

ERAS

EAST RIDING ARCHAEOLOGICAL SOCIETY

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AUGUST 1996

Easington Barrow

Roman Kiln Excavation

Hayton 1996

Lecturers for 1996/7

*Memories of a
Scottish Excursion*

*Coin Hoards
of the Civil War*

*Ancient DNA:
Using Molecular Biology*

Diary Dates



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Your new membership card will be enclosed with this newsletter and I can see that Peter Halkon has brought together an inviting mixture of subjects and speakers. He has also provided a brief run-down on the speakers and their subjects (see page 5). Some members have expressed disquiet about walking through dark areas in the town to the Old Grammar School venue, though personally I feel safer there than I would in the very 'boisterous' areas of town near the bus station. Certainly, though, parking can be a problem and I have been asked to remind you that parking in the Market Square is illegal and you run the risk of a parking ticket there. One nearby carpark that has been suggested is the other side of Castle Street (the dual carriageway) which is well-lit.

For those wanting to learn more about archaeology this winter there are at least five courses listed in Hull University's Continuing Education Prospectus. Their two-year part-time Certificate in Archaeology course also has a new intake this autumn. Copies of the prospectus can be obtained from the:

Centre for Continuing Education, Development and
Training
University of Hull
FREEPOST
Hull, HU6 72X
or telephone: 01482 465415

There seems to have been more archaeology than usual in my daily paper this summer - fish bones from a medieval site in Dover, the search for a lead casket (claimed to contain the heart of Robert the Bruce) during excavations at Melrose Abbey, the discovery of a barbican during the excavation of the moat of the Tower of London and so on. Our own area has seen plenty of activity, plus chances for ERAS members to participate. Martin Millet, Peter Halkon and others have been busy during another season of excavation at Hayton (see below) and, just when you thought it was safe to go on holiday, a Roman pottery kiln turned up at Tollingham, near Holme on Spalding Moor, where it was excavated at short notice by Rodney Mackey with assistance from a number of hastily-assembled ERAS members

Rodney Mackey will also be directing the ERAS excavation at Easington. Details were given in Pete Walker's last newsletter, but the essential information is listed below. This is a rare opportunity for members to dig at a Bronze Age barrow before it is lost to the sea.

So, welcome to the new lecture season, the dig at Easington and the Society's regular Field Study Group Meetings. The Field Study Group has found a new venue - Hull and East Riding's warehouse down Chapel Lane Staithe (which will eventually become the Museum's new entrance).

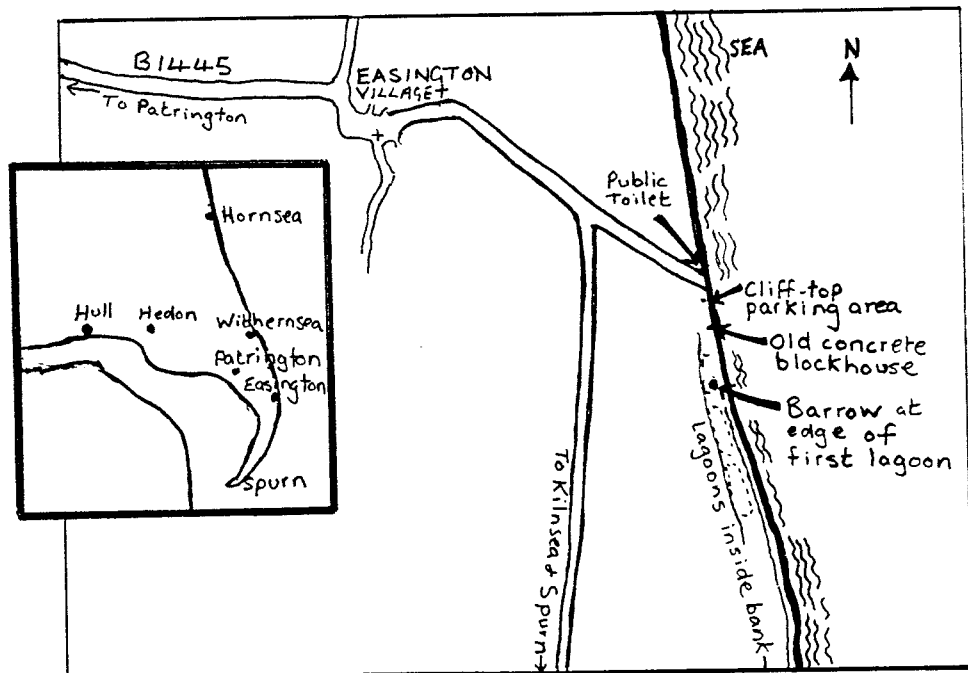


EASINGTON BRONZE AGE BARROW EXCAVATION

- ◆ **DATES** Saturday 31 August and continuing every day except Mondays throughout September
- ◆ **TIMES** 10am -5.30pm
Or just as much time as you can spare
- ◆ **PLACE** Map reference TA4087/1808
From Hull take the A1033 past Hedon to Patrington, then the B1445 from Patrington to Easington. Go through the village and, immediately after, bear left to the clifftop next to the caravan park. Leave vehicles on the clifftop parking area and walk south past an old concrete blockhouse (5 mins only)
- ◆ **BRING** Kneeling mat, trowel, packed lunch
- ◆ **VOLUNTEERS** Especially welcome on weekdays, but the excavation will also be operating at weekends. All volunteers must be paid-up members of ERAS (because of insurance cover) and nobody under 15 years of age without checking first (contact numbers below)
- ◆ **SAFETY** Please ensure that you have had an anti-tetanus jab within the last ten years

For more information phone:

Rod Mackey 01482 866816 *or*
Kate Dennett 01482 445232



RECENT EXCAVATIONS

A Roman Kiln Excavation, Tollingham

About twelve ERAS members took part in an emergency excavation near Holme-on-Spalding Moor during the second week in August. Humber Archaeology Partnership (formerly the Humberside Archaeology Unit) had been keeping a watching brief as machines stripped the surface off a site in preparation for the construction of a lorry park. Large quantities of pottery were revealed, but as the H.A.P team were due to go on holiday, ERAS was called in to help.

An area of approximately 11m x 6m was cleaned, revealing a clay kiln, associated stoking pits and a waste pottery dump. Similar to those found at Hasholme, the kiln had two pedestal supports for the pot floor, but was constructed at a shallower depth so that the top had been sliced off by the machine.

