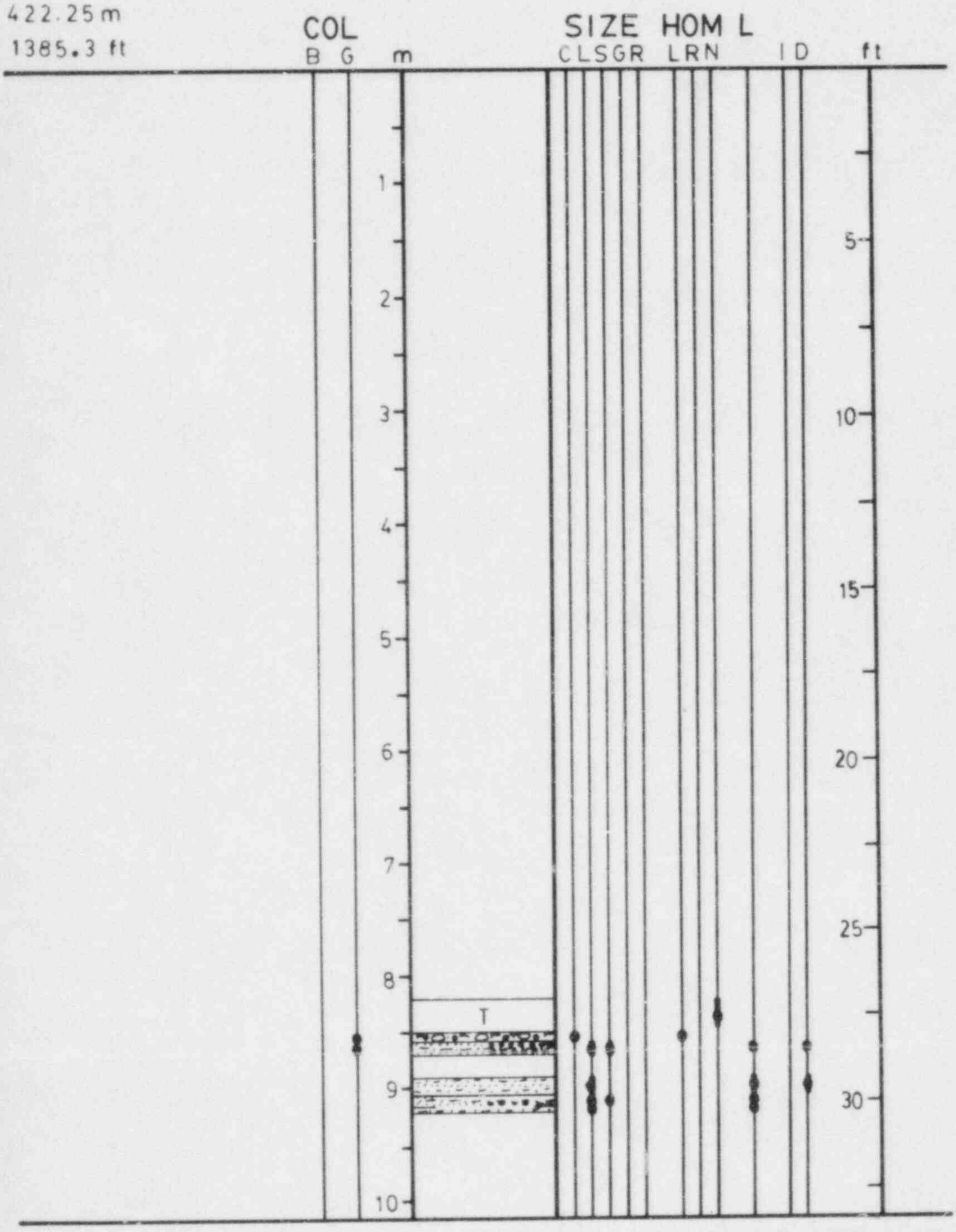
