1. THE PALAEOLITHIC PERIOD (*c.*950kya[1] to 9,700BP[2]): UPDATED RESEARCH AGENDA

1.1. Archaeological Period 1: Cromerian and Intra-Anglian (Marine Isotope Stages 25-12: c.950-450 kya[1])

1. What may analyses of artefact assemblages contribute to studies of the material culture of the earliest colonisers of western Doggerland?
2. From how early may this material date?
3. Where is pre-Anglian material found, and what may we deduce from its distribution about the routes of movement of early colonisers (e.g. along the Bytham River and ancestral routes of the Trent)?
4. Can we detect traces of intra-Anglian activity within the region, and in particular how should we interpret rare finds of artefacts associated with Anglian outwash and till?
5. Can we define more closely the distribution of sediments likely to yield traces of Period 1 activity and associated organic remains (notably those relating to the River Bytham and precursors of the Trent and Witham)?

1.2 Archaeological Periods 2 and 3: Pre-Levallois (Late MIS 12-Early MIS 8: 450-250kya) and Levallois (Late MIS 8–Early MIS 6: 250-150kya) Lower Palaeolithic

1. Can we locate convincing evidence for Period 2 activity in the region?
2. Can we elucidate further the distribution, topographic location, character and date of Period 3 material, especially in sealed contexts in terraces?
3. What is the range and variability of Levallois (prepared core) technology, and what may East Midlands assemblages contribute to studies of the development of this technique?
4. What is the composition of Lower Palaeolithic assemblages of non-Levallois/ Levallois type, and how might this have changed over time?

1.3 Archaeological Period 4: Mousterian (MIS 3: 60–40kya)

1. How can we locate additional caves and open-air sites with evidence for Mousterian activity?
2. How might caves and open sites have been related?
3. Can we refine by radiocarbon dating the chronology of Mousterian sites and key artefact types (e.g. bout coupé axes)?
4. Can we characterise more precisely the extant artefact collections from the region?

1.4 Archaeological Period 5: Early (Late MIS3-Early MIS2: 40000-25000BP) & Late (Late MIS 2:13000-9700BP) Upper Palaeolithic

1. How may studies of East Midlands sites contribute to testing and dating of the proposed EUP and LUP cultural succession?
2. How may studies of artefact typologies and raw materials contribute to our understanding of patterns of hunter-gatherer mobility
3. What was the relationship between caves and open-air sites, and may we discern differences in artefact typologies?
4. How were EUP and LUP sites distributed across the landscape, and what contrasts may be observed with earlier and later (Mesolithic) periods?
5. What may artefact analyses contribute to studies of relationships between groups across Doggerland and of regional cultural traditions?
6. Can work at sites such as Creswell Crags elucidate the chronology of the recolonisation of western Doggerland after the Late Glacial Maximum?
7. May further important examples of Palaeolithic artwork be preserved in caves of the Magnesian Limestone or elsewhere?
8. How may lithic technology and typology have changed at the Terminal Palaeolithic-Mesolithic transition and what may this signify culturally?

1.5 Pleistocene environmental change

1. Can we shed further light upon the development of the pre-Anglian river systems that may have served as corridors of movement for the earliest hominins (especially the Bytham River and precursors of the Trent)?
2. How may studies of fauna, pollen and other organic material from palaeochannels, caves, terrace sediments and other deposits refine our understanding of the evolving environment, and how may this have varied spatially?
3. Where are resources for the identification, recording and study of organic remains best targeted?

1.6 General themes

1. How best may we extend and enhance regional fieldwalking or test-pitting programmes as means of prospecting for open-air sites?
2. How can we enhance the Historic Environment Record dataset for study of the Palaeolithic?
3. How can we elucidate further the archaeological potential of the submerged landscapes of Doggerland?
4. How can we ensure that resources are focused upon monitoring quarries with the highest potential for unearthing Pleistocene cultural and environmental remains?
5. How can we maximise the research yield of Pleistocene sites investigated during developer-funded work?