A very large quantity of pottery was recovered, which appears to be of 4th century date. It includes loop-handled jars, flagons, wide-mouthed jars, flanged bowls, carinated cups and flat-bottomed dishes. It is hoped that the Field Study Group will be able to categorise and quantify this assemblage.

Kate Dennett

Field work at Hayton, July 1996

At the time of writing the bulldozer has just backfilled the spoil on a most successful season's excavation, which provided both expected results and some surprises.

The site was discovered in 1993 by a local farmer who found on the surface of one of his fields a large

amount of tile which was recognised as part of a Roman under-floor heating system or hypocaust. After gridded field walking, and geophysical survey, the site was first excavated in August 1995. Two trenches were opened, one over large ditches revealed by geophysical surveying and a smaller trench in the area where most tile had been found. In that first season an Iron Age 'ladder' enclosure containing several round houses, which had been replaced by early Roman timber buildings was found. Overlying this was the trace of a wall-footing running towards the concentration of later Roman building material in the second trench. Although only 5m square, this area contained much tile, wall plaster (some painted), the remnants of stone walls and fragments of window glass. The major aim of the 1995 season was to try to work out the plan of this later Roman building, and recover more of the layout of its early Roman and Iron Age predecessors.

Those who participated in the topsoil stripping by hand last year will have noted with relief that a mechanical digger was used this time and an area c40x25m was opened. Once the ploughsoil had been removed, grooves made by subsoilers and other modern agricultural machinery were clearly visible. Medieval rig and furrow had been far more damaging, however, as archaeological features were much better preserved under the rigs, whereas the furrows had destroyed much of the stratigraphy.

Preliminary cleaning revealed the 'missing' sections of last year's Iron Age round houses and a related complex of enclosure ditches. Gulleys of other round-houses were also found. On excavation the enclosure ditches were found to contain Late Iron Age pottery and a complete cow skeleton. The ancient inhabitants had had trouble fitting the animal into the hole they had dug, probably due to



its *rigor mortis*, for the legs were sawn off and thrown in with the rest of the burial.

The round houses were replaced, possibly in the 2nd century AD by a large timber building aligned N-S. Some samian and other fine wares were found and it is likely that the three cremation burials, one in a complete bowl, date from this phase of activity.

At some stage, probably in the later third/fourth centuries a Roman style bath suite was constructed with a hypocaust. Though only one pila (floor support) remained upstanding, the position of the others could be seen as pinky-orange squares, contrasting with the black of the surrounding soot, ash and rubble. One of the tiles had the graffito CANDIL or possibly CANDID inscribed on it, though we need expert advice before this can be confirmed. Despite heavy stone robbing the outline of at least three rooms could be made out, and the low parallel walls of the stone flue passage leading from the furnace to the hot room, upon which would have rested a boiler. A small well to supply water had been dug next to the bath house, which contained animal bone and rubble. Only the upper layers of this feature were excavated.

The whole alignment of the building was then changed to run E-W across the site, outlining the foundations of a possible corridor house. Once again, the stone robbers had been busy and in some cases only the faintest traces of walls remained. To the west of the site was a corn drying or malting oven.

Around 18 infant burials were excavated as well as the articulated pelvis and legs of an adult, the rest of the skeleton running under the edge of the trench. Another feature of the site were 'barbecued' sheep burials, a possible explanation of these being the deliberate deposition of the left-overs of a sacrificial meal, as most of the choice joints were missing.

Finds suggested activity on the site throughout the Roman period. A programme of wet-sieving was also undertaken to retrieve seed and plant remains and small bones. Some geophysical surveying was carried out on the site of the annexe of the Roman fort at the other side of the A1079 from our site, and a programme of aerial photography was designed to place the site in the wider context of the surrounding countryside.

A further season is planned next year to complete the excavation of the hypocausted building and

the well, with its promise of well-preserved organic remains.

Finally, none of this would have been possible without the hard work and enthusiasm of all those who shared in the excavation including: the supervisory staff, Durham University archaeology students, Continuing Education students from Leeds and Hull Universities, sixth form students, East Riding Archaeological Society members and local volunteers, who, together with the most supportive and interested community of Hayton helped to make our 1996 season both productive and enjoyable.

Peter Halkon and Martin Millett

1996/7 LECTURE PROGRAMME

Reports Meeting

East Yorkshire has much to offer in the way of archaeology and many groups are active in exploring this. The reports meeting provides a chance to catch up with some of the fieldwork that has been going on. There will be contributions from Humber Archaeology Partnerships (the successor to the Humberside Archaeology Unit), the Societies own project on Bainton, Winestead, Hull Museums and Hayton.

David Neave

No stranger to many members, Dr David Neave has recently published a new edition of Pevsner's Buildings of England volume on East Yorkshire. David Neave is a senior lecturer in the Department of History at the University of Hull. This fully illustrated lecture will provide a survey of the standing buildings of East Yorkshire.

Terry Manby

Terry is one of the foremost authorities on the Neolithic and Bronze Age in Northern England. Formerly curator of Doncaster Museums, he excavated many important sites in East Yorkshire, perhaps the most famous being the Kilham Long Barrow and the multi-period site at Thwing. In this lecture Terry will provide an insight into new discoveries and ideas on the Neolithic period in East and North Yorkshire, setting them in a national context.

Paul Bahn

The co-author of a standard archaeology text book 'Archaeology-Theories, Method and Practice', with Colin Renfrew, Paul, who comes from Hull, is a nationally acclaimed authority on Palaeolithic

art and a popular speaker in previous ERAS lecture seasons. In what promises to be a lavishly illustrated lecture, our speaker will review the cave art of the Ice-age, including recent finds in France.

Mark Roberts

Boxgrove in West Sussex hit the international headlines several years ago when the team, led by Mark Roberts, from the Institute of Archaeology, University College, London, found part of the leg bone of our oldest European ancestor. Beside that discovery this long-term research project has examined the changing ancient environment of Palaeolithic southern England through the study of its fauna (including the voles mentioned in the title) and flora. Many fine tools have been found as well as the bones of the quarry that our earliest ancestors hunted.

Mark Newman

A lively and well-informed speaker, Mark is one of the archaeologists for the National Trust and in recent years has been involved in an archaeological survey of Fountains Abbey and the Romantic gardens of Studley Royal. By a clever combination of documentary research, including oil-paintings, this lecture will present an exploration of the development of a Medieval and 18th century landscape in a beautiful part of

Yorkshire.

