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A diatom assessment of borehole sediments from the Jubilee Line Extension

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Report to the Museum of London Archaeology Service

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Introduction

The diatom assessment was carried out in conjunction with pollen and lithostratigraphical assessments. At this assessment stage the primary aim of the diatom evaluation was to determine, for selected samples: whether or not diatoms are present or absent; the quality of preservation of diatoms and; and to list the main species present and their ecological, particularly salinity, optima. An additional aim was to evaluate the potential use of diatom analysis in further investigations of these sediments and in particular the usefulness of diatom analysis in, qualitatively or quantitatively, reconstructing the salinity conditions under which the sediments formed. Using the preliminary conclusions of this investigation it is hoped that the diatom assessment will assist in focusing on key questions within the site stratigraphy re. salinity and sea-level during different periods of the location's development.

Methods

Details of field sampling and monolith sub-sampling are given in Wilkinson & Naylor (1995). The positions of sub-samples used for both diatom and pollen analysis are also indicated in Wilkinson & Naylor (1995).

Preparation of diatom slides followed standard procedures (Battarbee 1986). Cleaned solutions from each sub-sample were evaporated on 2 coverslips at different concentrations and were mounted in Naphrax. Slides were examined using a Leitz, or Zeiss research microscope with phase contrast illumination at a magnification of x1000 or x1200. Where necessary, diatom identifications were confirmed using the collection of diatom floras and publications lodged at the Environmental Change Research Centre, UCL and in the authors collection.

Diatom species have been assigned to halobian groups (Figures 1-9) according to the system of Hustedt. The principle source of data on species ecology used was the survey of Denys (1992).

The diatoms in the halobian groups have optimal growth in water with salinity equivalent to the following approximate ranges (Hustedt 1957: 199): polyhalobian >30 g l^{-1} ; mesohalobian 0.2-30 g l^{-1}; oligohalobian halophilous, optimum in slightly brackish water; oligohalobian indifferent, optimum in freshwater but tolerant of slightly brackish water; unknown, taxa with unknown salinity optima. Oligohalobian halophobous species are restricted to freshwater environments and are intolerant of brackish and marine waters.

Assessment Results

The results of the diatom assessment are presented as a qualitative 'histograms' for each site, showing whether a diatom species is: present (shown either as dots or given a value of 3 on the arbitrary scale), common (given an arbitrary value of 6) or abundant (given an arbitrary value of 9). Diatom species are grouped on the figures according to their salinity preferences. The depth scale in diagram units (taken from the lithostratigraphical profiles of Wilkinson & Naylor (1995) has been related to the either Ordnance datum or site datum. Summary Tables 1-9 summarise the results of the assessment for each site, showing diatom valve concentration, quality of preservation, species diversity, and diatom assemblage type; these are related to the percentage counting potential of each sample. The abbreviations in the used in the Tables are as follows: m - marine, b - brackish, f - freshwater, a - aerophilous, indet. - indeterminate, frag. - fragment

Canada Water (Figure 1, Table 1)

Twelve samples were assessed for diatoms from the material sampled at the Canada Water site. In all of these there were very low concentrations of diatom valves or diatom valves were absent. Preservation of the valves was poor or very poor, all valves being fragmented and partially dissolved and species diversity was low. Given the low valve numbers, the validity of any inferences of salinity made from assemblage type is questionable (see table). However, fragments of brackish water taxa (*Diploneis didyma, Nitzschia navicularis, Cyclotella striata*) were found in the two uppermost samples from Monolith 1. Fragments of freshwater species (*Aulacoseira* sp., *Fragilaria* cf. *brevistriata, Fragilaria* cf. *construens* var. *binodis, Tabellaria flocculosa, Nitzschia* cf. *recta* [aerophilous], *Achnanthes microcephala*) were found in the two lowermost samples from Monolith 2. In addition a single brackish species fragment (*Nitzschia navicularis*) was found in the lowermost sample of Monolith 2. A single valve of the freshwater benthic species *Achnanthes minutissima* was found in the basal sample from Monolith 4. For the other samples it was not possible to assign valve fragments to diatom taxa because of their very poor state of preservation.

The presence of freshwater diatom fragments in the lowermost samples of Monolith 2 is consistent with the association of the peat horizon with a transgressive event (see Wilkinson & Naylor 1995, Scaife 1995, cf.Tilbury IV *sensu* Devoy 1979). Other than a single freshwater diatom valve and fragmentary, indeterminate remains, there is no diatom evidence for conditions associated with the underlying silt, sand and alluvium. The silt (unit 5) discussed in the sedimentological assessment is therefore unlikely to have been deposited in deep water where one would have expected better diatom preservation. However, the partial diatom assemblages of the uppermost samples from Monolith 1, in alluvial strata overlying the peat, include brackish water taxa consistent with the tidal Thames.

London Bridge (Figure 2, Table 2)

Five samples were assessed from the two monoliths taken from London Bridge Shaft. Although diatoms were present in all of these samples, valve concentrations and species diversity was low or very low and preservation poor or very poor in all five. The potential for carrying out percentage diatom counts is therefore low or very low.

The poor preservation of diatoms in the basal unit (13) is not surprising given the high human input (Wilkinson & Naylor 1995) and possible existence of a former ground surface. The diatom assemblages of the overlying alluvial units (12, 11) are consistent with the suggestion for inundation of the site (Wilkinson & Naylor 1995), containing a mixture of polyhalobous/mesohalobous taxa typical of the tidal Thames and a significant oligohalobous indifferent (freshwater) element. The latter includes *Fragilaria pinnata*, which along with some other *Fragilaria* taxa is a 'weed' species, being opportunistic and tolerant of brackish water conditions. The diatom assemblage of unit 10, interpreted a mixed terrestrial and alluvial deposit (Wilkinson & Naylor), is consonant with this lithostratigraphical evidence. *Hantzschia amphioxys* and *Melosira (Ellerbeckia) arenaria* are aerophilous species often associated with terrestrial or semi-terrestrial habitats, whilst *Cyclotella striata* is the dominant planktonic taxon in part of the tidal River.

Union Street (Figure 3, Table 3)

Eighteen samples from the Union Street site were assessed for diatoms. Valve concentrations and species diversity were very low in Monoliths 4E and 4F and diatom preservation was also poor in these samples. Diatoms were absent from the sample from Monolith 4A and there were low valve concentrations, species diversities and poor preservation in samples from Monolith 4B and the uppermost sample from Monolith 4C. These samples have little potential for percentage counting. Diatoms were, however, present in all samples and valves were well, or moderately well, preserved in Monolith 4D.

The poor preservation of diatom assemblages in the complex of peats lying between c. -0.6m and c.-2.3 m OD is not surprising, given the consistently poor preservation of diatom silica in most peats. The remaining diatom valves in units 32-27 are mainly heavily silicified oligohalobous indifferent taxa eg. *Pinnularia* spp. However, polyhalobous species are present to some extent in the basal peat (unit 32, 31) whilst (surprisingly) they are absent from the organic silt/sand (29) layers associated with higher water levels. The mesohalobous species *Nitzschia navicularis* is present in unit 29, suggesting either increased water conductivity, contact with the tidal river or movement of sediment deposited under a more saline regime.

The sample from unit 26 shows a shift to a more brackish diatom flora, consistent with the organic silt. Relatively well preserved estuarine diatom assemblages are found in the silts and peat silt transitions sampled in Monolith 4D and at the base of Monolith 4C. Unfortunately the diatom assemblages occurring in the alluvium of units 22-18 are poorly preserved, but do record a consistent mixed (brackish/fresh/marine) estuarine flora.

Joan Street (Figure 4, Table 4)

Sixteen samples were assessed from the Joan Street sequence. Diatoms were more or less absent from the peat units 41 to 36. Exceptionally a moderately well preserved freshwater (oligohalobous indifferent and halophilous) diatom assemblage was present in sample 1(c) {labelling uncertain here but 2 samples seem to correspond to the basal monolith 5} 38-40. This may have bearing on the comments re. the sampling of sediments below the peat. The survival of a freshwater diatom assemblage within the peat, and not elsewhere in the peat, suggests a transition from aquatic lain sediments to a more ephemeral aquatic environment (see comments re. Tilbury IV in Wilkinson & Naylor 1995 p13). Presumably the grey clay beneath, if sampled, would contain evidence for estuarine conditions. Elsewhere in the peat indeterminate valve fragments and a single fragment of the freshwater species *Synedra ulna* (unit 38) were present. In the organic silts and alluvium of units 34 and 33 moderately well preserved freshwater/brackish diatom assemblages were present. The uppermost sample from Monolith 1(a) contains a well preserved estuarine diatom assemblage with an aerophilous component (*Navicula mutica, Melosira arenaria*)

St.Stephen's East, Westminster (Figure 5, Table 5)

Eleven samples were assessed for diatoms from the St.Stephen's East, Westminster site. Diatoms were absent from the three samples of Monolith 3 and the basal sample (36-38 cm) from Monolith 2 (units 55-53).

In unit 51 a low concentration of freshwater diatom species was dominant with a smaller component of the brackish planktonic species *Cyclotella striata*. This assemblage is consistent with the molluscan evidence for freshwater conditions and suggestion of over bank flooding, which would have introduced an estuarine diatom component.

Diatom preservation was good or moderately good in all of the overlying units (50-47, 45-42) which were assessed. All contained mixed assemblages dominated by freshwater species, but with a significant estuarine component indicating contact with the River. The reconstruction of salinity would require percentage diatom counts, for which these well preserved assemblages are appropriate.

