

Palaeoecology Research Services

**Assessment of biological remains from excavations on
land to the rear of 1 America Street, London Borough
of Southwark (site code: AMA01)**

by

Benjamin R. Gearey, Jason Kirkby, O. J. Dawes, Allan
Hall, Harry Kenward and John Carrott

PRS 2002/21

*Palaeoecology Research Services
Unit 8, Dabble Duck Industrial Estate
Shildon, County Durham DL4 2RA*

**Assessment of biological remains from excavations on land to the rear of
1 America Street, London Borough of Southwark (site code: AMA01)**

by

Benjamin R. Gearey, Jason Kirkby, O. J. Dawes, Allan Hall, Harry Kenward and John Carrott

Summary

Two bulk sediment samples, six diatom samples, 16 pollen samples, a 50 cm monolith for particle size analysis, and five samples for investigation for the eggs of intestinal parasitic nematodes, recovered from the excavation of a late Roman cemetery at land to the rear of 1 America Street, London Borough of Southwark, were submitted to PRS for an assessment of their interpretative potential.

Biological remains were sparse and generally poorly preserved in the examined samples. Pollen survival was particularly poor and no meaningful ecological or archaeological information could be determined. Where present, the diatoms represented tidal mudflats and showed little evidence for any change in this depositional regime. Small fragments of very decayed wood recovered from Context 552 were almost certainly the remains of the base of the coffin associated with skeleton 494 and were identified as oak (Quercus). The only significant invertebrate remains (also from Context 552) were those of the burrowing beetle Anommatus duodecimstriatus which were probably intrusive to the deposit. No eggs of intestinal parasitic nematodes were seen in the samples.

Particle size analysis showed that the sediment consisted of silty/clayey sand with a slight but sustained increase in the percentage of silt/clay up the sequence. The results indicated that the sediment was fluvially deposited under moderate to low energy conditions. The gradual nature of the increase in the finer sediment fraction suggests this was a fairly steady process, perhaps, for example, as a result of channel migration away from the site.

No further work on the current material is recommended and all of the remaining samples may be discarded unless they are to be processed for purposes other than those considered in this assessment.

KEYWORDS: LAND TO THE REAR OF 1 AMERICA STREET; LONDON BOROUGH OF SOUTHWARK; ASSESSMENT; LATE ROMAN; CEMETERY; PLANT REMAINS; CHARRED PLANT REMAINS; POLLEN; DIATOMS; INVERTEBRATE REMAINS; INTESTINAL PARASITIC NEMATODE EGGS; PARTICLE SIZE ANALYSIS; DEPOSITIONAL ENVIRONMENT

Contact address for authors:

Palaeoecology Research Services
Unit 8
Dabble Duck Industrial Estate
Shildon
County Durham DL4 2RA

Prepared for:

AOC Archaeology Group
Unit 7
St Margarets Business Centre
Moor Mead Road
Twickenham TW1 1JS

10 July 2002

Assessment of biological remains from excavations on land to the rear of 1 America Street, London Borough of Southwark (site code: AMA01)

Introduction

An archaeological excavation was carried out by AOC Archaeology Group on land to the rear of 1 America Street, London Borough of Southwark, between October 2001 and March 2002. The site was centred on NGR: TQ 3220 8010 and bounded by America Street to the south, Keppel Row to the north and Great Guildford Street to the west.

Two bulk sediment samples ('GBA'/'BS' *sensu* Dobney *et al.* 1992) for plant and invertebrate macrofossils, six subsamples from two 50 cm monolith columns for diatoms, 16 pollen samples (14, including 4 control samples, from grave fills, and 2 from fills of vessels), a 50 cm monolith for particle size analysis, and five samples for investigation for the eggs of intestinal parasitic nematodes (each taken from the stomach area of individual skeletons), were submitted to PRS for assessment.

All of the submitted material was from deposits associated with a late Roman cemetery, overlying (at 80-100 cm) a prehistoric sand eyot and truncated by a 19th century basement.

Methods

Bulk sediment samples

The two submitted bulk sediment samples were inspected in the laboratory and their lithologies were recorded, using a standard *pro forma*. One of the samples was selected for processing, following the procedures of Kenward *et al.* (1980; 1986), for recovery of plant and invertebrate macrofossils.

The flot and washover resulting from processing were examined for plant and

invertebrate macrofossils. The residue was scanned for larger plant macrofossils and other biological and artefactual remains.

Pollen

Following an initial visual assessment of the samples sent for palynological analyses it was determined that, as these consisted of predominantly inorganic sands, it was unlikely that countable or well-preserved concentrations of pollen would be present in these sediments. Two samples—Sample 61 (Context 467) and Sample 23 (Context 400)—were selected for analysis to investigate this supposition. This required the processing of relatively large (5 cm³) samples to extract sufficient organic residue.

Samples were prepared using standard techniques including KOH digestion, HF treatment and acetylation (Moore *et al.* 1991). The samples were mounted in silicon oil and counted at a magnification of x400. Identifications were made using standard keys and a reference collection.

Diatoms

Diatom preparations followed standard preparation techniques (Round *et al.* 1990). Information regarding the environmental tolerance and ecological requirements of diatoms are based on Denys (1991, 1992), de Wolf (1982, 1993) and Van Damm *et al.* (1994).

Each slide was scanned thoroughly for the presence/absence of diatoms. Where present, diatoms have been identified to genus or species level if possible. Although quantitative analysis has not been undertaken, estimates of

relative abundance have been made to indicate the dominant species, if any.

Parasites

The samples were examined for the eggs of intestinal parasitic nematodes using the 'squash' technique of Dainton (1992).

Although primarily for the detection of intestinal parasitic nematode eggs the 'squash' technique routinely reveals other microfossil remains, and where present (or markedly absent) these have also been noted.

Particle size analysis

Monolith sequence 073 (grid square 300/610) was sampled for particle size analysis (psa). Due to the fine particle size of the sediment, it was determined that psa was best performed utilising a laser particle sizer in the Institute for Estuarine and Coastal Studies at the University of Hull. Fifteen subsamples were extracted at regular intervals from the monolith.

Particle size analysis was performed on a MasterSizer 2000 optical unit, using a Hydro2000MU accessory unit for sample mixing. The mixing process used was the tumbler method. Each sample was placed into a clean glass jar with a secure lid, and the jar rotated about its circumference for 30 full revolutions. The jar was thoroughly cleaned between each sample. The less than 1 mm fraction was retained (no larger fraction was present) and added to the dispersant (water) in the Hydro2000 MU unit, until an obscuration factor close to 15% was reached. The obscuration helps the operator to set the concentration of the sample when it is added to the dispersant and is a measure of the amount of laser light lost due to the introduction of the sample within the MasterSizer 2000 analyser beam. The MasterSizer uses the optical unit to capture the actual scattering pattern from the field of

particles and then calculates the size of the particles that creates this pattern. The output is in the form of a percentage distribution of particle size.

Results

Archaeological information, provided by the excavator, is given in square brackets.

Bulk sediment samples

The results are presented in context number order. A brief summary of the processing method and an estimate of the remaining volume of unprocessed sediment follows (in round brackets) after the sample numbers.

Context 552 [base of coffin associated with skeleton 494]

Sample 88/T (5 kg sieved to 300 microns with paraffin flotation and washover; approximately 7 litres of unprocessed sediment remains)

Moist, very dark grey-brown (internally mid grey), crumbly to unconsolidated (working soft), slightly humic (?from rotted coffin wood), slightly clay silty sand. A few small (to 10 mm) fragments of decayed wood were also present.

This sample yielded a large residue of about 800 cm³ of quartz sand with a little rounded flint gravel (to 35 mm) and traces of brick/tile (to 35 mm), glass (15 mm), and pottery and bone (both to 30 mm).

The washover of about 40 cm³ consisted of rather small (<15 mm) granular, rounded and rather decayed wood fragments (the largest of which were identified by sectioning as oak, *Quercus*), and a little charcoal (to 5 mm). There were a few insect fragments which had not been extracted by paraffin flotation and these were added to the flot, which itself consisted largely of small (to 3.1 mm) rounded sac-like structures which were probably fungal perithecia or sclerotia (but which were *not* the very characteristic sclerotia of the soil fungus, *Cenococcum*, widely recorded from archaeological sediments). There were modest numbers of insect remains, almost all of which were from the beetle *Anommatus duodecimstriatus* (Müller). This species is a blind burrower whose natural association is probably with decaying wood underground. There are modern records from mouldering wood in damp places, and it has occasionally been noted in archaeological deposits, including graves. It may have burrowed down to the decaying coffin timbers at any time since burial but most probably from the 19th century basement,

since it has been found in cellars. The only other insect remains were fragments of a staphylinid (either *Quedius* or *Philonthus* species), a very decayed fly larva or puparium, and the apex of a moth pupa.

Context 592 [decayed coffin wood associated with skeleton 591]
Sample 100

Moist, light to mid yellow-brown to mid grey-brown (mottled on mm- and cm-scales), crumbly (working more or less soft), slightly clay silty sand. Humic patches, presumably of very rotted coffin wood, were present but no pieces of wood were seen. A few modern contaminant arthropods were noted.

No further investigation of this sample was undertaken.

Pollen

The results are presented in context number order.

Context 400 [associated with skeleton 401]
Sample 23

The examined subsample was barren of remains.

Context 467 [associated with skeleton 468]
Sample 61

Very low concentrations of poorly preserved palynomorphs were present, including ?Lactuceae, *Polypodium*, *Filipendula*, and Chenopodiaceae.

Diatoms

The two monolith samples together represented a 95 cm sequence through the deposits. The results are presented in sequence order, lowest first, with the height above the base level given in round brackets.

Monolith sample 31

Context 397 (4-5 cm): Barren

Context 421 (13-14 cm): Barren

Context 420 (23-24 cm): Diatoms were very sparse and poorly preserved. Some unidentifiable broken diatoms were present together with a few fragments of *Cyclotella striata* (Kütz.) Grun. in Cleve and Grun. (brackish plankton).

Monolith sample 32

Context 419 (39-40 cm): Diatoms were rather abundant though mostly present as broken fragments. The dominant species was *C. striata* (brackish plankton) and *Gyrosigma acuminatum* (Kütz.) Rabenh.. Other species present were *Paralia sulcata* (Ehrenb.) Cleve, *Opephora pacifica* (Grun.) Petit (both marine planktonic types); *Nitzschia navicularis* (Breb. ex Kütz.) Grun. in Cleve and Grun., *Diploneis smithii* (Breb. ex W. Sm.) Cleve, *Diploneis didyma* (Ehrenb.) Cleve (brackish epipellic); and *Fragilaria* sp. (freshwater plankton).

Context 418 (65-66 cm): Diatoms were rather sparse and their preservation poor. Only two species were present—*C. striata* (brackish plankton) and *N. navicularis* (brackish epipellic).