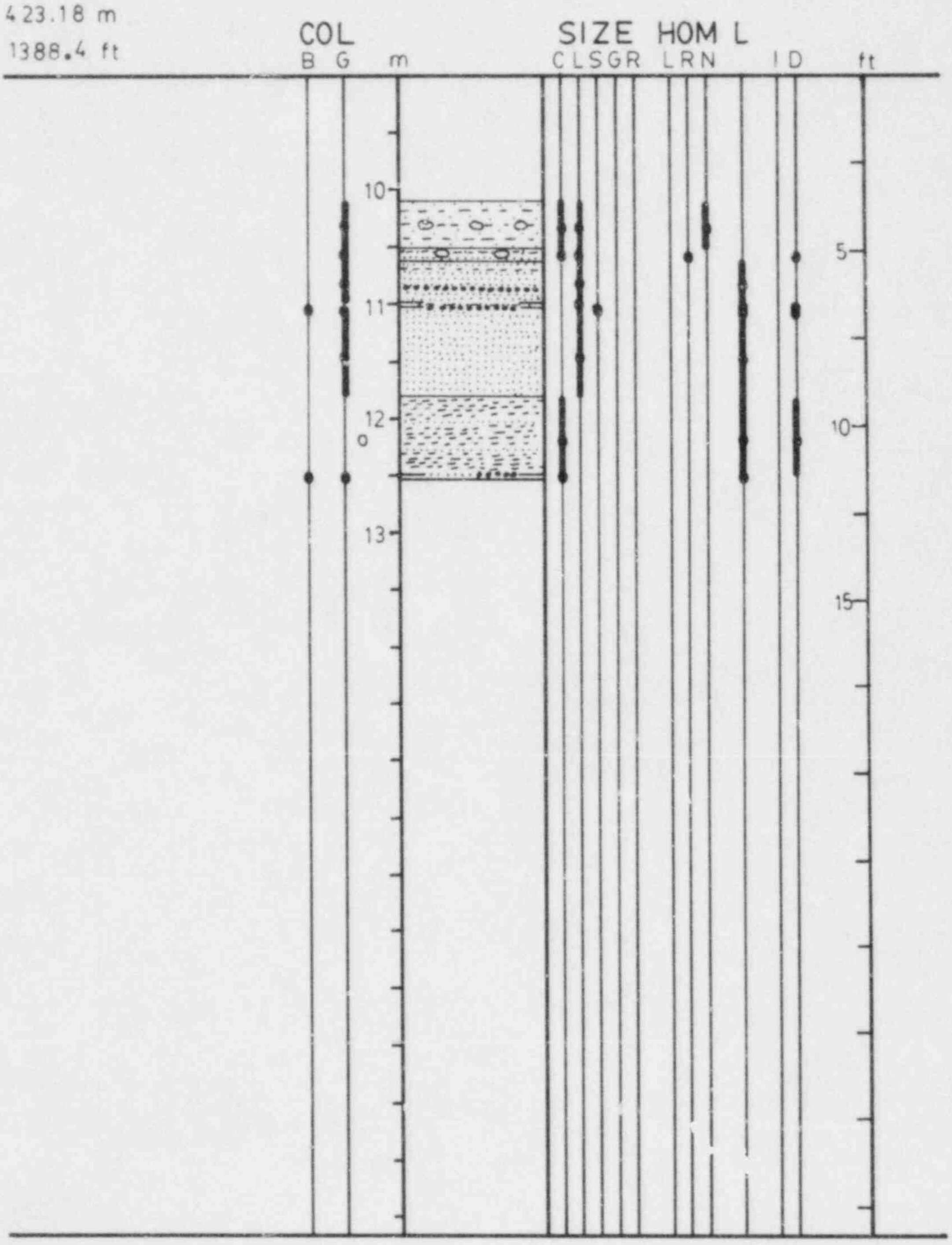
422.22 m
1385.2 ft