Westminster Underground Station (Figure 6, Table 6)

Five samples were assessed for diatoms from the Westminster Underground Station site. Diatoms are absent from the basal, alluvial sand (unit 62) and from the lower sample of the organic silt (unit 61). A poorly preserved brackish-marine assemblage was present in the upper part of unit 61. The diatom assemblage does not however indicate a terrestrial environment (see Wilkinson & Naylor 1995), but it is possible that any aerophilous diatom valves have been lost because of unfavourable conditions for preservation. The estuarine nature of the assemblage does support the hypothesis for an occasional input of flood water.

The diatom assemblage of the lower part of the alluvium (unit 60), although poorly preserved, indicates the estuarine nature of the depositional environment, consonant with the idea of increased water depth or frequency of flooding. The uppermost sample of unit 60 is very poorly preserved but fragments resembled those of brackish water taxa. Except for the lower sample in unit 60, which has some potential for percentage counting, the samples assessed from this sequence have very low or no further potential for diatom investigations.

Palace Chambers South, Westminster (Figure 7, Table 7)

Seven samples were assessed from the three monoliths sampled at the Palace Chambers South, Westminster site. Diatoms are absent from units 58 and 59. A single valve of the brackish water species *Nitzschia navicularis* was present in the basal sample of unit 57. The upper sample from the same unit is dominated by the same species, along with other mesohalobous taxa, but also polyhalobous and oligohalobous indifferent species. Again the mixed diatom assemblage with estuarine and freshwater elements is consistent with the suggestion (Wilkinson & Naylor 1995) for deposition during over bank flooding. Identifiable diatom fragments are absent from the coarse sand of unit 56. As a whole the Palace Chambers South sequence has no potential for diatom percentage counting, with the exception of the upper sample from unit 57, although even here the potential for percentage counts is low.

Parliament Square (Figure 8, Table 8)

From the two monoliths taken at the Parliament Square site, seven samples were assessed for diatoms. Diatoms are absent from the basal sample (unit 80) and are present in low or very low concentrations in the other samples, with poor preservation and low diversity. The site therefore has little potential for percentage diatom counting.

Given the proposed origin of the basal silts, in a low energy, deep water environment, or by over bank flooding it is perhaps unusual that no diatom valves were recovered from unit 80. The diatom assemblages of units 79 to 76 all have dominantly brackish water diatom assemblages (the estuarine taxa *Cyclotella striata* and *Nitzschia navicularis* are particularly abundant), with marine planktonic and freshwater diatom components. This is consistent with deposition within a water course or over bank flooding as suggested by Wilkinson & Naylor (1995)

Storey's Gate (Figure 9, Table 9)

Thirteen samples were assessed for diatoms from the four monoliths sampled at the Storey's Gate site.

Diatoms are more or less absent from the basal unit (90) of the organic silt, with only a single indeterminate fragment present. The lower sample of unit 89, also within the organic silt, has a freshwater diatom assemblage, with no estuarine component. The upper sample of unit 89 also consists mostly of freshwater taxa, but here there is also a brackish water component (mesohalobous and halophilous taxa). Both samples from unit 89 are therefore consistent with the hypothesis (Wilkinson & Naylor 1995) for a (freshwater) feature like an ox-bow lake, but subject to occasional flooding. The diatom concentrations in unit 89 are moderately high and assemblages are moderately diverse. Although preservation is poor both sample have some potential for diatom percentage counting.

Diatom concentrations are very low in the silt-rich alluvium (units 88-86) overlying the organic silt. In units 88 and 87 the diatom assemblages are predominantly freshwater-brackish or brackish-freshwater. In unit 86 mesohalobous and polyhalobous (estuarine) species are dominant. At the boundary of the alluvium and alluvial sand (unit 86/85) a single freshwater, and possibly semi-terrestrial, aerophilous species, *Pinnularia major*, is present. This is consistent with the signs of sediment oxidation and the idea that the sediment surface was periodically exposed to the air (Wilkinson & Naylor 1995). Alternatively this large & heavily silicified taxon may be the only surviving component of a freshwater assemblage, decreased by drying of the sediment and exposure to the atmosphere. No samples were examined from the fine sand deposit (unit 85). The diatom assemblage of unit 84, the overlying alluvium, is a species poor, mesohalobous/polyhalobous one and is consistent with the hypothesis that this phase represents over bank flooding. The alluvial sands represented in units 83 and 82 also have estuarine (mesohalobous, polyhalobous) taxa, but larger numbers of oligohalobous indifferent and halophilous species ie. freshwater taxa. This could represent a freshwater environment subject to flooding. Diatoms are more or less absent from the upper sample examined from unit 82.

Overall two samples, the top and basal samples from the sequence, have no potential for percentage diatom counting. The remainder are of variable quality, but some may be of use if salinity reconstruction is required for a specific period where an adequately preserved diatom assemblage is present.

Conclusions and Recommendations

A total of ninety-four samples have been assessed from the nine sites investigated. In general diatom preservation, concentration and species diversities are low and therefore the potential for making percentage diatom counts, with the aim of salinity reconstruction is low. However, at a number of sites particular samples or groups of samples, which may be associated with periods of particular interest may be of value in this context. In addition, the information available from the assessment may itself be of use in environmental reconstruction and to support or refute the inferences of other lines of evidence. An example of this would be, where a diatom assemblage of low diversity, but of distinctive composition and ecology, is present.

All twelve samples from the Canada Water site are unsuitable for percentage counting and similarly all five samples from the London Bridge site are of low counting potential. Of the eighteen samples from Union Street six samples taken from Monolith 4D and from the base of Monolith 4C have very good or some potential for diatom counting. Of the sixteen samples from Joan Street a single, freshwater, assemblage from the base of the whole sequence and four samples, with fresh to estuarine assemblages, from the top of Monolith 1a have moderate to good potential for diatom counting. At the St. Stephen's East site, of the eleven samples examined, diatoms are absent from Monolith 3 and poorly preserved or absent from the base of Monolith 2. However, the top six samples from this site are of good or excellent potential for percentage diatom counting. Of the five samples assessed from Westminster Underground Station, a single sample from the base of Monolith 1 (unit 60) is of some potential in percentage diatom counting, this unit is possibly partly derived from flood deposition. Similarly of the seven samples assessed from the Palace Chambers South site a single sample from the upper part of unit 57 is of some potential. Again this was interpreted as a flood deposit. None of the seven samples from Parliament Square have any potential for further diatom investigations as a result of low valve concentrations and poor preservation. Thirteen samples were assessed from Storey's Gate, the top and basal samples are not suitable for further diatom analysis, however, the remainder of the diatom sequence is of variable quality, and may be of some value in percentage diatom counting.

As in all investigations of estuarine sediments where diatom analysis is employed a knowledge of the taphonomy of the deposits is critical in research design and interpretation. Sediments derived principally as flood deposits, but also with *in situ* diatom components may be difficult to use in salinity reconstruction, as the relative contributions and identities of the discrete components is not usually clear. Those sites with continuous contact with the River may be more reliable for salinity reconstructions related to the River. Sites usually isolated from the River, with only a small estuarine flood component may give a better local picture. This said it seems that at a number of sites: Storey's Gate, Union Street, Joan Street, St. Stephen's East and possibly Palace Chambers South and Westminster Underground Station a sample or sequence of samples my be of value in reconstructing the salinity regime of the locality during particular periods. These late Holocene sediments range in age from the later prehistoric period to the Tudor period, proxy-dating is discussed in by Wilkinson & Naylor 1995; & Scaife 1995).

The method suggested for further diatom work would be the employment of percentage counting on spot samples of best known provenance and age. These would be selected where particular research questions have been highlighted, for example in relation to salinity or other ecological changes such as the *Tilia* decline (Scaife 1995). This would be coupled with salinity reconstruction either using the Hustedt grouping scheme (eg. Battarbee 1988), or preferably with the collaboration of Dr.Steve Juggins using a diatom/salinity transfer function (Juggins 1992) to make quantitative estimates of salinity. The latter method, being labour intensive is best suited to the analysis of spot samples or short sequences. These, however, may be of great value both within the Jubilee Line palaeoenvironmental work and in testing hypotheses about the tidal nature of the River Thames in London.