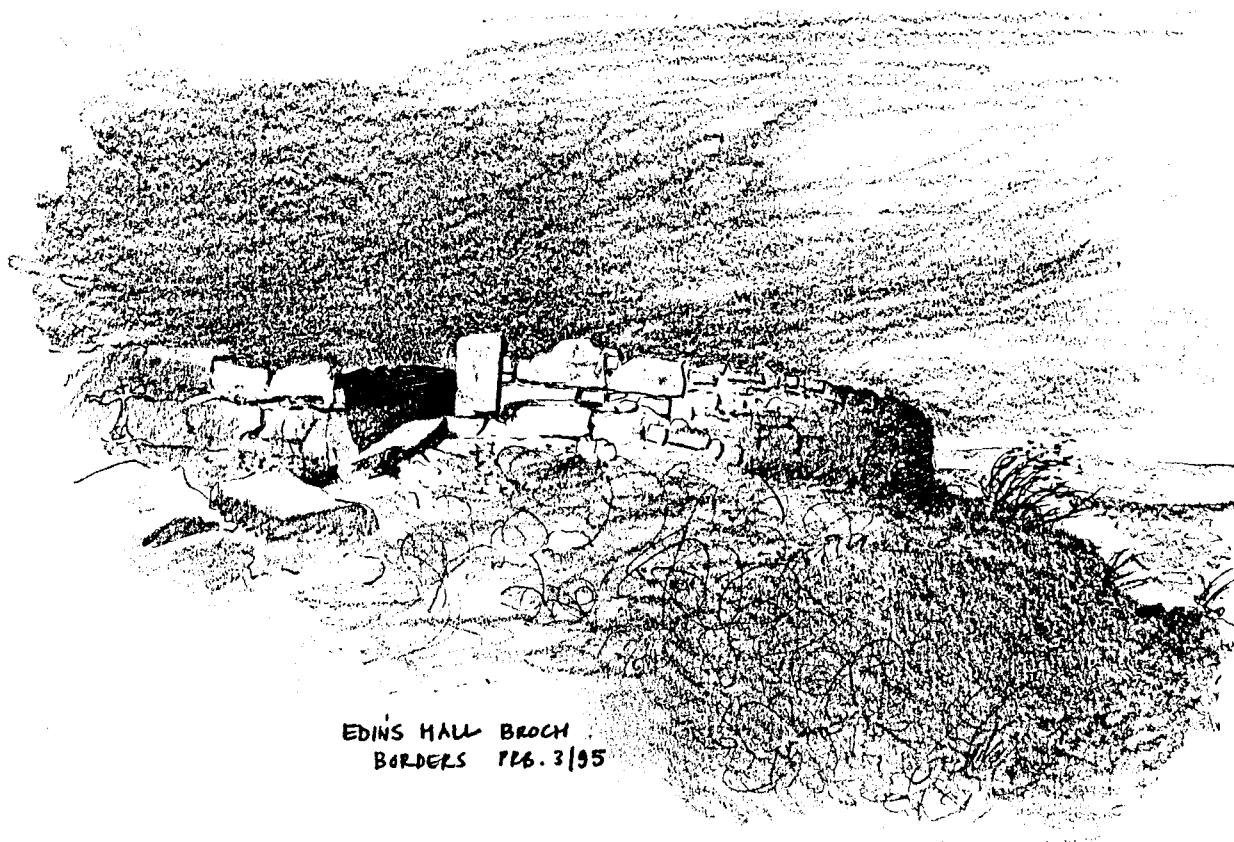
Peter Crew

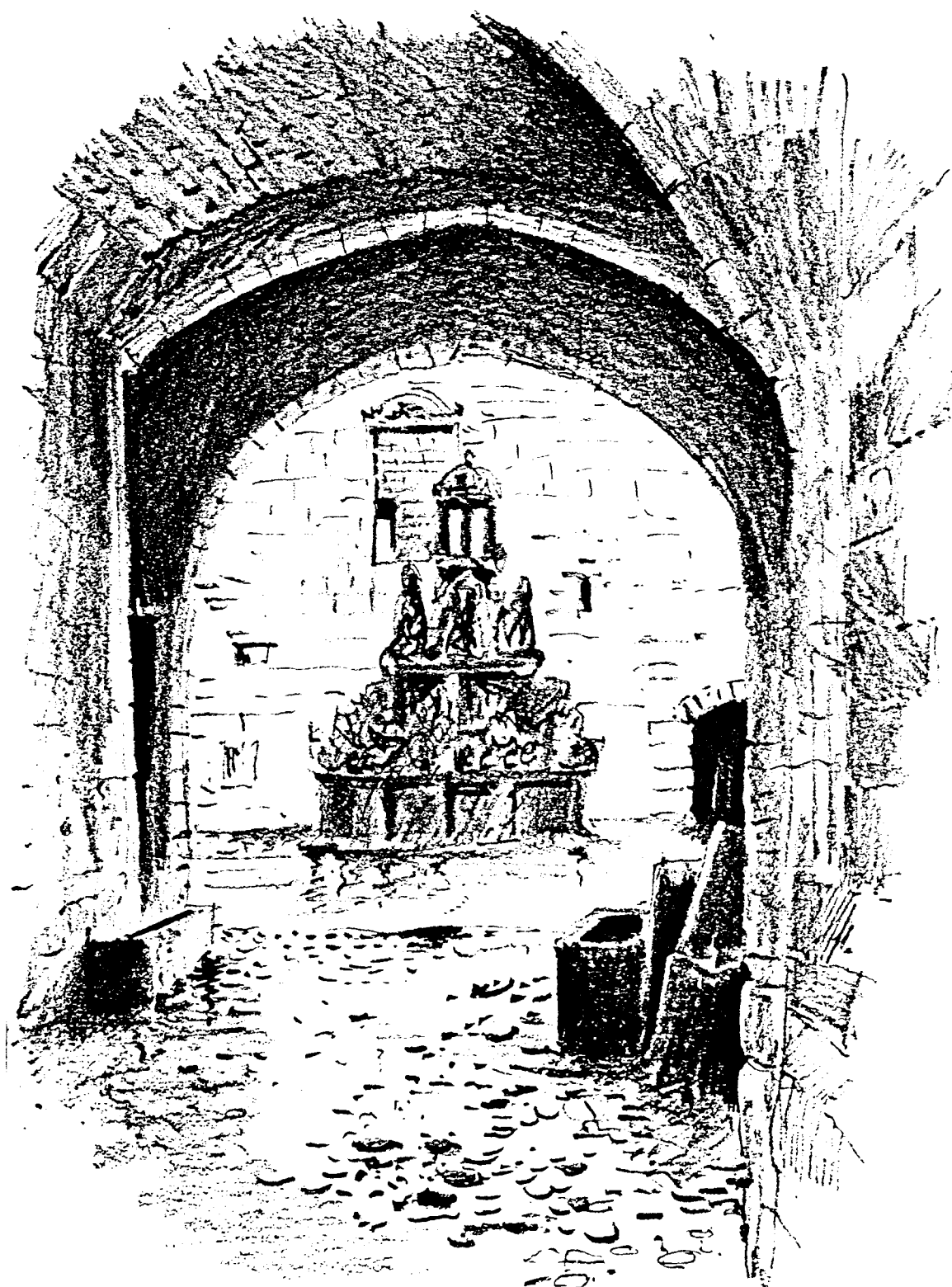
Peter Crew is the archaeologist for the Snowdonia National Park in North Wales. After excavating a hill-fort at Bryn y Castell on which he found a large amount of iron slag and other evidence for iron working, he decided that the only way to really understand the nature of this industry is to do it experimentally. Since then he and his wife Susan have established an international reputation for their work on early iron working, and Peter has toured extensively lecturing and hosting conferences on this topic. His research suggests that the importance of the Iron Age iron industry has been seriously underestimated and his lecture has particular relevance for those interested in this period in East Yorkshire.