Context 417 (86-87 cm): Diatoms were, again, sparse and their preservation poor. Species identified were *C. striata* (brackish plankton); *P. sulcata*, *Actinoptychus senarius* (Ehrenb.) Ehrenb., *Thalassiosira eccentrica* (Ehrenb.) Cleve, and *O. pacifica* (all marine plankton).

Parasites

No eggs of intestinal parasitic nematodes were recorded from the five examined samples. Four of the 'squash' samples (from Contexts 382, 424, 433, and 455) were entirely inorganic, with the fifth (Context 467, Sample 62) also containing traces of organic detritus but no recognisable microfossils.

Particle size analysis

The samples were taken from the base of the monolith upwards—hence the sample at 50 cm corresponds to the top of the sequence.

The analyses reports for each sample (see Appendix) present a table showing % volume of each size class of sediment and graphs showing the particle size distribution and cumulative frequency along a logarithmic scale (in microns). In addition, summary statistics/parameters of particle size distribution are also given. These include non-inclusive measurements of kurtosis, skewness, standard deviation (sorting) and mean/median grain size calculated from the entire particle size distribution and inclusive statistic measurements of these parameters based on grain size at symmetrically distributed percentiles. It should be noted that the inclusive statistic values are different to the normal (non-inclusive) values of these parameters based upon the whole curve. It is considered that the inclusive values be used for interpretation rather than those calculated on the basis of the whole curve as the inclusive values are more robust, being less prone to

bias due to small amounts of material at the extremes of the sediment distribution.

Text descriptions of the degree of sorting, skewness and kurtosis and also the mean/median grain size are given for each sample, alongside the parameters and a broad breakdown of the sediment in terms of silt, sand and gravel content are given. If there is a requirement for a more in depth description of the sediment (e.g. very coarse, coarse, medium, fine etc.) these can be described according to the Wentworth Scale (see Table 1 in Appendix). The appended table shows grain size classes for sediments upon which the particle size analyses in this report are based.

Notes regarding the particle size analysis results

Size Units

1 mm sediment diameter = 1000µm (microns)
phi (Φ) = $-\log_2 S$, where S is the particle size in mm.

Skewness

Skewness describes a form of measurement of the symmetry of particle size distribution across the sample. A high positive skew ($>+ 0.30$) describes a sample with a tail of fine sediment, a high negative skew (<-0.30) describes a sample with a tail of coarse sediment. Samples ranging from 0.10 to -0.10 are near symmetrical.

Sorting

The sorting coefficient is a way of describing the spread of particles across the sample. The range varies as follows: less than 0.35—very well sorted; through 0.71-1.00—moderately sorted; to greater than 2.00—very poorly sorted.

Discussion and statement of potential

Bulk sediment samples

Small fragments of very decayed wood recovered from Context 552 were almost certainly the remains of the base of the coffin associated with skeleton 494 and were identified as oak (*Quercus*). The only significant invertebrate remains were those of the burrowing beetle *Anommatus duodecimstriatus* which were probably intrusive to the deposit.

These remains were of no interpretative value beyond the identification of the coffin timber. If these samples can be taken as typical of those recovered from the site then any further study of plant and invertebrate remains from other deposits is likely to be similarly unrewarding.

Pollen

No palynological information could be obtained from Sample 23 (Context 400). Very low concentrations of poorly preserved pollen were identified in Sample 61 (Context 467). The taxa present included ?Lactuceae (dandelions, etc.), *Polypodium* (common polypody), *Filipendula* (meadowsweet) and Chenopodiaceae (fat hen family). The poor preservation of these thick walled, usually robust palynomorphs suggests that differential preservation has affected the sample. This is not surprising given the sedimentary context—the grains in this sample may very well be of secondary derivation.

In the light of these considerations, no meaningful ecological or archaeological (e.g. regarding the inclusion of floral grave goods) information could be derived from the analyses and the investigation of further samples was not considered worthwhile.

Diatoms

The absence of diatoms in samples from Context 397 (4-5 cm) and Context 421 (13-14 cm) was unsurprising given the sampled context of cemetery soils. However, sufficient species were present in other samples to enable some comments to be made regarding the palaeoenvironmental and depositional context in the period following cemetery inundation.

Only a few taxa were present in Context 420 (23-24 cm), all of which are associated with marine or brackish conditions. The occurrence of these brackish mud dwelling species

suggests deposition within a mudflat of an estuarine margin. This context is indicated as being an uppermost cemetery soil—it is possible that the occurrence of diatoms thus represents an initial stage of inundation of the site.

The dominant species from Context 419 (*Cyclotella striata* (brackish plankton) and *Gyrosigma acuminatum*) are both common in estuarine and tidal river waters (e.g. inner Humber and Thames). The freshwater fluvial species are tolerant of saline conditions and are also found in marginal tidal waters. The *in situ* assemblage is most likely to be comprised of the benthic mud dwelling (epipellic) species. As such, the depositional environment represented is probably a tidal mudflat with the mixture of marine/brackish and freshwater planktonic types washed onto the flats by frequent tidal inundation.

Diatoms were sparse in the sample from Context 418 and the assemblage was not diverse. A preservational bias is likely, as the dominant species are relatively robust centric diatoms, which are more resistant to dissolution and breakage than other species. It is probable that the depositional environment is still tidal mudflat even though marine and brackish plankton dominate the assemblage—the *in situ* benthic population (e.g. *N. navicularis*) is not well preserved.

The diatoms from Context 417 were, again, a mixture of marine/brackish plankton and benthic mud dwelling species. This was interpreted as a mudflat environment subject to frequent tidal inundation.

In conclusion, it would appear from the diatoms that the upper deposits of the sequence (Contexts 417-419) represent tidal mudflats, with little evidence for any change in this depositional regime.

Parasites

No eggs of intestinal parasitic nematodes were seen in the samples and it is considered highly unlikely that any other unexamined samples

from similar deposits would contain these remains.

Particle size analysis

The general sequence showed that the sediment consisted of silty/clayey sand. There was a slight but sustained increase in the percentage of silt/clay up the sequence, from 22% at the base to 34% silts/clays in the uppermost sample. Other than in the two uppermost samples (46.4 cm and 50 cm), the percentage of sand did not fall below 70%. Inclusive mean grain size indicated fine sands between 0 cm and 28.6 cm from the base of the sequence with very fine sands from 28.6 cm to 50 cm. Sorting was very poor for all samples.

The results indicated that the sediment was fluvially deposited under moderate to low energy conditions. The 'fining up', or increase in the finer fraction of fine sands, silts and clays relative to coarser sands, reflects a reduction in the energy of the fluvial regime responsible for the deposition of the sediment from the base to the top of the sequence. The gradual nature of this increase suggests that this was a fairly steady process, perhaps, for example, as a result of channel migration away from the site. Without additional stratigraphic information, it is not possible to comment further on this.

Recommendations

No further work on the plant and invertebrate remains from the samples considered here is recommended.

No further investigation of samples for pollen is warranted.

The absence of diatoms below approximately 20 cm (from the base of the examined sequence) indicates that the potential of the lowermost sediments from the grave fill or cemetery soils to reveal any

palaeoenvironmental or palaeohydrological information from diatom analysis is zero. The presence of diatoms in all the other samples does, at least, enable some inferences concerning the environment under which the uppermost contexts were deposited. However, due to the generally poor preservation of the diatoms, and the problems of possible differential dissolution bias, any interpretations remain somewhat tentative. A more detailed study of the diatoms within this sedimentary sequence is unlikely to provide any more specific data in addition to those results already obtained. In view of the above comments, it is not recommended that further palaeoenvironmental analyses be carried out on these samples.

No further investigation of samples for the eggs of intestinal parasitic nematodes is recommended.

Further study of the particle size analysis results, in conjunction with additional details relating the sequence to the stratigraphy of the site as a whole, is unlikely to add significantly to the information presented here.

Retention and disposal

All of the remaining unprocessed samples may be discarded unless they are to be processed for purposes other than those considered in this assessment.

Archive

All material is currently stored by Palaeoecology Research Services (Unit 8, Dabble Duck Industrial Estate, Shildon, County Durham), along with paper and electronic records pertaining to the work described here.

Acknowledgements

The authors are grateful to Alys Vaughan-Williams of AOC Archaeology Group for providing the material and the archaeological information.

References

- Battarbee, R. W. (1986). *Diatom Analysis*, pp. 527-70 in Berglund, B. E. (ed), *Handbook of Holocene Palaeoecology and Palaeohydrology*. Chichester and New York: John Wiley.
- Dainton, M. (1992). A quick, semi-quantitative method for recording nematode gut parasite eggs from archaeological deposits. *Circaea, the Journal of the Association for Environmental Archaeology* **9**, 58-63.
- Denys, L. (1991, 1992). *A check-list of the diatoms in Holocene deposits of the western Belgian coastal plain with a survey of their apparent ecological requirements*. Belgium: Belgische Geologische Dienst. Professional Paper **246**, 1-41.
- De Wolf, H. (1982). Method of coding of ecological data from diatoms for computer utilisation. *Mededelingen Rijks Geologische Dienst*. **36**, **2**, 95-98.
- De Wolf, H. (1993). *Ecological Coding for Diatoms*. Haarlem: Geological Survey of the Netherlands.
- Dobney, K., Hall, A. R., Kenward, H. K. and Milles, A. (1992). A working classification of sample types for environmental archaeology. *Circaea, the Journal of the Association for Environmental Archaeology* **9** (for 1991), 24-6.
- Kenward, H. K., Hall, A. R. and Jones, A. K. G. (1980). A tested set of techniques for the extraction of plant and animal microfossils from waterlogged archaeological deposits. *Science and Archaeology* **22**, 3-15.
- Kenward, H. K., Engleman, C., Robertson, A. and Large, F. (1986). Rapid scanning of urban archaeological deposits for insect remains. *Circaea* **3**, 163-172.
- Moore, P. D., Webb, J. A. and Collinson, M. E. (1991). *Pollen Analysis*. 2nd Edition. Oxford: Blackwells.
- Van Damm, H., Mertens, A. and Sinkeldam, J. (1994). A coding checklist and ecological indicator values of freshwater diatoms from the Netherlands. *Netherlands Journal of Aquatic Ecology* **28**, 117-133.