Acknowledgements

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Figure 1. Canada Water

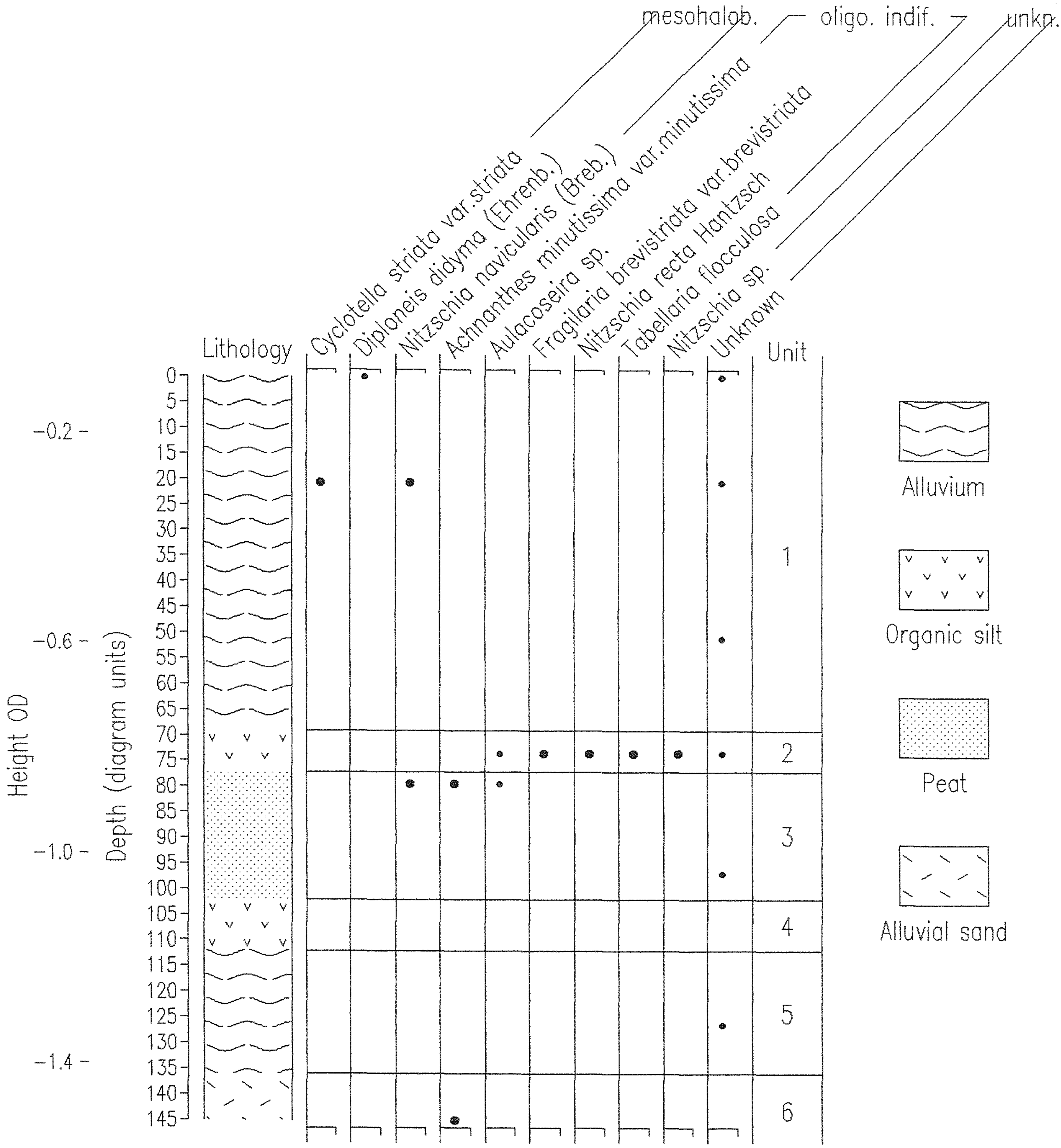


Figure 2. London Bridge