Mick Aston

A Senior Lecturer in the Department of Continuing Education at the University of Bristol, Mick has now become a TV celebrity as senior archaeologist on Channel 4's Time Team, the most popular archaeology programme on British Television. An entertaining speaker, his own specialism is in Medieval landscape archaeology. In his lecture, he will take us behind the scenes at the making of Time team. As we expect a large attendance this lecture will be held at the Ferens Art Gallery.

Memories of an ERAS excursion





LINLITHGOW PALACE
PFB 3/85

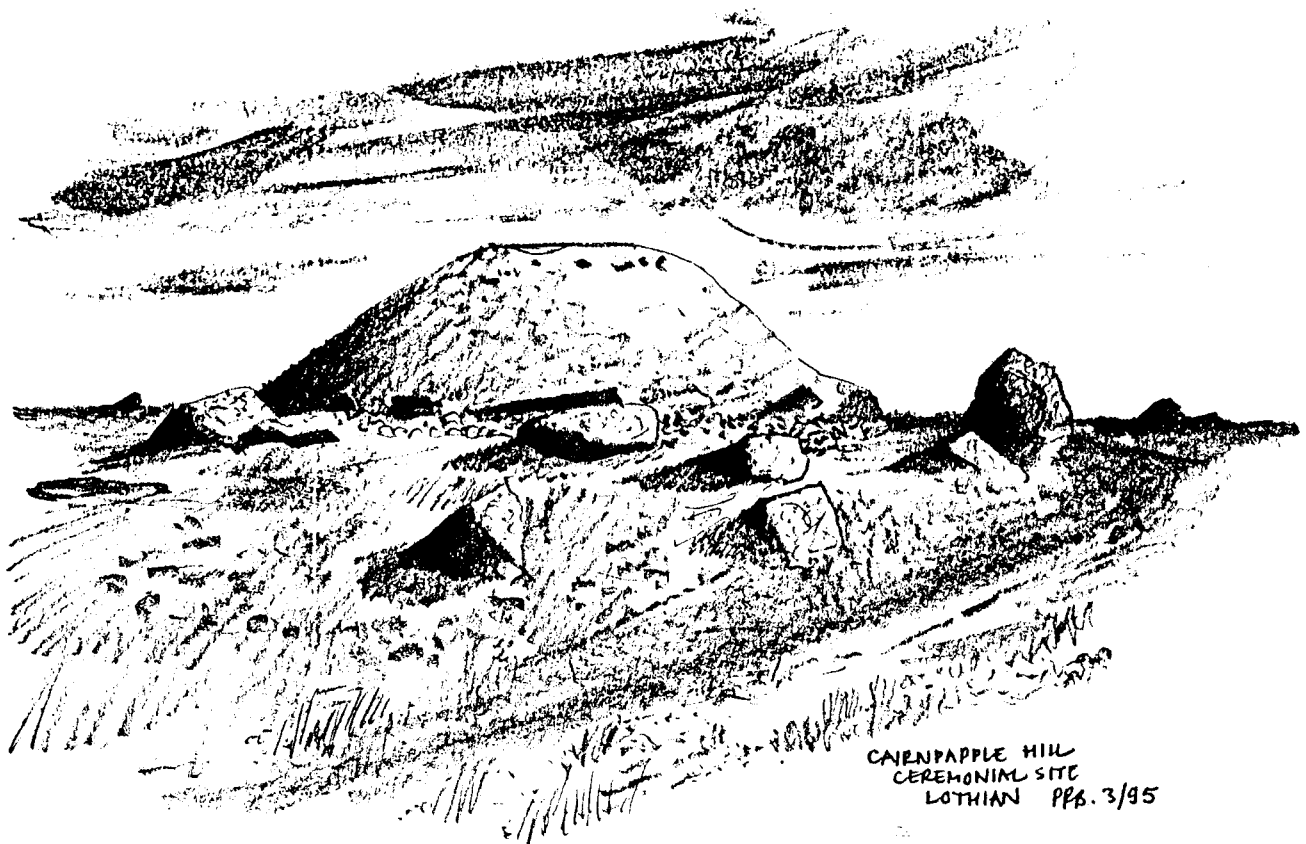
It is some time now since ERAS members went on their trip to southeast Scotland (a year last Easter), but these sketches by Peter Bartle bring back happy memories. Led by Andrew Foxon, we were treated to a wide range of sites, many in spectacular settings. Even when the surroundings weren't exactly picturesque, they were none the less memorable, as in the case of the large Balfarg henge in the middle of a housing estate. It would be unusual enough to see a large green space in the middle of a modern housing development - but a henge monument.....?

We didn't start with the henge, though, but with the broch, fort and settlement of Edinshall (or Edin's Hall). Getting down from our coach some time after we had crossed the border but before we were into Lothian, it wasn't immediately obvious what we had stopped to look at because it wasn't visible from the road, but we were glad enough to get out and stretch our legs. It was after we'd 'stretched our legs' for some time up the hillside that we were able to appreciate the fine position commanded by the fort and the broch on the shoulder of a hill above the steep sides of the Whiteadder valley with the river running below.