Appendix

Particle Size Analysis data sheets and Table 1 showing the Wentworth scale of particle sizes

Institute of
estuarine
& coastal
studies



THE
UNIVERSITY
OF HULL

IECS
The University of Hull
Cottingham Road
Hull
HU6 7RX

Lab telephone: (01482) 465661
Office telephone: (01482) 465667
Fax: (01482) 465001
E-mail: N.V.Proctor@hull.ac.uk
Web site: http://www.hull.ac.uk/iecs

Result Analysis Report

Sample Name: Arch/core/0cm depth **Obscuration:** 13.94 %
Measured by: OLLY **Measured:** 07/02/02 10:29:22 **Weighted Residual:** 0.664 %
Sample Bulk Lot Ref: 0cm depth **Analysed:** 07/02/02 10:29:23 **SOP Name:** soil

Percentile Grain Size: **D[v,0.84] = 479.93um = 1.06phi** **Skewness = .59**
D[v,0.05] = 3.25um = 8.27phi **D[v,0.96] = 643.86um = .64phi** **Standard Deviation = 205.39 um = 2.28phi**
D[v,0.16] = 32.31um = 4.95phi **Non Inclusive Parameters:** **Volume Weighted Mean:**
D[v,0.5] = 243.66um = 2.04phi **Kurtosis = -0.36** **D[4,3] = 263.69um = 1.92phi**

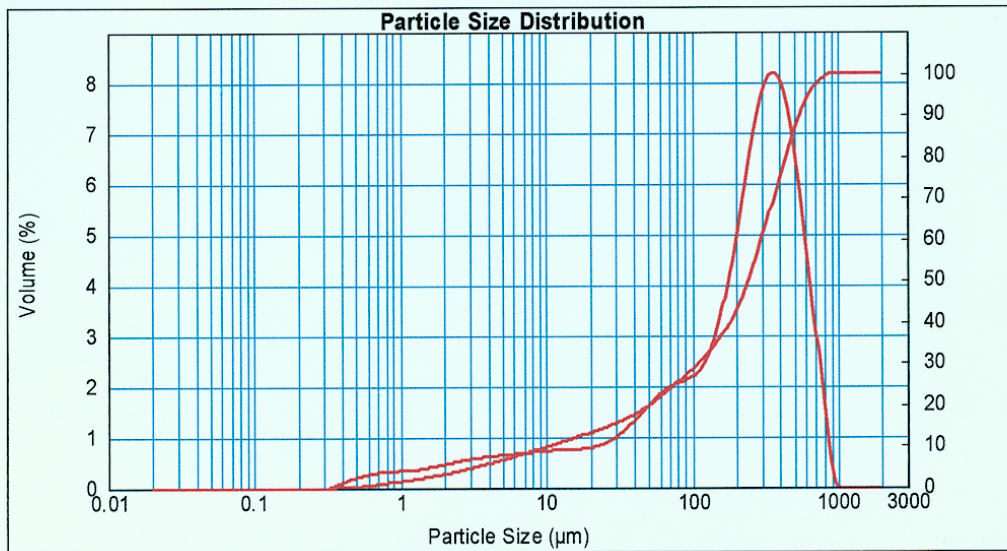
Inclusive Standard Deviation = 2.13 phi (Very Poorly Sorted) **Gravel Content = 0 %**
Inclusive Skewness = -0.57 (Strongly Coarse Skewed) **Sand Content = 77.69 %**
Inclusive Kurtosis = 1.31 phi (Leptokurtic) **Silt/Clay Content = 22.31 %**
Inclusive Mean Grain Size = 2.68 phi (Fine Sand)
Median Grain Size (D[v,0.5]) = 2.04 phi (Fine Sand)

Size (µm)	Volume In %
0.010	0.26
0.490	1.30
0.980	1.71
1.950	2.45
3.900	

Size (µm)	Volume In %
3.900	2.96
7.800	3.31
15.600	3.81
31.300	6.52
62.500	

Size (µm)	Volume In %
62.500	9.66
125.000	19.13
250.000	34.77
500.000	14.14
1000.000	

Size (µm)	Volume In %
1000.000	0.00
2000.000	0.00
8000.000	0.00
10000.000	0.00



Malvern Instruments Ltd.
Malvern, UK
Tel := +[44] (0) 1684-892456 Fax +[44] (0) 1684-892789

Mastersizer 2000 Ver. 3.01 C:\Program Files\Malvern Instruments\Mastersizer 2000\Measurement ...\Archaeology1.mea
Serial Number : 34205-79 02 Jul 2002 12:44:01

institute of
estuarine
& coastal
studies



THE
UNIVERSITY
OF HULL

IECS
The University of Hull
Cottingham Road
Hull
HU6 7RX

Lab telephone: (01482) 465661
Office telephone: (01482) 465667
Fax: (01482) 465001
E-mail: N.V.Proctor@hull.ac.uk
Web site: http://www.hull.ac.uk/iecs

Result Analysis Report

Sample Name: Arch/core/3.57cm depth **Obscuration:** 15.81 %
Measured by: OLLY **Measured:** 07/02/02 10:38:10 **Weighted Residual:** 0.531 %
Sample Bulk Lot Ref: 3.57cm depth **Analysed:** 07/02/02 10:38:11 **SOP Name:** soil

Percentile Grain Size: **D[v,0.84] = 480.46um = 1.06phi** **Skewness = .7**
D[v,0.05] = 3.78um = 8.05phi **D[v,0.95] = 659.51um = .6phi** **Standard Deviation = 208.6 um = 2.26phi**
D[v,0.16] = 36.72um = 4.77phi **Non Inclusive Parameters:** **Volume Weighted Mean:**
D[v,0.5] = 235.84um = 2.08phi **Kurtosis = -0.17** **D[4,3] = 263.04um = 1.93phi**

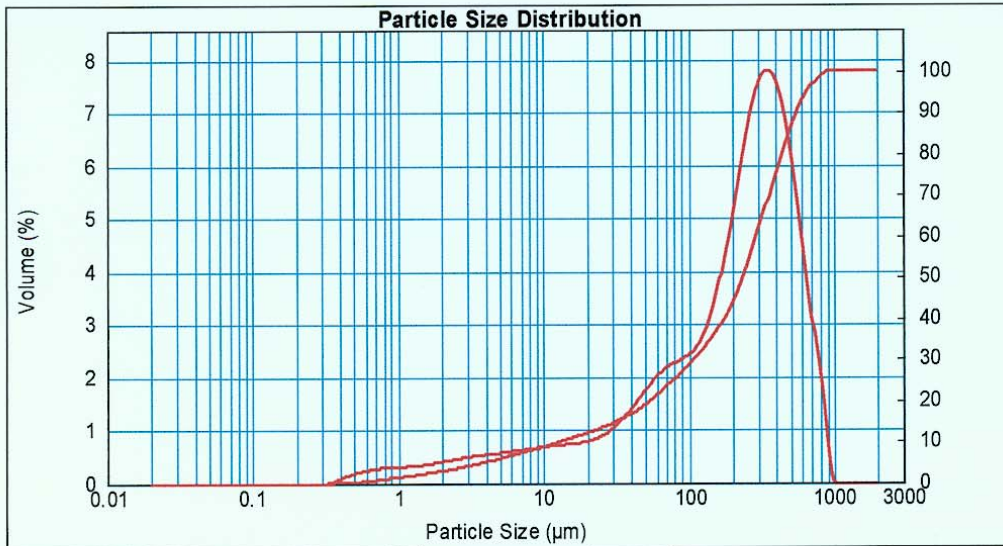
Inclusive Standard Deviation = 2.06 phi (Very Poorly Sorted) **Gravel Content = 0 %**
Inclusive Skewness = -0.52 (Strongly Coarse Skewed) **Sand Content = 78.19 %**
Inclusive Kurtosis = 1.3 phi (Leptokurtic) **Silt/Clay Content = 21.81 %**
Inclusive Mean Grain Size = 2.64 phi (Fine Sand)
Median Grain Size (D[v,0.5]) = 2.08 phi (Fine Sand)

Size (µm)	Volume In %
0.010	0.23
0.490	1.19
0.980	1.55
1.950	2.14
3.900	2.14

Size (µm)	Volume In %
3.900	2.66
7.800	3.16
15.600	3.86
31.300	7.03
62.500	7.03

Size (µm)	Volume In %
62.500	10.66
125.000	19.97
250.000	33.26
500.000	14.30
1000.000	14.30

Size (µm)	Volume In %
1000.000	0.00
2000.000	0.00
8000.000	0.00
10000.000	0.00



Malvern Instruments Ltd.
Malvern, UK
Tel := +[44] (0) 1684-892456 Fax +[44] (0) 1684-892789

Mastersizer 2000 Ver. 3.01 C:\Program Files\Malvern Instruments\Mastersizer 2000\Measurement... \Archaeology1.mea
Serial Number : 34205-79 02 Jul 2002 12:44:20

institute of
estuarine
& coastal
studies



THE
UNIVERSITY
OF HULL

IECS
The University of Hull
Cottingham Road
Hull
HU6 7RX

Lab telephone: (01482) 465661
Office telephone: (01482) 465667
Fax: (01482) 465001
E-mail: N.V.Proctor@hull.ac.uk
Web site: http://www.hull.ac.uk/iecs

Result Analysis Report

Sample Name: Arch/core/7.1cm depth Obscuration: 14.80 %
 Measured by: OLLY Measured: 07/02/02 10:45:46 Weighted Residual: 0.585 %
 Sample Bulk Lot Ref: 7.1cm depth Analysed: 07/02/02 10:45:47 SOP Name: soil

Percentile Grain Size: D[v,0.84] = 516.25um = .96phi Skewness = .73
 D[v,0.05] = 3.98um = 7.97phi D[v,0.96] = 714.86um = .48phi Standard Deviation = 225.36 um = 2.15phi
 D[v,0.16] = 40.11um = 4.64phi Non Inclusive Parameters: Volume Weighted Mean:
 D[v,0.5] = 257.43um = 1.96phi Kurtosis = -0.01 D[4,3] = 285.7um = 1.81phi

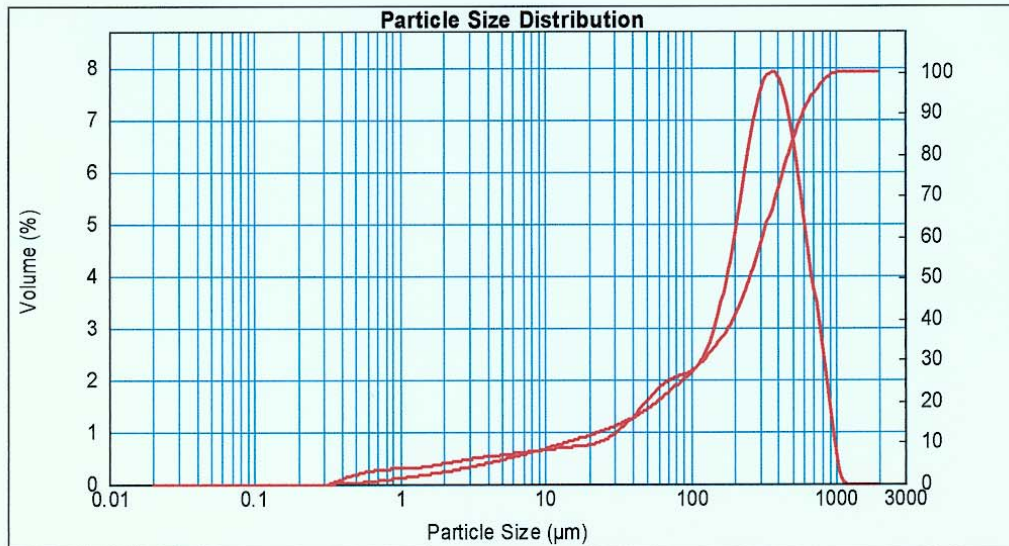
Inclusive Standard Deviation = 2.06 phi (Very Poorly Sorted) Gravel Content = 0 %
 Inclusive Skewness = -0.53 (Strongly Coarse Skewed) Sand Content = 79.4 %
 Inclusive Kurtosis = 1.34 phi (Leptokurtic) Silt/Clay Content = 20.6 %
 Inclusive Mean Grain Size = 2.52 phi (Fine Sand)
 Median Grain Size (D[v,0.5]) = 1.96 phi (Medium Sand)