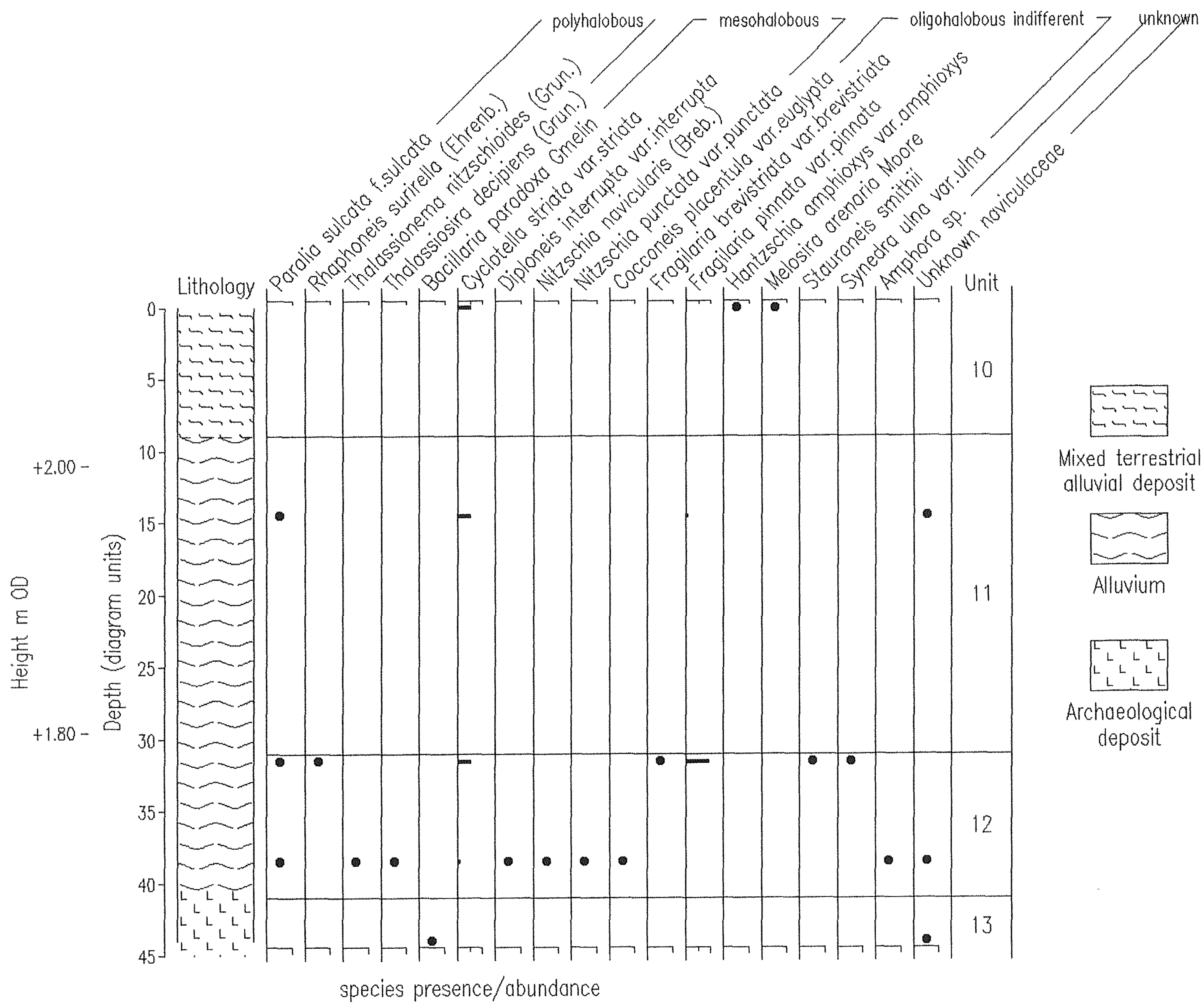
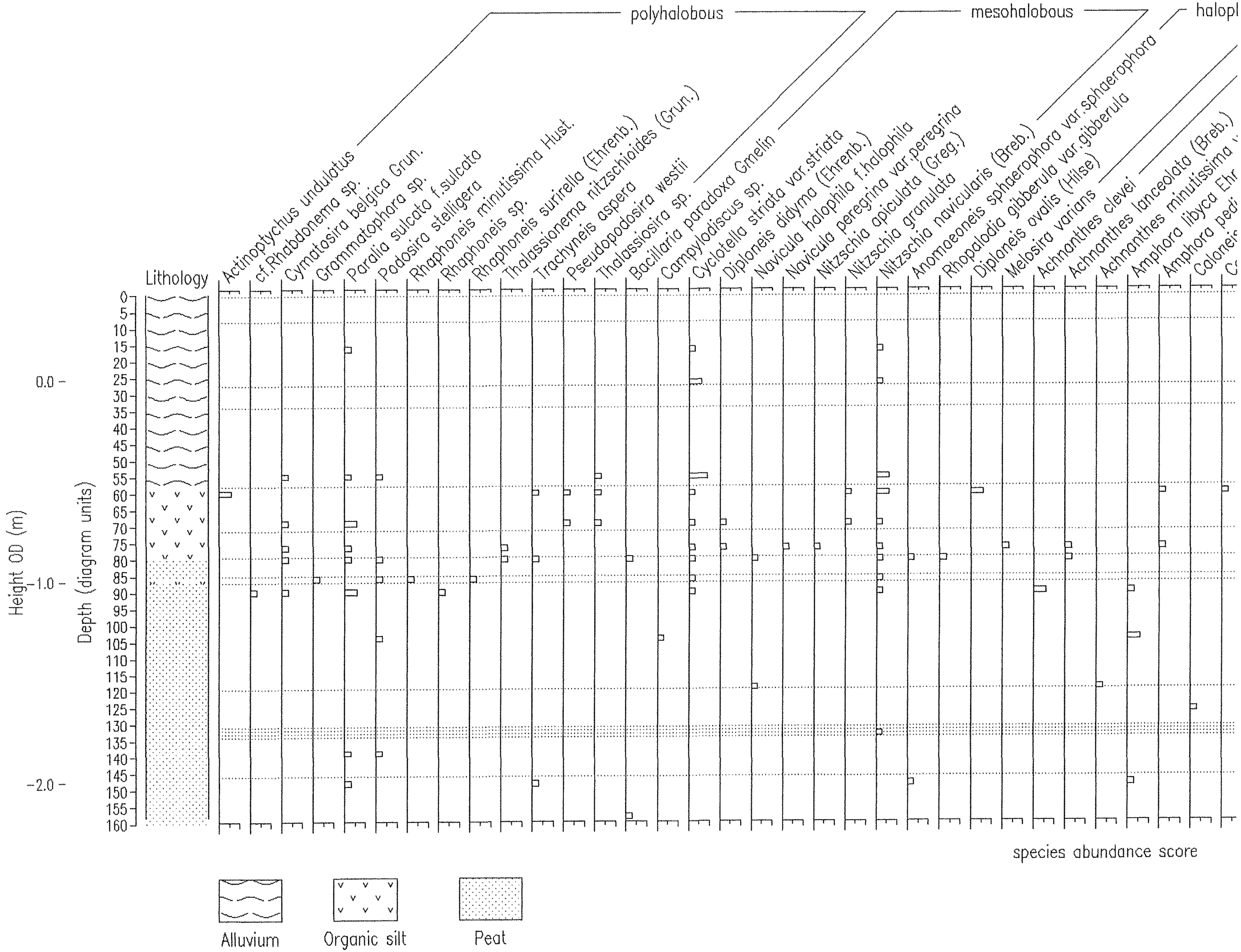
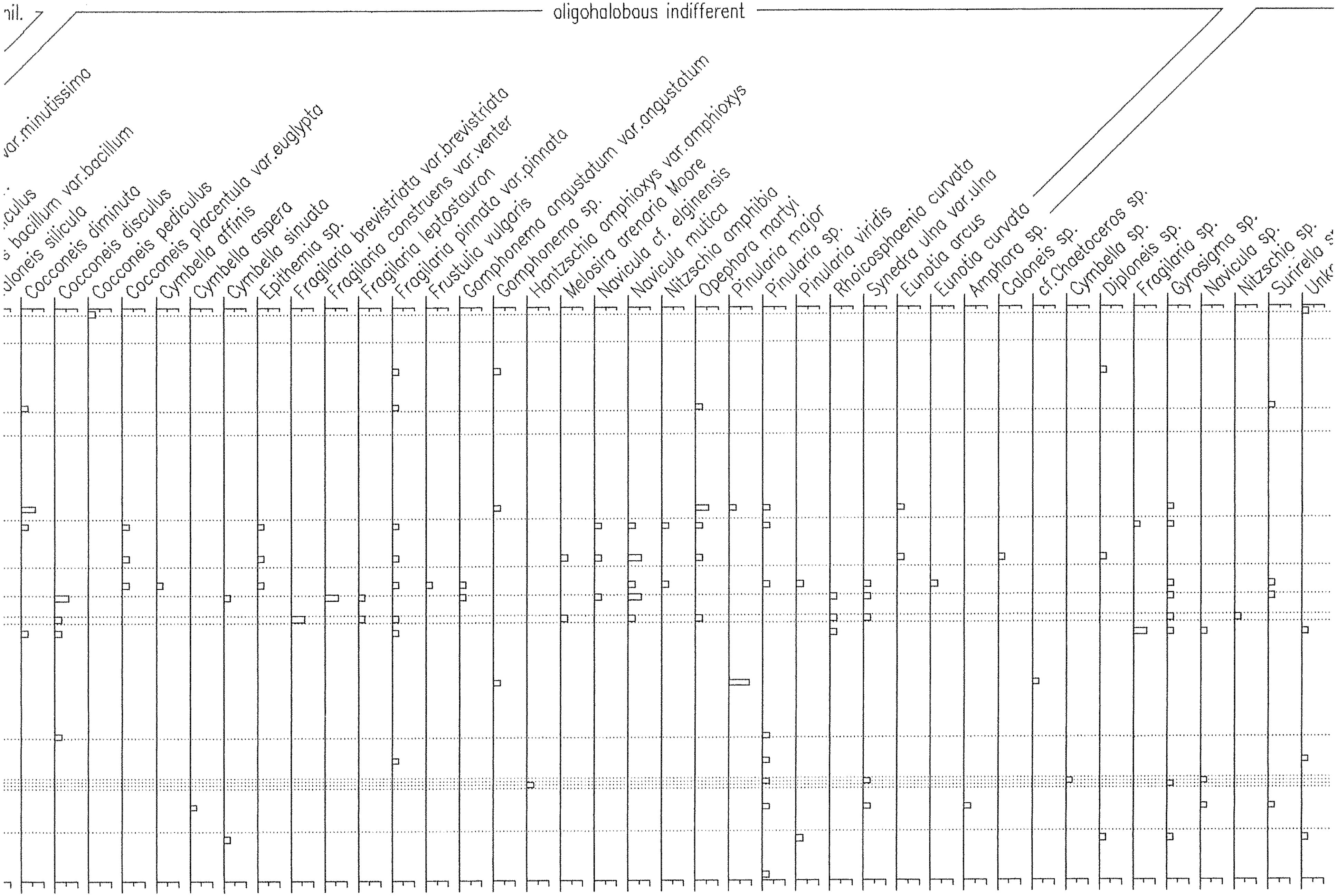
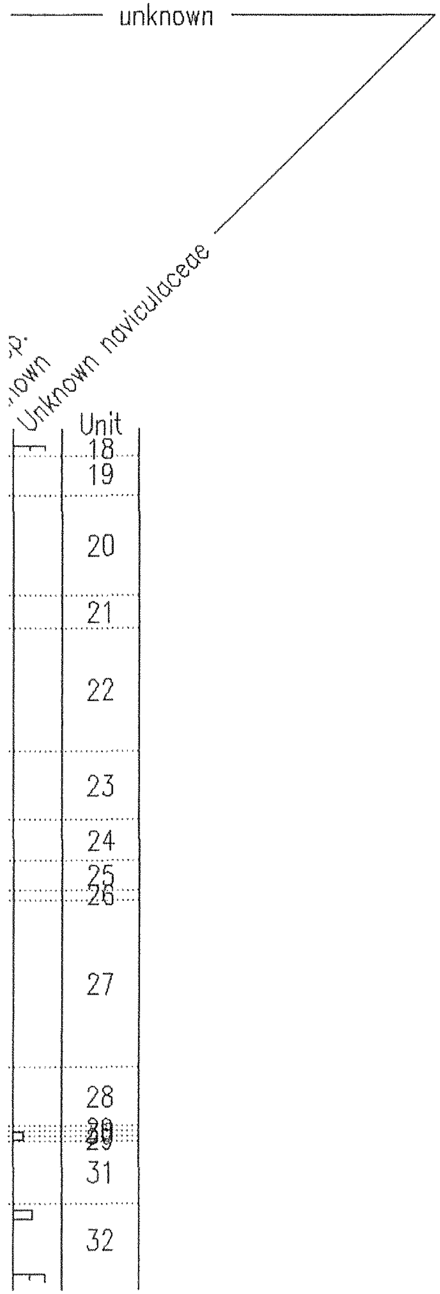