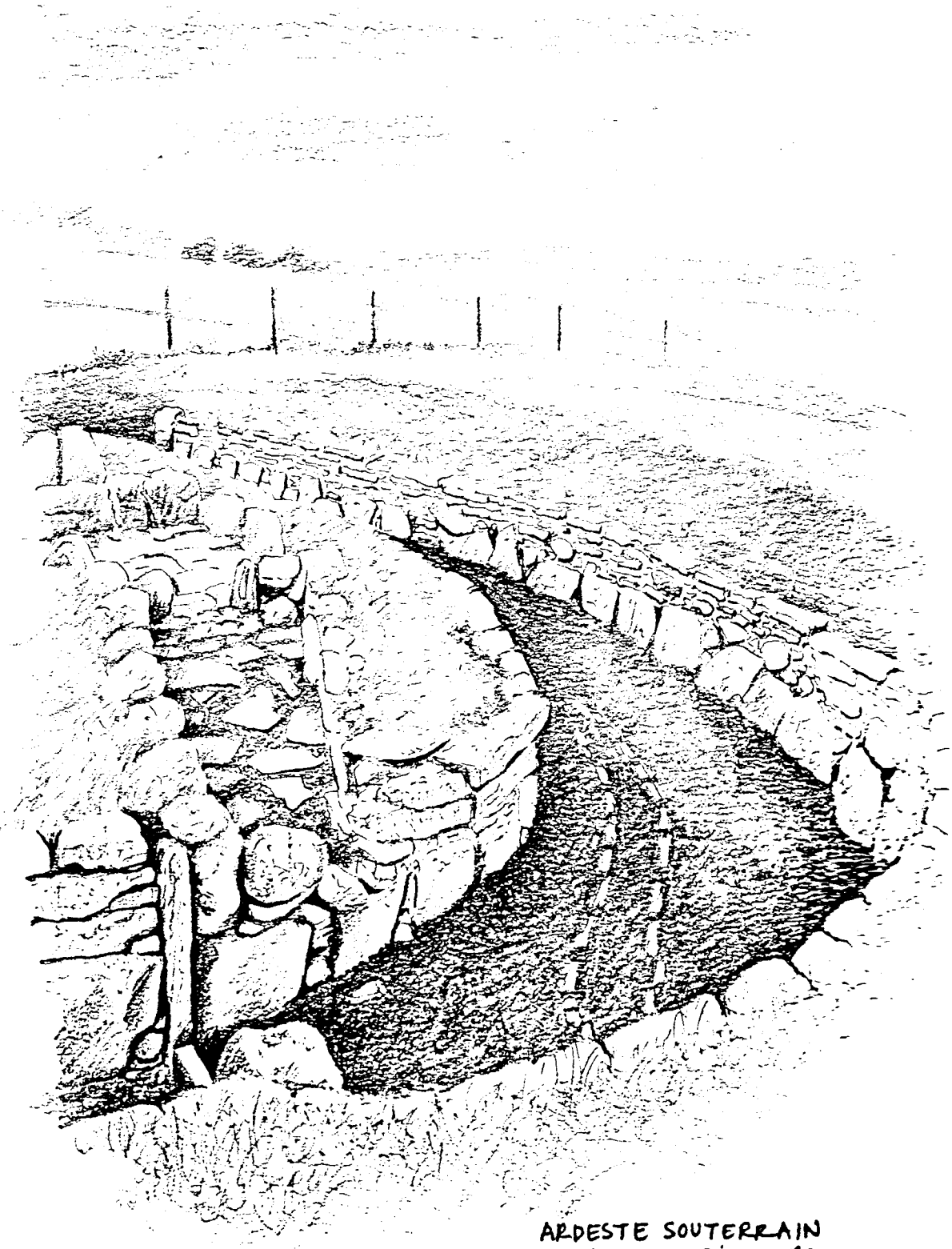
The fort was built first, an oval area enclosed by a double rampart and ditches. Later, the broch was added in a corner, large for a broch at an internal diameter of 17m and something of an outlier as brochs go - most of these defensive structures with a honeycomb of cells within their drystone walls were built much further north and west.

Linlithgow palace was another stronghold, built on a promontory jutting into Linlithgow loch and protected from the town, by a deep ditch and a *pele* or stockade. It was probably converted into a stronghold for Edward I at the beginning of the 12th century from an earlier royal manor house and was made almost entirely of wood and earth. Another ditch and palisade was built around the promontory to defend the castle against attack from the loch.

The castle was commanded by the English until the battle of Bannockburn in 1314 when it reverted to Scottish hands. In 1424 a disastrous fire destroyed most of the town of Linlithgow as well as the castle. James I almost immediately started a programme of rebuilding work. There were additions and rebuilding in the reign of James IV,



CAIRNAPPLE HILL
CEREMONIAL SITE
LOTHIAN PFB. 3/95



ARDESTE SOUTERRAIN
ANGUS 3/95 P.B.

completed by James V. Prince Charles Edward Stuart was the last of the Stuarts to occupy the castle and in 1746 another fire, this time left burning by troops billeted within, soon took hold of the building and destroyed the roof, so that it is now an imposing shell.

Other varied sites I remember were the banana-shaped souterrain or earth-house at Ardestie in Angus and the stone circle of Balbirnie, looking suspiciously neat after it had been re-erected 125m from its original position as a result of road-widening. (I also remember the firestation on the roundabout - or, atleast, I *think* I do..)

Our last site of the weekend was suitably majestic (and exposed) - Cairnpapple Hill in West Lothian. It was used as a ritual and burial site from c.2800 BC to c. 1500 BC. Once cleared of trees in the late neolithic, an arc of seven holes was made in the rock. Cremated bone was placed in six of the holes and three standing stones were probably erected nearby. The site was then converted into a henge, with an oval of standing stones surrounded by a ditch and an outer bank. Two graves were dug within the henge

Later, a massive kerbed burial mound was constructed within the henge, covering two Bronze Age cist-burials. Two final burials on the site were probably Iron Age in date.

From the summit on Cairnpapple Hill we could appreciate its position: we could see the mountains of Arran to the west and the Firth of Forth and the North Sea to the east, the Pentlands to the south and the Ochid Hills to the north. And if we bent down with an eye to a glass spyhole in the ground, we could see the view within, the main beaker grave inside the cairn. A truly noble end to our Scottish weekend.

