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circaea

This Issue: - Noddle on epiphyseal closure - - Rackham et al. on Freswick - Booth on beetles - Reviews

The Bulletin of the Association for Environmental Archaeology

CIRCAEA is the Bulletin of the Association for Environmental Archaeology, and is published three times a year. It contains news and short articles as well as more substantial papers and notices of forthcoming publications and conferences. Editorial policy is to include material of a controversial nature where important issues are involved. Although a high standard will be required in scientific contributions, the Editors will be happy to consider material the importance or relevance of which might not be apparent to the editors of scientific and archaeological journals, such as papers which consider in detail methodological problems like the identification of difficult bioarchaeological remains.

Circaea is edited by Allan Hall, Harry Kenward and Terry O'Connor, and is assembled and printed at the University of York. Circaea is distributed free to members of the AEA and is available to institutions and non-members at six pounds sterling per annum. At present, copyright resides with individual authors. Circaea is published by the Association for Environmental Archaeology, c/o Room 530, Fortress House, 23 Savile Row, London W1X 2AA. Enquiries concerning membership of the AEA should be sent to N. D. Balaam at that address.

Notes to contributors

Articles for inclusion in Circaea should be typed double spaced on A4 paper. Line drawings should be in black ink on white paper or drawing film to fit within a frame 165 x 245 mm. Captions should be supplied on a separate sheet of paper, and labelling on figures should either be in Letraset (or an equivalent) or should be in soft pencil. Half-tone photographs can be accommodated, but authors wishing to make extensive use of photographs, or colour, should note that they may be asked to contribute towards the high cost of production. The editors will modify short contributions to fit the layout and convention of Circaea. The same principle will be applied to idiosyncracies of spelling and punctuation. Scientific articles will be submitted to referees: authors may, if they wish, suggest suitable referees for their articles. TWO COPIES of scientific articles should be submitted. Authorities must be given to Latin names, either at their first mention or in a comprehensive list, and species lists should follow a named check-list. References should follow the so-called modified Harvard convention, but with journal titles preferably given in full, not abbreviated. World list abbreviations will, however, be acceptable if the author has a definite preference. For guidance as to the preparation of material for publication, contributors are referred to The British Ecological Society's booklet 'A Guide to Contributors to the Journals of the BES', and The Royal Society's 'General Notes on the Preparation of Scientific Papers' (3rd ed. 1974, The Royal Society). Text proofs of papers will be provided and should be returned within three days of receipt. Ten free reprints will normally be supplied to the authors of scientific articles: further copies will be available, if requested at the time proofs are returned, at a charge of 5p per page plus postage.

Back-numbers and a limited supply of articles can be purchased at the following rates: back-numbers - two pounds per part; articles - 5p per page plus postage.

Copy dates: January issue - 15th November; May issue - 15th March; September issue - 1st July.

The Editors, c/o Environmental Archaeology Unit, University of York, York YO1 5DD, U.K.

Editorial

The terminal stages of 1983 saw the publication of no less than two AEA Proceedings volumes by British Archaeological Reports. The two volumes contain a wide variety of papers, showing the breadth which environmental archaeology has attained. Just as important is how the books look: there is no point in trying to convert archaeologists if they can't be persuaded to read our productions. Martin Jones and Bruce Proudfoot are to be congratulated on their editing skills.

Far be it from us to usurp Treasurer Balaam's job by revealing the detailed cost of one year's production of Circaea, but volume 1 worked out at a little over 1 pound per copy (about a third of this being postage). With the generous subvention towards the cost of publishing the paper by Rackham et al. from the Scottish Development Department, however, costs for this issue are likely to be a little lower. Readers might be interested to know that the Royal Entomological Society's journal Antenna cost about 1.50 pounds (exclusive of postage) per issue to produce in 1981-2. Admittedly, Antenna has a glossy cover and is printed on jolly nice paper, but AEA members can see through such frippery and appreciate real quality, can't you?

On the seamy political front, changes in the overall funding of archaeology in England have yet to have any serious effect on those of us on the fringes of rescue archaeology. Whisperings that the work of the current Inspectorate will continue as at present for another two years suggest that we should not be holding our breath in fearful anticipation. Now that the Commissioners have been appointed, perhaps we should be offering constructive advice and suggestions. Professors Renfrew and Cramp are no strangers to the groves of archaeological science, and their appointment must give cause for optimism.

Change of address

Dr. J. A. Taylor has asked us to point out that enquiries pertaining to the Environmental Consultancy Service listed in Circaea 1(3) should NOT be sent to the Geography Department at Aberystwyth, but to Glyn Ceiro, Dole, Bow Street, near Aberystwyth, SY23 5AE; Telephone 0970 828436.

Front cover: Circaea lutetiana L., Enchanter's Nightshade.

First Aid for Animal Bones - Revisited

Jennie Coy is proposing to rewrite this well known Rescue Handbook, and would like to hear from colleagues who may have suggestions as to how the book could be improved and updated. Comments to:

Jennie Coy, Faunal Remains Project, Department of Archaeology, University of Southampton, SO9 5NH.

CIRCAEA turns up!

When we were casting around for a name for this organ, we happened on CIRCAEA in the usual sort of serendipitous way that such things occur. My greatest qualm though was that, in its botanical guise, Circaea hadn't a lot to do with environmental archaeology. Enchanter's nightshade, after all, isn't a very likely plant to find its way into an archaeological context - or any other depositional environment, for that matter.

Judge of my satisfaction, then, at finding two fruits of the plant in a tenth-century context at Coppergate, York (what do you mean, you've never heard of Coppergate?). They came from a sample rich in remains of woodland mosses - Thuidium tamariscinum, Atrichum undulatum, Eurhynchium striatum and Mnium hornum, for example - with small numbers of birch (Betula) and alder (Alnus) fruits, holly (Ilex) leaf fragments and seeds, one seed of climbing corydalis (Corydalis claviculata) and five of wood sorrel (Oxalis acetosella). Mixed with this woodland component, but otherwise probably quite unconnected with it, was an abundance of evidence of dyeplants - root fragments of madder (Rubia tinctorum), stems of dyer's greenweed (Genista tinctoria) and an exotic clubmoss (Diphasium complanatum). Add to this some buff-coloured patches of fine clay that look suspiciously like fuller's earth, and there you have the basis for a meaty discussion in some microfiche archive report.

Incidentally, the palaeobotanist's vade mecum, Godwin's History of the British Flora (1975 edn.), records Circaea pollen from several sites up and down the country, but the only fruit seems to be the Reids' record from Cromer Forest Bed deposits at Pakefield in Suffolk, from the early years of this century. I should be grateful if anyone can add any more records; the only one from abroad that I know of is Knörzer's from 11-12th century deposits at Büderich, W. Germany (Rheinische Ausgrabungen 1, 1968), where the single fruit of C. lutetiana is seen as coming from alder carr in the vicinity of the site.

With apologies to those who detest palaeobotanical stamp-collecting...

Allan Hall

Stranger than truth

The photograph shows carbonised *Allium ursinum* (ramsons) bulbs, recovered from the 2nd century AD Iron Age broch at Buchlyvie, near Stirling, central Scotland. These, and several other bulbs, were found together in an occupation layer within the broch. *A. ursinum* is a damp woodland plant and these bulbs have clearly been collected and brought to the broch for some purpose. Like its better-known relative, *A. sativum* (garlic), *A. ursinum* has for a long time been used in folk medicine and as a source of food. Unlike *A. sativum*, it is not recorded as having been used in magical or mystical activities. However, given its similarity to garlic, its strong acrid smell and known medicinal properties, it is possible that, in the absence of *A. sativum*, the bulbs of *A. ursinum* were also collected for use in ritual activities.

W. E. Boyd

Department of Botany, University of Glasgow, Glasgow G12 8QQ

Book Reviews

U. Körber-Grohne, M. Kokabi, U. Piening and D. Planck. 1983. Flora und Fauna im Ostkastell von Welzheim. Landesdenkmalamt Baden-Wurttemberg, Stuttgart: Theiss (Forschungen und Berichte zur Vor- und Fruhgeschichte in Baden-Wurttemberg, 14), 151 pp, 27 pls. About 15 pounds.

There is presently some discussion of the means of publishing archaeological results, with the threat of the 'stinking fiche' (Current Archaeology 89) and the problems that environmental archaeologists in particular have (Circaea 1(3)). It is therefore very interesting to see this book, as an example of how some German ancient monuments authorities publish environmental results.

Welzheim was a Roman frontier fort in the Schwabian forest near Stuttgart, and this volume covers the botanical and zoological results from the excavations. There is an archaeological introduction, followed by information on the present-day climate, soils, etc. The bulk of the volume consists of a very detailed account of the plant and animal remains from two wells and various other features, illustrated with excellent photographs and some drawings. The botanical part lists the very large flora and gives a detailed interpretation of the plant communities represented, how some of them got into the well (such as in animal dung), and the kind of use that was made of the various parts of the landscape, both near and far. The more interesting plant remains are fully described and illustrated. The short animal bone report likewise lists and describes the bones and interprets them in terms of animal husbandry and hunting.

For those who find German books daunting, there are summaries in English and English captions on the tables and illustrations, while the German text is clearly written with none of the excessive botanical terminology or jargon sometimes found in English works.

The relevance of this work to British environmental archaeologists is in the example it gives of how large seed floras, identified most exactly, together with wood and mosses can permit a detailed reconstruction of plant communities and agriculture. Until our National Vegetation Survey is published there are few objective data on British plant communities for us to use here, although many of the communities discussed for Welzheim are probably broadly similar.

Another important aspect of the book is that it provides data on practical identification criteria for certain plant taxa, based on Professor Körber-Grohne's extensive experience. In the absence of any modern book on the identification of archaeological plant remains, descriptions such as these are most useful and can be understood with only a small German vocabulary.

Beetles were not identified. Paradoxically, one of the main beetle identification works widely used in Britain is a German publication, yet there seem to be no archaeological beetle specialists currently publishing in Germany. Likewise, pollen analysis of archaeological deposits does not seem to be done very often, either in Britain or Germany. Another point is that the animal bone reported from Welzheim all represents large mammals, yet many wells like that at Skeldergate in York (The Archaeology of York 14(3)) also yield abundant small bones.

Wells are a very important depositional environment from which evidence can be obtained that would not otherwise be preserved, and books like this should encourage us to study them thoroughly and, if at all possible, to publish them fully.

K.-E. Behre. 1983. Ernährung und Umwelt der wikingerzeitlichen Siedlung Haithabu. Die Ausgrabungen in Haithabu 8, Neumünster: Wachholtz, 219 pp, 32 pls. About 30 pounds.

Haithabu (Hedeby) in North Germany was an important Viking trading settlement until its destruction c. AD 1066, when neighbouring Schleswig was occupied instead. Extremely large numbers of waterlogged and charred plant remains have been studied over a number of years and are reported in this volume.

Reports on the archaeology and environment of Haithabu have been appearing in volumes similar to the Archaeology of York series, and this book brings together results published in Haithabu fascicules and elsewhere.

Twenty-five taxa of cultivated and useful wild plants are given a detailed treatment of description and comparison with other such finds, and discussion, which allows anyone finding such plant remains to compare them very precisely with the Haithabu results. Since many cultivated plants such as flax and plums seem to have recognizable ancient varieties, this section of the volume is of great value to those who find the plants elsewhere. The discussion of agriculture is likewise useful.

The discussion of natural vegetation, woodland, mosses and even fungi might be of more restricted interest because this relates to the surroundings of Haithabu, but more generally it is interesting to see another example of landscape reconstruction.

All the plant remains are described in 70 pages with the characters used to separate them from similar relatives, numbers found, sizes and present distribution near Haithabu. I find this a useful reference section for seed identifications because it gives data independent of my own judgement and the limitations of my reference collection. I would prefer, however, to have had more taxa photographed, rather than many plates of the same thing, such as hop fruits; pictures are an indispensible addition to descriptions.

It is interesting that both this Haithabu report and a fascicule dealing with Viking-age material from York (The Archaeology of York 14(4)) were published within months of each other, yet treating similar sites in such different ways. Although one is a book and the other a fascicule which combines several branches of archaeological science (and admittedly suffers from dealing with one of the first pieces of environmental work to have been undertaken at York), comparison is both inevitable and interesting. I think the very clear presentation of the Haithabu results is of immense value to other archaeobotanists who, like me, look first at the species lists and then for specific information relating to various aspects of the work. Much of this kind of material is presented on microfiche in the York fascicule; this is awkward to

use and I feel that there could be a justification for some botanical fascicules to present these data as clearly as for the Haithabu results. Perhaps the results from the Coppergate site could be presented in such a form, together with those from the sites in the York fascicule under discussion here. The latter has the advantage of an archaeological introduction, and much more evidence of consideration of archaeological questions, using a range of data, such as the exact nature of the deposits investigated. It will be interesting to see whether there is evidence of cross-fertilization of ideas in future works.

At a price equivalent to four issues of the Journal of Archaeological Science, I think this book is much better value, and if I hadn't bought my own copy, I would certainly have suggested that the University library bought one - perhaps they need one as well.

G. Berggren. 1981. Atlas of seeds and small fruits of Northwest European plant species. Part 3. Salicaceae - Cruciferae. Stockholm: Swedish Museum of Natural History, 261 pp, 104 pls. About 30 pounds.

This book contains descriptions of the fruits and seeds of 122 genera, with keys to the species in each family and genus and photographs of all the taxa, in a well-produced volume with very few printing errors - a fine achievment considering the very technical nature of the subject matter.

The title is a little confusing, as Britons would consider 'Northwest Europe' to include the British Isles, yet this is really a Scandinavian seed atlas, so users in this country should remember that the flora will be slightly different.

A very thorough botanical approach has been used in this book which, whilst it may be commended by some, may also be a great mistake. The book is riddled with technical botanical terms. The main justification for these should be to convey an exact meaning, yet 'hirsute' for 'clothed with rather long, not very stiff hairs' seems hardly to differ from 'pilose' for 'hairy with rather long soft hairs'. Far more serious is the omission of nearly one such term per page from the 164-term glossary - such as adnate (p. 12), imbricate and recurved (15), ligneous (20), trullate (21) and dentate (22). The Scandinavian botanist, who is presumably the main customer at whom the book is aimed, will thus have to resort to a selection of technical dictionaries before he can fully undertand one page of the book! I believe that unnecessary technical terminology like 'tomentose' instead of 'woolly' is a great hindrance to subject like botany where it may be used to impart a scientific aura at the expense of comprehensibility, just as the excessively worn and impractical trowel is used by some diggers to give an impression of long experience. Pollen analysis has suffered from a proliferation of different technical terminologies until Miss Robin Andrew produced a pollen file in plain English, and I think that Ms Berggren would do well to take note of this for future volumes.