Figure 3. Union Street




nil.
oligohalobous indifferent
var.minutissima
culus
bacillum var.bacillum
loneis silicula
Cocconeis diminuta
Cocconeis disculus
Cocconeis pediculus
Cocconeis placentula var.euglypta
Cymbella affinis
Cymbella aspera
Cymbella sinuata
Epithemia sp.
Fragilaria brevistriata var.brevistriata
Fragilaria construens var.venter
Fragilaria leptostauron
Fragilaria pinnata var.pinnata
Frustulia vulgaris
Gomphonema angustatum var.angustatum
Gomphonema sp.
Hantzschia amphioxys var.amphioxys
Melosira arenaria Moore
Navicula cf. elginensis
Navicula mutica
Nitzschia amphibia
Opephora martyi
Pinularia major
Pinularia sp.
Pinularia viridis
Rhoicosphaenia curvata
Synedra ulna var.ulna
Eunotia arcus
Eunotia curvata
Amphora sp.
Caloneis sp.
cf.Chaetoceros sp.
Cymbella sp.
Diploneis sp.
Fragilaria sp.
Gyrosigma sp.
Navicula sp.
Nitzschia sp.



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Unknown naviculaceae
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Figure 4. Joan Street

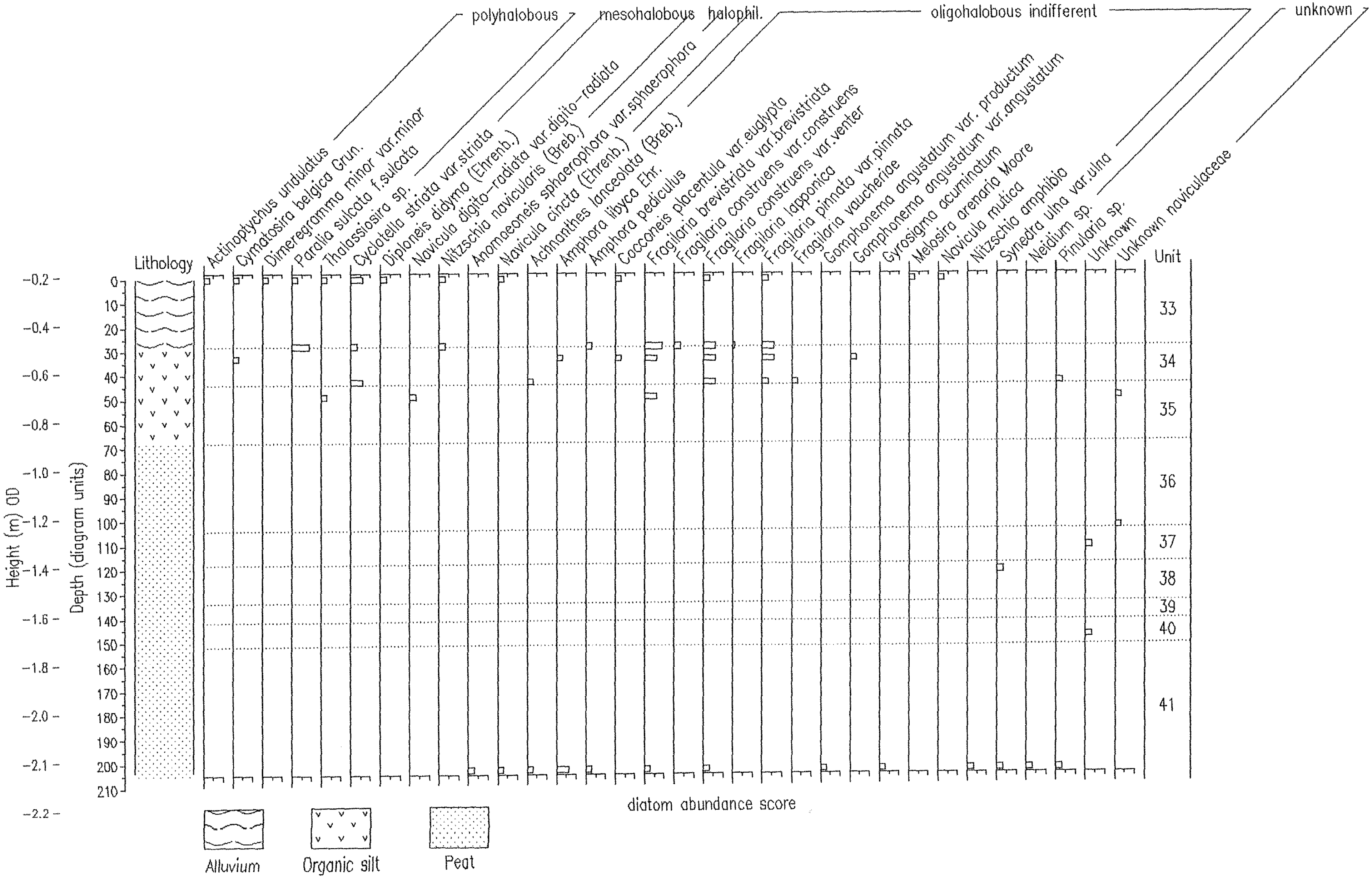
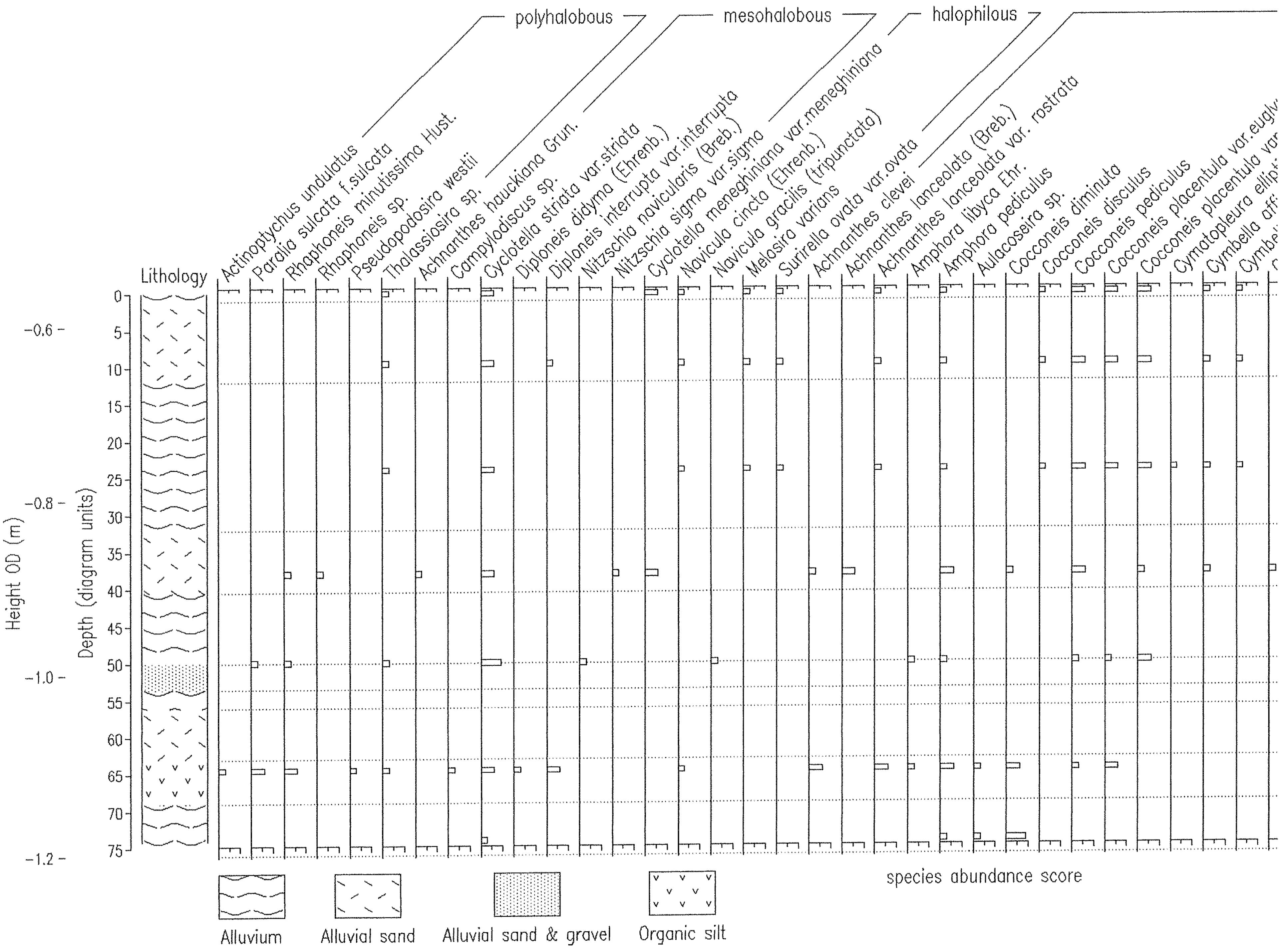
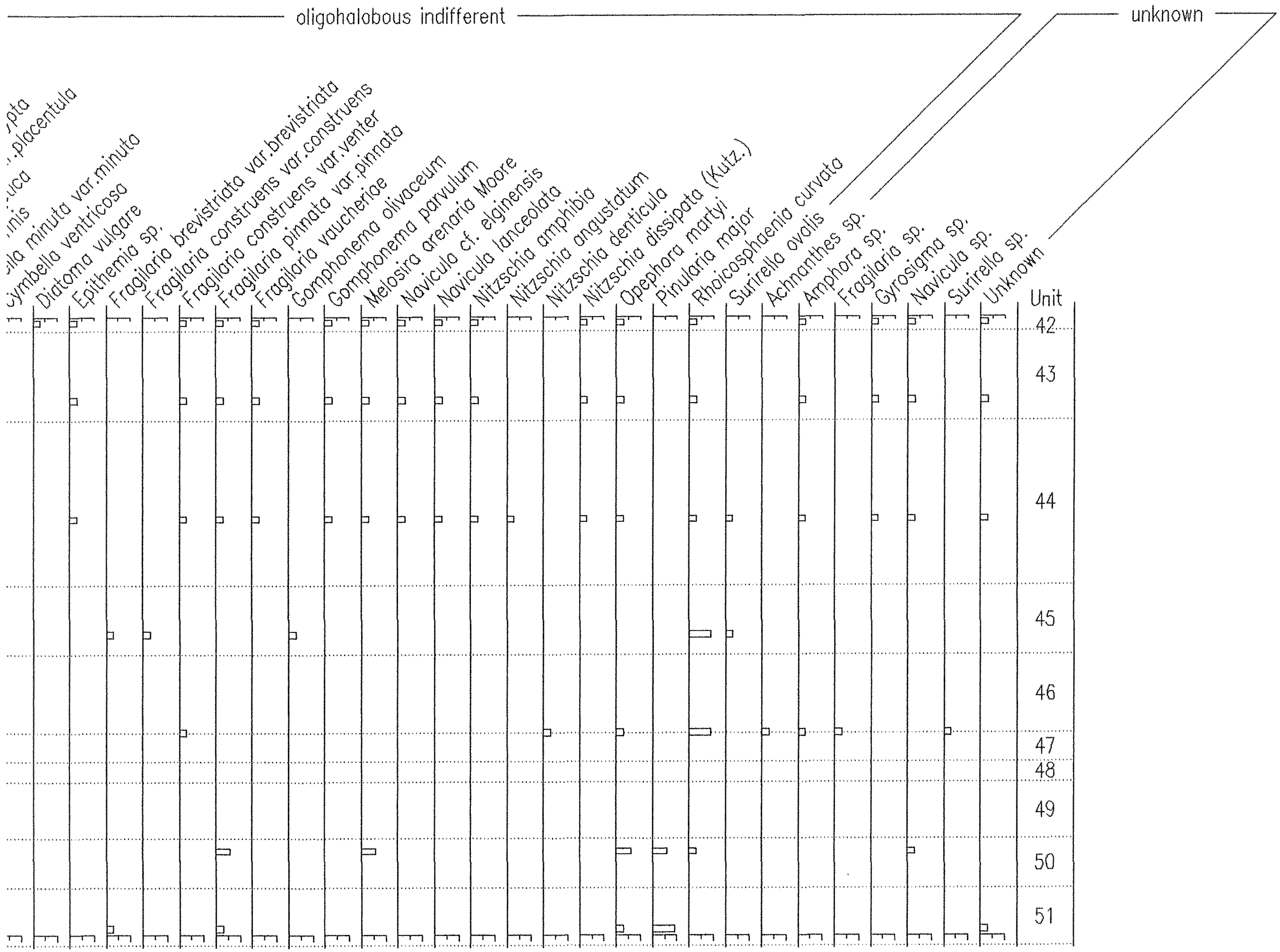