Two rolled flint handaxes and a rolled pointed quartzite handaxe (centre) from deposits correlated to the Etwall Sand and Gravel (MIS 8) at Willington, Derbyshire (© T.S. White and Trent Valley Palaeolithic Project)

[1] kya: thousand years ago (period falling outside limits of radiocarbon dating)
[2] BP: uncalibrated years before present (within limits of radiocarbon dating)

1. THE PALAEOLITHIC PERIOD (*c.*950 kya[1] to 9,700BP[2]): RESEARCH OBJECTIVES

Updated Research Agenda / Research Objectives	**1.1** Period 1: Cromerian and Intra-Anglian					**1.2** Periods 2-3: Pre-Levallois and Levallois Lower Palaeolithic				**1.3** Period 4: Mousterian				**1.4** Period 5: Early and Late Upper Palaeolithic								**1.5** Environ-mental change			**1.6** General themes				
	1	2	3	4	5	1	2	3	4	1	2	3	4	1	2	3	4	5	6	7	8	1	2	3	1	2	3	4	5
1A Refine knowledge of the earliest (Period 1) hominin activity in the East Midlands	●	●	●		●																	●	●	●		●		●	●
1B Test the hypothesis that hominins may have been absent from the East Midlands in the pre-Levallois Lower Palaeolithic (Period 2)						●			●																	●		●	●
1C Confirm the extent and nature of early human activity in the region during the Mousterian (Period 4)										●	●	●	●										●	●		●		●	●
1D Further investigate Upper Palaeolithic (Period 5) open-air sites in the East Midlands														●	●	●	●	●	●		●		●	●	●	●			
1E Investigate Upper Palaeolithic use of the limestone caves of Derbyshire and Nottinghamshire														●	●	●	●	●	●	●	●		●	●		●			
1F Investigate the annual patterns of movement of Late Upper Palaeolithic hunter-gatherers															●	●	●	●							●				
1G Elucidate from terrestrial sources the changing Pleistocene environment of the East Midlands																						●	●	●				●	●
1H Explore the submerged Pleistocene landscapes of Doggerland																	●	●				●	●	●		●	●		

[1] kya: thousand years ago (period falling outside limits of radiocarbon dating); [2] BP: uncalibrated years before present (within limits of radiocarbon dating)

Research Objective 1A
Refine knowledge of the earliest hominin activity in the region (pre-Anglian: Cromerian complex of Period 1)

Summary:
The East Midlands is located astride the former Bytham River, which prior to obliteration of established drainage networks by the Anglian glaciation would have flowed eastwards towards East Anglia[1], and hence is critically situated to provide information relating to the earliest (pre-Anglian) hominin activity in Britain[2]. It is recommended that wherever possible resources be focused during developer-funded work upon the identification and characterisation of cultural remains contained within deposits associated with the Bytham River[3,4] and with more northerly pre-Anglian rivers (including precursors of the Trent, Witham and Humber[5]). This should enhance studies of the distribution and character of early hominin activity, including migration routes, and might identify distinctions within artefact assemblages that could elucidate spatial and chronological variability. Fieldwork should also focus upon the retrieval of associated organic remains with the aim of elucidating the variety of ecological zones exploited by early hunter-gatherers (see Objective 1G). Valuable guidelines for Palaeolithic prospection, which are relevant to this and other objectives, have been provided by Collcutt[6] and the Research and Conservation Framework for the British Palaeolithic[7], and could provide the basis for a research project aimed at synthesising current evidence and prospecting for additional data.

Agenda topics addressed: 1.1.1-1.1.3; 1.1.5, 1.5.1-1.5.3; 1.6.2; 1.6.4; 1.6.5.

East Midlands Resource Assessment and Research Agenda: 41.

SHAPE 2008 sub-programmes: New frontiers: the remote past (Pleistocene and Palaeolithic archaeology; 11112.310).

Other specialist period/subject research strategies:
English Heritage & Prehistoric Society Research and Conservation Framework for the British Palaeolithic 2008: Primary Research Themes 1 & 2; Strategic Research/Conservation Theme 1.
English Heritage Research Strategy for Prehistory 2010: Theme PR1 (landscape perspectives), Topic 9 (reconstructing Pleistocene and early Holocene landscapes).