The book does not, however, seem to have been written with archaeobotanists in mind, though many copies have been bought through the AEA. The seed identification works of Bertsch and of Katz, Katz and Kipiani have not been cited in the literature in the present book, nor have any of the useful identification notes appearing in many archaeobotanical reports (such as those of Körber-Grohne, Knörzer and Behre and exemplified by two of the books also reviewed in this issue of Circaea). The fact that the plates are labelled with the names of the taxa presented is an improvement over part 2 (which dealt with Cyperaceae), but the coating of the seeds, used to make surface cell patterns clearer in plates 88 onwards, is a mystery.

It will be up to the users of this book to treat it properly. The pictures are very useful for checking reference material, for building up a good visual memory and for rough checking, but I hope that they will not be used alone for seed identification. The final means of seed determination can only be comparison with reference material, however useful the descriptions and photographs.

I regret finding myself so critical of what I feel are serious shortcomings in such a monumental piece of work; it remains, however, a useful addition to the meagre literature.

James Greig

Clutton-Brock, J. and Grigson, C. (eds.) 1983. Animals and Archaeology: 1. Hunters and their prey. B.A.R. International Series 163. 350 pp. 14 pounds.

This volume is the first of four presenting papers from the 4th Conference of the International Council for Archaeozoology, which was held in London in April 1982. The twenty-five papers cover a wide geographical area and chronological range, and present much that is new in archaeozoology.

The editors, in their brief Preface, group the papers into three categories, and this review follows their sub-division. The first and largest category comprises a series of studies in bone taphonomy. This is a field which arouses strong passions among bone specialists, principally between those who consider that exhaustive examination of the taphonomy of a sample is essential, and those who believe it to be imponderable and therefore best left unpondered. The former camp are led into the field by a useful review paper in which Glyn Isaac considers assemblages from early hominid sites and warns of the danger of reconstructing past human behaviour in the context of modern behavioural preconceptions. The theme is illustrated by some useful diagrams, but rather more detailed consideration of the home-base and food-sharing behaviour of other primates would have been helpful.

Papers by Bunn and Shipman take up the question of early hominid life-style and diet, and illustrate the extent to which jargon and unnecessary neologism can obfuscate an otherwise informative text. Bunn's contribution to the demise of English is the solidly tautologous '... tooth induced gnaw marks ...'
Shipman is less pleonastic, uses cartoons to delightful effect, and finally conjures up a lovely image of an early hominid rushing up to a carcass on the savannah and hacking off a lump of meat, then racing away, munching, while hotly pursued by the irate predator which slayed the beast in the first place. A third taphonomy paper, by Potts, is less satisfactory, building theories on small samples, using data-sets which can't even begin to represent post-burial taphonomic loss, and relating modern disarticulation data from proboscideans and hippos (sic) to studies of ancient bovids.

The vital question of how a pile of bone fragments came to be in a certain deposit is considered by a number of contributors. Behrensmeyer demonstrates lucidly that the frequencies observed on most early hominid sites exceed a predicted 'background' frequency of bone accretion on land surfaces, and Hill sets out the degree of similarity between assemblages from ancient hominid sites and those from hyaena dens. The smaller vertebrates are discussed in a particularly elegant paper by Payne. Unprofessional though it may be to criticise the style of writing in scientific papers, Payne's eminently readable exposition of a thorough piece of research came as a welcome relief after ethnographic studies by Crader and Bunn. Crader has examined butchery sites of the Bisa people of Zambia, who use metal tools, and Bunn reports bone assemblages from hunting camps of the San people, who he says use metal knives and small axes. The use of such ethnographic parallels as homologues for Pleistocene hominids does not inspire confidence among non-ethnographers.

The second group of papers concerns the economic interpretation of bones from hunting sites. Inevitably, the Optimal Foragers emerge from the undergrowth, apparently undeterred by Butzer's recent apposite remark that 'Spatial behaviour is fundamentally rational in economic terms, but it is not necessarily optimal and is never exclusively economic.' (Butzer 1982, 258).

Foley uses an objective study of prey-attributes to model likely hominid preferences. This is an excellent theoretical exercise, although Crader's observation that the Bisa avoid butchering hippopotamus meat because of its disgusting smell should serve as a caveat. Another important paper is that by Clark and Yi. Most readers will be frightened off by the authors' use of '... to operationalise a complete optimal foraging scenario ...' in the first paragraph, but having got that out of their systems, Clark and Yi settle down to a workman-like application of Hardesty's (1975) niche-width algorithm to late Pleistocene and early Holocene Spain.

Of the papers which survey hunting sites in different parts of Europe, none stands out as particularly worthy or otherwise. Altuna contributes a thought-provoking comparison of which species are illustrated in caves with those whose bones are found in the caves. The general conclusion which he reaches is that people drew horses but ate deer, and explanations for this are advanced, although Altuna does not appear to consider the possibility that horses were a major part of the diet but that some cultural factor meant that their bones were not

accumulated at the home-base. In discussing Mesolithic bones from Maglemosegaard, Aaris-Sorensen calculates the minimum taphonomic loss from the assemblage. Informative though this is, his method makes no allowance for individuals in the original population not represented in the sample, and is invalidated if there has been anatomical selection prior to deposition, a point which refers back to the batch of taphonomy papers.

The third category of papers concerns work going on in the Americas, from Patagonia to Greenland. The gem of these is a lengthy piece by Dale Guthrie. Instead of theorising about the effectiveness and potential utility of osseous projectile points, he has made large numbers of them and flung them at a moose. The results of this experiment demonstrate clearly that Rangifer antler is the raw material par excellence, and that the typical elongated and slender form of Palaeoindian antler points gives optimum utility. No doubt this could all have been determined by theoretical modelling, but the results would have been less convincing. The moose, it should be said, was already dead, but still warm. The theme of resource availability is used by Goñalons in his survey of sites in Patagonia. The likely economic importance of different resources at different periods in this academically neglected region is linked to man's exploitation of a changing ecosystem.

The ICAZ conference was an interweaving of different attitudes and approaches, and this has produced a valuable but diverse assortment of papers, all of which deserve (and some certainly require) a careful second reading. Maybe the selection of papers could have had a more thematic basis, although this might have excluded some of the less obviously classifiable contributions. Reference has already been made to the mauling of English by some of the North American authors: one can only assume that the editors, both well-known for the clarity of their writing, swallowed hard and decided not to interfere. In taking on the editing of four such volumes, Drs Grigson and Clutton-Brock face an awesome task. On the evidence of this first volume, the results will be essential reading. One last morsel from the grammatical dog's breakfast: on p. 36, Pat Shipman has 'Potts, Bunn and me ...' and in the same sense on p. 37 'Potts, Bunn and I ...'
Bravo!

References

Butzer, K. W. (1982). Archaeology as human ecology: method and theory for a contextual approach. Cambridge University Press.

Hardesty, D. (1975). The niche concept: suggestions for its use in human ecology. Human Ecology 3, 71-85.

Terry O'Connor

Anon (no date). Death of a wolf. Creswell Crags Visitor Centre Report no. 3. ?Publisher. Price 1.50 pounds. 24pp.

This is an intriguing publication for several reasons, not the least being the challenge of deciding how to cite it, since the only evidence as to origin appears on the back cover, where there is a list of 'contributors' (do we take them as the authors?) and a couple of logos perhaps indicating 'Nottinghamshire County Leisure Services/Countryside' and 'Derbyshire County Council' to be the publishers. Even the printers have remained anonymous - astonishing since the booklet is so well produced!

Let me say at this point that I am discussing what is (basically) an excellent publication within its own frame of reference. The inability to categorise it (scientific paper? leaflet? tourist catch?) is a result of its pioneering nature. Here we have (again, basically) a well-written, well structured scientific report, with the qualities of 'Scientific American' - good presentation and layout, clear text, splendid use of diagrams, development sketches and reconstructions. 'Death of a wolf' is, I suppose, best described as a scientific report aimed at a mass market, namely the 25,000 people a year who pass through Rogan Jenkinson's Creswell Crags Visitor Centre. It is a description of the sediments infilling a fissure near Dog Hole Cave, revealed by a rockfall in 1978. It sets the scene in the introduction, outlining local glacial events and the history of excavations at Creswell. The discovery of the fissure and its excavation leads to an account of the sediment sequence, with various physical and chemical analyses. A brief paragraph on the two flint artefacts is followed by sections on vertebrates, molluscs (including an interesting account of the modern fauna and the transport of aquatics by birds), and dating. The rest of the text and illustrations comprise a series of reconstructions of infill stages and subsequent history, very well presented, followed by a brief conclusion and references. French and German summaries are given.

I am now obliged to mention the work's failings. The English is mainly very clear, as befits a popular publication, but there are occasional travesties ('....such work is made more important due to....', p. 5) and descents into jargon. There are some inadequacies of presentation: for example in fig. 5 most species are only given undefined 'percentage frequencies', and only three given as number of individuals. The capitalisation of specific epithets in figs. 5 and 7 is just the sort of thing to scare biologists away - presumably we were only saved from more of this in figs. 8-10 by the presentation of Latin names in capitals throughout. There are other shortcomings of a kind which it is hoped can be avoided in future Creswell Crags Reports: giving 'salmon' as the English equivalent of 'Salmo sp.' (fig. 7) (when the trouts are Salmo species too) and, in the same figure, the translation of 'deer' into 'Cervus sp.', which ignores at least three other deer genera; the interpretation of the distribution of gnawed bone (p. 15), apparently contradicting table 14; the failure to identify the 'remarkably well-preserved' frogs to species (p. 12); the use of 'plan' where 'section' is meant (p. 8); 'phospherous' for 'phosphorus' (p. 8); 'C_2CO_3' for '$CaCO_3$' (p. 9); the presentation of a modern wolf skull on p. 13 with the caption 'fossil bones from Dog Hole Fissure'; and so on. The illustrations, too, though pleasing to the eye, have their failings. The representation of Discus rotundatus in fig. 11 will not bear comparison with modern specimens; and the peripheral vignettes too often illustrate scenes for which no evidence is apparent - for example what appears to be a raven on p.10, the

coniferous monoculture on p. 7, and the red indians on p.9. The uncritical interpretation of the mollusc evidence is particularly disturbing - a malacologist assures me that the species described as woodland indicators are likely to have been just as abundant on vegetated rocky ground.

Now, it may be thought wrong to criticise such details in a popular work. Such a patronising view is, however, particularly dangerous since the non-specialist reader is not in a position to judge or qualify inexactitude, and the work is in fact quite likely to be used as a source by scholars. Also, there is more to this report than at first meets the eye. It looks to me a lot like the future of archaeological publication: succinct, readable, well-presented, heavily illustrated, full of imaginative reconstructions - in short, saleable. Either through direct government pressure or through financial stress, it looks as though we shall all have to SELL if we want our work published and not lost in the archives. I refrain from moral judgement on this point - I would like to see more good popularly-accessible reports like this one, but in addition I would like to see more complete data presentation, to avoid the temptation to over-simplify in the absence of checkable facts. However, saleable publication throws up a lot of frightening possibilities.

It is easy (with skill) to sell a good story like 'Death of a wolf', about a small and distinctive feature or data set. But how do you sell tedious facts about complex sites, or 200 contexts' worth of seed lists or subtly different beetle assemblages, or come to that, coarse ware or artefact-free Anglian build-up, without serious compromise and gross over-simplification? There is compromise enough in the present report, from the choice of a title (the perceptive will observe that 'Death of four foxes, two of them foetal, and where did the bits of wolf come from?' might be more appropriate) to the repeated simplification of the evidence to a single interpretation - not always the best, either. Has there been pressure applied by a local government department or a publicity consultant? I cannot accept the glib view that 'if it can't be presented popularly it doesn't deserve publishing at all'. We hear this from some archaeologists, usually the kind who, over a few pints, will confess that they have no serious intention of placing objective interpretations on their results, just the one that sounds best....'that's how you get on in archaeology'.

So, in summary, we have a mostly excellent publication from which we can all get good ideas about presenting data in an attractive form, and and by which we are warned of some of the dangers inherent in popularisation. The concept is laudable, but the content is too flawed to be regarded as wholly successful.

Harry Kenward

Further news of the joint AEA/BSBI Conference

ARCHAEOLOGY AND THE FLORA OF THE BRITISH ISLES

Man's influence on the evolution of plant communities

21-23 September, St Anne's College, Oxford

Speakers:

woodland section	- Dr Judith Turner, Prof. Ian Simmons
grassland section	- Dr Mark Robinson, Ms Alison McDonald, Mr George Lambrick, Mr James Greig
arable section	- Mr Martin Jones, Dr Peter Reynolds
moorland section	- Dr Peter Moore, Dr Frank Chambers
coastal section	- Dr Robert Jones
urban section	- Dr Allan Hall

Booking forms will be available in the next issue of CIRCAEA, or from BSBI, 70 Castlegate, Grantham, Lincs. (please enclose SAE).

Provisional costs (pounds sterling):

Conference Fee: 7.50
B & B: 10.10
Lunch: 3.50
Conference Dinner: 12.50
Optional excursion: 1.50

Full details in next CIRCAEA

Martin Jones
Joanna Martin (BSBI)

A provisional key to the British species of Tachyporus (Coleoptera, Staphylinidae) based on elytral chaetotaxy

Roger Booth*

Introduction

Fragments of Tachyporus species, particularly elytra, are quite common in archaeological deposits, but they are remarkably difficult to name reliably using conventional key characters. The majority of keys to species of Tachyporus are based upon colour differences, with structural characteristics taking second place. However, in a revision of the North American species of the genus, Campbell (1979) based his key on characters of elytral chaetotaxy. He showed that for many species, colouration was an unreliable guide to identity, with several similarly coloured species included under one name and variably coloured species being described under several names. Although the large setae at the sides of the pronotum, elytra and hindbody are readily observable, and their size is used as a key character, those setae on the dorsal surface of the elytra are usually overlooked. These setae, although often short, are always erect and are readily distinguishable from the surrounding recumbent pubescence. Where a seta has been lost, its point of insertion can be readily located if the specimen is suitably orientated and illuminated by diffused lighting (Campbell 1979). The number and positioning of these dorsal setae provide very good taxonomic characters, and are specific for many species, thus enabling many archaeological fragments to be specifically identified. Like most characters, some variation between individuals exists, and more commonly, individuals may be asymmetrical. However, by considering the numbers of rows of setae, rather than their exact number, much of this variation can be absorbed within the key.