Size (µm)	Volume In %
0.010	0.23
0.490	1.16
0.980	1.47
1.950	2.07
3.900	2.57

Size (µm)	Volume In %
3.900	2.57
7.800	3.02
15.600	3.65
31.300	6.43
62.500	9.58

Size (µm)	Volume In %
62.500	9.58
125.000	18.58
250.000	33.84
500.000	17.20
1000.000	0.19

Size (µm)	Volume In %
1000.000	0.19
2000.000	0.00
8000.000	0.00
10000.000	0.00



Malvern Instruments Ltd.
Malvern, UK
Tel := +[44] (0) 1684-892456 Fax +[44] (0) 1684-892789

Mastersizer 2000 Ver. 3.01 C:\Program Files\Malvern Instruments\Mastersizer 2000\Measurement ...\Archaeology1.mea
Serial Number : 34205-79 02 Jul 2002 12:44:39

institute of
estuarine
& coastal
studies



THE
UNIVERSITY
OF HULL

IECS
The University of Hull
Cottingham Road
Hull
HU6 7RX

Lab telephone: (01482) 465661
Office telephone: (01482) 465667
Fax: (01482) 465001
E-mail: N.V.Proctor@hull.ac.uk
Web site: http://www.hull.ac.uk/iecs

Result Analysis Report

Sample Name: Arch/core/10.7cm depth **Obscuration:** 16.33 %
Measured by: OLLY **Measured:** 07/02/02 10:53:49 **Weighted Residual:** 0.523 %
Sample Bulk Lot Ref: 10.7cm depth **Analysed:** 07/02/02 10:53:50 **SOP Name:** soil

Percentile Grain Size: **D[v,0.84] = 606.42um = .98phi** **Skewness = .73**
D[v,0.05] = 2.99um = 8.39phi **D[v,0.95] = 696.6um = .52phi** **Standard Deviation = 222.85 um = 2.17phi**
D[v,0.16] = 31.39um = 4.99phi **Non Inclusive Parameters:** **Volume Weighted Mean:**
D[v,0.5] = 240.77um = 2.05phi **Kurtosis = -0.12** **D[4,3] = 272.05um = 1.88phi**

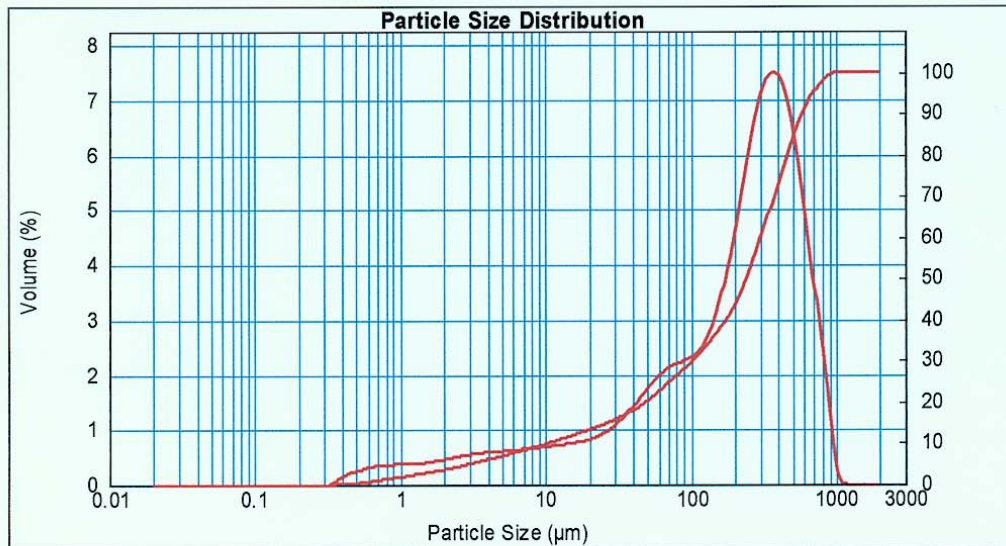
Inclusive Standard Deviation = 2.19 phi (Very Poorly Sorted) **Gravel Content = 0 %**
Inclusive Skewness = -0.54 (Strongly Coarse Skewed) **Sand Content = 76.97 %**
Inclusive Kurtosis = 1.28 phi (Leptokurtic) **Silt/Clay Content = 23.03 %**
Inclusive Mean Grain Size = 2.68 phi (Fine Sand)
Median Grain Size (D[v,0.5]) = 2.05 phi (Fine Sand)

Size (µm)	Volume In %
0.010	0.34
0.490	1.49
0.980	1.78
1.950	2.38
3.900	2.80

Size (µm)	Volume In %
3.900	2.80
7.800	3.19
15.600	4.01
31.300	7.06
62.500	10.23

Size (µm)	Volume In %
62.500	10.23
125.000	18.20
250.000	32.08
500.000	16.40
1000.000	0.06

Size (µm)	Volume In %
1000.000	0.06
2000.000	0.00
8000.000	0.00
10000.000	0.00



Malvern Instruments Ltd.
Malvern, UK
Tel : +[44] (0) 1684-892456 Fax +[44] (0) 1684-892789

Mastersizer 2000 Ver. 3.01 C:\Program Files\Malvern Instruments\Mastersizer 2000\Measurement ...\Archaeology1.mea
Serial Number : 34205-79 02 Jul 2002 12:44:51

institute of
estuarine
& coastal
studies



THE
UNIVERSITY
OF HULL

IECS
The University of Hull
Cottingham Road
Hull
HU6 7RX

Lab telephone: (01482) 465661
Office telephone: (01482) 465667
Fax: (01482) 465001
E-mail: N.V.Proctor@hull.ac.uk
Web site: http://www.hull.ac.uk/iecs

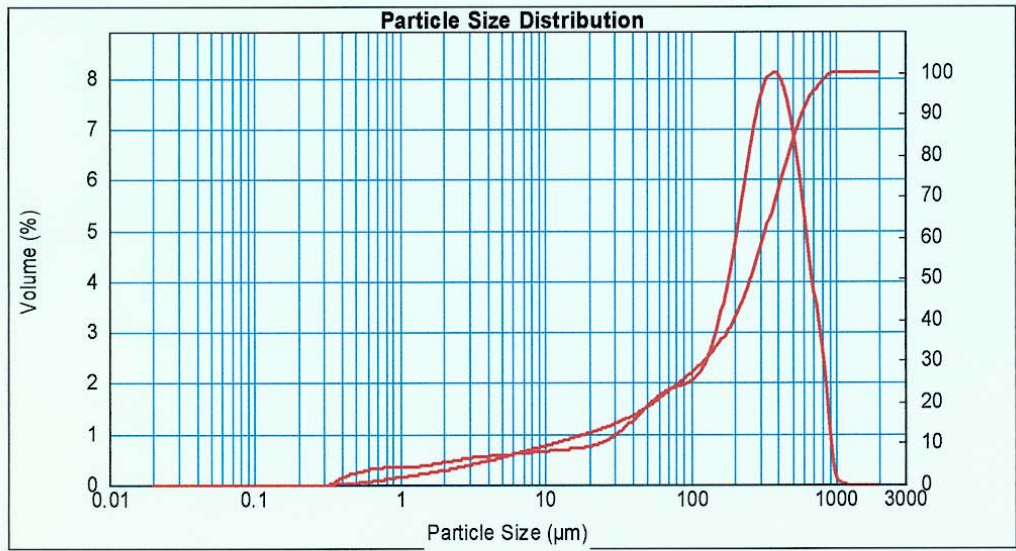
Result Analysis Report

Sample Name: Arch/core/14.3cm depth Obscuration: 13.81 %
 Measured by: OLLY Measured: 07/02/02 11:01:27 Weighted Residual: 0.630 %
 Sample Bulk Lot Ref: 14.3cm depth Analysed: 07/02/02 11:01:28 SOP Name: soil

Percentile Grain Size: D[v,0.84] = 514.33um = .96phi Skewness = .62
 D[v,0.06] = 3.28um = 8.26phi D[v,0.95] = 696.16um = .62phi Standard Deviation = 220.26 um = 2.18phi
 D[v,0.16] = 36.72um = 4.77phi Non Inclusive Parameters: Volume Weighted Mean:
 D[v,0.5] = 260.64um = 1.94phi Kurtosis = -0.3 D[4,3] = 283.85um = 1.82phi

Inclusive Standard Deviation = 2.12 phi (Very Poorly Sorted) Gravel Content = 0 %
 Inclusive Skewness = -0.66 (Strongly Coarse Skewed) Sand Content = 78.91 %
 Inclusive Kurtosis = 1.37 phi (Leptokurtic) Silt/Clay Content = 21.09 %
 Inclusive Mean Grain Size = 2.56 phi (Fine Sand)
 Median Grain Size (D[v,0.5]) = 1.94 phi (Medium Sand)

Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %
0.010	0.32	3.900	2.66	62.500	8.97	1000.000	0.05
0.490	1.38	7.800	3.00	125.000	18.17	2000.000	0.00
0.980	1.66	15.600	3.62	250.000	34.48	8000.000	0.00
1.950	2.26	31.300	6.20	500.000	17.24	10000.000	0.00
3.900		62.500		1000.000			



Malvern Instruments Ltd. Mastersizer 2000 Ver. 3.01 C:\Program Files\Malvern Instruments\Mastersizer 2000\Measurement ...\Archaeology1.mea
 Malvern, UK Serial Number : 34205-79 02 Jul 2002 12:45:07
 Tel : +[44] (0) 1684-892456 Fax +[44] (0) 1684-892789

institute of
estuarine
& coastal
studies



THE
UNIVERSITY
OF HULL

IECS
The University of Hull
Cottingham Road
Hull
HU6 7RX

Lab telephone: (01482) 465661
Office telephone: (01482) 465667
Fax: (01482) 465001
E-mail: N.V.Proctor@hull.ac.uk
Web site: http://www.hull.ac.uk/iecs

