

Diatom assessment of samples from the A31 site at Ringwood, Hampshire

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Introduction

A geoarchaeological evaluation was carried out by AOC Archaeology at Ringwood, Hampshire.

A 4m sequence of gravel and sand, alluvium and foreshore river margin deposits (R.Avon) was sampled and the 6 samples selected for diatom assessment are shown, with depths and sediment descriptions, in Table 1 (Virgil Yendell pers. comm.).

The purpose of carrying out the diatom assessment is to record the presence or absence of diatoms and the potential of diatom assemblages for further analysis. Of particular interest is whether diatoms might provide an indication of the changing nature of the aquatic environment, for example the water quality. The diatom assessment takes into account the numbers of diatoms, the state of preservation of the diatom assemblages, species diversity and diatom species environmental preferences.

Methods

Diatom preparation followed standard techniques (Battarbee *et al.* 2001). Two coverslips were made from the sample and fixed on a slide in Naphrax for diatom microscopy. A large area of the coverslips was scanned for diatoms at magnifications of x400 and x1000 under phase contrast illumination using a Leica microscope. Diatom floras and taxonomic publications were consulted to assist with diatom identification; these include Hartley *et al.* (1996) and Krammer & Lange-Bertalot (1986-1991).

Results & Discussion

A summary of the results of the diatom evaluation for are shown in Table 2 and a table of the diatom taxa identified is presented in Figure 3 (Excel file attached): 1 – present; 2 - common; 3 - abundant.

Table 2. Summary of diatom evaluation results for samples from (WS603) Ringwood A31 site (mod – moderate; aero – aerophilous; n-pk – non-planktonic; fw – freshwater; ep - epiphyte)

Sample (Top Depth m bgl)	Diatoms	Diatom numbers	Quality of preservation	Diversity	Assemblage type	Potential for % count
D1 (1.23)	present	high	poor to mod	mod low	fw n-pk aero	good
D2 (1.40)	present	high	mod to poor	mod	fw n-pk aero	good
D3 (1.50)	present	high	mod to poor	mod	fw n-pk aero	good
D4 (1.86)	present	high	mod to poor	mod	fw n-pk aero	good
D5 (2.60)	present	very low	very poor	very low	fw ep n-pk	none
D6 (2.70)	absent	-	-	-	-	none

Diatoms are absent from the bottom sample (D6). A small number of poorly-preserved diatoms are present in sample D5. Both these samples are from the river gravel and sand deposits at the base of the sequence. The diatoms in D5 are epiphytic and non-planktonic diatoms; these include *Cocconeis placentula*, *Achnanthes lanceolata*, *Fragilaria capucina* var. *mesolepta*, *Fragilaria construens* var. *binodis*, *Gomphonema angustatum*, *Rhoicosphaenia curvata* and *Synedra ulna*. No diatom plankton was recorded. The diatom assemblage of sample D5 represents shallow water habitats.

The absence or poor preservation of diatoms in D6 and D5 reflects unfavourable conditions for diatom silica preservation (Flower 1993, Ryves *et al.* 2001) and is the result of taphonomic processes. Diatom dissolution and breakage is caused by factors such as high sediment acidity or alkalinity, through flow of water in the sediments, the under-saturation of sediment pore water with dissolved silica, cycles of prolonged drying and rehydration, or physical damage to diatom valves from abrasion.

Samples D4 and D3 are from alluvium, and samples D2 and D1 are from sediments representing foreshore river margins. There are high numbers of diatoms and the quality of diatom valve preservation varies from moderate to poor. Diatom species diversity is moderately high and all four samples have good potential for percentage diatom counting. The diatom assessment shows that all four samples contain similar diatom assemblages.

Samples D4 to D1 all contain an aerophilous diatom component. These diatoms are associated with semi-terrestrial habitats and ephemeral aquatic conditions and are able to survive prolonged dry periods. Aerophilous taxa in D4 to D1 include *Amphora montana*, *Ellerbeckia arenaria*, *Hantzschia*

amphioxys, *Navicula cincta*, *Nitzschia amphibia*, *Pinnularia major* and *Pinnularia microstauron*. The component of aerophilous diatoms, species that are able to grow in damp soil, may also represent the inwash of terrestrial material.

In addition D1 contains some chrysophyte stomatocysts. These cysts are often formed in response to adverse aquatic conditions, such as drying out. They are heavily silicified and can therefore be preferentially preserved.

Epiphytic diatoms, particularly *Cocconeis placentula*, are common in samples D4 to D1. These represent shallow water habitats with the growth of aquatic macrophytes.

Benthic diatoms are present in the top four samples. These diatoms include *Caloneis bacillum*, *Diploneis ovalis*, *Gyrosigma attenuatum*, *Navicula elginensis*, *Navicula minima*, *Navicula tripunctata*, *Stauroneis anceps* and *Surirella* sp. These mud-surface diatoms are associated with shallow water.

A large number of non-planktonic diatoms are present in samples D4 to D1. There are relatively high numbers of *Fragilaria* spp.; these are consistent with the interpretation of a marginal deposit in the top two samples. These species are able to colonise and grow under rapidly changing aquatic conditions. The importance of these diatoms suggests that there was variation in aquatic conditions where these opportunistic *Fragilaria* taxa, with broad environmental ranges, were able to colonise and expand their populations. These *Fragilaria* taxa include: *Fragilaria brevistriata*, *Fragilaria construens* var. *venter*, *Fragilaria lapponica* var. *martyi*, *Fragilaria pinnata*, *Fragilaria construens*, *Fragilaria construens* var. *binodis* and *Fragilaria lapponica*.

Other shallow-water non-planktonic diatoms occurring commonly in the top 4 samples include *Achnanthes lanceolata*, *Achnanthes clevei*, *Achnanthes minutissima*, *Amphora pediculus*, *Reimeria sinuata*, *Fragilaria vaucheriae*, *Gomphonema angustatum* and *Syndra ulna*.

Open water diatom plankton is absent from the sequence. However, two (rheophilous) species associated particularly with flowing water, *Melosira varians* and *Meridion circulare* are present in sample D3.

Further, percentage diatom analysis of the top four samples may be useful when employed in conjunction with radiocarbon dating, other palaeoenvironmental, and geoarchaeological analyses. The samples that have good potential for percentage diatom analysis might be used to examine diatom species changes in response to habitat and water quality changes. Further it may be possible to reconstruct aquatic nutrient levels and pH using transfer functions (Battarbee *et al.* 2000) if this is relevant to the catchment archaeology at the site.

Conclusions

- Diatoms have been assessed from 6 samples from a sediment sequence at the A31 Ringwood site.
- Diatoms are well preserved in the top 4 samples and these samples have good potential for percentage diatom analysis. However, diatoms are poorly preserved or absent in the 2 bottom samples. These 2 samples were taken from river gravel and sand deposits, and the samples have no further potential for diatom analysis.
- Throughout, the assemblages of non-planktonic, benthic and epiphytic diatoms represent shallow-water habitats. Open water planktonic diatoms are absent.
- The components of aerophilous diatoms and *Fragilaria* taxa reflect marginal habitats or, in the case of the former group, perhaps the inwash of semi-terrestrial sediments. However, in the top 4 samples, relatively diverse diatom assemblages are present, suggesting that there was some stability for the growth of diatom communities.
- In conjunction with other geoarchaeological and palaeoenvironmental analyses it would be possible to carry out diatom-based reconstruction of past water quality if this is relevant to the catchment archaeology at the site.

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