Setae in the following positions may be considered:

1. Sutural (S)
2. Discal setae in 1, 2 or 3 rows (ID, MD, OD)
3. Humeral (H)
4. Sublateral (SL)
5. Lateral (L)
6. Apical (A)

These positions are shown in Fig. 1 (Tachyporus nitidulus).

The three discal rows are labelled as inner, mid and outer discal. The numbers of setae in the inner (when present) and mid discal rows varies between 1 and 4, but the outer discal row (when present) is normally only represented by a single seta (two setae on one elytron of a single T. nitidulus have been observed). The apical setae can be the most difficult to locate, and so less importance has been attached to them in the key. However, a maximum of four apical setae occur on each elytron, and their positions remain fairly constant. One apical seta is present at the end of the sutural and lateral rows in all British species. The other two setae are found more or less between the inner and mid discal rows, and between the outer and sublateral rows. These two setae are both absent in T.obtusus, T. formosus and T. pallidus, and the outer one is absent in T. solutus and T. transversalis.

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The setation is easier to observe in diffused light rather than under direct lighting. A piece of frosted glass or thin tracing paper, placed next to the specimen, between it and the light source, provides a convenient light diffuser to eliminate the surface glare of direct lighting. For further details, Campbell (1979) should be consulted.

Measurements of elytral length (used in the following key) were made with the aid of an eye-piece graticule and taken along the suture from the apex of the scutellum to the sutural angle.

Nomenclature follows Pope (1977).

Key to species

In the chaetotactic formulae which follow the species names in the key, rows or positions, numbered 1 to 6 above, are referred to by the abbreviation given above. The numbers of elytral setae in typical, normally symmetrical specimens precede the position, with ranges for atypical specimens in parentheses. Elytral lengths are given as means, with ranges and the number of observations, n, in parentheses.

1a) One row of discal setae (mid discal) present. (Occasionally in transversalis, a sutural seta is duplicated, but this does not represent an inner discal row).....12
-b) Two or three rows of discal setae.....2

2a) Three discal rows of setae, sutural row always present. Small species, elytra less than 0.85 mm long. (If outer discal seta absent from one elytron, then size small.).....3
-b) Two rows of discal setae, outer discal seta never present. Mostly larger species, elytra at least 0.87 mm long (except quadriscopulatus, see couplet 10).....7

3a) Humeral seta absent. Normally one inner discal seta. tersus Erichson
[3(2) S, 1(0) ID, 3(2) MD, 1 OD, 2 SL, 5(4) L, 4 A]
Elytra 0.74 mm (range 0.70 to 0.80, n=12).
-b) Humeral seta present. Normally two inner discal setae.....4

4a) Normally one sublateral seta.....5
-b) Normally two sublateral setae.....6

5a) Elytra with fine microsculpture. Pronotum dull testaceous to piceous, much lighter than head and elytra.....atriceps Stephens
[2-3(1) S, 2 ID, 2-3 MD, 1(0) OD, 1 H, 1(2) SL, 4(3) L, 4 A]
Elytra 0.70 mm (range 0.62 to 0.76, n=16).
-b) Elytra without microsculpture. Generally darker species. Pronotum pitchy on disc, paler near edges. Elytra dark reddish brown to pitchy, paler towards apex.....scitulus Erichson
[2(3) S, 2 ID, 2 MD, 1(0) OD, 1H, 1 SL, 3-4(5) L, 4 A]
Elytra 0.69 mm (range 0.62 to 0.74, n=5).

6a) Less convex species, elytra depressed dorsally. Last joint of maxillary palp subulate. Apical third of abdominal tergites testaceous.....nitidulus (Fabricius)
[3(2) S, 2 ID, 3(2-4) MD, 1(2) OD, 1 H, 2(1) SL, 5(4) L, 4 A]
Elytra 0.70 mm (range 0.62 to 0.78, n=25).

-b) More convex species. Apical segment of maxillary palp relatively long and slender. Abdominal tergites more or less uniformly dark, at most apical margins only paler.....pusillus Gravenhorst
[3(4) S, 2(3) ID, 3 MD, 1(0) OD, 1 H, 2(1) SL, 5(4) L, 4 A]
Elytra 0.76 mm (range 0.72 to 0.84, n=10).

7a) Sutural row of setae absent. Two or three pairs of lateral setae restricted to basal half to two-thirds of elytra. Punctures of hindbody acupunctate.....8

-b) Sutural row normally present. Usually four or more pairs of lateral setae spaced along whole edge of elytra (rarely only 3 present, often asymmetrically). Punctures of hindbody acupunctate in solutus, otherwise fine.....9

8a) Three pairs of lateral setae. Elytra black in basal half, testaceous in apical half, sharply demarcated. Abdominal tergites less strongly punctured.....obtusus (Linnaeus)
[2(1-3) ID, 2(4) MD, 1 SL, 3(4) L, 2 A]
Elytra 1.08 mm (range 0.95 to 1.13, n=12).

-b) Two pairs of lateral setae. Elytra testaceous, infuscated near scutellum and base only, side margins testaceous. Abdominal tergites more strongly punctured.....formosus Matthews
[1 ID, 1(2) MD, 1 SL, 2 L, 2 A]
Elytra 0.93 mm (range 0.92 to 0.95, n=8).

9a) Setae on pronotum and elytra short and fine. Three pairs of apical setae. Hindbody acupunctate.....solutus Erichson
[1-2(0-3) S, 1(2) ID, 3(2) MD, 1 SL, 4-5 L, 3 A]
Elytra 1.02 mm (range 0.92 to 1.09, n=10).

-b) Lateral setae of pronotum and elytra longer and stouter. Usually four pairs of apical setae. Hind body finely punctured....10

10a) Small, elytra c. 0.7 mm long. Pronotum testaceous. Elytra dull testaceous, usually without darker basal markings. Last two segments of maxillary palps infuscated.
quadriscopulatus Pandelle
[2 S, 2 ID, 2 MD, 1 H, 1-2 SL, 4-5 L, 4 A]
Elytra c. 0.70 mm (n=1).

-b) Larger, elytra at least 0.87 mm long. Pronotum pitchy or testaceous, and elytra normally reddish testaceous with a well defined black base and scutellar patch, and generally with basal two-thirds of side margins black. Palps pale testaceous...11

11a) Humeral seta usually absent, if present then (?) on one side only. Pronotum testaceous.....chrysomelinus (Linnaeus)
[1-2(0-3) S, 2(1) ID, 2(1-3) MD, 0(1) H, 1 SL, 4(3-5) L, 4 A]
Elytra 0.92 mm (range 0.88 to 0.96, n=17).

-b) Humeral seta usually present, though occasionally absent one or both sides. Pronotum typically black or pitchy on disc, sides somewhat abruptly testaceous.....hypnorum (Fabricius)
[1-2(0-3) S, 2(0-1) ID, 2(1-3) MD, 1(0) H, 1(0) SL, 4(3-5) L, 4 A]
Elytra 0.97 mm (range 0.90 to 1.07, n=18).

12a) Pronotum with fine, elytra and hindbody with strong transverse microsculpture, upper surface somewhat iridescent. Small species.....transversalis Gravenhorst
[2-3(4) S, 3(2) MD, 1 SL, 3(2-4) L, 3 A]
Elytra 0.69 mm (range 0.62 to 0.74, n=12).

-b) Pronotum without, elytra and hindbody with weak microsculpture. Pronotum and elytra without iridescence. Intermediate in size. pallidus Sharp
[1(0-2) S, 2 MD, 1(0) SL, 3(2-4) L, 2 A]
Elytra 0.85 mm (range 0.80 to 0.90, n=13).

Although rather few specimens of some species were examined, there was sufficient stability in the setation to enable some obvious species groups to be recognised, and in many cases the pattern of setation was unique for a species. For example, in most keys, T. solutus and T. pallidus key out together on similar colouration, although structurally they are very distinct, whereas T. hypnorum and T. chrysomelinus, which are widely separated in keys on the pronotal colouration, are structurally very similar.

Teneral specimens are often collected, and these cannot usually be identified with certainty using existing keys, but, in most cases, they may be reaily identified using the above key. For example, teneral specimens of T. solutus, T. chrysomelinus, T. pallidus and T. atriceps have been seen standing over the name T. formosus.

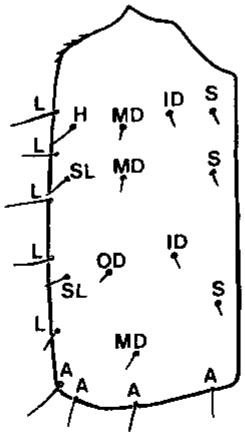

Figure 1. Elytral setae of Tachyporus nitidulus (Fabricius). For abbreviations see text.

The British T. nitidulus which I have examined have all had a fairly constant elytral setation (Fig. 1), illustrating the basic pattern from which the others are derived. However, North American material examined by Campbell (1979) was divided into Nearctic and Palaearctic forms, neither of which generally conform to the British pattern. In North American specimens, the internal sac of the male aedeagus contained a short, straight, sclerotized rod (Campbell 1979, 12, fig. 48), whereas British specimens have a short sclerotized rod which is distinctly curved dorso-ventrally (visible particularly in lateral view in cleared preparations). There is obviously a lot of taxonomic mileage left in 'nitidulus'.

T. obtusus, T. formosus and T. solutus form a distinct group of large, more robust species with acupunctate abdominal tergites, and with two or three pairs of apical setae. According to Cameron (1944), T. abdominalis (Fab.) is closely related to T. formosus. Since it is a widespread northern Holarctic species, it could possibly occur in the north of Britain. It would key to T. pallidus above, but it is a broader, more robust insect and it lacks elytral microsculpture.

In this study, which started initially when I was attempting to sort out my own material of the genus, I have examined all the species on the British list (Pope 1977) to make the key complete. It is only a preliminary investigation to date and virtually no use has been made of primary sexual characters. In particular, only typical forms, and none of their varieties, have been studied. However, it is hoped that this will form the basis for a revision planned for the future.

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Exact chronology of epiphyseal closure in domestic mammals of the past: an impossible proposition

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It must be true; it is in all the text books. 'It' is the conventionally accepted timing of epiphyseal closure in the common domestic mammals, which is widely used in archaeological reports. The text books include Sisson and Grossman's Anatomy of the Domestic Mammals (numerous editions), Barone (1966), and Zietzschmann and Krolling (1955). The same material is presented to biologists and archaeologists by Habermehl (1961), Schmid (1972) and Silver (1963 and 1969). Silver does, however, express some doubts in his second edition.

Most data in anatomical textbooks have been verified by generations of students and their mentors, but in this case the same figures (more or less) are continually presented because there is only one source, this being the thesis presented to the Societe Agriculturel de Science et Industrie in Lyons in 1897 by M. F. K. Lesbre. At the time when Lesbre was writing, early maturation of livestock was the almost obsessive aim of most progressive husbandmen, and his thesis seems to have been presented mainly to refute some exaggerated claims in this field: the ages of epiphyseal closure are casually presented in the form of tables. Apart from stating that his definition of closure was the disappearance of the junction on the exterior of the bones, Lesbre has little to say about the derivation of the data. The numbers, breed and sex of the animals used are not stated, though there is some mention of museum specimens. Lesbre himself did not attach too much importance to the exact chronology. He was aware that Tchirvinsky (1909) obtained ages of closure in the sheep somewhat younger than his own and attributed this to either their genetic staus, as an earlier maturing strain, or to their superior nutritional status compared with his specimens. Tchirvinsky had also used maceration to determine his point of closure. Lesbre was well aware that he lived in a period of rapid change in livestock husbandry. The extent to which earlier maturation was taking place is reflected in the age at which livestock were gaining championships at the prestigious Smithfield fatstock shows (Bull 1926). In 1875 the average age of bovine 1st prize winners was 4 years 1 month, but by 1900 it had dropped to 2 years 8 months, falling by another 7 months in the next 25 years; this cannot be due to changes in consumer taste alone, although there were complaints about excessive fatness in Smithfield champions.

In fact ages of epiphyseal closure are affected by genetic constitution, state of nutrition, and sex. It appears that native livestock in Africa and India mature later than Lesbre's ages: Emara (1937) found this in a number of Egyptian dairy cattle examined radiographically, and Dhingra (1976), also employing radiography, examined Banur and Nali sheep of unspecified sex with the same result. Smith (1956), on the other hand, using the modern Clun sheep, obtained ages very much younger than Lesbre's. My own work on goats indicates that feral animals are later maturing than fully domesticated animals (Noddle 1974). On the other hand, both Reiland (1978) and Lesbre find little difference in wild and domestic pigs.

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A number of authors have attributed differences in epiphyseal maturation to different nutritional states. Kurtin et al. (1975) did so in the case of acetabular fusion in lambs. Ellis and Lawrence (1978) examined the foot bones of foals normally fed and on a low plane of nutrition, and found that in the case of the 2nd phalanx maturation was between 7 and 12 months as opposed to 10-16 months respectively: for the 1st phalanx the figures were 8-12 months and 13-16 months, and for the distal metacarpal 8-12 months and 13-16 months. In my own collection there are three heifers of about 18 months which were known to have been suffering from chronic malnutrition at the time of death. Two Welsh Black heifers which were heavily parasitised, and one of which had become pregnant under one year old, nevertheless had mature metapodials and distal tibias. However, a Guernsey heifer said to have been sick all its life and very undersized had none of these epiphyses fused, so perhaps malnutrition is more deleterious in the earliest stages of life. Bullock and Rackham (1982) found that feral goats in the Southern Uplands of Scotland were maturing later than those on the island of Rhum (Noddle 1974). The mainland goats had died a natural death after being subjected to a number of inclement seasons, whereas the island goats came from a carefully culled population and had been shot.