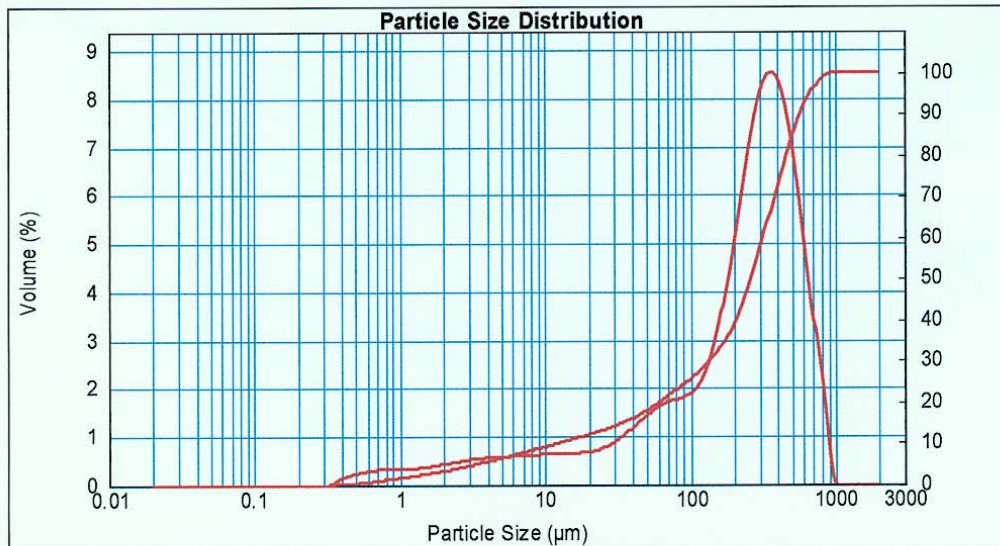
Result Analysis Report

Sample Name: Arch/core/17.85cm depth **Obscuration:** 13.85 %
Measured by: OLLY **Measured:** 07/02/02 11:08:56 **Weighted Residual:** 0.581 %
Sample Bulk Lot Ref: 17.85cm depth **Analysed:** 07/02/02 11:08:57 **SOP Name:** soil

Percentile Grain Size: **D[v,0.84] = 498.67um = 1phi** **Skewness = .57**
D[v,0.05] = 3.34um = 8.23phi **D[v,0.95] = 671.25um = .68phi** **Standard Deviation = 210.66 um = 2.25phi**
D[v,0.16] = 39.6um = 4.66phi **Non Inclusive Parameters:** **Volume Weighted Mean:**
D[v,0.5] = 262.06um = 1.93phi **Kurtosis = -0.33** **D[4,3] = 280.45um = 1.83phi**

Inclusive Standard Deviation = 2.07 phi (Very Poorly Sorted) **Gravel Content = 0 %**
Inclusive Skewness = -0.57 (Strongly Coarse Skewed) **Sand Content = 79.77 %**
Inclusive Kurtosis = 1.47 phi (Leptokurtic) **Silt/Clay Content = 20.23 %**
Inclusive Mean Grain Size = 2.53 phi (Fine Sand)
Median Grain Size (D[v,0.5]) = 1.93 phi (Medium Sand)

Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %
0.010	0.32	3.900	2.66	62.500	8.39	1000.000	0.00
0.490	1.36	7.800	2.88	125.000	19.21	2000.000	0.00
0.980	1.62	15.600	3.32	250.000	36.30	8000.000	0.00
1.950	2.25	31.300	5.81	500.000	15.88	10000.000	0.00
3.900		62.500		1000.000			



Malvern Instruments Ltd.
Malvern, UK
Tel := +[44] (0) 1684-892456 Fax +[44] (0) 1684-892789

Mastersizer 2000 Ver. 3.01 C:\Program Files\Malvern Instruments\Mastersizer 2000\Measurement ...\Archaeology1.mea
Serial Number : 34205-79 02 Jul 2002 12:45:23

institute of
estuarine
& coastal
studies



THE
UNIVERSITY
OF HULL

IECS
The University of Hull
Cottingham Road
Hull
HU6 7RX

Lab telephone: (01482) 465661
Office telephone: (01482) 465667
Fax: (01482) 465001
E-mail: N.V.Proctor@hull.ac.uk
Web site: http://www.hull.ac.uk/iecs

Result Analysis Report

Sample Name: Arch/core/21.4cm depth **Obscuration:** 14.26 %
Measured by: OLLY **Measured:** 07/02/02 11:20:12 **Weighted Residual:** 1.037 %
Sample Bulk Lot Ref: 21.4cm depth **Analysed:** 07/02/02 11:20:14 **SOP Name:** soil

Percentile Grain Size: **D[v,0.84] = 470.14um = 1.09phi** **Skewness = .39**
D[v,0.05] = 3.36um = 8.22phi **D[v,0.95] = 610.37um = .71phi** **Standard Deviation = 192.06 um = 2.38phi**
D[v,0.16] = 39.05um = 4.68phi **Non Inclusive Parameters:** **Volume Weighted Mean:**
D[v,0.5] = 258um = 1.95phi **Kurtosis = -0.63** **D[4,3] = 266.91um = 1.91phi**

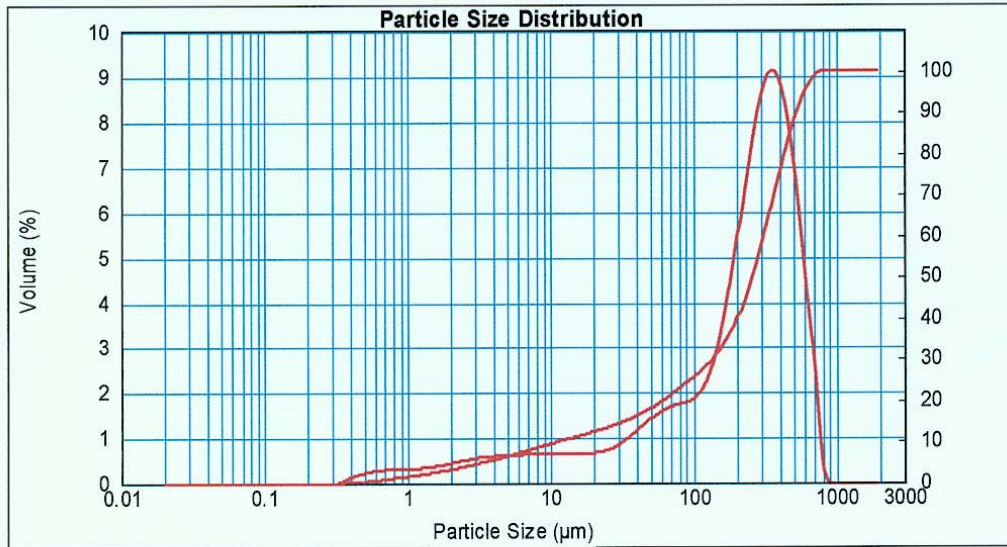
Inclusive Standard Deviation = 2.03 phi (Very Poorly Sorted) **Gravel Content = 0 %**
Inclusive Skewness = -0.69 (Strongly Coarse Skewed) **Sand Content = 79.74 %**
Inclusive Kurtosis = 1.48 phi (Leptokurtic) **Silt/Clay Content = 20.26 %**
Inclusive Mean Grain Size = 2.57 phi (Fine Sand)
Median Grain Size (D[v,0.5]) = 1.95 phi (Medium Sand)

Size (µm)	Volume In %
0.010	0.30
0.490	1.30
0.980	1.61
1.950	2.36
3.900	2.36

Size (µm)	Volume In %
3.900	2.81
7.800	2.96
15.600	3.23
31.300	5.69
62.500	5.69

Size (µm)	Volume In %
62.500	8.30
125.000	19.90
250.000	38.60
500.000	12.93
1000.000	12.93

Size (µm)	Volume In %
1000.000	0.00
2000.000	0.00
8000.000	0.00
10000.000	0.00



Malvern Instruments Ltd.
Malvern, UK
Tel := +[44] (0) 1684-892456 Fax +[44] (0) 1684-892789

Mastersizer 2000 Ver. 3.01 C:\Program Files\Malvern Instruments\Mastersizer 2000\Measurement ...\Archaeology1.me
Serial Number : 34205-79 02 Jul 2002 12:45:37

institute of
estuarine
& coastal
studies



THE
UNIVERSITY
OF HULL

IECS
The University of Hull
Cottingham Road
Hull
HU6 7RX

Lab telephone: (01482) 465661
Office telephone: (01482) 465667
Fax: (01482) 465001
E-mail: N.V.Proctor@hull.ac.uk
Web site: http://www.hull.ac.uk/iecs

Result Analysis Report

Sample Name: Arch/core/25cm depth **Obscuration:** 14.81 %
Measured by: OLLY **Measured:** 07/02/02 11:28:26 **Weighted Residual:** 1.566 %
Sample Bulk Lot Ref: 25cm depth **Analysed:** 07/02/02 11:28:27 **SOP Name:** soil

Percentile Grain Size: **D[v,0.84] = 458.93um = 1.12phi** **Skewness = .38**
D[v,0.05] = 2.92um = 8.42phi **D[v,0.95] = 590.57um = .76phi** **Standard Deviation = 190.41 um = 2.39phi**
D[v,0.16] = 25.94um = 5.27phi **Non Inclusive Parameters:** **Volume Weighted Mean:**
D[v,0.5] = 248.21um = 2.01phi **Kurtosis = -0.73** **D[4,3] = 254.86um = 1.97phi**

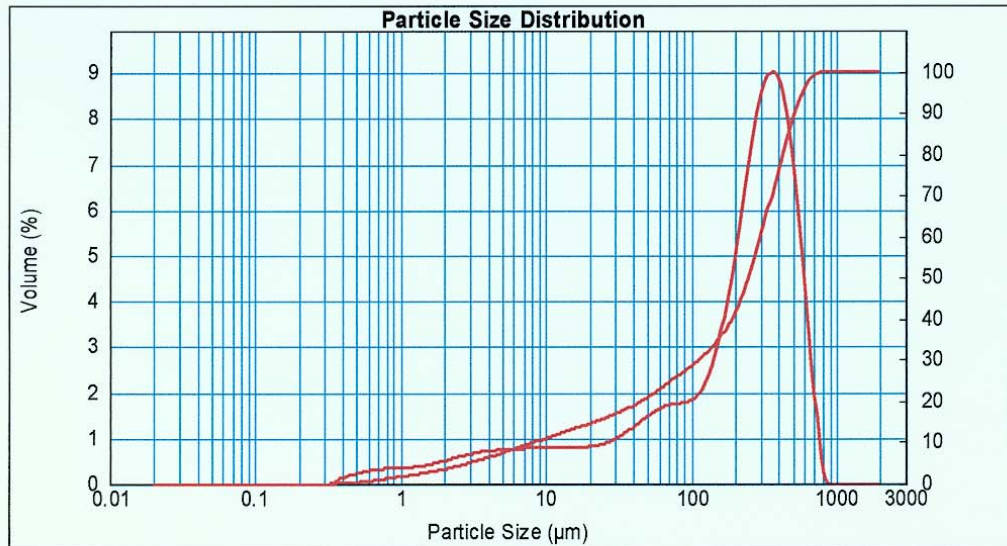
Inclusive Standard Deviation = 2.2 phi (Very Poorly Sorted) **Gravel Content = 0 %**
Inclusive Skewness = -0.62 (Strongly Coarse Skewed) **Sand Content = 76.81 %**
Inclusive Kurtosis = 1.3 phi (Leptokurtic) **Silt/Clay Content = 23.19 %**
Inclusive Mean Grain Size = 2.8 phi (Fine Sand)
Median Grain Size (D[v,0.5]) = 2.01 phi (Fine Sand)