5-2E
USGS, 1977
422.25 m
1385.3 ft



8-1C
USGS, 1977
423.18 m
1388.4 ft



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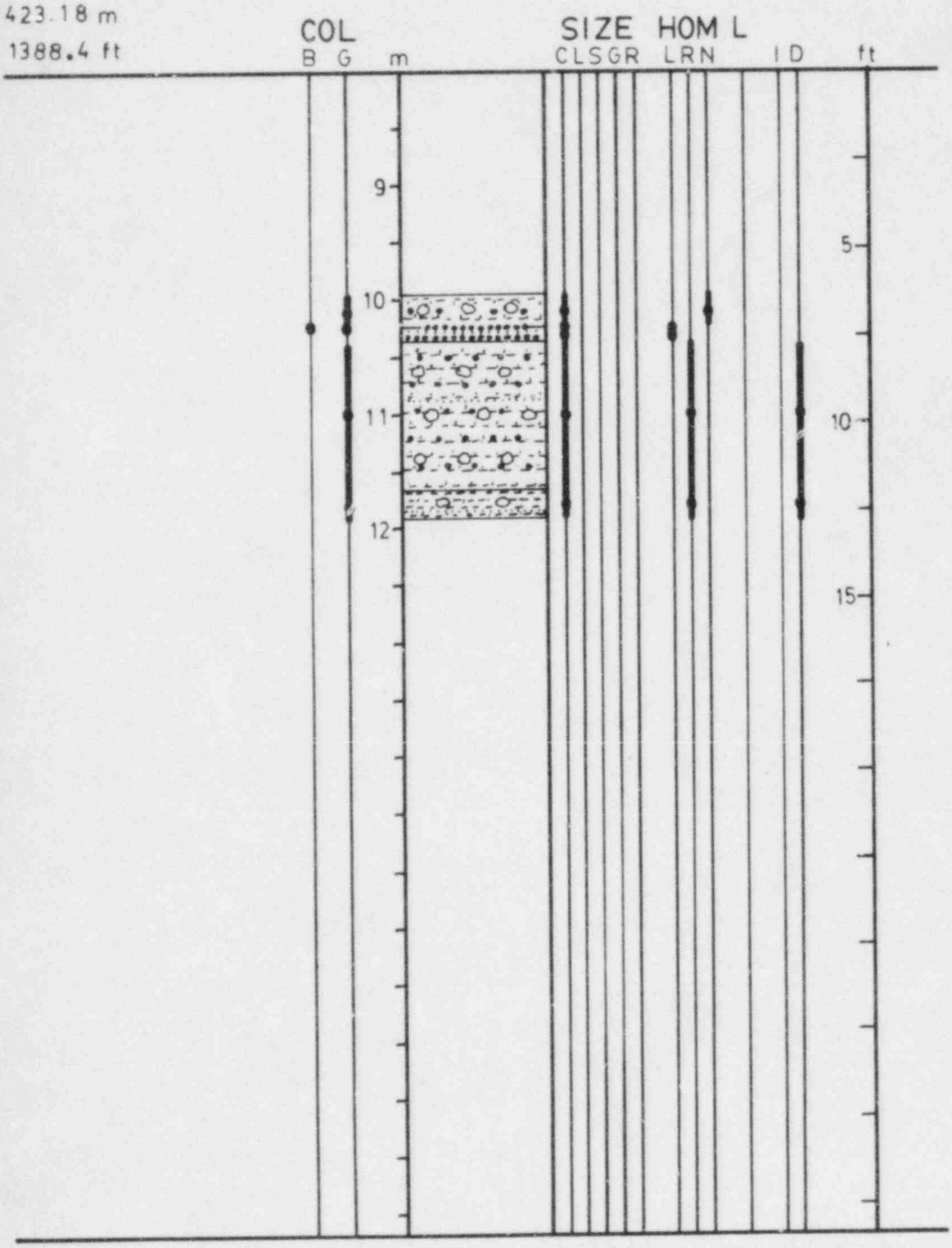
423.18 m
1388.4 ft



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16. ABSTRACT (200 words or less)

This report details the research accomplished during the second part of the New York State Geological Survey's three part program of geologic and hydrologic investigations at the Western New York Nuclear Service Center (August 1981-July 1982). Surficial gravel and the underlying till surface of the North Plateau area were measured using core log data and seismic techniques. Contour and isopach maps are included and show the surficial gravel layer to be lenticular in cross section and approximately forty feet thick at its center. The history of drilling at the site and all available subsurface information pertaining to site stratigraphy has been compiled and standardized. Geologic sections based upon the locations of all wells and their geologic logs show that a sandy stratum, previously reported to extend under the entire site at an elevation of 1350 feet, is not a continous layer. Analyses of surface and subsurface till samples show that Lavery Till can be subdivided into three subfacies using grain size distributions and the Kent Till can be distinguished. Initial measurements for movement determination on two landslides yield an average downslope movement rate of 0.23 meters/year. A site slope domain map, establishing five domains of varying sliding potential, has been compiled from aerial photos and field mapping.

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