References:

[1] McNabb, J. 2006. The Palaeolithic, in Cooper, N.J. (ed.) *The Archaeology of the East Midlands: An Archaeological Resource Assessment and Research Agenda*, University of Leicester: Leicester Archaeology Monograph 13, 19.
[2] Buteux, S. (ed.) 2009. *Digging Up the Ice Age*, Oxford: Archaeopress, 32-36, fig. 30.
[3] Graf, A. 2002. Lower and Middle Palaeolithic Leicestershire and Rutland: progress and potential, *Transactions Leicestershire Archaeological & Historical Society* 76, 1-46.
[4] e.g. Brooksby Quarry, Leicestershire: Jarvis, W., Cooper, L. and Beamish, M. forthcoming. Brooksby Quarry, Melton Road, Brooksby, *Transactions Leicestershire Archaeological & Historical Society*; Stephens, M., Challis, K., Cooper, L., Graf, A., Howard, A.J., Schreve, A.J. and Rose, J. 2008. New exposure of the Bytham River deposits at Brooksby, Leicestershire: context and importance', *Quaternary Newsletter* 115, 14-27.
[5] e.g. East Leake, Nottinghamshire: White, T.S., Bridgland, D.R. and Howard, A.J. 2007. East Leake Quarry, in White, T.S., Bridgland, D.R., Howard, A.J. and White, M.J. (eds) *The Quaternary of the Trent Valley and Adjoining Regions: Field Guide*, London: Quaternary Research Association, 84-87.
[6] Collcutt, S. 2006. Palaeolithic prospection: some simple guidelines, in Cooper (ed) 46-49.
[7] English Heritage & Prehistoric Society Research and Conservation Framework for the British Palaeolithic 2008; see also Buteux (ed) 2009, especially 111-120.

Research Objective 1B
Test the hypothesis that hominins may have been absent from the East Midlands during Period 2 (Pre-Levallois Lower Palaeolithic)

Summary:
Despite abundant data from areas of England to the south of our region, convincing evidence for hunter-gatherer activity in the East Midlands following retreat of the Anglian ice remains elusive[1]. Hominins are known to have exploited more southerly river valleys and other ecological zones during temperate stages of Period 2, including the Thames and East Anglia[2], and unless movements were impeded by obstacles such as the deep fjord-like feature into which the Nene flowed near Peterborough[3] there seems no reason why the East Midlands should not also have encouraged the attention of hunter-gatherers. Assessment of the extent of Period 2 hominin activity in the region is frustrated by an absence of evidence for deposits that may be dated securely to between late MIS12 and early MIS8[4]. It is recommended, therefore, that priority be accorded to the identification of deposits attributable to temperate stages of this period[5], followed by prospection for associated cultural material. This could be achieved by ensuring that the potential for the preservation of Period 2 deposits is established at an early stage of quarry developments across the region. The strategy should aim to confirm the presence or absence of Period 2 deposits, and, if these are found to be present, evaluate the potential for evidence of hominin activity.

Agenda topics addressed: 1.2.1; 1.2.4; 1.6.2; 1.6.4; 1.6.5.

East Midlands Resource Assessment and Research Agenda: 41.

SHAPE 2008 sub-programme: New frontiers: the remote past (1112.310).

Other specialist period/subject research strategies:
EH & Prehistoric Society Research and Conservation Framework for the British Palaeolithic 2008: Primary Research Theme 2; Strategic Research/Conservation Theme 2.
EH Research Strategy for Prehistory 2010: Theme PR1 (landscape perspectives), Topic 9 (reconstructing Pleistocene and early Holocene landscapes).

References:

[1] McNabb, J. 2006. The Palaeolithic, in Cooper, N.J. (ed) *The Archaeology of the East Midlands: An Archaeological Resource Assessment and Research Agenda*, University of Leicester: Leicester Archaeology Monograph 13, 22-24.
[2] e.g. Shreve, D.C., Bridgland, D.R., Allen, P., Blackford, J.J., Gleed-Owen, C.P., Griffiths, H.I., Keen, D.H. and White, M.J. 1993. Sedimentology, palaeontology and archaeology of the Middle Pleistocene River Thames terrace deposits at Purfleet, Essex, UK, *Quaternary Science Review* 21, 1423-1464.
[3] McNabb 2006, 24.
[4] Although identified on the fringe of our area at, for example, Peterborough and near Stoke Goldington, Buckinghamshire: McNabb 2006, 24.
[5] Compare Howard, A.J. and Knight, D. 2004 The Pleistocene Background, in Knight, D. and Howard, A.J. *Trent Valley Landscapes,* Kings Lynn: Heritage Marketing & Publications, 15.