Size (µm)	Volume In %
0.010	0.31
0.490	1.39
0.980	1.80
1.950	2.79
3.900	2.79

Size (µm)	Volume In %
3.900	3.40
7.800	3.58
15.600	3.87
31.300	6.05
62.500	6.05

Size (µm)	Volume In %
62.500	8.22
125.000	18.91
250.000	37.98
500.000	11.70
1000.000	11.70

Size (µm)	Volume In %
1000.000	0.00
2000.000	0.00
8000.000	0.00
10000.000	0.00



Malvern Instruments Ltd.
Malvern, UK
Tel := +[44] (0) 1684-892456 Fax +[44] (0) 1684-892789

Mastersizer 2000 Ver. 3.01 C:\Program Files\Malvern Instruments\Mastersizer 2000\Measurement ...\Archaeology1.meas
Serial Number : 34205-79 02 Jul 2002 12:45:58

institute of
estuarine
& coastal
studies



THE
UNIVERSITY
OF HULL

IECS
The University of Hull
Cottingham Road
Hull
HU6 7RX

Lab telephone: (01482) 465661
Office telephone: (01482) 465667
Fax: (01482) 465001
E-mail: N.V.Proctor@hull.ac.uk
Web site: http://www.hull.ac.uk/iecs

Result Analysis Report

Sample Name: Arch/core/28.6cm depth **Obscuration:** 14.99 %
Measured by: OLLY **Measured:** 07/02/02 11:36:09 **Weighted Residual:** 0.948 %
Sample Bulk Lot Ref: 28.6cm depth **Analysed:** 07/02/02 11:36:10 **SOP Name:** soil

Percentile Grain Size: **D[v,0.84] = 460.11um = 1.16phi** **Skewness = .47**
D[v,0.05] = 2.63um = 8.63phi **D[v,0.95] = 692.62um = .75phi** **Standard Deviation = 190.35 um = 2.39phi**
D[v,0.16] = 21.56um = 6.54phi **Non Inclusive Parameters:** **Volume Weighted Mean:**
D[v,0.5] = 236.76um = 2.08phi **Kurtosis = -0.58** **D[4,3] = 248.29um = 2.01phi**

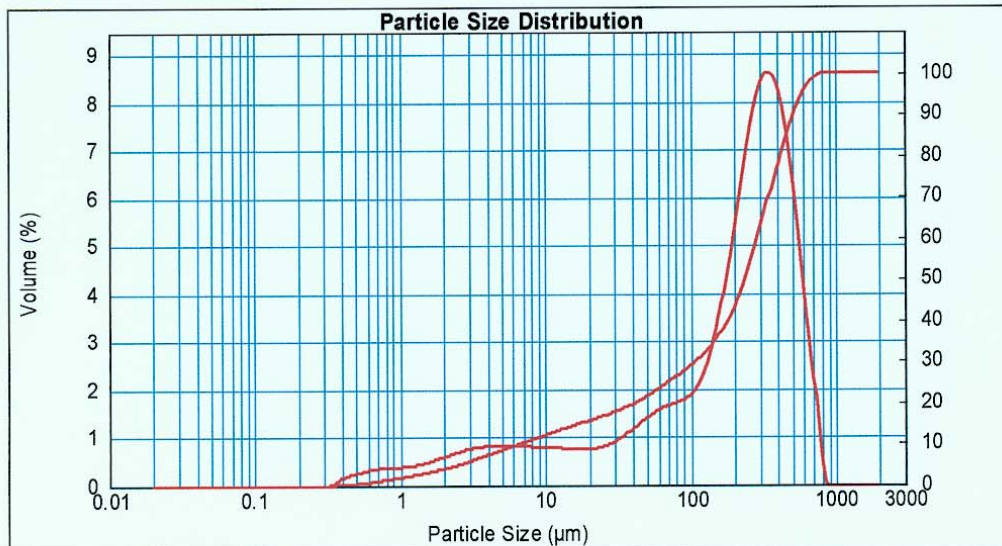
Inclusive Standard Deviation = 2.29 phi (Very Poorly Sorted) **Gravel Content = 0 %**
Inclusive Skewness = -0.62 (Strongly Coarse Skewed) **Sand Content = 76.24 %**
Inclusive Kurtosis = 1.33 phi (Leptokurtic) **Silt/Clay Content = 23.76 %**
Inclusive Mean Grain Size = 2.92 phi (Fine Sand)
Median Grain Size (D[v,0.5]) = 2.08 phi (Fine Sand)

Size (µm)	Volume In %
0.010	0.35
0.490	1.52
0.980	2.05
1.950	3.24
3.900	3.24

Size (µm)	Volume In %
3.900	3.71
7.800	3.55
15.600	3.59
31.300	5.75
62.500	5.75

Size (µm)	Volume In %
62.500	8.32
125.000	20.43
250.000	36.34
500.000	11.16
1000.000	11.16

Size (µm)	Volume In %
1000.000	0.00
2000.000	0.00
8000.000	0.00
10000.000	0.00



Malvern Instruments Ltd.

Malvern, UK

Tel: +[44] (0) 1684-892456 Fax +[44] (0) 1684-892789

Mastersizer 2000 Ver. 3.01 C:\Program Files\Malvern Instruments\Mastersizer 2000\Measurement...Archaeology1.mea
 Serial Number: 34205-79

02 Jul 2002 12:48:10

institute of
estuarine
& coastal
studies



THE
UNIVERSITY
OF HULL

IECS
The University of Hull
Cottingham Road
Hull
HU6 7RX

Lab telephone: (01482) 465661
Office telephone: (01482) 465667
Fax: (01482) 465001
E-mail: N.V.Proctor@hull.ac.uk
Web site: http://www.hull.ac.uk/iecs

Result Analysis Report

Sample Name: Arch/core/32.1cm depth **Obscuration:** 14.12 %
Measured by: OLLY **Measured:** 07/02/02 11:43:36 **Weighted Residual:** 0.611 %
Sample Bulk Lot Ref: 32.1cm depth **Analysed:** 07/02/02 11:43:37 **SOP Name:** soil

Percentile Grain Size: **D[v,0.84] = 492.68um = 1.02phi** **Skewness = .53**
D[v,0.05] = 2.85um = 8.45phi **D[v,0.95] = 657.85um = .6phi** **Standard Deviation = 211.64 um = 2.24phi**
D[v,0.16] = 23.19um = 5.43phi **Non Inclusive Parameters:** **Volume Weighted Mean:**
D[v,0.5] = 266.52um = 1.96phi **Kurtosis = -0.45** **D[4,3] = 270.93um = 1.88phi**

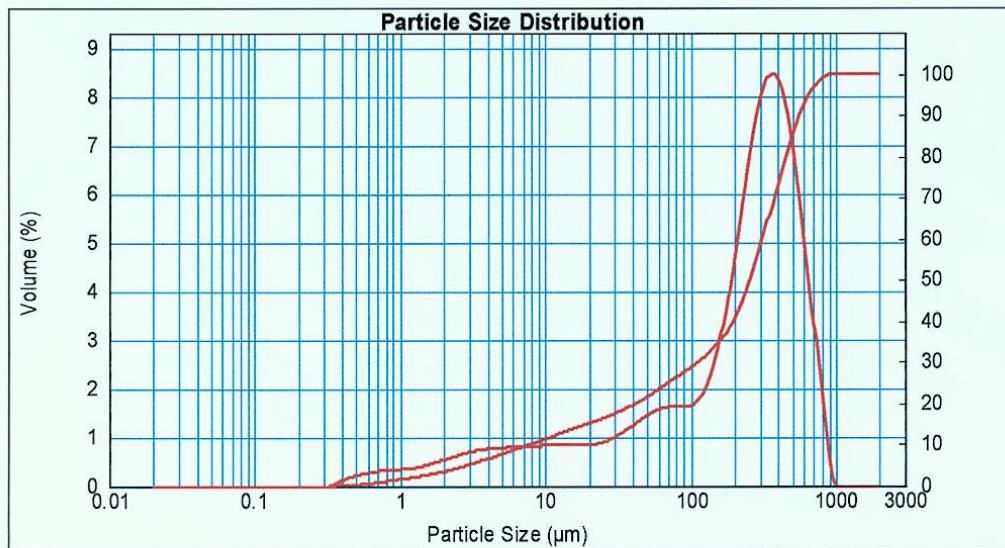
Inclusive Standard Deviation = 2.29 phi (Very Poorly Sorted) **Gravel Content = 0 %**
Inclusive Skewness = -0.61 (Strongly Coarse Skewed) **Sand Content = 76.18 %**
Inclusive Kurtosis = 1.26 phi (Leptokurtic) **Silt/Clay Content = 23.82 %**
Inclusive Mean Grain Size = 2.8 phi (Fine Sand)
Median Grain Size (D[v,0.5]) = 1.96 phi (Medium Sand)

Size (µm)	Volume In %
0.010	0.29
0.490	1.34
0.980	1.86
1.950	2.98
3.900	

Size (µm)	Volume In %
3.900	3.59
7.800	3.76
15.600	4.01
31.300	5.99
62.500	

Size (µm)	Volume In %
62.500	7.55
125.000	17.51
250.000	35.82
500.000	15.30
1000.000	

Size (µm)	Volume In %
1000.000	0.00
2000.000	0.00
8000.000	0.00
10000.000	



Malvern Instruments Ltd.
Malvern, UK

Tel := +[44] (0) 1684-892456 Fax +[44] (0) 1684-892789

Mastersizer 2000 Ver. 3.01 C:\Program Files\Malvern Instruments\Mastersizer 2000\Measurement ...\Archaeology1.me
Serial Number : 34205-79

02 Jul 2002 12:46:25

institute of
estuarine
& coastal
studies



THE
UNIVERSITY
OF HULL

IECS
The University of Hull
Cottingham Road
Hull
HU6 7RX

Lab telephone: (01482) 465661
Office telephone: (01482) 465667
Fax: (01482) 465001
E-mail: N.V.Proctor@hull.ac.uk
Web site: http://www.hull.ac.uk/iecs

Result Analysis Report

Sample Name: Arch/core/35.7cm depth **Obscuration:** 15.42 %
Measured by: OLLY **Measured:** 07/02/02 11:50:52 **Weighted Residual:** 0.714 %
Sample Bulk Lot Ref: 35.7cm depth **Analysed:** 07/02/02 11:50:54 **SOP Name:** soil