LECTURE SUMMARIES

Feb 26 **Crisis in England: coin hoards of the Civil War**

*Craig Barclay
Keeper of Numismatics and Decorative Art,
Yorkshire Museum*

Ed: *without our previous resident coin expert, Bryan Sitch, I have relied heavily for this lecture summary on a booklet kindly supplied by the speaker::*

C Barclay & E Besly (1994) *A Little Barrel of Ducatoons The Civil War Coinage of Yorkshire* Yorkshire Museum Publication ISBN 0 905807 081

In June 1993 a metal detectorist, William Caygill, found a hoard of coins in three pots. Amounting to well over 5000 coins, this hoard is the largest of the Civil War period ever discovered; however, it is only one of a large number of coin finds of the period found in Yorkshire. In his lecture, Craig Barclay examined how these coins relate to, and have added to, our knowledge of the period of the Civil Wars which started in 1642 and came to a head on 2 July 1644 in the Battle of Marston Moor near York.

Whereas the coins of today are tokens, each gold or silver coin in the 17th century contained precious metal which nearly measured up to the face value. The small difference between intrinsic and face value was included in the *seignorage* which was paid by merchants bringing bullion to the mint to be struck into coins. The quantity of bullion converted into coinage varied with the price which could be obtained for the metal itself. During the reign of Charles I it was not until 1632 that the mint started to strike his silver coins in large numbers. The coin was needed to pay Spanish troops in the Netherlands during the Thirty Years War. Although England remained neutral in this European conflict, in 1632 an arrangement was made for English ships to transport the silver for Spain. England did very well out of the deal, which also involved a large percentage of the bullion being struck into English coins. These coins were then used by the Spanish to buy bills of exchange from British merchants. Coin hoards dating to this period show the effect of this arrangement - large proportions of the Charles I silver coins are dated 1632 or later and are of poor quality.

Most of the coins produced before 1642 were struck at the royal mint in London, which had been housed between the inner and outer walls of the Tower of London since medieval times. Despite the large number of later Charles I coins mentioned above, most of the silver coinage in use during the Civil Wars had, in fact, been struck in Tudor times. When the Middleton hoard was buried in about 1647, the London mint had been making coins from Spanish silver for some 15 years but thirty five percent of the Middleton hoard coins were issued during the reign of Elizabeth I. Several factors contribute to this high proportion: Elizabeth enjoyed a long and stable reign, there was fresh silver coming in from the New World and in 1560-61 debased silver coins from the reigns of Henry VIII and his son were recalled and converted into new pristine coins in good quality silver.

Numerous hoards of silver coins have been found and therefore the amount of information about

them is large, but gold coins are much less common because only the fairly wealthy would possess them and, moreover, gold was scarce in the country partly because during the 1630s and 1640s large quantities of gold were exported to the Continent. Gold coins were struck in 22 carat gold which contains 91.7% gold. Sometimes the fluctuating price of gold necessitated the revaluation of gold coins to prevent them being melted down for the increased value of the actual gold. A twenty shilling 'unite' of James I had to be revalued in 1612 at 22 shillings. These revaluations could cause confusion, not helped by Charles I using the term 'unite' for a lighter-weight twenty-shilling coin.

In an era when there were no banks, coin hoards were generally made up of accumulated savings (although a few hoards do reflect the hurried burial of whatever valuables were available in a dire emergency); they therefore tend to contain the best and heaviest coins which the owner could collect and do not represent a true picture of the coinage in circulation. Groats, halfgroats, pennies and related fractions are generally under-represented in hoards. But even single finds are not truly representative: if dropped, a larger piece is more likely to be seen and retrieved and, indeed, if it is valuable more time and energy is likely to be expended by the owner in searching for it. Low value coins change hands more often, being useful in more everyday transactions, and thus stand a greater chance of being dropped.

The techniques used for making coins in the 17th century differed little from those used earlier. When bullion was brought to the mint it would be assayed for purity and blended with other batches to achieve the required standard. The metal was then cast into ingots and beaten into thin sheets. Coin blanks were cut from these sheets using shears and these in turn beaten into a more circular shape. All this was achieved by hand. After a final annealing and a cleaning in acid, each blank was ready to be placed between two steel dies and struck with a hammer to produce a coin. The production of dies was the responsibility of the engravers at the mint, and it was one of these, Nicholas Briot, who attracted controversy for trying to modernise the minting process. Although the process described above was unmechanised, Briot had the opportunity to try out his ingenious machinery when the king was forced to set up in York one of a series of emergency mints after losing control of London and hence the mint in its Tower.

Earlier in his reign Charles I had opened a mint in Aberystwyth simply for the purpose of coining

locally mined Welsh silver, but after Charles lost control of London and the money from wealthy supporters started running out, the establishment of a new mint became a necessity. In 1642 the king and his court moved to York and set about collecting gold and silver plate to convert into coin to pay the royalist troops. With time, mints were set in other centres as needed - Shrewsbury in 1642, Oxford in 1643-46, Bristol in 1643-45. However, only very small quantities of Oxford and Aberystwyth issues are found in Yorkshire hoards: the royalist coins did not travel far from their place of issue and, in any case, were vastly outnumbered by the coin being produced under parliamentary control in London.

During the siege of York, a system of free billeting of troops limited the requirement for new coins, but a number of siege towns were forced to set up emergency mints. The siege of Scarborough lasted for almost a year, during which Sir Hugh Chomley, who commanded the garrison, had what silver he could obtain cut into irregularly shaped pieces roughly the sizes and weights of current coins and marked with a value. Though these values were true to the actual weights of the siege pieces, they resulted in a wider range of denominations than the regal coinage.

During the siege of Pontefract a series of very fine coins was struck by the garrison, some of them in the name of Charles II, to whom the defenders gave their allegiance after the execution of his father in 1649. Most of the Pontefract coins were octagonal or lozenge-shaped. Unusually, a small number of gold pieces were struck from the same dies as the silver coins in the name of Charles II.

Some of the Civil War coinage originated from neither a royal nor a parliamentary mint. Copper farthings were produced by various holders of a royal patent, who were able to make a good profit from the manufacture because the face value of the farthings was sufficiently greater than the value of the copper they contained. The issue of these tokens eventually ceased in 1644, by which time the problems of counterfeiting were acute. It is thought that royalists were involved in the production of these counterfeits, which they then exchanged for silver coin.