Several workers have found difficulties in applying the conventional epiphyseal data to castrate males. Grant et al. (1972) could find no trace of fusion when they X-rayed the distal radial epiphysis of 3.5 year old steers. Figdor (1927) found that the proximal epiphysis of the tibia remained unfused in a 7 year old ox, and traces of union could still be observed in a 9 year old animal. Noddle (1974) found that there was anything up to 3 years delay in the maturation of castrate goats in comparison with intact females. However, there seems to be no similar delay in sheep, although it has not been deliberately studied. Certainly Smith (1956) could find none up to the age of 10 months. Kock (1935) found that ages of maturation in intact European Bison were similar to those in castrated domestic cattle, and American workers on their bison are happy to accept his findings, although there are anomalies in his text, a summary of his German thesis, which require clarification.

The timing of fusion in the earlier maturing epiphyses of present-day cattle is presented in Table 1. The material came from carcass dissections carried out by various agricultural institutions and the Meat and Livestock Commission (see acknowledgements) and the age of the animals at slaughter was known to the day. Feeding standards varied a little, in that the younger the animal was at slaughter, the higher was its plane of nutrition in the majority of cases. The animals were killed at predetermined carcass weights in most of the experiments, so that the ages tended to be grouped around a few points. The type of experiment being carried out is described by Frood (1976). Maceration was employed to determine whether fusion had taken place.

Maturation dates at the present time are much earlier than those of Lesbre. There is some separation of the sexually intact animals, females tending to be earlier than males, but the castrate male always lags behind by an increasing amount as it gets older. There is considerable emphasis on the Friesian breed in consequence, as most of the intact individuals were of this breed. However, there is a suggestion that the early maturing Hereford and Aberdeen Angus breeds also have early maturing epiphyses. Amongst the older steers used in the determination of the distal tibia timing, there was a difference between Hereford/Friesian crosses and the later maturing French breed crosses.

Epiphysis	Number of animals examined at relevant ages	Sex	Youngest fusion			Oldest unfused			Other authors and notes
			age	sex	breed	age	sex	breed	
Scapula coracoid process	7	all	9	C	J	11	F	Fr	Sisson, 7-10 months
Humerus distal	38	all	8	F,M	Fr	11.5	C	Fr	Sisson, 12-18; Emara, 30
Epicondyles	41	all	11	M	Fr	15	C	Ay	
Radius proximal	42	all	8	M	Fr	11.5	C	Fr	Sisson, 12-18; Emara, 30
First phalanx	17	F	9		Fr	11		Fr	Emara, 24; Sisson, 12-18
	16	M	9		Fr	12.5		Fr	Sisson, 12-18
	38	C	10.5		Fr	16		LRX	Sisson, 12-18
Second phalanx	38	all	8	F	Fr	11	C	Fr	Sisson, 18; Emara, 9
Metapodial	75	M,F	18	F	Fr	19	M	Fr	Sisson, 24-30 All castrates unfused to 19
Tibia distal	42	M,F	17	F	AA	19.5	M	H	Sisson, 24-30. Not definitive
	16	C	25		H,Fr	28		ChXFr	
Tibial tubercle partially fused to proximal epiphysis	2	M	16.5		H	16.5		H	2 days age difference between these animals
	20	C	18		SD,F	26		CH AA SH	This junction begins by formation of a lateral strip of periosteal bone followed by joining of complete interface
Tibial tubercle fully fused	5	F	17		AA	21		Fr	
	5	M	18		H	19		H	
	21	C	22		SM,AA SH	28		Fr	Oldest not definitive
Tibia proximal epiphysis to fibula rudiment	10	M	17		H	19		H	
	19	C	22		SM,Fr	28		Fr	

Table 1. Chronology of epiphyseal fusion. All ages in months.
Abbreviations: F - female; M - male; C - castrate male.
AA - Aberdeen Angus; CH - Charolais; Ay - Ayrshire; Fr - Friesian; H - Hereford; J - Jersey; LRX - Lincoln Red Cross; SD - South Devon; SH - Shorthorn; SM - Simmental

There is a hint that castrate males might be more susceptible to the effects of their current state of nutrition on the age at which their epiphyses mature than intact animals. Amongst the Hereford/Friesian steers there was a difference of about 40 days between the youngest and the oldest tibial fusions found. The youngest animal had been on summer feeding, and the later on more restricted winter rations. Might we anticipate a spate of epiphyseal fusions taking place as the animals enter into a phase of compensatory growth when they are turned out onto spring pasture after a winter of deprivation?

Another imponderable factor is the age at which an animal was castrated, which may well have had an effect on the timing of bone maturation. All the steers in Table 1 were castrated in the first week of life, and in the past this operation may well have been carried out on older animals. Columella (Forster and Heffner 1954, 187-8) writes that the Carthaginian Mago '... is in favour of castrating calves while they are still young and tender...' but if not done then the operation should not be carried out until the animal is two years old. Youatt (1870) suggests that the best age is between one and three months, and deplores waiting until two years as was the practice '... in some parts of the north of the kingdom'. Thus castration around the age of puberty, when effects on maturation timing would be difficult to determine, would not seem to be advocated. Two year old castrates would probably have the thick-set bones and horncores characteristic of bulls, and these are not commonly found in archaeological deposits.

Considerably greater difficulty has been found in obtaining bones from older animals for the determination of the timing of the later maturing bones. A Friesian cow aged 2 years 3 months which was certainly not in a good nutritional state had a mature femoral head epiphysis, but all other epiphyses in this group (fusing around 3.5 years according to Lesbre) remained open. A number of older steers suggested that the calcaneum would mature around 4 years, and a 6.5 year old Welsh Black/Dexter cross again has a mature femoral head but no other mature late bones. It is suggested that the vertebrae and peripheral epiphyses of the pelvic girdle would not mature until about 10 years old in castrate males (5.5 to 6.5 years in Friesian cows).

Thus considerable caution should be used in assessing chronological ages from bone maturation. All that is justified is the use of maturation stages based on the four groups of bones which tend to fuse at about the same time. These can then be integrated with dental eruption and wear data, but where the two do not agree, dental data must take precedence. In practice it is not thought that the immature bones of a steer of about 6-8 years would occur very often in an archaeological deposit, unless there had been a mass slaughter in battle, for example. Such an animal would most likely be in use for traction, and would be coming to the peak of its working life.

On the other hand, economic uses and reasons for slaughter should not be assumed, particularly for the earlier periods of prehistory. Ryder (1981) has suggested that an African type of tribal husbandry was prevalent during the European Neolithic and Bronze Age, and recent work, e.g. Spratt (1978), Pryor (1976) and Fleming (1978) suggests that a form of ranching operated at least in marginal areas during the Neolithic and early Bronze Age. It seems unlikely that such pastoralists would know the exact age of their older stock unless they had an individual ritual significance as amongst the African Nuer (Karp and Maynard 1983). In more recent times, Levitan (1978) has described

Early	Scapular coracoid, distal humerus and its epicondyles, proximal radius, phalanges, central part pelvic girdle, vertebral elements, fusion of sacrum.
Intermediate	Distal tibia and metapodials.
Late	Proximal humerus, distal radius, proximal and distal ulna and femur, proximal tibia, calcaneum.
Very late	Peripheral parts of pelvic girdle, central epiphyses of vertebrae.

Table 2. Groups of epiphyses fusing within a short period and related skeletal events.

large numbers of rams and goats almost certainly killed for ritual purposes at a Roman temple. At the present day, Redding (1982) could find no clear raison d'etre in the selection of goats slaughtered in a Middle East subsistence flock. Such economic information as can be deduced from the age pattern of the archaeological material is more likely to emerge from using fairly wide stages of maturity rather than spuriously exact chronological ages.

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Report on Environmental Survey 1979

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Introduction

Caithness, at the northern extremity of mainland Britain, has an archaeological importance out of proportion to its size: like the Orkney islands to the north, its prehistoric monuments are impressive and numerous. Nor should its historical importance be under-estimated: it formed an integral part of the earldom of Orkney, a major element in the political geography of Viking Britain. Only one settlement site in the area has, however, hitherto been claimed from the Viking and late Norse periods: Freswick Links (Fig. 2). Excavations by A. O. Curle and V. G. Childe in the 1930s and 1940s (Curle 1939; Childe 1943) uncovered structures and a notable collection of artefacts, now in the National Museum in Edinburgh. The site also has earlier structures and artefacts and the overall sequence and significance has been summarised in a separate publication (Batey 1982).

Situated on the eastern coast of Caithness (NGR ND 3765 6760 centre), the site is subject to very considerable erosion along the sand dune terrace fronting the sea to the east (as well as from a large rabbit colony on the landward side). Collection of weathered-out artefactual material and observations of midden deposits in the cliff-faces prompted a major pilot survey in September 1979, funded by the Ancient Monuments Inspectorate of the Scottish Development Department. The aims were to collect further material, both artefactual and environmental, on a systematic basis, and to record the degree of coastal and other erosion. Prior to this, in July 1979, one of the authors took a sample column for environmental analysis from one point on the eroding cliff-face (Zone E, Fig. 3). The results of this initial sampling and the pilot scheme are detailed below and have led to the SDD funding a major survey and excavation programme.

The subsequent programme of survey and excavation took place in the spring and summer of 1980, August 1981 and August and September 1982. This major programme will be continued for a fourth season, we hope, in 1985. In addition, separate rescue excavations were carried out in September and October of 1979 on an adjacent site, in Freswick Castle. A summary report on the surveys and excavations carried out in 1979 and 1980 is available (Batey et al. 1981), as are progress reports on the 1981 and 1982 surveys and excavations (Batey et al. 1982; 1983).

This is the final report of the 1979 pilot environmental survey and indicates, in advance of the major publications anticipated from the more recent work (Jones et al. 1983), the preliminary environmental results and conclusions and the site's overall potential. All documentary material relating to this final report is placed in the archives of the National Monuments Record of Scotland, Royal Commission on the Ancient and Historical Monuments of Scotland, 54 Melville Street, Edinburgh.

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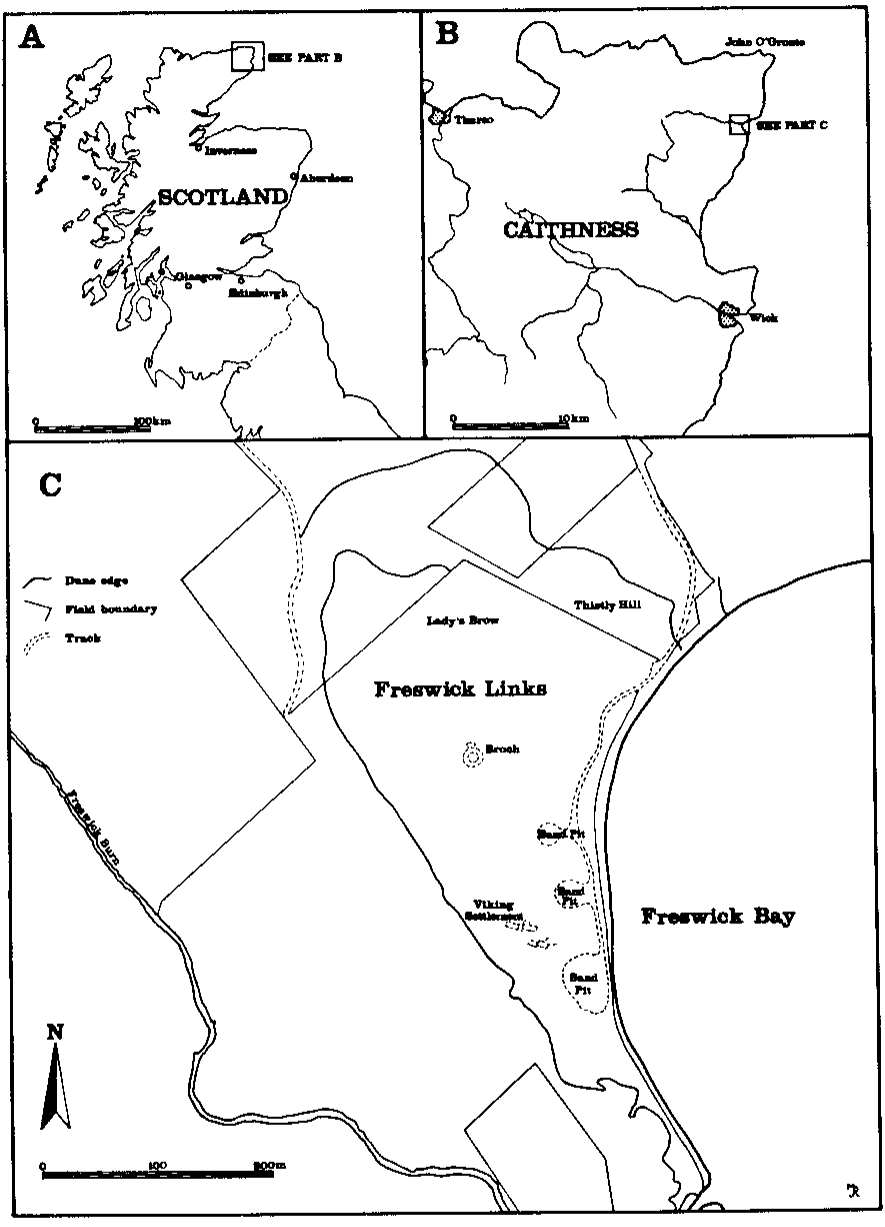

Figure 2. Location map of Freswick and the Links (M. J. Rains; Crown Copyright).