Percentile Grain Size: **D[v,0.84] = 459.51um = 1.12phi** **Skewness = .66**
D[v,0.05] = 2.21um = 8.82phi **D[v,0.95] = 614.63um = .7phi** **Standard Deviation = 199.96 um = 2.32phi**
D[v,0.16] = 16.07um = 6.05phi **Non Inclusive Parameters:** **Volume Weighted Mean:**
D[v,0.5] = 232.41um = 2.11phi **Kurtosis = -0.48** **D[4,3] = 247.71um = 2.01phi**

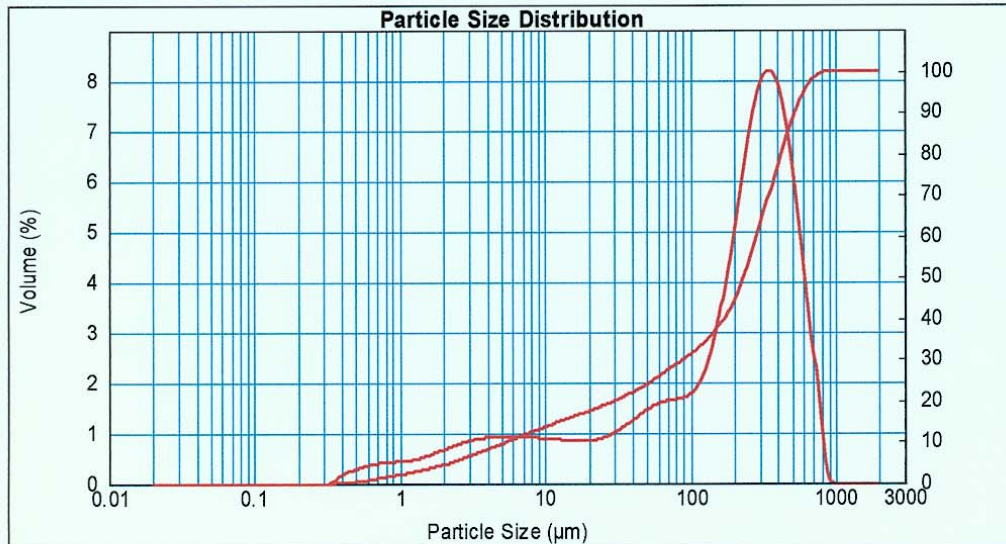
Inclusive Standard Deviation = 2.46 phi (Very Poorly Sorted) **Gravel Content = 0 %**
Inclusive Skewness = -0.63 (Strongly Coarse Skewed) **Sand Content = 73.78 %**
Inclusive Kurtosis = 1.19 phi (Leptokurtic) **Silt/Clay Content = 26.22 %**
Inclusive Mean Grain Size = 3.09 phi (Very Fine Sand)
Median Grain Size (D[v,0.5]) = 2.11 phi (Fine Sand)

Size (µm)	Volume In %
0.010	0.40
0.490	1.72
0.980	2.32
1.950	3.62
3.900	4.14

Size (µm)	Volume In %
3.900	4.14
7.800	3.99
15.600	4.02
31.300	6.01
62.500	7.94

Size (µm)	Volume In %
62.500	7.94
125.000	18.95
250.000	34.65
500.000	12.24
1000.000	0.00

Size (µm)	Volume In %
1000.000	0.00
2000.000	0.00
8000.000	0.00
10000.000	0.00



Malvern Instruments Ltd.
Malvern, UK
Tel : +[44] (0) 1684-892456 Fax +[44] (0) 1684-892789

Mastersizer 2000 Ver. 3.01 C:\Program Files\Malvern Instruments\Mastersizer 2000\Measurement...\Archaeology1.me
Serial Number : 34205-79 02 Jul 2002 12:46:37

institute of
estuarine
& coastal
studies



THE
UNIVERSITY
OF HULL

IECS
The University of Hull
Cottingham Road
Hull
HU6 7RX

Lab telephone: (01482) 465661
Office telephone: (01482) 465667
Fax: (01482) 465001
E-mail: N.V.Proctor@hull.ac.uk
Web site: http://www.hull.ac.uk/iecs

Result Analysis Report

Sample Name: Arch/core/39.3cm depth **Obscuration:** 13.94 %
Measured by: OLLY **Measured:** 07/02/02 12:00:31 **Weighted Residual:** 0.639 %
Sample Bulk Lot Ref: 39.3cm depth **Analysed:** 07/02/02 12:00:32 **SOP Name:** soil

Percentile Grain Size: **D[v,0.84] = 609.31um = .97phi** **Skewness = .65**
D[v,0.05] = 2.43um = 8.68phi **D[v,0.95] = 696.31um = .52phi** **Standard Deviation = 226.86 um = 2.14phi**
D[v,0.16] = 14.97um = 6.06phi **Non Inclusive Parameters:** **Volume Weighted Mean:**
D[v,0.5] = 249.08um = 2.01phi **Kurtosis = -0.3** **D[4,3] = 271.69um = 1.88phi**

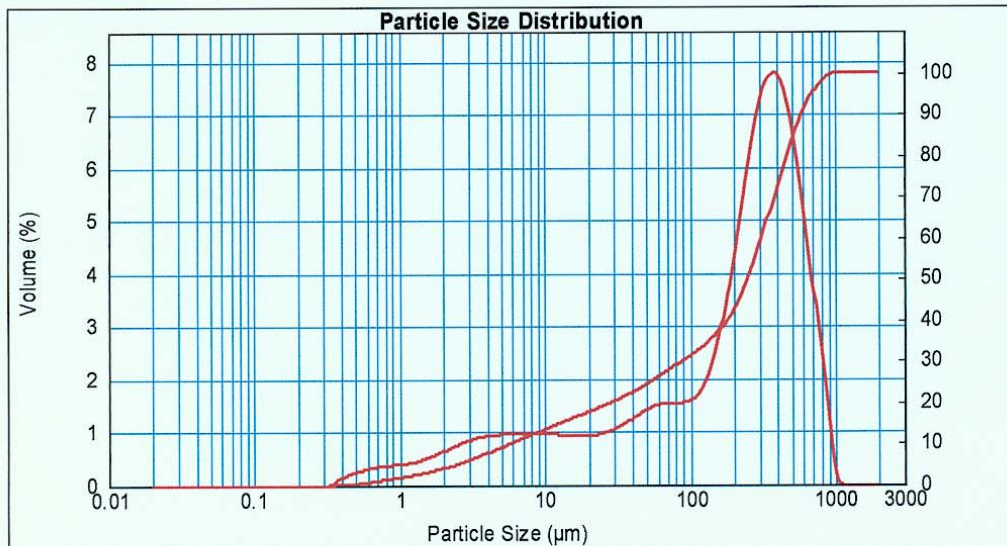
Inclusive Standard Deviation = 2.51 phi (Very Poorly Sorted) **Gravel Content = 0 %**
Inclusive Skewness = -0.62 (Strongly Coarse Skewed) **Sand Content = 73.42 %**
Inclusive Kurtosis = 1.12 phi (Leptokurtic) **Silt/Clay Content = 26.68 %**
Inclusive Mean Grain Size = 3.01 phi (Very Fine Sand)
Median Grain Size (D[v,0.5]) = 2.01 phi (Fine Sand)

Size (µm)	Volume In %
0.010	0.34
0.490	1.52
0.980	2.15
1.950	3.60
3.900	

Size (µm)	Volume In %
3.900	4.32
7.800	4.32
15.600	4.37
31.300	5.96
62.500	

Size (µm)	Volume In %
62.500	7.24
125.000	16.32
250.000	33.04
500.000	16.78
1000.000	

Size (µm)	Volume In %
1000.000	0.03
2000.000	0.00
8000.000	0.00
10000.000	



Malvern Instruments Ltd.
Malvern, UK
Tel : +[44] (0) 1684-892456 Fax +[44] (0) 1684-892789

Mastersizer 2000 Ver. 3.01 C:\Program Files\Malvern Instruments\Mastersizer 2000\Measurement ...\Archaeology1.mea
Serial Number : 34205-79 02 Jul 2002 12:46:47

institute of
estuarine
& coastal
studies



THE
UNIVERSITY
OF HULL

IECS
The University of Hull
Cottingham Road
Hull
HU6 7RX

Lab telephone: (01482) 465661
Office telephone: (01482) 465667
Fax: (01482) 465001
E-mail: N.V.Proctor@hull.ac.uk
Web site: http://www.hull.ac.uk/iecs

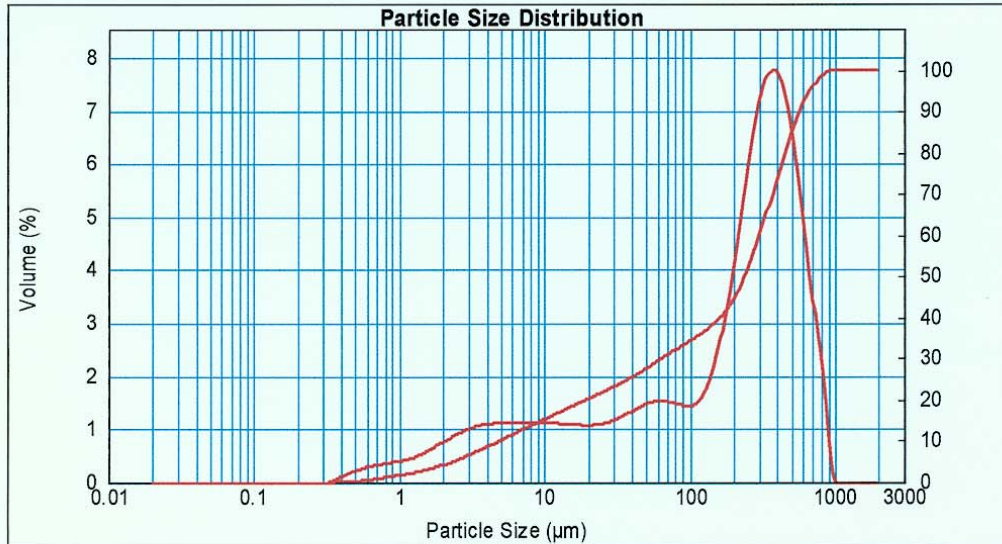
Result Analysis Report

Sample Name: Arch/core/42.9cm depth **Obscuration:** 14.53 %
Measured by: OLLY **Measured:** 07/02/02 12:27:45 **Weighted Residual:** 0.583 %
Sample Bulk Lot Ref: 42.9cm depth **Analysed:** 07/02/02 12:27:46 **SOP Name:** soil

Percentile Grain Size: **D[v,0.84] = 496.33um = 1.01phi** **Skewness = .62**
D[v,0.06] = 2.31um = 8.75phi **D[v,0.96] = 673.63um = .67phi** **Standard Deviation = 222.79 um = 2.17phi**
D[v,0.16] = 11.05um = 6.5phi **Non Inclusive Parameters:** **Volume Weighted Mean:**
D[v,0.5] = 238.85um = 2.07phi **Kurtosis = -0.45** **D[4,3] = 258.8um = 1.96phi**