Though most of the coins circulating during the Civil Wars was English, some came from further afield. The principal Scottish coin, the 'thistle merk' was legal tender in England, but at a value of thirteen and a half pence it was not popular. However, twelve such coins were found in the Middleham hoard. Ireland possessed its own

distinctive coinage bearing a harp on the reverse. Like their Scottish counterparts, they are frequently found bent and buckled as a result of rudimentary testing by the suspicious English.

Some coins came from even further away. Such were the difficulties experienced by the king as a result of the war that in March 1644 he issued a proclamation assigning specific values to various foreign coins. These continental coins have been found in areas of the country where the king exerted influence. The most important group are the 247, mostly ducats of the Spanish Netherlands, identified in the Middleham hoard. Because of their high face value they amounted to some twenty percent of the value of the hoard. The most likely explanation for the presence in Yorkshire of so many continental coins is the location of sea-ports on the northeast coast. Many important pieces of gold and silver were sent to the Low Countries by Queen Henrietta Maria in exchange for weapons and coins.

Counterfeit coins have been found in a number of Yorkshire hoards, including the Middleham. Some were cast from genuine coins, some from handmade dies. Plated forgeries were carefully excluded from hoards and are only appear among casual or detector finds. Some of these may have been deliberately discarded by disgusted owners once the silver plate had worn off.

Counterfeiting was not the only fraud involving coins: 'clipping' was rife. Gold or silver was effectively stolen from the coinage in parings trimmed away from the edges of coins, gradually eroding the value of the coinage. Yorkshire appears to have suffered particularly from the attentions of the coin clippers. Given that clipped coins are probably under-represented in hoards, the problem was doubtless even greater than the evidence from hoards suggests.

Although Craig Barclay had covered most of the range of coins circulating in Yorkshire during the Civil Wars, he concluded by emphasising that the bulk of the coinage was still produced by the London mint. No distinction appears to have been made between the coins struck before and after the king was ousted. They would have been indistinguishable to most people. After Charles was executed, however, his portrait was removed from the coinage and parliament issued 'breeches money', but it was not until 1696 that parliament recalled the king's coins to be melted down. Such was the task that temporary mints had to be set up in several cities, including York.

Only two coins of today have a lineage from the Civil War period - the one pound coin (corresponding to the gold unite of Charles I) and the five-pence piece (descended from the silver shilling).

Ancient DNA; using molecular biology to explore the past

Dr Terence A Brown

Department of Applied Biochemistry & Applied Molecular Biology, UMIST.

Ed: This article is a summary of a seminar given on 14 February 1996 in the Department of Biological Science, University of Hull. I have also used a review article by T A and K A Brown.

The term 'ancient DNA' is used to describe DNA fragments in preserved biological material. It covers a wide time span which could be described as forensic, archaeological and palaeontological periods. The first demonstration of ancient DNA was made in 1984 by Russell Higuchi, who cloned fragments of DNA from a 140-year-old museum specimen of a quagga, an extinct member of the horse family. It was soon followed by the work of Svante Pääbo, who published a short sequence of DNA extracted from a 2,400-year-old mummy. In these first extractions of ancient DNA the method available involved cloning the fragments and had severe practical difficulties, which seemed to limit its usefulness. It was also assumed that DNA could be extracted only from exceptionally well-preserved material, such as mummies, museum skins and frozen animals, where the DNA had not undergone normal degradation processes after death.

A technical breakthrough occurred with the invention of the polymerase chain reaction (PCR). This method avoids the difficulties encountered in cloning ancient DNA as it directly produces more copies of the ancient fragments without the need for cloning. Moreover, it can be used on much smaller quantities of DNA because of the high amplification achieved. It is also possible to target those parts of the DNA which relate to some particular gene which the researcher might be most interested in. It is not all that simple, of course, and one obvious pitfall when you are multiplying DNA fragments so many times is that it is only too easy to get lots of copies of any tiny amount of contaminating DNA (either ancient or modern). The PCR technique has, however, provided a stimulant for a lot of work and some

exciting successes. The first important results, appearing in 1988 and 1989, were achieved from a 7000-year-old human brain from a Florida peat bog and then from the liver of a 4000-year-old Egyptian mummy and the museum skins of an extinct marsupial wolf.

Despite the additional discoveries made feasible with PCR, it was still generally assumed that suitable ancient DNA could not be obtained from material that had not been preserved in some way, either naturally or artificially (like bog bodies or mummies) and was not too old for all the DNA to have degraded. These assumptions were shattered in 1990: firstly, three groups of researchers reported identifying DNA from hard tissue such as bones and teeth, a commonly surviving part of the body; secondly, a group of workers produced a DNA sequence from a 16-million-year-old *Magnolia* leaf preserved in anoxic deposits in Idaho (though this claim is still regarded as controversial).

Since 1990, the body of work on ancient DNA has increased and the technique is becoming more directed at particular research objectives but in a wide range of disciplines, such as archaeology, forensic science, conservation biology, taxonomy and palaeontology. Sources of DNA used have included bones and teeth, mummies, bog bodies, hair, fingernails, faeces, charred seeds, mummified seeds and amber specimens. Wood and pollen remain difficult materials from which to obtain DNA and bog remains from highly acidic or alkaline situations are also unsuitable. Dates have been claimed right back to the 135 million years of amber specimens, but the age limits of DNA are still controversial because they do not tally with the observed breakdown rate of DNA in the laboratory.

Even ancient DNA studies of a less controversial nature are not wholly straightforward. Techniques of DNA extraction have had to adapt to the particular difficulties of ancient DNA sources which may include chemical compounds capable of inhibiting the PCR reactions. The PCR method still has limitations. It introduces errors when it copies DNA. This is generally not a problem with modern DNA but in ancient DNA the error rate is higher and, though not an unsurmountable problem, decreases the rate at which progress can be made. The difficulties increase when a heterozygous diploid locus is being looked at. Most organisms (except the most simple) are diploids, that is, they have two strands of DNA, one from each parent. Where the DNA is different from the two parents at any particular place, or locus, on a gene, the result of PCR will be a mixture of the different

DNA sequences and thus it becomes much more difficult to reconstruct the original DNA.

Having talked so much about the difficulties and limitations, what makes the effort worthwhile for archaeology? It can supplement or confirm information obtained by more conventional means, but it also has the potential for providing information and interpretation that is unavailable by any other method.