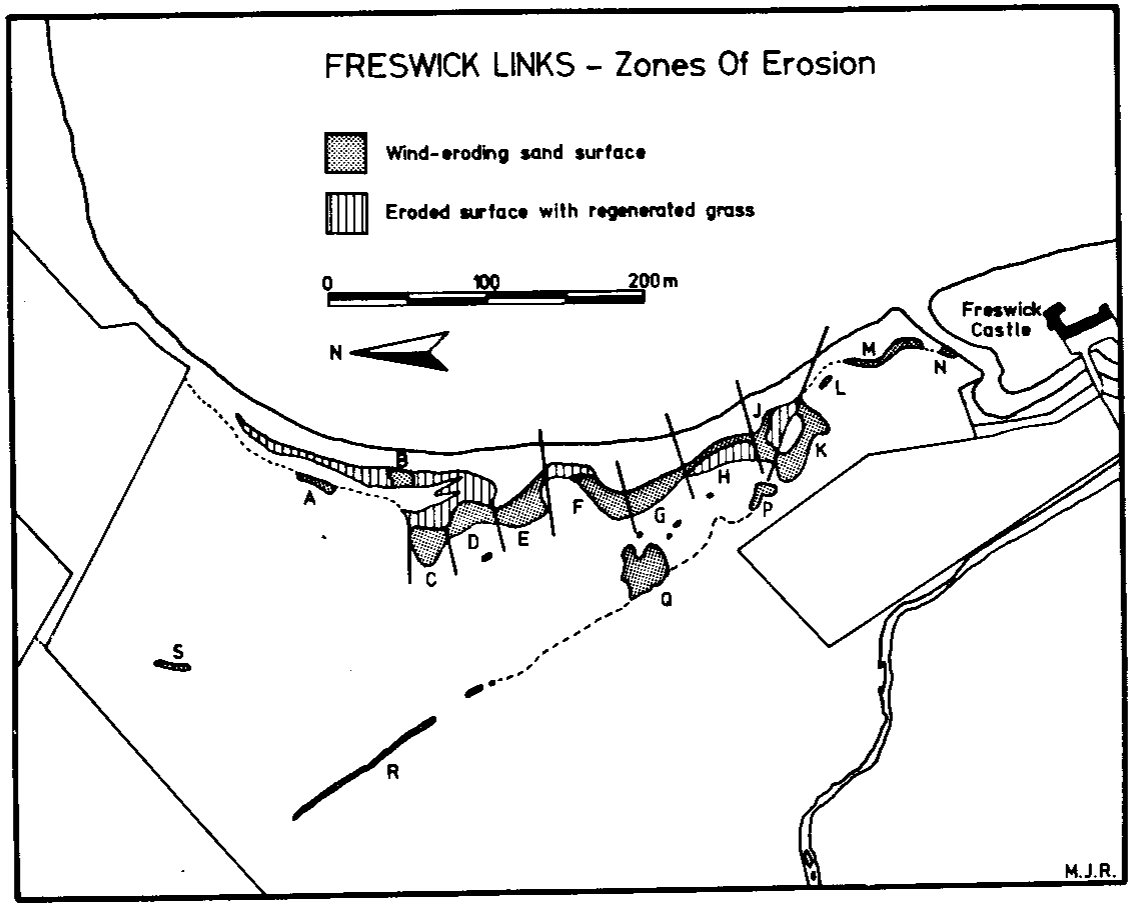

Figure 3. Freswick Links: zones of erosion (C. D. Morris & M. J. Rains; Crown Copyright).

The midden deposits

The previous excavations at Freswick, alluded to above, were carried out by F. Tress-Barry, A. J. H. Edwards, Curle and Childe (summarised in Batey 1982). These workers have variously noted or failed to note the presence of midden or vertebrate material. Edwards (1925; 1927), Curle (1939) and Childe (1943) all describe the occurrence of midden deposits on their excavations, sometimes noting deposits 'full of fish bones' or deposits of 'midden and fish bones' (Childe 1943, 10). Nevertheless the only environmental work carried out on these excavations was a short report by Margery Platt (Curle 1939, 109) identifying small mature ox, pony, dog, sheep, red deer, grey seal, pig, gannet, and cod collected during Curle's excavations of a number of Norse structures.

The midden deposits noticed recently are very extensive and likely to prove the most significant deposits at the site. Since methodical collection first began in 1978, they have yielded a large group of grass-tempered pottery similar to that from the Norse sites excavated in the 1930s and 1940s. The proximity of part of these extensive deposits to the latter excavations and the occurrence of the pottery indicates an association with the Norse settlement. The midden deposits lie in the top two metres of the sand dune terrace and extend for over 300 metres, being visible in the sand cliffs for much of the seaward side of the Links (Fig. 4). The eroding sections of the deposits show a very clear stratigraphy with a number of layers that can be traced for some metres; the total thickness of the deposits varies somewhat but is generally about 75 cm. Detailed examination of these is part of the major survey and excavation programme which began in 1980; measured drawings have been produced of all visible eroding sections in Zones C, D and E (Fig. 3). An indication of the nature of these deposits in the vicinity of Column 2 is given by Fig. 5 by way of example.

The sand cliff is eroding heavily in places and it is apparent that much of the midden has been lost. Material from the midden is disturbed and distributed over large areas of the sand-slip to the seaward side of the Links and also over areas on the landward side where rabbit activity and subsequent weathering are quite rapidly destroying substantial amounts of the remaining midden deposit. Although the actual landward extent is uncertain, the scale of this deposit is quite immense, and it would not be an overestimate to say that tonnes are eroding every year.

Pilot environmental sampling: column samples

The first sample column (1) for detailed biological analysis was collected in July 1979 with the object of assessing the potential in terms of environmental and economic information available from the middens. This material was analysed and reported on in time to initiate the survey and further sampling of the midden deposits in September 1979. The second column (2) was sampled then, recording the stratigraphy in more detail, and in order to test more adequately for the changes observed from the analysis of Column 1.

Both sample columns were designed to test the need for a detailed excavation and assist in the subsequent establishment of a structured sample design for the site as a whole. As a result, a comprehensive sampling strategy for the recovery of material from the eroding midden sections was established in 1980 (Batey et al. 1981; 1982; 1983). The amount of material deriving from this programme is very large and processing is expected to take some years. Since the results from the

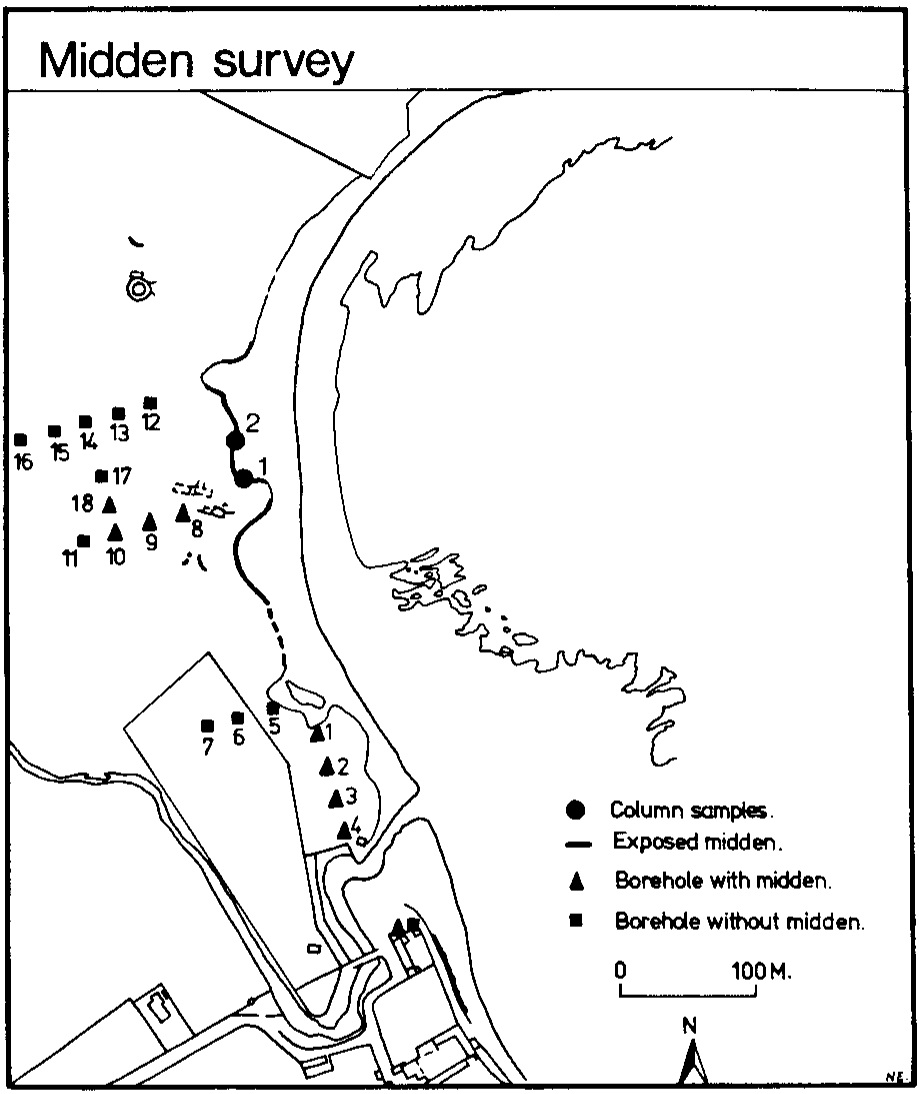

Figure 4. Freswick Links: 1979 Midden survey (D. J. Rackham & N. Emery; Crown Copyright).

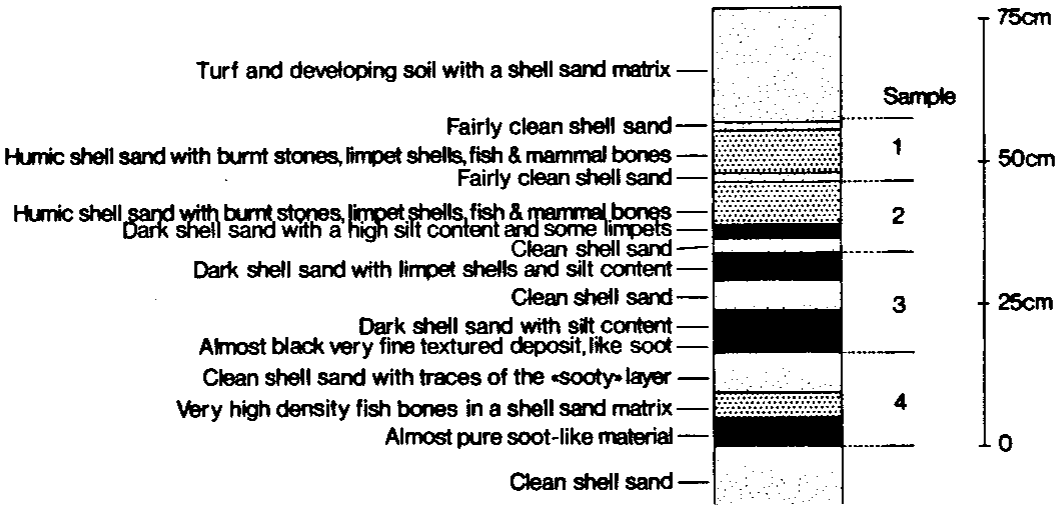

Figure 5. Diagrammatic section of sample column 1, showing position of samples (M. J. Rains; Crown Copyright).

column samples have some value as a pilot study of the site and its economy (Morris 1982, 75-7, 89) it has been decided to publish this environmental analysis in advance of the major study in which it would have no place. The results serve as a good indication of the desirability of such a pilot scheme as a forerunner of a major excavation project.

Sample Column 1

Sample Column 1 was taken from the cliff section (Figs. 3 and 4) in Zone E. The column was divided, somewhat arbitrarily, into four sub-samples vertically, and each comprised about 15 cm of the section at a point where the depth of the deposits was approximately 60 cm. There were varying characteristics plainly visible in the stratigraphy of the section that were confirmed when the samples were processed. Since only preliminary sampling was intended, limited field notes were taken from which the diagrammatic section (Fig. 5) was constructed.

A stratigraphy similar to that illustrated for the sample area was also observed in other parts of the exposed section. Modern roots had penetrated into the top layers of the midden and later processing of the samples indicated that some roots had penetrated through to the lower regions of the deposit. The sample column was 22.5 cm wide and cut 20 cm into the face.

Results (See Tables 3 and 4)

The samples are small, and it has been necessary to quantify the finds from the samples in terms of weight, because of the very fragmented state of some materials (such as the limpets Patella vulgata), and the scarcity of others. For samples of this size the relative weights may give a better indication of abundance than fragment counts or minimum numbers of individuals.

The samples were all wet-sieved through a series of sieves with diminishing mesh sizes of 3.35 mm, 1.0 mm and 0.6 mm apertures. Floating material was collected, as it washed over, in a 0.3 mm sieve. The floats were sorted under the microscope at a magnification of x16. The 3.35 mm and 1.0 mm fractions were dried and sorted for fish bones, carbonised cereal grains and other seeds. A portion only of the smallest fraction, 1.0 mm - 0.6 mm, was dry-sorted as a check against the loss of identifiable fragments of plant or animal through the 1.0 mm sieve.

Discussion

Table 3 (sample content) indicates more precisely the nature of the deposits in the midden. The abundance of stone in samples 1 and 2, much of which is scorched, along with the abundance of limpets, testifies to a difference in the origin of the material in comparison with the layers below or a change in the economy. The high density fish bone layer and the 'sooty' deposits did not occur in the upper half of the deposit.

The variety of identifiable remains from such small samples is encouraging, but the most abundant elements were limpet shells and fish bones (Table 4). These consisted of some hundreds of shells and bones from the column as a whole and particularly interesting was the great variation in proportions and numbers in each sample, bearing out the field observation at the time of collection. Fish remains are

	1	2	3	4
<0.6 mm fraction shell, sand + silt (wet)	7800	6030	6030	8280
1.0-0.6 mm shell sand, bone, shell etc.	786	482	899	2486
3.35-1.0 mm shell sand, bone, shell etc.	111	124	57.5	78
Stone fraction >3.35 mm	627	862	159	28.6
Limpet shells >3.35 mm	679	305	134	14.2
Other marine shells >3.35 mm	5.1	0.1	5.4	1.5
Crustacean remains >3.35 mm	0.5	1.3	0.1	0
Fish remains >1.0 mm	75.0	38.1	9.4	111.2
Mammal bone >3.35 mm	2.1	3.4	0.7	0.1
Bird eggshell >3.35 mm	<1.0	0	<1.0	0
Carbonised cereal grains and other seeds	<1.0	<1.0	<1.0	<1.0
Other burnt material >3.35 mm	12.8	3.6	4.0	0.1
Total weight (kg)	10.10	7.85	7.30	11.00

Table 3: Column 1, sample content (weight in grammes)

particularly numerous in sample 4 and certainly most of these derive from the horizon between 9 and 5 cm. Sample 3 produced few, then numbers increase in 2 and 1 corresponding with the midden layers between 46.5-39 cm and 55.5-48 cm. Changes in the abundance of fish species were also noted. Cod (Gadus morhua) predominated in 4 and 3, sample 2 produced haddock (Melanogrammus aeglefinus) as well as cod, but in the top sample (1) ling (Molva sp.) was the most abundant fish. The variation in abundance of limpet shells is also marked; a dramatic increase in weight and numbers occurs towards the top of the midden with limpet shells constituting as much as 6% by weight of the total sample in 1 in contrast to 0.13% in 4.