Figure 5. St. Stephen's East




oligohalobous indifferent
unknown
Cymbella minuta var.minuta
Cymbella ventricosa
Diatoma vulgare
Epithemia sp.
Fragilaria brevistriata var.brevistriata
Fragilaria construens var.construens
Fragilaria construens var.venter
Fragilaria pinnata var.pinnata
Fragilaria vaucheriae
Gomphonema olivaceum
Gomphonema parvulum
Melosira arenaria Moore
Navicula cf. elginensis
Navicula lanceolata
Nitzschia amphibia
Nitzschia angustatum
Nitzschia denticula
Nitzschia dissipata (Kutz.)
Opephora martyi
Pinularia major
Rhoicosphaenia curvata
Surirella ovalis
Achnanthes sp.
Amphora sp.
Fragilaria sp.
Gyrosigma sp.
Navicula sp.
Surirella sp.
Unknown
Unit
42
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50
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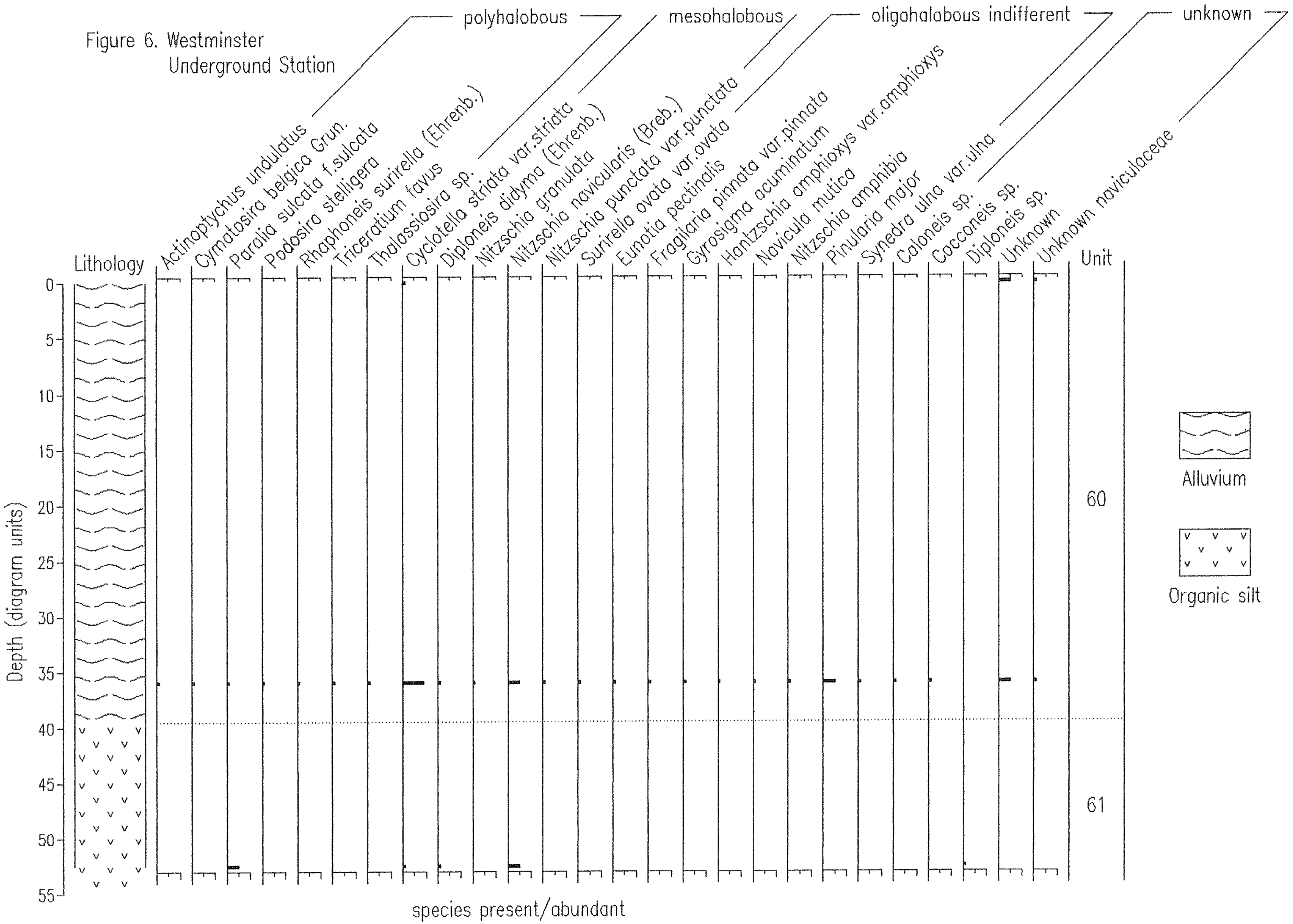


Figure 6. Westminster Underground Station
polyhalobous
mesohalobous
oligohalobous indifferent
unknown
Lithology
Actinoptychus undulatus
Cymatosira belgica Grun.
Paralia sulcata f.sulcata
Podosira stelligera
Rhaphoneis surirella (Ehrenb.)
Triceratium favus
Thalassiosira sp.
Cyclotella striata var.striata
Diploneis didyma (Ehrenb.)
Nitzschia granulata
Nitzschia navicularis (Breb.)
Nitzschia punctata var.punctata
Surirella ovata var.ovata
Eunotia pectinalis
Fragilaria pinnata var.pinnata
Gyrosigma acuminatum
Hantzschia amphioxys var.amphioxys
Navicula mutica
Nitzschia amphibia
Pinularia major
Synedra ulna var.ulna
Caloneis sp.
Cocconeis sp.
Diploneis sp.
Unknown
Unknown naviculaceae
Unit
Depth (diagram units)
0
5
10
15
20
25
30
35
40
45
50
55
60
61
Alluvium
Organic silt
species present/abundant