Sex determination of human bones is an obvious example where DNA work might help. Usually, examination of particular morphological features of an intact skeleton gives a good indication of the sex. However, if the skeleton is immature, incomplete or poorly preserved, then determination of sex will be less certain: if only a single bone is found, or the skeleton has been cremated, then there is no chance. Since male humans have both X and Y chromosomes and female only the X chromosome, this was an obvious target for ancient DNA studies. With a few exceptions, unfortunately, attempts to use ancient DNA to sex human bones has proved unsuccessful, though it is routine with modern DNA. More recent work with a tooth enamel gene which differs between men and women has shown some success and looks like providing a reliable means of sexing ancient DNA.

Kinship studies have been attempted in the past by typing features of skeletons thought to have a genetic basis, such as dental patterns. These morphological features are much less accurate than the genetic data potentially available by DNA analysis, but a problem would remain in making conclusions about the degree of relatedness of a small number of individuals unless the genetic variability of the whole population could be determined.

DNA studies of human remains have been pursued in the search for population interpretation on a larger scale - how prehistoric populations expanded and migrated, but there is also scope for using ancient DNA to contribute to this study in a less contentious manner, namely by using the DNA from plant remains associated with human occupation. Dried seeds and burnt grain are commonly found on archaeological sites, often in large quantities in storage pits. Museums generally will agree to allow the destruction of some of this material for research, and the moral objections increasingly being raised by some people to the study of their ancestors' bones are circumvented. Agriculture is considered to have originated some 10,000 years ago in the 'Fertile Crescent' where

wheat, originally growing wild there, was cultivated. From there, the technology spread into and across Europe and along coastal routes. This expansion of agriculture can be considered to reflect concurrent human contacts. With time, new types of wheat also spread between peoples. The presence of types of wheat at a number of contemporaneous sites can provide evidence for the degree of trade and exchange between those sites. Like bones, comparisons between wheat grains have in the past been made on the basis of visible differences, but DNA analysis should be capable of identifying much finer variation. The genetic information in DNA is, moreover, not affected by environmental factors in the way that the physical appearance of plant material may be.

The speaker has been involved in research at UMIST, in conjunction with Martin Jones of Cambridge University, on the DNA of burnt grain from the Danebury hillfort excavations. Initially it was quite controversial to say that DNA could be obtained from burnt grain so some time was first spent obtaining corroboratory evidence to validate the work. Various areas of the wheat chromosome were looked at to find an area (locus) where the DNA differed sufficiently between different wheat varieties to be identified as different by PCR of ancient DNA. Two related genes which code for the glutenin seed storage proteins were chosen because they exist in tens of different forms (alleles). When the PCR, cloning and sequencing procedure was performed on modern wheat some 30 different sequences were found which fell into five groups, just what seemed to be required for a test of genetic relatedness. With ancient wheat, however, different results were obtained. The sequences did not cluster. One

possible explanation was that the assemblage of ancient wheat was extremely heterogenous, not a pure culture of one wheat, but it is very unlikely that the assemblage could be as mixed as the sequence results suggest. The preferred explanation is that although the results initially look like a glutenin sequence, it was a chimera - bits of sequences linked on to bits of other sequences, caused by what Dr Brown called 'Jumping PCR' which occurred because the ancient DNA was in a fragmented state.

'Could the data be rescued?' was the obvious question. If it is assumed that the sequences arose from 'Jumping' PCR, then by looking for parts of sequences that are the same, one should be able to find the breaks and thus reconstruct what the DNA sequence *should* be. Using this method, five alleles were identified, one of which is very similar to modern wheat, one is similar to modern emmer wheat, while the other three may make phylogenetic sense when analysed by computer. The conclusion of Dr Brown and his researchers is that the wheat glutenin DNA method is indeed an exploitable technique.

Though attracting at times rather wild media speculation, yielding sometimes controversial results, and needing more research into the degradation of DNA with time and the chemical nature of the breakdown products, it seems that work on ancient DNA is here to stay, even though it might not always sound as dramatic as the press would have us believe.

Reference

Brown TA and K A Brown (1994) Ancient DNA: Using molecular biology to explore the past
Bioessays 16(10) 719-726

STOP PRESS: Special price book offer for ERAS members

Martin Foreman's 'Further Excavations at the Dominican Priory, Beverley 1986-1989' is available to members at £22.50 (half the £45 retail price) Order forms from the ERAS secretary or ring Sheffield Academic Press 01142 670044

DIARY DATES

Sat 31st Aug	Start of the ERAS Easington Barrow excavation	Wed 18th Sept	ERAS Reports Meeting Old Grammar School, Hull
Weds 4th Sept	ERAS Field Study Group Meeting Unit 3 Chapel Lane Staithe, Hull	Wed 2nd Oct	ERAS Field Study Group Meeting Unit 3 Chapel Lane Staithe, Hull
Sat 7th Sept	Local History Bookfair, Memorial Hall, Beverley 10.00am - 4.00pm	Sat 12th Oct	Tony Brewster Memorial Lecture Dr Patrick Ottaway The Romans on the Yorkshire Coast 2pm The Public Library, Vernon Rd. Scarborough
Local History Week 1996, Beverley Library 7.30pm £1.50 per event. Book at Beverley Reference Library or phone 01482 885358		Wed 16th Oct	ERAS Lecture; David Neave, The Buildings of East Yorkshire The Old Grammar School, Hull
Mon 9th Sept.	- Professor D.Woodward Worlds of Work: Labourers & Building Craftsmen in Beverley and Hull, 1450 - 1750	Wed 6th Nov	ERAS Field Study Group Meeting Unit 3 Chapel Lane Staithe, Hull
Tues 10th Sept	Mick Stanley Creating the Local Landscape	Wed 20th Nov	ERAS Lecture: Terry Manby, A Neolithic Revolution? Recent research into Eastern Yorkshire and Northern England
Wed 11th Sept	Rod Mackey Beverley Westwood - An Archaeologist's View	Wed 4th Dec	ERAS Field Study Group Meeting Unit 3 Chapel Lane Staithe, Hull
Thur 12th Sept	Faith Mann Medieval Sculpture in the East Riding	Wed 18th Dec	ERAS Lecture: Paul Bahn, New Light on Old Pictures - an up-date on Ice Age Art Old Grammar School, Hull
Fri 13th Sept	Arthur Credland Shipbuilding in Hull and on the Humber		



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