Apart from those fish noted in the table, a small flatfish (Pleuronectidae) is present, and saithe (Pollachius virens) is indicated by a single otolith. The bones of cod and ling all appear to derive from animals in excess of one metre long and the high density layer of fish bones (sample 4) suggests that the consumption of fish was a major facet of the economy at this period. A larger sample would give a much better indication of the range of fish species and their role in the economy.

Cereal grains, which are most abundant in the top sample (1), were examined by Alison M. Donaldson of Durham University, on whose work this paragraph is based. The barley grains are all hulled: in sample 1, six of the eight grains show marked asymmetry indicating a 6-row variety ('bere' is the only 6-row variety remaining in cultivation today, all the others being 2-row, with nearly all symmetrical grains). A larger sample would be needed to ascertain the proportion of asymmetrical grains in the lower samples. The absence of oats in the lower samples cannot support comment in such a small sample, but the evidence from Orkney suggests that oats is a later introduction (Donaldson, in prep.). All the wild plant taxa represented are referable either to a heathland/bog community or to a dune grassland or similar community of disturbed or unstable ground. A few species may have been weeds of arable land but none is restricted to such a habitat. Recent excavations have exposed evidence of possible cultivation marks buried in the dunes (Batey et al. 1982, 55-6; 1983, 53).

	1	2	3	4
Mammal:				
Large ungulate indet	1	-	-	-
Large mammal indet	-	1	-	-
Medium mammal indet	-	-	1	-
Homo sapiens L. man	-	1	-	-
Fish:				
Gadus morhua L. cod	6	6	3	8
Melanogrammus aeglefinus (L.) haddock	-	1	-	-
Molva molva (L.) ling	6	-	-	-
Pollachius virens (L.) saithe	-	1	-	-
gadoid spp.	4	2	-	12
Flatfish indet.	1	-	-	-
Fish indet.	100+	100+	50+	100+
Shellfish:				
Crustacean crab indet.	*	*	*	-
Patella vulgata L. limpet	163	65	25	3
Littorina littorea (L.) periwinkle	1	-	1	-
Plant remains (carbonised):				
Avena sativa oats (charred caryopses)	31	2	-	-
Hordeum sp. barley (charred caryopses)	8	-	1	2
Atriplex sp. orache (seed)	-	1	-	-
Calluna vulgaris (L.) Hull heather (leaves and flowers)	abund	-	-	abund
Carex spp. sedges (nutlets)	2	4	-	-
Chenopodium album L. fat hen (seeds)	1	2	-	-
Empetrum nigrum L. crowberry (seed)	-	-	1	-
Euphorbia sp. spurge (seed)	-	1	-	-
Gramineae spp. grasses (caryopses)	3	-	-	-
Stellaria media (L.) Vill. chickweed (seeds)	6	6	-	-
Viola sp. violet (seed)	-	1	-	-

* = present

Table 4: Column 1, species list. Bones are recorded by number of fragments, shells by number of individuals and plants by number of items, i.e. whole seeds, per sample.

Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sample volume (litres)	5.77	5.5	4.0	6.2	6.06	5.7	6.38	2.08	6.95	0.93	5.78	6.68	4.44	1.46	4.69
Sub-sample retained (litres)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.3	0.2	0	0.3	0.3	0.2	0.3
Volume processed (litres)	5.47	5.2	3.7	5.9	5.76	5.4	6.08	1.88	6.65	0.73	5.78	6.38	4.14	1.26	4.39
Stone volume (litres)	0.04	0.57	0.1	0.3	0.46	0.68	1.89	0.33	0.7	0.1	0.97	2.98	1.03	0.1	0
Residues:															
0.5-0.85 mm fraction (litres)	1.45	0.92	0.51	0.33	0.16	0.22	0.41	0.3	0.62	0.2	0.42	0.1	0.3	0.2	1.56
0.85-2.0 mm fraction (litres)	0.03	0.04	0.02	0.07	0.02	0.02	0.02	0.01	0.05	0.01	0.03	0.02	0.04	0.02	0.02
>2.0 mm fraction (litres)	0.01	0.06	0.03	0.03	0.06	0.04	0.04	0.01	0.06	0.01	0.09	0.08	0.07	0.01	0.01
Sorted material:															
Mollusc shells (g)	8.5	83.5	61.0	90.0	7.0	89.5	36.0	<1.0	74.0	23.5	146.0	249.0	579.0	10.0	21.0
Fish bone (g)	2.5	22.0	35.0	144.0	42.0	56.0	67.0	2.0	77.0	12.0	70.0	62.0	84.0	3.3	5.0
Crustacean (g)	0	<1.0	0	<1.0	<1.0	<1.0	0	0	<1.0	<1.0	2.0	21.5	72.0	<1.0	<1.0
Other bone, eggshell, carbonised material etc. (g)	<1.0	3.5	18.0	7.0	45.0	30.0	9.0	1.0	25.5	<1.0	11.5	2.0	2.5	0	0

Table 5. Column 2: Sample content.

The remaining sources of evidence for the economy and environment of the site are not sufficiently numerous for discussion. The weathered-out midden material at the base of the cliffs was observed to contain large numbers of mammal bones, and ox, pig, and sheep were identified among these remains along with some bones of wild bird species.

The evidence from the visible stratigraphy and the results of the analysis of these small samples show that there were major changes in the material being deposited in the middens, no doubt associated with the development of the adjacent settlement. It would be unrealistic from the evidence presented here to make any assessment in economic terms of these changes, which could well be spatial and behavioural rather than economic. However, given the extreme paucity of information relating to the economy and environment of the settlement excavated by Curle and Childe (see below) the importance of these preliminary samples is to show that such evidence is present in abundance and ideally suited to a detailed recovery programme.

Sample Column 2

In the light of the dramatic variations between the proportions of different species in each sub-sample of Column 1, it was decided, in taking a second column sample, to ensure that sub-samples were from each clearly defined stratigraphical context. Column 2 was taken in Zone D some metres north of the position of sample Column 1 (Fig. 4). Fifteen samples were taken from a column 1.5 m high, 0.45 m wide and 0.30 m deep.

The stratigraphy of the section was recorded and sampling confined where possible to individual horizons. Owing to the collapse of part of the cliff section between Column 1 and Column 2 no stratigraphic link could be made but a possible relationship is offered in the discussion below. The stratigraphy and samples are illustrated in Fig. 7.

The sampling ceased at a level equivalent to Column 1. The samples were processed in the same manner as those from sample Column 1 but recorded in terms of volume and weight. The sieve sizes were 2.00 mm, 0.85 mm and 0.50 mm mesh. The sizes were changed from those used for Column 1 because the 0.85 mm mesh was viewed as a more efficient size for the recovery of identifiable remains and the 0.30 mm mesh appeared unnecessarily small.

The samples again showed a wide variation in the number and type of inclusions within them. Samples 7, 12 and 13 had a very high stone content. The bulk of the material in the samples passed through the 0.50 mm sieve, those samples with a high shell sand content leaving the most residue on this sieve (Table 5).

Results (see Tables 5 and 6)

In common with the finds from Column 1, the most abundant remains in Column 2 are fish bones and molluscs and again the relative abundance of all the finds changes significantly from sample to sample.

Starting at the base of the section, sample 13 represents the first major layer of the midden and contains abundant fish remains (including an almost solid layer of fish), a relatively large number of limpets (34/litre of sample), and the largest sample of fragmented crustacean exoskeletons from the section. Samples 11 and 12 are of similar character but with a diminishing proportion of all of these groups (10 limpets/litre in 12 and 5.5/litre in 11; see Table 6). The relatively unproductive samples, 8 and 10 coincide with small phases of sand blow (Fig. 7) which divide the midden layers (i.e. samples 7, 9 and 11).

The upper half of the deposits are dominated by a layer that is represented by samples 3, 4, 5 and 6. These again show a high number of finds but in contrast to the lower layers shells are infrequent (4.5 limpets/litre) and crustacean remains almost absent. Mammal bone fragments have become more common, although still infrequent, but fish bones remain dominant in the samples.

Discussion

The fish bones have been analysed in greater detail than the other remains since they were more abundant. The principal aim of the present investigation is to identify the different kinds of fish present in the deposits. In addition, the size of the whole fishes has been estimated for the abundant species. Fish remains have been identified by comparing ancient specimens with modern reference material in the Environmental Archaeology Unit, University of York.

Many of the large number of bones in a fish skeleton cannot be identified to species. Fin rays, ribs and branchiostegial rays do not possess sufficient characters to allow specific determinations. Furthermore, fish bone is not as robust as bird or mammal bone and tends to break into many tiny fragments. As a result a large number of bones and fragments cannot be identified (see Table 6), others can only be assigned to family and a relatively small proportion may be determined to species. Most effort has been directed towards identifying characteristic remains such as otoliths, jaw bones and dermal structures. Where possible other head bones, for instance angular-articulars and post-temporals, have been considered. Vertebral centra have mainly been determined to family while a few have been assigned to species and a small number left unidentified. It is likely that, as work on the more recently collected samples proceeds, the range of bones identified and the numbers of fish species will increase.

Once identified, an attempt has been made to estimate the size of the whole fishes represented in a sample. This has been done for the most abundant species: cod, saithe and ling. The estimate was arrived at by comparing the identified bones with small, medium and large reference skeletons of the species. This rather inaccurate method does show roughly the size structure of the assemblages. Table 7 gives the approximate figures for the total length in centimetres of the three commonest taxa when divided into size classes of small, medium and large.

Two of the more interesting features of the fish remains recovered from these midden deposits are the astonishingly good condition of the bone and the great variety of skeletal elements. Clearly the depositional environment, an accumulating midden and sand dune, has done

much to preserve the bone from mechanical damage. The alkaline nature of the sand, resulting from the presence of marine mollusc shell fragments, has also assisted in preserving the bones. Fish scales, tiny fragile bones and otoliths are all very well preserved. There is some evidence for mechanical damage to bones and some otoliths are broken; however, when samples are compared to similar material from the adjacent site at Freswick Castle the excellent condition of the remains becomes apparent.

The number of identified fragments of each species is listed in Table 4 and the minimum number of individuals (calculated by taking all the bones of one size class for each species and determining the minimum number of whole fish necessary to account for those bones) and the size classes of the three commonest species are tabulated in Table 8. The remaining species identified from the samples all occurred at minimum numbers of one.

Perhaps the most obvious result to emerge from this investigation was the dominance of three members of the cod family: cod, saithe and ling. Other species were present as a single individual per sample, represented by six or less bones. While a small number of other gadids may be present in the deposits, the largest part of the bones identified as Gadidae are vertebrae from either cod or saithe.

As important as the kinds of fish present is the absence or paucity of a large number of species which live in the coastal waters of Caithness. No species of cartilaginous fishes (sharks, dogfish and rays - Elasmobranchii) have been identified. Herring (Clupea harengus) was represented by a single bone, while mackerel (Scomber scombrus) was absent. These fish are valuable food species occurring locally today in large numbers.

There appears to have been very little change in the number of species occurring in the samples as the deposits were laid down. Moreover, within each species, the size classes of the fish do not appear to have altered significantly (although there are more small saithe in the lower samples). However, only a small amount of the midden has been examined, and the results have reinforced the need for more extensive investigation. Other minor differences between the upper and lower midden can be pointed out. The upper has gurnard (Trigla sp.), while the lower has sprat (Sprattus sprattus) and lumpsucker (Cyclopterus lumpus), sprat bones being abundant in samples 12 and 13, present in 9 and 11, but absent in the samples above these.

From the evidence available from this pilot investigation, it seems likely that a fishery specializing in the capture of large cod and ling in addition to saithe of all sizes was operating at the time the deposits were forming. Occasionally, the remains of other fish (herring, eel (Anguilla anguilla), haddock, whiting (Merlangius merlangius), lumpsucker and flatfish) were also discarded. While the majority of these less important species were probably incidental catches, some may have arrived on the site within the guts of the large food fish. It is also possible that some of the less common fish remains entered the deposits in other ways; for example, small bones washed up on the strand line may have been swept up by the wind, or seabirds and other scavengers may have collected stranded fish from the shore and deposited them on the midden.

Sample	1	2	3	4	5
Mammal:					
Ox	-	(1)	-	2	-
Sheep or goat	-	-	-	(1)	-
Large ungulate	-	-	-	-	1
Small ungulate	-	-	-	1	-
Large animal	-	-	1	-	+
Medium animal	-	-	-	-	+
Mammal bone indet.	-	+	+	-	-
Antler fragment	-	-	-	-	-
House mouse Mus musculus L.	-	-	1	-	-
Wood mouse Apodemus sylvaticus L.	-	-	-	-	(2)
Rodent indet.	-	-	1	-	-
Small mammal indet.	-	-	1	2	2
Bird:					
Fowl Gallus sp.	-	-	1	1	3
Bird indet.	-	-	2	1	1
Bird eggshell indet.	-	-	-	+	+
Fish:					
Sprat Sprattus sprattus L.	-	-	-	-	-
Herring Clupea harengus L.	-	-	-	1	-
Eel Anguilla anguilla (L.)	-	-	-	1	-
Cod family Gadidae indet.	2	8	11	31	9
Cod Gadus morhua L.	-	-	3	2	3
Haddock Melanogrammus aeglifinus (L.)	-	1	-	-	-
Whiting Merlangius merlangius (L.)	-	1	-	-	-
Saithe Pollachius virens (L.)	-	11	10	10	4
Ling Molva cf. molva (L.)	1	-	2	2	3
Gurnard family Triglidae	1	1	-	1	1
Lumpsucker Cyclopterus lumpus L.	-	-	-	-	-
Flatfish Pleuronectidae	-	-	-	-	-
Fish indet.	40+	100+	100+	100+	100+
Molluscs:					
Limpet Patella vulgata L.	1+	21+	13+	26+	1
Periwinkle Littorina littorea (L.)	-	3+	4	6+	+
Rough winkle Littorina saxatilis (Olivi)	1	-	-	-	-
Flat winkle Littorina littoralis (L.)	-	1	-	-	-
Dog whelk Nucellus lapillus (L.)	-	-	-	-	-
Mussel Mytilus edulis L.	(1)	-	-	-	-
Crustaceans:					
Crab? indet. claw fragments	-	3	-	3	2
Edible crab Cancer pagurus L.	-	-	-	-	-
Barnacle sp. indet.	-	-	-	-	-
Plant remains:					
Barley Hordeum sp.	-	-	1	5	-
Oats Avena sp.	-	-	-	-	1
Knotgrass Polygonum aviculare L.	-	-	-	-	-
Gramineae indet. caryopses	-	-	-	-	-
Carbonised rootlets indet.	-	-	-	+	-
Bladderwrack cf. Fucus sp.	-	-	-	-	-
Burnt peat/wood peat	-	-	+	+	-

+ present ++ common ( ) comparable with

Table 6. Column 2: Species list. Remains recorded in the same way as in Table 4.