Figure 7. Palace Chambers South

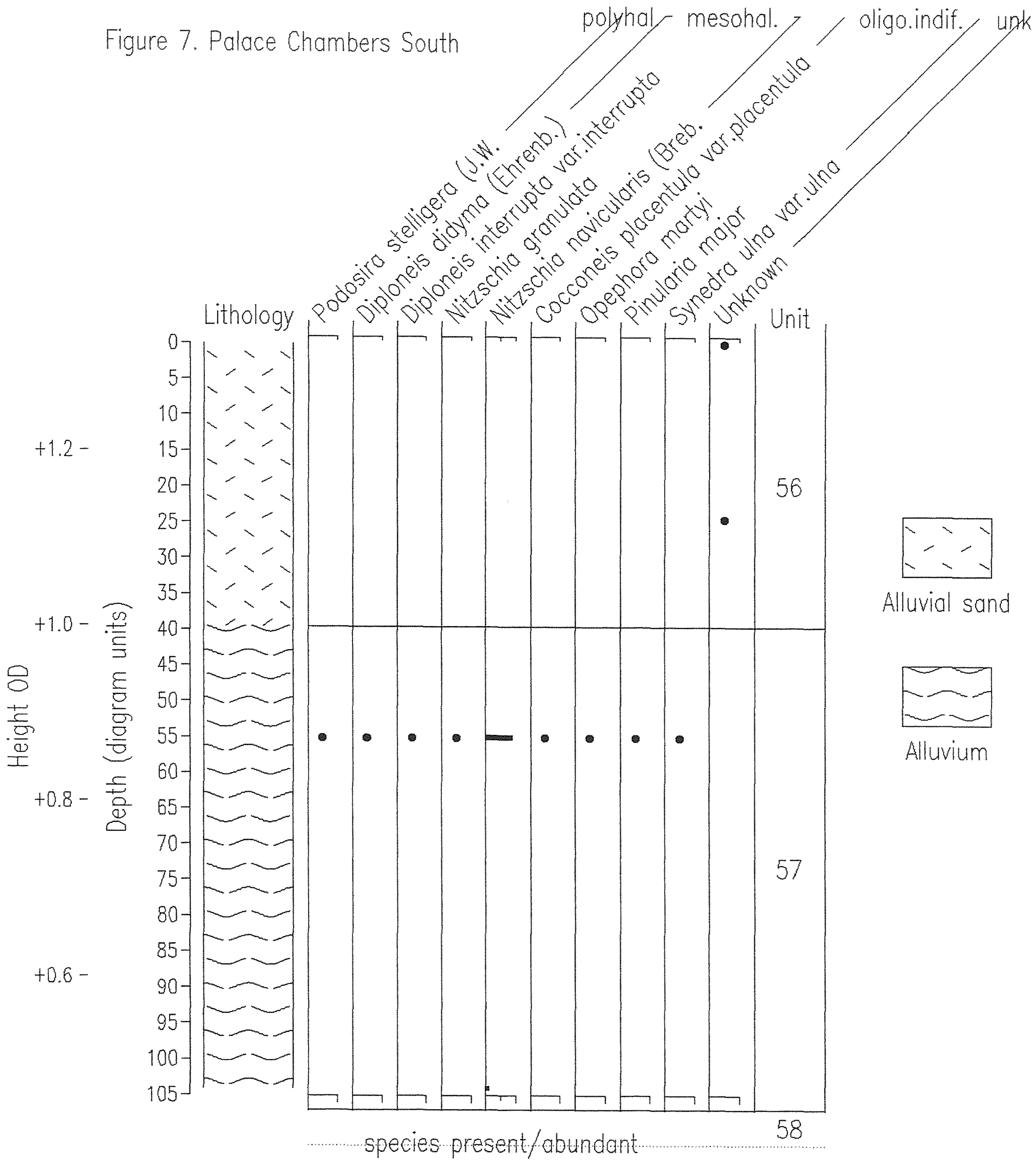


Figure 8. Parliament Square

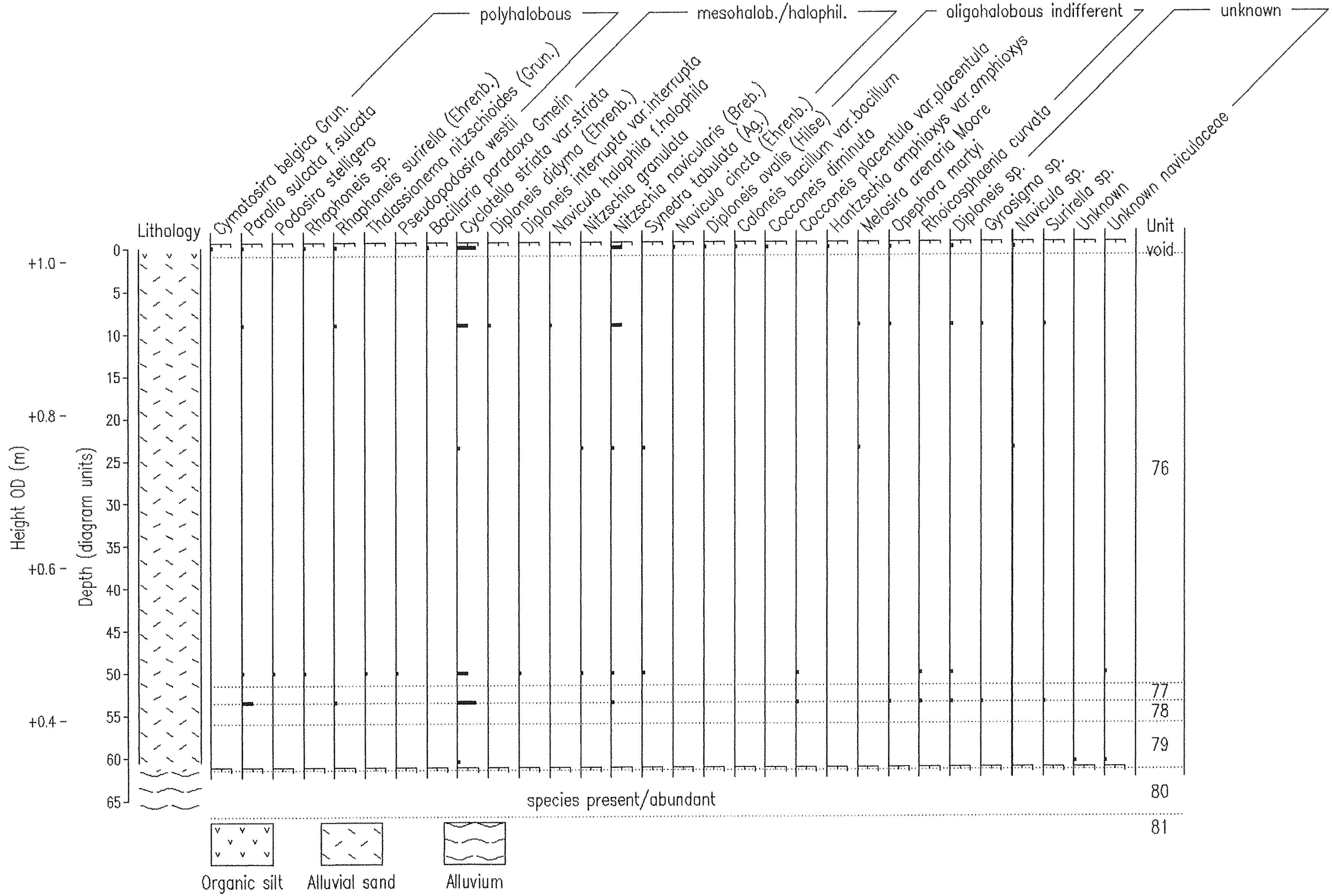
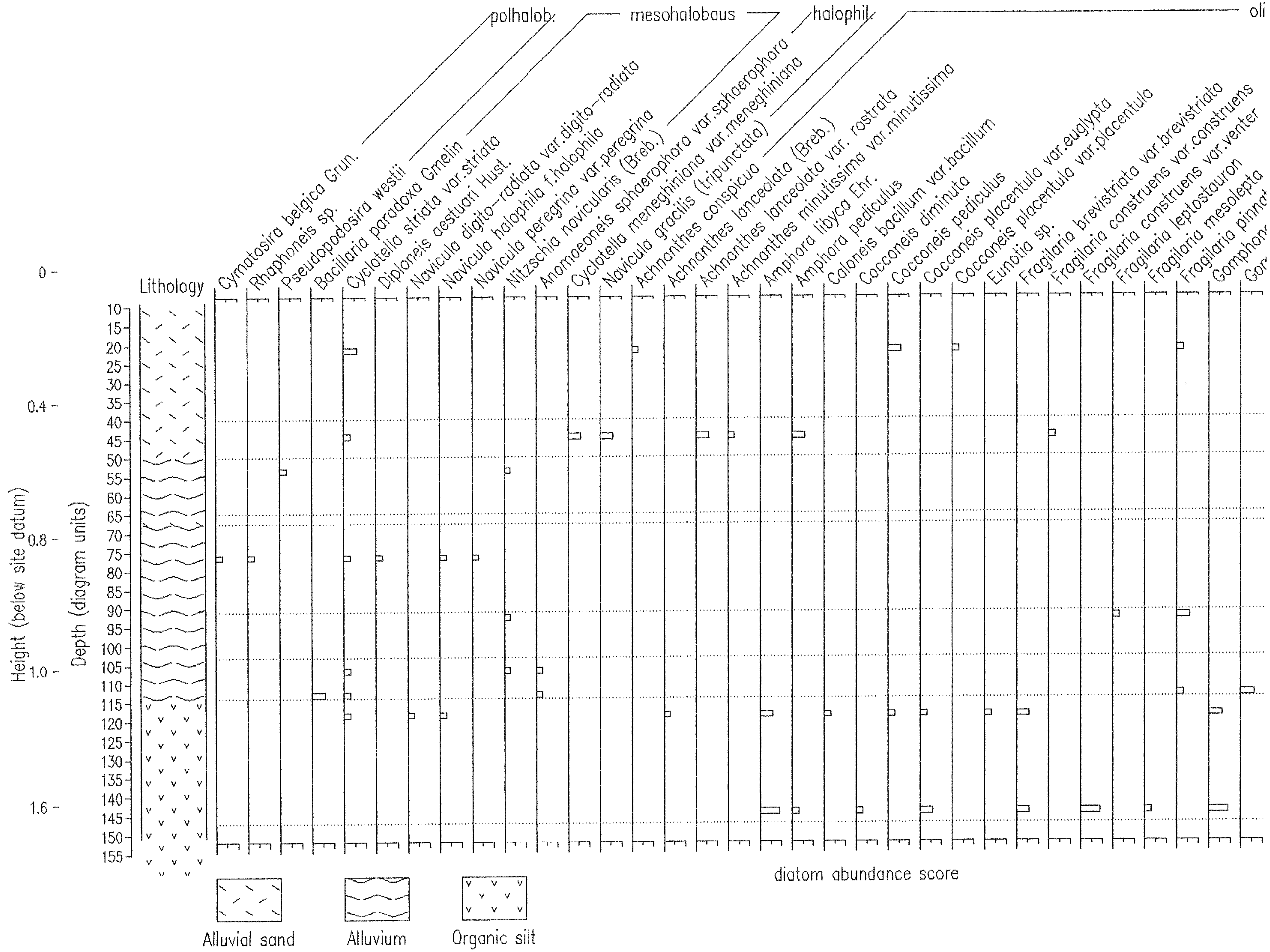
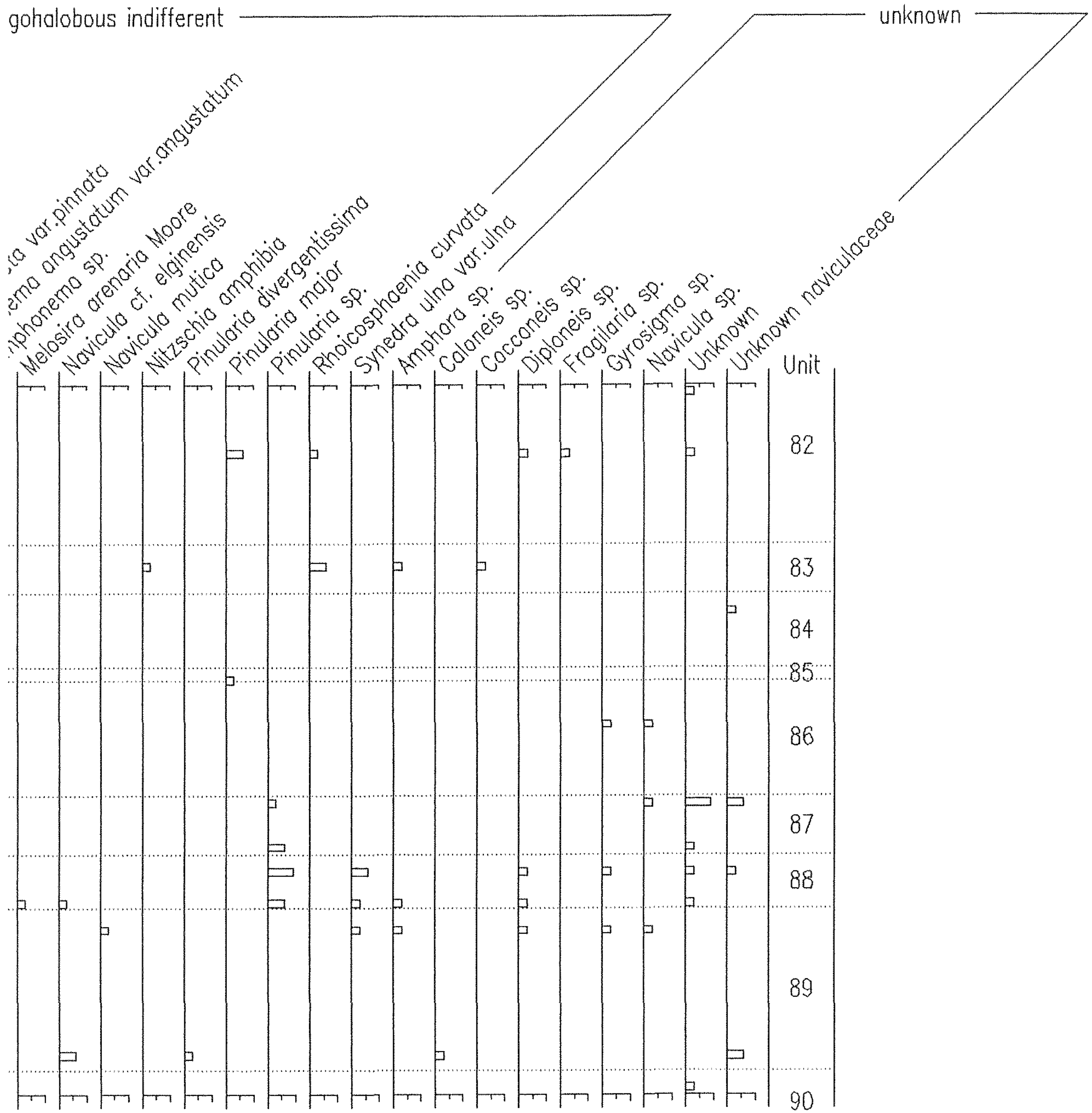