Inclusive Standard Deviation = 2.61 phi (Very Poorly Sorted) **Gravel Content = 0 %**
Inclusive Skewness = -0.63 (Strongly Coarse Skewed) **Sand Content = 70.25 %**
Inclusive Kurtosis = .98 phi (Mesokurtic) **Silt/Clay Content = 29.75 %**
Inclusive Mean Grain Size = 3.19 phi (Very Fine Sand)
Median Grain Size (D[v,0.5]) = 2.07 phi (Fine Sand)

Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %
0.010	0.27	3.900	5.07	62.500	6.76	1000.000	0.00
0.490	1.44	7.800	5.04	125.000	15.17	2000.000	0.00
0.980	2.39	15.600	4.99	250.000	32.73	8000.000	0.00
1.950	4.27	31.300	6.28	500.000	15.58	10000.000	0.00
3.900		62.500		1000.000			



Malvern Instruments Ltd.
Malvern, UK
Tel := +[44] (0) 1684-892456 Fax +[44] (0) 1684-892789

Mastersizer 2000 Ver. 3.01 C:\Program Files\Malvern Instruments\Mastersizer 2000\Measurement... \Archaeology1.mea
Serial Number : 34205-79 02 Jul 2002 12:47:00

institute of
estuarine
& coastal
studies



THE
UNIVERSITY
OF HULL

IECS
The University of Hull
Cottingham Road
Hull
HU6 7RX

Lab telephone: (01482) 465661
Office telephone: (01482) 465667
Fax: (01482) 465001
E-mail: N.V.Proctor@hull.ac.uk
Web site: http://www.hull.ac.uk/iecs

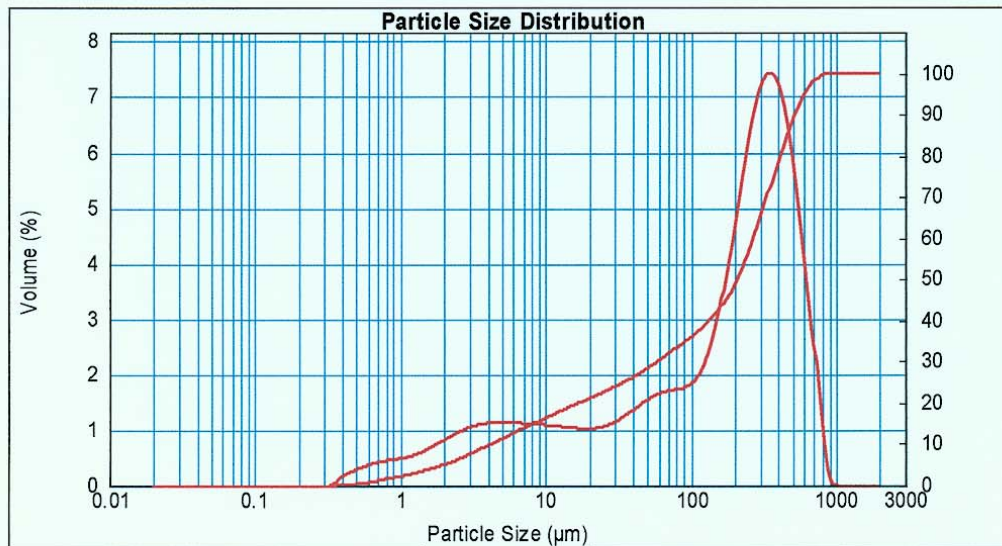
Result Analysis Report

Sample Name: Arch/core/46.4cm deep **Obscuration:** 14.51 %
Measured by: OLLY **Measured:** 07/02/02 12:35:32 **Weighted Residual:** 0.749 %
Sample Bulk Lot Ref: 46.4cm deep **Analysed:** 07/02/02 12:35:34 **SOP Name:** soil

Percentile Grain Size: **D[v,0.84] = 450.2um = 1.16phi** **Skewness = .66**
D[v,0.05] = 1.95um = 9phi **D[v,0.95] = 611.53um = .71phi** **Standard Deviation = 202.99 um = 2.3phi**
D[v,0.16] = 9.5um = 6.72phi **Non Inclusive Parameters:** **Volume Weighted Mean:**
D[v,0.5] = 207.6um = 2.27phi **Kurtosis = -0.4** **D[4,3] = 231.99um = 2.11phi**

Inclusive Standard Deviation = 2.65 phi (Very Poorly Sorted) **Gravel Content = 0 %**
Inclusive Skewness = -0.61 (Strongly Coarse Skewed) **Sand Content = 69.3 %**
Inclusive Kurtosis = .99 phi (Mesokurtic) **Silt/Clay Content = 30.7 %**
Inclusive Mean Grain Size = 3.38 phi (Very Fine Sand)
Median Grain Size (D[v,0.5]) = 2.27 phi (Fine Sand)

Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %
0.010	0.40	3.900	5.10	62.500	8.19	1000.000	0.00
0.490	1.85	7.800	4.87	125.000	17.88	2000.000	0.00
0.980	2.75	15.600	4.79	250.000	31.58	8000.000	0.00
1.950	4.49	31.300	6.46	500.000	11.65	10000.000	0.00
3.900		62.500		1000.000			



Malvern Instruments Ltd.
Malvern, UK
Tel := +[44] (0) 1684-892456 Fax +[44] (0) 1684-892789

Mastersizer 2000 Ver. 3.01 C:\Program Files\Malvern Instruments\Mastersizer 2000\Measurement... \Archaeology1.me
Serial Number : 34205-79 02 Jul 2002 12:47:17

institute of
estuarine
& coastal
studies



THE
UNIVERSITY
OF HULL

IECS
The University of Hull
Cottingham Road
Hull
HU6 7RX

Lab telephone: (01482) 465661
Office telephone: (01482) 465667
Fax: (01482) 465001
E-mail: N.V.Proctor@hull.ac.uk
Web site: http://www.hull.ac.uk/iecs

Result Analysis Report

Sample Name: Arch/core/50cm depth **Obscuration:** 14.30 %
Measured by: OLLY **Measured:** 07/02/02 12:42:14 **Weighted Residual:** 0.744 %
Sample Bulk Lot Ref: 50cm depth **Analysed:** 07/02/02 12:42:15 **SOP Name:** soil

Percentile Grain Size: **D[v,0.84] = 476.02um = 1.07phi** **Skewness = .69**
D[v,0.05] = 1.85um = 9.08phi **D[v,0.95] = 660.08um = .62phi** **Standard Deviation = 219.76 um = 2.19phi**
D[v,0.16] = 6.8um = 7.2phi **Non Inclusive Parameters:** **Volume Weighted Mean:**
D[v,0.5] = 207.72um = 2.27phi **Kurtosis = -0.42** **D[4,3] = 237.68um = 2.07phi**

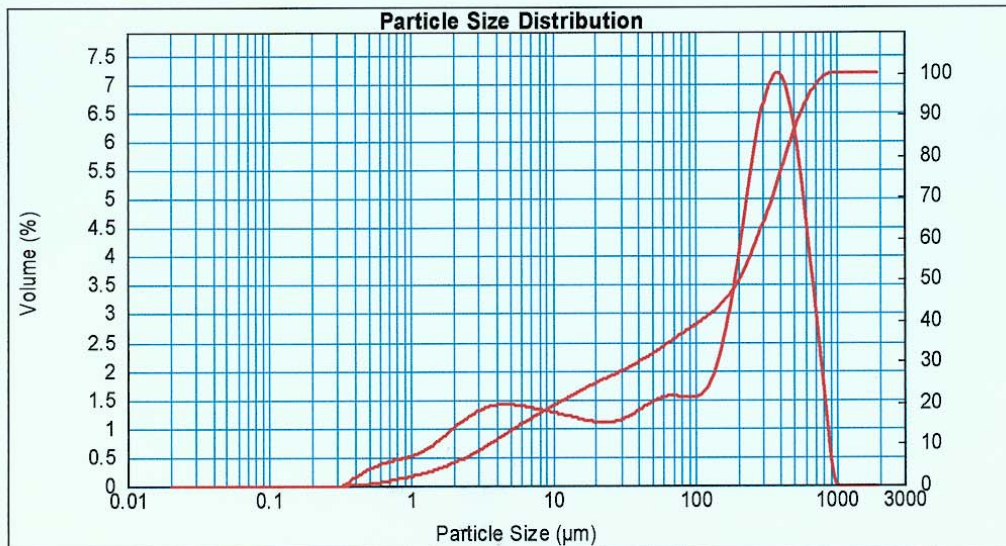
Inclusive Standard Deviation = 2.81 phi (Very Poorly Sorted) **Gravel Content = 0 %**
Inclusive Skewness = -0.61 (Strongly Coarse Skewed) **Sand Content = 65.86 %**
Inclusive Kurtosis = .82 phi (Platykurtic) **Silt/Clay Content = 34.14 %**
Inclusive Mean Grain Size = 3.51 phi (Very Fine Sand)
Median Grain Size (D[v,0.5]) = 2.27 phi (Fine Sand)

Size (µm)	Volume In %
0.010	0.36
0.490	1.84
0.980	3.14
1.950	5.58
3.900	

Size (µm)	Volume In %
3.900	6.29
7.800	5.66
15.600	5.08
31.300	6.18
62.500	

Size (µm)	Volume In %
62.500	7.05
125.000	14.56
250.000	30.32
500.000	13.93
1000.000	

Size (µm)	Volume In %
1000.000	0.00
2000.000	0.00
8000.000	0.00
10000.000	



Malvern Instruments Ltd.
Malvern, UK
Tel : +[44] (0) 1684-892456 Fax +[44] (0) 1684-892789

Mastersizer 2000 Ver. 3.01 C:\Program Files\Malvern Instruments\Mastersizer 2000\Measurement ...\Archaeology1.me
Serial Number : 34205-79 02 Jul 2002 12:47:40

Table 1. Wentworth scale of particle sizes ($\phi(\Phi) = -\log_2 S$, where S is the particle size in mm).

Particle Size Table (Wentworth Scale)

Wentworth (1922) after Udden	Phi	(mm)	Microns um
BOULDER	-8	256	256000
COBBLE	-7	128	128000
	-6	64	64000
	-5	32	32000
PEBBLE	-4	16	16000
	-3	8	8000
	-2	4	4000
GRANULE	-1	2	2000
SAND Very coarse	0	1	1000
Coarse	1	1/2	500
Medium	2	1/4	250
Fine	3	1/8	125
Very fine	4	1/16	62.5
SILT Coarse	5	1/32	31.3
Medium	6	1/64	15.6
Fine	7	1/128	7.8
Very fine	8	1/256	3.9
CLAY Coarse	9		1.95
Medium	10	1/1024	0.98
Fine	11		0.49
Very fine			0.01