6	7	8	9	10	11	12	13	14	15
4	1	-	3	-	1	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
1	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
+	+	-	2	-	1	-	+	+	-
-	2	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	1	-	2	-	-	-	-
-	-	-	-	-	-	-	-	-	-
1	-	-	-	-	-	-	-	-	-
+	+	-	+	+	++	+	+	-	-
-	-	-	-	10	-	1	100+	21	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
11	16	-	13	8	3	13	1	3	-
1	3	-	4	2	2	2	4	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
4	1	-	8	6	85	53	3	1	-
7	3	-	5	-	8	10	3	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	2	-	-	-	-
-	-	-	-	3	-	-	-	-	-
100+	100+	24	100+	50+	100+	100+	100+	40+	50+
32+	2+	1	22+	6+	32+	61+	141+	3+	2+
3+	7+	-	+	+	2+	-	-	+	1
-	-	-	-	-	5	-	-	-	1
-	-	-	-	-	5	5	1	-	-
-	-	-	-	-	-	-	1	-	-
-	-	-	-	1	-	-	-	(1)	-
1	-	-	4	1	30+	100+	200+	5	2
-	-	-	-	-	-	3	6	-	-
-	-	-	-	-	+	+	-	+	+
2(1)	(1)	-	3	-	3	2(2)	-	-	-
(1)	(1)	-	-	-	8	15	-	-	-
-	-	-	-	-	1	-	-	-	-
-	-	-	-	-	+	-	-	-	-
+	-	-	-	-	-	-	-	-	-
-	-	-	-	-	+	-	-	-	-
-	-	-	-	-	-	-	-	-	-

FRESWICK LINKS 1980 · Zone D, cliff section.

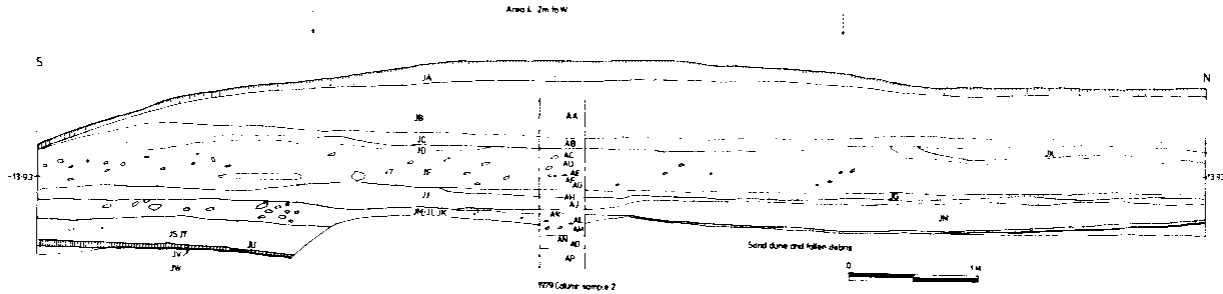

Figure 6. Section of eroding cliff and sample column 2. Letters refer to site recording codes for individual horizons (K. F. King, C. E. Batey & N. Emery; Crown Copyright).

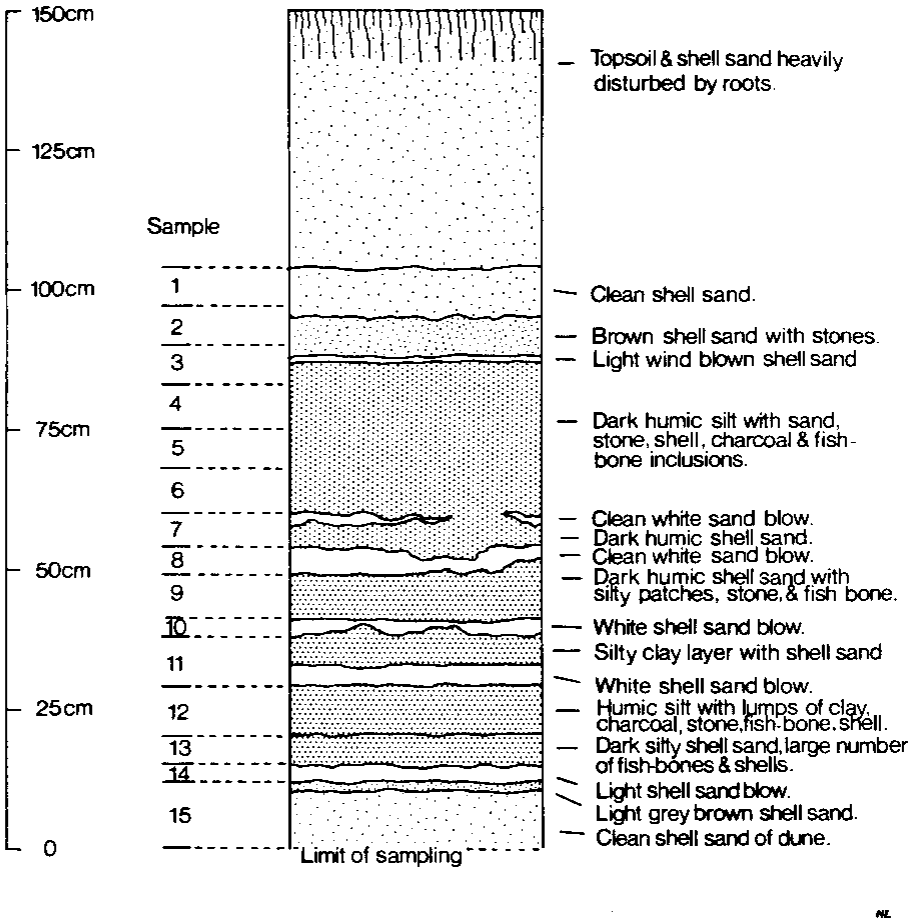

Figure 7. Freswick Links: Detailed drawing of sample column 2 with individual horizons and samples taken (D. J. Rackham & N. Emery; Crown Copyright).

	cod	saithe	ling
Small (s)	0-40	0-30	0-50
Medium (m)	40-80	30-60	50-100
Large (l)	80+	60+	100+

Table 7. Size classes of fish used in this work. Measurements are in centimetres.

	cod			saithe			ling		
	l	m	s	l	m	s	l	m	s
Sample									
1	-	-	-	-	-	-	1	-	-
2	-	-	-	1	-	1	-	-	-
3	1	1	-	-	1	1	1	1	-
4	1	1	-	1	2	1	1	1	-
5	1	1/m	-	-	1	-	1	-	-
6	1	-	-	-	1	1	1	-	-
7	1	-	-	-	1	-	1	-	-
8	-	-	-	-	-	-	-	-	-
9	2	-	-	-	2	4	1	-	-
10	-	2	-	-	1	-	-	-	-
11	1	1	-	-	1	3	1	-	-
12	1	-	-	-	-	2	1	-	-
13	2	-	-	-	1	1	1	2	-
14	-	-	-	-	1	-	-	-	-

Table 8. Minimum numbers and size classes of the three major fish species.

Sample	ppm	Context
1	344	Buried stabilised dune surface, N of Zone A
2	380	Clean dune sand above sample 1
3	556	Very thin midden-like layer in sand matrix, N end Zone C
4	488	Dune sand above sample 3
5A (81cms below turf)	576	Stratified layers of midden and sand blow, N end Zone D
5B (74cms)	840	
5C (71cms)	604	
5D (67cms)	544	
5E (64cms)	2688	
5F (60cms)	680	
5G (56cms)	848	
5H (46cms)	976	
5I (38cms)	2280	
5J (35cms)	1088	
5K (32cms)	2416	
5L	5152	Midden layer stratigraphically above 5K
5M	4800	Midden layer stratigraphically above 5L
5N	952	Sand above 5M
6A (81cms below top)	2032	Stratified layers adjacent to Column 2, S end of Zone D
6B (62cms)	3392	
6C (40cms)	3808	
6D (1cm)	3680	
7A (bottom layer)	896	Very sandy midden, N end of Zone F
7B (midden)	1304	
7C (midden)	1824	
7D (top layer)	2352	Top layer of midden below turf line

Table 9. Acid-extractable phosphate data (from a report by M. J. Alexander). Samples 5L-N were taken 2 metres further N, owing to turf overhang.

The other remains identified from the samples do not justify lengthy discussion. Mammal bones are uncommon, although they are more frequent in the upper half of the deposits than the lower. Birds are represented by bones of the domestic fowl, and the eggshell fragments recovered are similar to those of Gallus.

Variation in abundance of the molluscs has already been noted. There seems to have been strong selection in favour of limpets, and apart from periwinkle (Littorina littorea) the other species may almost be incidental. Only the edible crab (Cancer pagurus) has been identified from the crustacean remains, which occur in the greatest abundance in samples 12 and 13. The barnacle (Balanus and Chthalamus spp.) fragments are small and are probably a component of the shell sand.

The samples in this column have a lower number of identified plant remains than those from Column 1, and a concentration of the cereal remains in samples 12 and 13.

Despite the collapse of part of the thirty or more metres of section between the columns, initial study of the stratigraphy of the sand cliff suggests that much of Column 2 may post-date the deposits in Column 1. Further work may shed light on this.

Phosphate Survey

Introduction

Seven groups of samples were taken from coastal locations for analysis. The intention was to test the potential value of a phosphate survey on the Links. Fig. 8 shows the location of the samples and Table 9 the results.

Discussion

A number of tentative conclusions can be made concerning the results of the survey. Samples with a concentration of less than 1000 ppm phosphate probably represent the background level of the natural soil. The remaining samples - and certainly those with over 2000 ppm - strongly suggest that phosphate was added in some way. Although older layers might contain residual phosphate from the weathering of shells, random tests with hydrochloric acid suggested that all samples reacted similarly and that shell content was uniform and independent of age. All the samples with a concentration of more than 1000 ppm came from definite midden horizons. Preliminary examination of those with concentrations of about 2500 ppm shows them to be very humose, and those with concentrations over 1000 ppm all contain visible organic matter. There is appreciable variation even within the midden layers, and samples 5L and 5M show remarkably high levels of phosphate.

It is clear that the uneroded middens contain high levels of additional phosphate and are very humose. However, although the technique picks out the organic-rich midden, this appears to be as easily recognized by texture and colour. Thus the auger survey seems to be a more immediate way of determining the nature and lateral extent of the midden deposits.

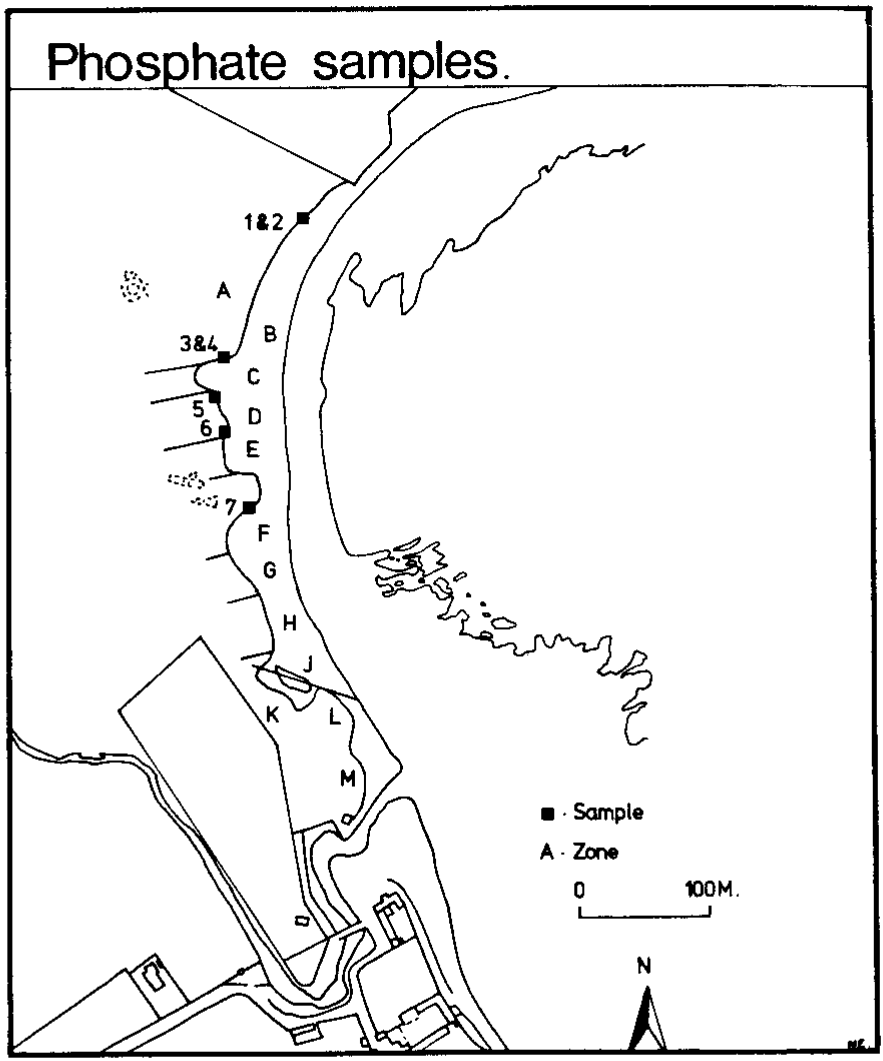

Figure 8. Freswick Links: 1979 Phosphate survey. Sample locations in relation top zones of erosion (D. J. Rackham & N. Emery; Crown Copyright).