Figure 9. Storey's Gate




gohalobous indifferent
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...ta var.pinnata
...ema angustatum var.angustatum
...phonema sp.
Melosira arenaria Moore
Navicula cf. elginensis
Navicula mutica
Nitzschia amphibia
Pinularia divergentissima
Pinularia major
Pinularia sp.
Rhoicosphaenia curvata
Synedra ulna var.ulna
Amphora sp.
Caloneis sp.
Cocconeis sp.
Diploneis sp.
Fragilaria sp.
Gyrosigma sp.
Navicula sp.
Unknown
Unknown naviculaceae
Unit
82
83
84
85
86
87
88
89
90

Canada Water

Table 1. Canada Water, CAN91, summary of diatom state and potential.

Monolith/ Depth (m) OD	Depth (cm)	Concentration	Preservation	Diversity	Diatom Assemblage Type	Counting Potential
1	8-10	very low	very poor	very low	b frag. & indet.frag.	none
1	28-30	very low	very poor	very low	2 b, indet. centric	none
2	14-16	very low	very poor	very low	indet. frag. cf. coarse m sp.	none
2	30-32	very low	poor	low	f	very low
2	36-38	very low	poor	low	f/b	very low
3	8-10	absent	-	-	-	none
3	16-18	very low	very poor	very low	indet. frag.	none
3	20-22	absent	-	-	-	none
4	6-8	absent	-	-	-	none
4	22-24	very low	very poor	very low	indet. frag.	none
4	30-32	absent	-	-	-	none
4	40-42	very low	very poor	very low	1 f	very low

London Bridge

Table 2. London Bridge Shaft, summary of diatom state & potential.

Monolith	Depth (cm)	Concentration	Preservation	Diversity	Diatom Assemblage Type	Counting Potential
M1	36-38	v.low	v.poor	v.low	f b a	v.low
M2	4-6	low	poor	low	b f m	low
M2	22-24	low	poor	low	f b m	low
M2	30-32	low	poor	low	m b f	low
M2	36-38	v.low	v.poor	v.low	?b indet.	v.low

Union Street Table 3. Union Street, UNS91, summary of diatom state and potential.

Monolith/ Depth (m) OD	Depth (cm)	Concentration	Preservation	Diversity	Diatom Assemblage Type	Counting Potential
4A +0.75 to +0.28	36-38	±absent	-	-	cf. fragment of m centric	none
4B +0.37 to -0.13	20-22	v.low	v.poor	v.low	b f m	low
4B +0.37 to -0.13	38-40	v.low	v.poor	v.low	b f m	low
4C -0.10 to -0.60	26-28	v.low	v.poor	v.low	b f m	low
4C -0.10 to -0.60	44-46	low	poor	moderate	b f m	moderate/ low
4D -0.63 to -1.13	8-10	low	poor	moderate	b f m	moderate/ low
4D -0.63 to -1.13	18-20	high	moderate	high	f b m	very good
4D -0.63 to -1.13	24-26	moderate/high	moderate	moderate/high	b m f	good
4D -0.63 to -1.13	34-36	moderate/low	moderate/poor	moderate/low	b m f	moderate to good
4D -0.63 to -1.13	40-42	low	poor/moderate	low	f b m	some
4E -1.1 to - 1.6	18-20	v.low	v.poor	v.low	f b m	low
4E -1.1 to - 1.6	40-42	v.low	v.poor	v.low	f	low
4F -1.56 to -2.06	2-4	v.low	v.poor	v.low	f	low
4F -1.56 to -2.06	16-18	v.low	v.poor	v.low	f	little
4F -1.56 to -2.06	18-20	v.low	v.poor	v.low	f b	little
4F -1.56 to -2.06	24-26	v.low	v.poor	v.low	f m	little
4G -1.82 to -2.32	16-18	v.low	v.poor	v.low	f m	little
4G -1.82 to -2.32	32-34	v.low	v.poor	v.low (2 spp.)	f (b)	none

Joan Street

Table 4. Joan Street, JOA 91, summary of diatom state and potential

Monolith /Depth (m) OD	Depth (cm)	Concentration	Preservation	Diversity	Diatom Assemblage Type	Counting Potential
1a +0.03 to -0.53	18-20	moderately high	moderately good	medium	b/f/m/aero	good
1a 0.03 to - 0.53	44-46	moderate/low	moderate	moderate/low	f/b/m	moderate/ good
1b	2-4	moderate/low	moderate/ poor	low/moderate	f/m	moderate
1b	12-14	low	poor	low	f/b	moderate/ low
1b	18-20	low	poor	low	f/b	low
1b	36-38	absent	-	-	-	none
1b	42-44	absent	-	-	-	none
1c	14-16	absent	-	-	-	none
1c	38-40	moderate	moderate	moderate	f	moderate
1c 0.96 to - 1.46	14-16	absent	-	-	-	none
1c 0.96 to - 1.46	26-28	±absent	-	-	-	none
1c 0.96 to 1.46	34-36	±absent	-	-	-	none
1c 0.96 to 1.46	44-46	±absent	-	-	-	none
1d -1.41 to -1.91	16-18	absent	-	-	-	none
1d -1.41 to -1.91	26-28	±absent	-	-	-	none
1d -1.41 to -1.91	36-38	±absent	-	-	-	none

St. Stephen's East

Table 5. St. Stephens East, Westminster Area 4, summary of diatom state and potential.

Monolith	Depth (cm)	Concentration	Preservation	Diversity	Diatom Asseemblage Type	Counting Potential
1	4-6	high	good	high	f + b/m plankton	excellent
1	12-14	high	good	high	f + b/m plankton	excellent
1	24-26	high	good	high	f + b/m plankton	excellent
1	36-38	high	moderate	moderate/high	f + b/m	excellent
2	4-6	moderate	moderate	moderate	f + b/m	good
2	18-20	moderate/low	moderate/low	moderate/high	f/b/m	good
2	24-26	v.low	poor	low	f	low
2	36-38	absent (2 chrysophyte cysts)	-	-	-	none
3	4-6	-	-	-	-	none
3	14-16	-	-	-	-	none
3	36-38	-	-	-	-	none

Westminster Underground Station

Table 6. Westminster Underground Station WUS92, Trench E, summary of diatom state and potential.

Monolith	Depth (cm)	Concentration	Preservation	Diversity	Diatom Assemblage Type	Counting Potential
1	8-10	v.low	v.poor	v.low	b	v.low
1	39-40	low/moderate	poor	moderate	b m f	some
2	6-8	v.low	v.poor	v.low	b m	v.low
2	38-40	absent	-	-	-	-
2	48-50	absent	-	-	-	-

Palace Chambers South

Table 7. Palace Chambers South, WSS94, summary of diatom state and potential

Monolith	Depth (cm)	Concentration	Preservation	Diversity	Diatom Assemblage Type	Counting Potential
1	8-10	±absent, single indet. frag.	-	-	-	none
1	28-30	± absent, indet. frags.	-	-	-	none
2	18-20	v.low	poor	v.low	f b m	some
3	18-20	single valve	poor	-	b	none
3	24-26	absent	-	-	-	none
3	32-34	absent	-	-	-	none
3	44-46	absent	-	-	-	none

Parliament Square

Table 8. Parliament Square, PSQ94 summary of diatom state and potential.

Monolith	Depth (cm)	Concentration	Preservation	Diversity	Diatom Assemblage Type	Counting Potential
1	8-10	low	poor/moderate	low	b f m	low
1	18-20	v.low	poor	low	b m f	low
1	34-36	v.low	v.poor	v.low	b f	low
2	28-30	v.low	v.poor	low	b m f	low
2	32-34	v.low	v.poor	low	b m f	low
2	40-42	v.low	v.poor	low	b f	low
2	46-48	-	-	-	-	none

Storey's Gate

Table 9. Storey's Gate (W682), summary of diatom state and potential.

Monolith	Depth (cm)	Concentration	Preservation	Diversity	Diatom Assemblage Type	Counting Potential
1	8-10	±absent	-	-	-	none
1	28-30	low	moderate	low	f m	some
2	12-14	mod/low	moderate	moderate	f b m	good
2	22-24	v.low	poor	v.low	b m	little
2	38-40	v.low	v.poor	1 sp. (+chrysophyte cysts)	f	little
3	8-10	low	poor	low	b	some
3	26-28	v.low	poor	v.low	f b	some
3	36-38	v.low	poor	v.low	f ?	low
3	42-44	v.low	poor	v.low	b f	low
4	6-8	v.low	v.poor	v.low	f b	low
4	12-14	moderate	poor	moderate	f (some b)	some/moderate
4	40-42	moderate	poor	moderate/low	f	some
4	48-50	±absent, 1 frag	-	-	-	none