The object of this survey was to ascertain the westward extent of the midden deposits visible in the sand cliffs. Initially, the in situ deposits of the midden, both along the cliff edge and in areas inland where they had been exposed by erosion, were plotted on a 1:2500 map showing the present position of the sand cliff. Derived midden material lying on the sand was not recorded, since in most of these locations the actual midden deposits had already weathered out. In order to determine the inland extent of the midden deposits a screw auger was used, sampling to a depth of over two metres in some borings. All midden deposits in the cliff section occurred in the top two metres and augering to a greater depth was considered unnecessary. When possible, auger points on the Links were placed on a main north-south survey line and on three subsidiary westerly lines at right angles to the main one. The distribution of midden material, recognized by texture, colour and inclusions, in the auger holes is indicated on Figs. 4 and 9.

Results

Four localities on the Links were examined: borings 1-4, on a north-south transect, sampled the southern area; borings 5-7, on an east-west transect, investigated the area in the vicinity of Zones K and P; borings 8-11, a westerly transect on the landward side of the area excavated by Curle, tested the extent of the midden readily observable in Zones E and F and recorded in his excavations; and borings 12-16 sampled the area west of Zone C. As the the last five were negative, two further borings, 17 and 18, were made to link the two westerly transects to gauge the northerly extent of the surviving midden deposits.

Augering was not carried out further north. There was no midden in the cliff section more than 25 metres north of the line of the third east-west transect and, apart from a midden deposit in a dune section about 1.5 metres above the surrounding ground surface immediately north of the broch site, there was little evidence of midden in this area - merely some sparse weathered-out material. The borings on the third transect tend to support the hypothesis that the midden north of this line, even where once present, has almost entirely eroded away, leaving only the small dune north of the possible broch site. This suggests the loss of a large part of the Norse period land surface.

Discussion

The evidence from augering indicates that midden deposits are preserved intact in parts of the southern half of the Links. The northern area, apart from one small section in a raised dune, appears to be barren. However, it is known from excavation that material is buried under the high dunes of Lady's Brow, even though none was visible on the surface in 1979 (Zone S; Batey et al. 1982, 56-7, Area 9). If the exposed section of midden north of the putative broch is of Norse age, it would suggest that at that time the broch would have been covered by dune sand to its present surviving height and that the general ground level must have been over a metre higher than at present in this area.

In the southerly area of the Links, the midden appears to be concentrated towards the seaward side, only being revealed in the first four auger holes. The dip slope behind the cliff edge in this area may have been caused by erosion which would have limited the landward extent. Recent evidence from Areas 11-14 suggests that the dune surface itself was cultivated, though this use is stratigraphically earlier than the midden deposits (Batey et al. 1983, 53).

The most extensive areas of midden occur to the west of that area of cliff where midden is visible. This is the central part of the Links and the midden extends for up to 100 metres inland in this region. There is evidence from the borings that the thickness of the midden decreases inland. The midden material in boring 18 was only a few centimetres thick, and at a depth of about 126 cm. The exposure of midden at the landward edge of the Links 25 m south of the second transect is very thin and may be the lowest layer of a midden already largely eroded from this area. North and north-east of here, in the cliff area and inland around the buildings excavated by Curle, is the area of surviving midden with the greatest depth of deposits. In this region the deposits are covered by 50 cm or more of wind-blown shell sand. A more extensive auger survey in conjunction with ground survey transects at regular intervals across the Links should enable a fairly accurate estimate of the depth, thickness and extent of these deposits and some indication of their stratigraphy over wide areas.

Conclusions

The environmental information from earlier excavations does not greatly assist modern consideration of the site. However, the fact that the deposits were thought worthy of note is important. The fish-rich midden recorded by Childe is of particular interest because it is probably recognizable on the site today in the eroded section of the sand cliff in Zone D (see above, Column 2). The site of Childe's excavations no longer exists but, from examination of the photographs in the National Monuments Record of Scotland, it seems to have been in the locality of the spur at the south of Zone D as designated in 1979 (see Fig. 3).

The results of the analysis of the information collected during the pilot survey indicates that the size of the settlement, in terms of buildings and associated occupation and midden deposits, is considerably greater than was evident from the buildings uncovered by Curle and Childe and suggests a settlement of some size and importance. The environmental samples, while not of sufficient size to give detailed conclusions, give a broad and useful guide to the economy of the site, which is not furnished by the extensive excavations of Curle and Childe. It is apparent that agriculture and animal husbandry were components of the subsistence economy of the site with oats and barley being grown and cattle, sheep and pigs kept. However, the marine resources appear to have been exploited far beyond the level hitherto recorded from coastal Norse settlements, but as indicated below, more recent work at Birsay, Orkney, and Sandwick, Shetland, reflect similar levels of exploitation. It appears that fishing may have been a major component of the economy of the site - an aspect that the earlier excavators completely failed to note.

The work in 1979 has been both at a specific and a general level. The auger and phosphate surveys were exercises to gain a broad conception of the nature and potential of deposits over a wide area. They have indicated that the extent of the site is very large. The sample columns have demonstrated the richness of environmental data available for analysis alongside more conventional archaeological data at this site. The pilot survey of the erosion zones (Batey et al. 1981, 3-8) and the analysis detailed above indicated the necessity and potential for a major project at the site. They have also indicated the potential for the analysis of spatial and economic changes in these middens associated with the late Norse settlement.

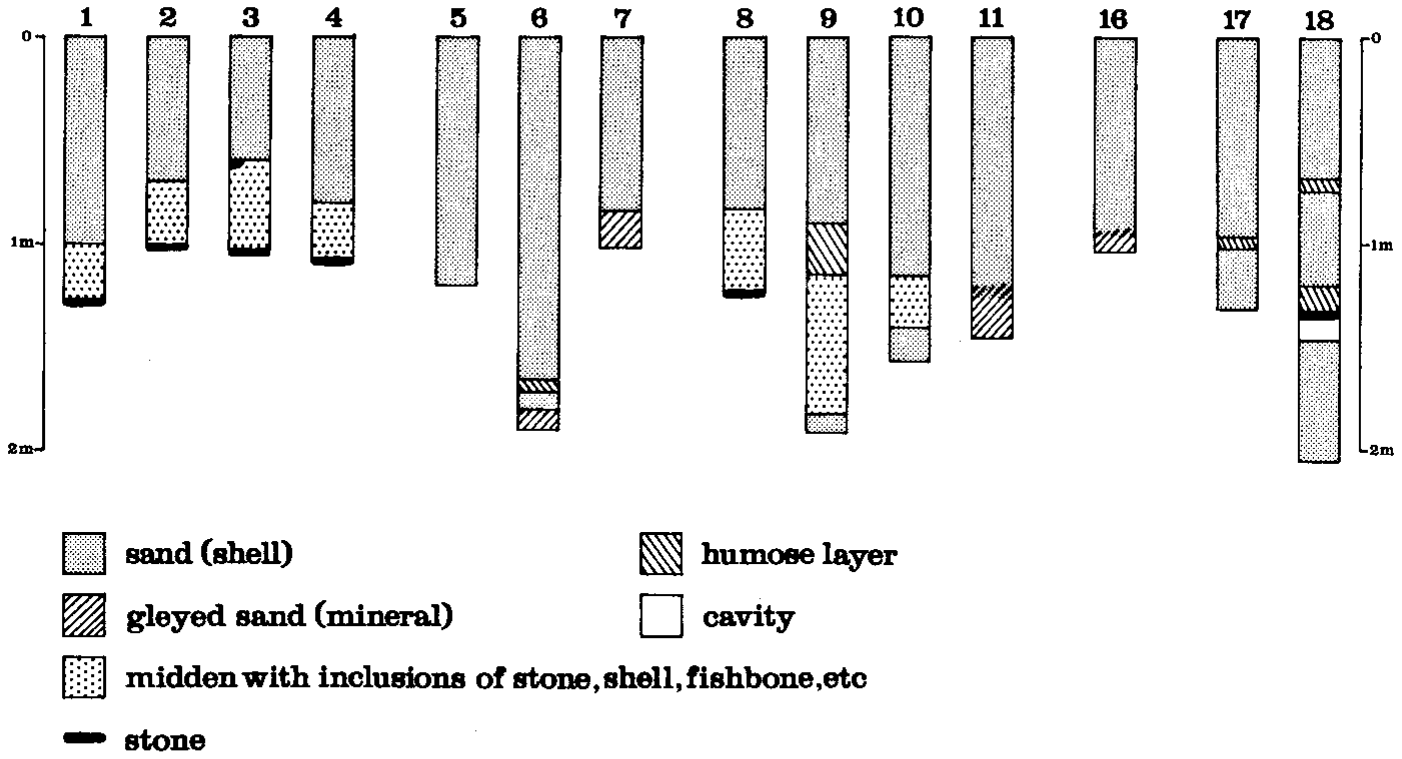

Figure 9. Freswick Links: Auger survey results (D. J. Rackham & M. J. Rains; Crown Copyright).

While many of the remains identified from the samples discussed above give limited environmental and economic information, the results have formed the basis of the sampling strategies that have been employed on the recent Freswick excavations (Jones et al. 1983). These are such that all the classes of material already identified will be represented by sufficient sample sizes for a detailed analysis of each and of their relative contributions to the site economy. This will be particularly important in a consideration of the agricultural activities at the site and their relation to fishing and other exploitation of marine resources. In particular, it is likely that details of the fishing techniques used and locations exploited will become evident. In addition, information concerning fish processing and carcass treatment will be available from detailed studies of the bones.

The general results of the analysis of these samples from Freswick Links can be compared with recent work on the Norse sites at Sandwick, Shetland and Birsay, Orkney. Excavations at both of these sites have incorporated similar intensive environmental analyses to those currently being conducted at Freswick. All three sites are coastal and preliminary results indicate extensive exploitation of marine resources. The material reported from excavations at Buckquoy, Birsay (Ritchie 1977) and that from Room 5 on the Brough of Birsay (Seller 1982) shows an increasing exploitation of cod and other gadid fish in the Norse period. The latter phases at these sites were very significantly more productive of fish and shellfish, but at Buckquoy mammal bone far outweighed the fish remains as was the case, to a lesser degree, at Room 5. On the late Norse site at Sandwick (Bigelow, forthcoming) the overwhelming dominance of fish material among the bones and the abundance of shellfish is similar to the pattern reported here for Freswick. Bigelow reports that small saithe are by far the most numerous at this site and at Freswick the preliminary evidence presented here suggests a similar situation, although large ling and cod may well be the most important species. Preliminary analyses of samples from the late Norse site at Beach View, Birsay (Donaldson et al. 1981) has also indicated that large cod and ling are abundant. Bigelow reports hulled barley and oats from Sandwick; these are cereals also found at a number of Birsay sites (ibid.) and at Freswick. With the analyses of the large quantities of environmental and artefactual material from these excavations in hand, we can expect our knowledge of the economies of these Norse sites in Northern Scotland and the Northern Isles to increase appreciably in the next few years. The potential of the results from this and more recent work, such as that at the Norse site of Tuquoy, Westray (Owen 1982), makes further work at Freswick an exciting prospect.

Acknowledgements

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column samples by Anthony Curtis and Bruce Lamden. We are grateful to Gerald Bigelow for providing a copy of his paper on Sandwick prior to publication, and to Olwyn Owen for a copy of her interim report. Thanks are due also to Diana Reynolds for assistance with photographs of Professor Childe's excavation. We wish to thank those responsible, as indicated in the captions, for drafting and for production of the photographic work we thank Messrs T. Middlemass and T. Woods of the Department of Archaeology, University of Durham.

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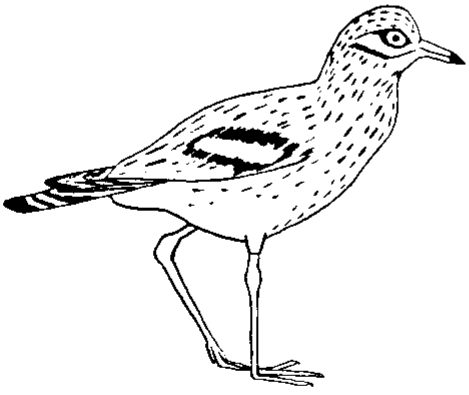
The Inside Back Page

The Editors of this worthy journal inform me that there has been a degree of curiosity as to the origin of the nom de plume (more correctly nom d'Olivetti) under which this page appears. The name, of course, derives from Burhinus oedicnemus (L.), the stone curlew, and this seemed to be an opportunity to acquaint the Circaea readership with a little of the natural history of this estimable bird.

The stone curlew is the only European species of the nine which make up the family Burhinidae. Collectively the family is often known as the thick-knees, an apellation which shows ornithologists to be anatomical charlatans, incapable of distinguishing a bird's knee from its ankle. B. oedicnemus is to be found in the warmer and drier parts of England, principally on the chalklands from Salisbury Plain to the Norfolk Breckland. Here they live a rather uninteresting existence, not even bothering to build a nest but laying two or three eggs straight onto the stony ground. They are furtive birds, much given to evading notice by crouching among the sparse herbage. In this position the stone curlew much resembles a rabbit, albeit one with a beak, which deception must afford the bird rather questionable protection from passing predators. This probably explains why stone curlews are uncommon, and extremely shy.

Stone curlews reached the minor headlines of the press a couple of years ago when one which had strayed into East Sussex was shot and consumed. The felony came to light when an ornithologically-inclined neighbour recognised a pathetic pair of feet protruding from a dustbin. Those who had shot the bird were very apologetic, explaining that it had tasted excellent, and that they had taken it for a duck. As the accompanying illustrations clearly show, the confusion is easily made.



Such, then, is Burhinus oedicnemus, one of the minor backwaters of the British avifauna. You may ask why this recondite, swollen-jointed dweller in chalky places came to be used as a literary logo. There is no single reason: suffice it to say that any species which can number among its folk-names such gems as long-legged peewit and goggle-eyed plover deserves a wider public awareness.

Burhinus