Research Objective 1C
Confirm the extent and nature of early hominin activity during Period 4 (Mousterian)

Summary:

The East Midlands is one of few areas of Britain to have yielded a dataset for this period, albeit acquired principally by antiquarian explorations of limestone caves to the north and west of the region, and has significant potential for elucidating this poorly known period of prehistory[1]. Classic Mousterian *bout coupé* axes[2] are dispersed widely across the region, including Harlaxton in Lincolnshire, Duston and Marston Trussell in Northamptonshire, and Aylstone in Leicestershire[3], while typologically diagnostic hand-axes and flake tools implying repeated visits by hunter-gatherer groups and associated fauna have been recovered from limestone caves in Derbyshire and Nottinghamshire[4]. Further studies of extant artefact and faunal collections are recommended, particularly those recovered from antiquarian and more recent investigations at Creswell Crags[5], together with targeted excavation of sites likely to preserve significant stratified deposits with associated artefacts and environmental remains[6]. Faunal or botanical data would sharpen our picture of the regional environment, which in Britain generally was characterised by short, alternating, periods of cold and warm temperatures with rapid transitions and by dry open grasslands (the 'Mammoth Steppe')[7]. Caves and areas buried beneath material eroded from exposed rock faces are particularly important for the preservation of *in situ* remains, and should be targeted for excavation[8]. The potential of lowland environments is exemplified outside the region by the remarkable collection of Mousterian artefacts and fauna recovered from a palaeochannel at Lynford in Norfolk[9] and the woolly rhinoceros remains recovered from late Pleistocene sands and gravels at Whitemoor Haye in Staffordshire[10], and appropriate deposits should be identified and targeted during the assessment of quarry schemes within the region.

Agenda topics addressed: 1.3.1-1.3.4; 1.5.2-1.5.3; 1.6.2; 1.6.4; 1.6.5.

East Midlands Resource Assessment and Research Agenda: 42.

SHAPE 2008 sub-programmes: New frontiers: the remote past (11112.310); Understanding artefacts and material culture (11111.510).

Other specialist period/subject research strategies:
EH & Prehistoric Society Research and Conservation Framework for the British Palaeolithic 2008: Primary Research Theme 2; Strategic Research/Conservation Themes 1 & 2.
EH Research Strategy for Prehistory 2010: Theme PR1 (landscape perspectives), Topic 9 (reconstructing Pleistocene and early Holocene landscapes) and PR3 (understanding prehistoric society, Topic 18).
Research Framework for the Archaeology and Palaeontology of Creswell Crags and the Limestone Heritage Area (June 2010): Section 6.2

References:

[1] McNabb, J. 2006. The Palaeolithic, in N.J. Cooper (ed) *The Archaeology of the East Midlands,* 29-31.
[2] Roe, D.A. 1981. *The Lower and Middle Palaeolithic Periods in Britain*, London, RKP, 240-267; White, M.J. and Jacobi, R.M. 2003. Two sides to every story: *bout coupé* handaxes revisited, *Oxford Journal of Archaeology* 21, 109-133.
[3] McNabb 2006, 31; Roe 1981, 261-264.
[4] e.g. Creswell Crags, Derbyshire: Jenkinson, R.D.S. 1984. *Creswell Crags: Late Pleistocene Sites in the East Midlands*, Oxford: British Archaeological Reports British Series 122; Pettitt, P.B. and Jacobi, R.M. 2009. The archaeology of Creswell Crags, in Bahn, P. and Pettitt, P. 2009. *Britain's Oldest Art: The Ice Age Art of Creswell Crags*, London: English Heritage, 16-35.
[5] Wall, I.J. and Jacobi, R.E.M. 2000: *An Assessment of the Pleistocene collections from the cave and rockshelter sites in the Creswell Area*. Creswell Heritage Trust. http://archaeologydataservice.ac.uk/archives/view/creswellcrags_eh_2006/
[6] See Research Framework for the Archaeology and Palaeontology of Creswell Crags and the Limestone Heritage Area 2010: Section 6.2.
[7] McNabb 2006, 31.
[8] Pettitt, P.B., Jacobi, R.M., Chamberlain, A.T., Pike, A.W.G., Schreve, D., Wall, I., Dinnis, R. and Wragg Sykes, R. 2009. Excavations outside Church Hole, Creswell Crags; the first three seasons (2006-8), Transactions Thoroton Society 113, 35-53.
[9] *Research and Conservation Framework for the British Palaeolithic* 2008, 17.
[10] Schreve, D.C., Howard, A.J., Currant, A.P., Brooks, S., Buteux, S.T.E., Coope, G.R., Crocker, B.T., Field, M.H., Greenwood, M., Richards, M.P., Smith, D., Tetlow, E. and Toms, P. (forthcoming) A Middle Devensian woolly rhinoceros from Whitemoor Haye Quarry, Staffordshire (UK): palaeoenvironmental context and significance, *Journal of Quaternary Science*.

Research Objective 1D
Further investigate Period 5 (Upper Palaeolithic) open-air sites

Summary:
Recent archaeological investigations in the region have located several nationally important open-air sites dating from the Early and Late Upper Palaeolithic[1]. Further prospection and analysis is recommended to elucidate their character, spatial distribution and topographic settings, including assessment of the most appropriate fieldwalking methods. Key sites include an Early Upper Palaeolithic open-air site and hyaena den at Glaston and, for the Late Upper Palaeolithic, *in situ* concentrations of Creswellian (Late Magdalenian) flintwork and debitage on a river terrace near Newark[3], an *in situ* Creswellian lithic scatter found eroding out of a path in Bradgate Park near Leicester[4] and an extensive *in situ* long-blade assemblage at Launde, also in Leicestershire[5-6]. These sites represent the open-air equivalents of the Derbyshire and Nottinghamshire cave sites (Objective 1E), and analyses of associated lithic material may shed important light upon hunter-gatherer movements (Objective 1F) and in particular the relationship between open-air and cave locations. The Newark site, for example, yielded lithic material that from trace element analysis may have derived from southern English raw material sources[3], and along with other Creswellian open-air and cave sites may have formed part of an annual subsistence round extending well beyond the Trent Valley to upland sites such as Creswell Crags or southwards to the Severn basin[7].

Agenda topics addressed: 1.4.1-1.4.6; 1.4.8; 1.5.2-1.5.3; 1.6.1; 1.6.2.

East Midlands Resource Assessment and Research Agenda: 42.

SHAPE 2008 sub-programmes: New frontiers: the remote past (11112.310); fresh toolkits: methodological and theoretical research and innovation (14171.310).

Other specialist period/subject research strategies:
EH & Prehistoric Society Research and Conservation Framework for the British Palaeolithic 2008: Primary Research Theme 3; Strategic Research/Conservation Themes 1 & 2.
EH Research Strategy for Prehistory 2010: Theme PR2 (innovative studies of sites and monuments, Topics 14 & 15; Critical Priority 3: understanding sites without structures).
Research Framework for the Archaeology and Palaeontology of Creswell Crags and the Limestone Heritage Area (June 2010), Section 6.1.6, 6.2.7

References:

[1] McNabb, J. 2006. The Palaeolithic, in Cooper, N.J. (ed) *The Archaeology of the East*, University of Leicester: Leicester Archaeology Monograph 13, 36, 39-41.
[2] *Cooper, L.P., Thomas, J.S., Beamish, M.G., Gouldwell, A., Collcutt, S.N., Williams, J, Jacobi, R.M., Currant, A. and Higham, T.F.G.* forthcoming. An Early Upper Palaeolithic open-air station and mid-Devensian hyaena den at Grange Farm, Glaston, Rutland, UK, *Antiquity.*
[3] Garton, D. and Jacobi, R.M. 2009. An extensive Late Upper Palaeolithic flint scatter at Farndon Fields, near Newark, Nottinghamshire, *Archaeological Journal* 166, 1-37.
[4] Cooper, L. 2002. A Creswellian campsite, Newtown Linford, *Transactions of the Leicestershire Archaeological and Historical Society* 73, 91-97.
[5] Cooper, L. 2006. Launde, a Terminal Palaeolithic campsite in the English Midlands and its Northern European context, *Proceedings Prehistoric Society* 72, 53-93; *Research and Conservation Framework for the British Palaeolithic* 2008, 20.
[6] See also Cooper, L. 2004. The hunter-gatherers of Leicestershire and Rutland, in Bowman, P. and Liddle, P. (eds) 2004. *Leicestershire Landscapes*, Leicestershire Museums Archaeological Fieldwork Group Monograph 1, 12-29.
[7] Pettitt, P. 2008. The British Upper Palaeolithic, in Pollard, J. *Prehistoric Britain*, Oxford: Blackwell, 41-42, fig. 2.10.

Research Objective 1E
Investigate Upper Palaeolithic use of the limestone caves of Derbyshire and Nottinghamshire

Summary:
The caves and rock shelters of the Magnesian and Carboniferous limestones of Derbyshire and Nottinghamshire preserve a nationally important Palaeolithic resource - most spectacularly at Creswell Crags[1], which in addition to the first parietal artwork in Britain (including engravings of bison, deer, horse and birds in Church Hole Cave)[2-3] has yielded the most northerly Early Upper Palaeolithic lithic artefacts in the region[4]. On-going investigations in talus accumulations below Church Hole have revealed a hitherto unknown cave (the Crypt) with stratified Creswellian lithic artefacts and a remarkably diverse fauna[5], and emphasise the potential for the preservation of further unexplored caves buried beneath slope deposits in this and other gorges within the region. Such caves may preserve crucial artefact evidence for Upper Palaeolithic activity[6] and may shed important light upon the Early to Late Upper Palaeolithic cultural succession. We would recommend, therefore, continued prospection for Upper Palaeolithic cave sites along the Magnesian Limestone escarpment of the Derbyshire-Nottinghamshire border and in the Carboniferous Limestone of the White Peak[7], combined with targeted investigations of selected sites[8]. Palaeoenvironmental records for this period from the region remain sparse, and caves and other sites with stratified deposits also provide important opportunities for the preservation of fauna, pollen and other environmental remains that may elucidate variations in environmental conditions across the region and over time.

Agenda topics addressed: 1.4.1-1.4.8; 1.5.2; 1.5.3; 1.6.2.

East Midlands Resource Assessment and Research Agenda: 42.

SHAPE 2008 sub-programmes: New frontiers: understanding subterranean places; 11112.110).

Other specialist period/subject research strategies:
EH & Prehistoric Society Research and Conservation Framework for the British Palaeolithic 2008: Primary Research Theme 3; Strategic Research/Conservation Theme 3.
EH Research Strategy for Prehistory 2010: Theme PR2 (innovative studies of sites and monuments, Topic 13; Critical Priority 2: setting prehistoric sites in context).
Research Framework for the Archaeology and Palaeontology of Creswell Crags and the Limestone Heritage Area (June 2010).
Williams, J. 2009. The use of Science to Enhance Our Understanding of the Past, *National Heritage Science Strategy* Report 2, English Heritage, Section 3.3.1

References:

[1] Jenkinson, R.D.S. 1984. *Creswell Crags: Late Pleistocene Sites in the East Midlands,* Oxford: British Archaeological Reports British Series 122; Pettitt, P.B. and Jacobi, R.M. 2009. The archaeology of Creswell Crags, in Bahn, P. and Pettitt, P. 2009. *Britain's Oldest Art: The Ice Age Art of Creswell Crags*, London: English Heritage, 16-35.
[2] Bahn, P. and Pettitt, P. 2009. *Britain's Oldest Art: The Ice Age Art of Creswell Crags*, London: English Heritage.
[3] Pettitt, P., Bahn, P. and Ripoll, S (eds) 2007. *Palaeolithic Cave Art at Creswell Crags in European Context*, Oxford: Oxford University Press.
[4] Howard, A.J. and Knight, D. 2004, 23; McNabb, J. 2006, 36.
[5] Pettitt, P.B., Jacobi, R.M., Chamberlain, A.T., Pike, A.W.G., Schreve, D., Wall, I., Dinnis, R. and Wragg Sykes, R. 2009. Excavations outside Church Hole, Creswell Crags; the first three seasons (2006-8), Transactions Thoroton Society 113, 35-53.
[6] Charles, R. and Jacobi, R. 1994. The Late Glacial Fauna from the Robin Hood Cave, Creswell Crags: a re-assessment, *Oxford Journal of Archaeology* 13, 1-32.
[7] Following on from work by Holderness, H., Davies, G., Chamberlain, A. and Donahue, R. 2007. *A conservation Audit of Archaeological Cave Resources in the Peak District and Yorkshire Dales*, Cave Archaeology and Palaeontology Research Archive (http://www.capra.group.shef. ac.uk).
[8] Research Framework for the Archaeology and Palaeontology of Creswell Crags and the Limestone Heritage Area, Section 6.2.

Research Objective 1F
Investigate the annual patterns of movement of Late Upper Palaeolithic hunter-gatherers

Summary:
The wide variety of evidence from the East Midlands for Late Upper Palaeolithic activity, including open air sites[1], caves and rock shelters[2], raises the possibility of exploring settlement patterns, mobility and hunting strategies in ways that are possible in few other regions of the country. Systematic studies of Late Upper Palaeolithic lithic artefact morphology and technology could usefully be combined with scientific analyses aimed at establishing the potential sources of raw materials. Current work on artefact sourcing by trace element analyses of worked stone and potential source materials is of particular interest in this respect, and from sites at Farndon[1] and elsewhere has identified possible linkages between sites distributed widely over the Trent and Severn catchments and beyond[3-4]. Trace element analysis may well be useful as a technique for unravelling the annual patterns of movement of hunter-gatherers within and beyond the East Midlands, and could potentially be extended to sites of the Early Upper Palaeolithic and other periods where we can be confident that the observed pattern of finds reflects the original distribution of activity foci. This technique might be augmented by isotopic studies of human bone to elucidate the movement of people (oxygen, strontium and sulphur) and their diets (stable carbon and nitrogen)[5].

Agenda topics addressed: 1.4.2-1.4.5; 1.6.1.

SHAPE 2008 sub-programmes: Bright science: technical and technological innovation (14171.210); understanding artefacts and material culture (11111.510).

Other specialist period/subject research strategies:
EH & Prehistoric Society Research and Conservation Framework for the British Palaeolithic 2008: Primary Research Theme 3; Strategic Research/Conservation Theme 2.

EH Research Strategy for Prehistory 2010: Theme PR3 (understanding prehistoric society, Topic 18) PR5 (Realising the full potential of scientific techniques, Topic 29).
Research Framework for the Archaeology and Palaeontology of Creswell Crags and the Limestone Heritage Area (June 2010): Section 6.1.6.
Williams, J. 2009. The use of Science to Enhance Our Understanding of the Past, *National Heritage Science Strategy* Report 2, English Heritage, Section 3.4.1.

References:

[1] Garton, D. and Jacobi, R.M. 2009, An extensive Late Upper Palaeolithic flint scatter at Farndon Fields, near Newark, Nottinghamshire, *Archaeological Journal* 166, 1-37.
[2] Jenkinson, R.D.S. 1984. *Creswell Crags: Late Pleistocene Sites in the East Midlands.* Oxford, British Archaeological Reports British Series 122; Pettitt, P.B. and Jacobi, R.M. 2009. The archaeology of Creswell Crags, in Bahn, P. and Pettitt, P. 2009. *Britain's Oldest Art: The Ice Age Art of Creswell Crags*, London: English Heritage, 16-35.
[3] Pettitt, P. 2008. The British Upper Palaeolithic, in Pollard, J. *Prehistoric Britain*, Oxford: Blackwell, 41-43.
[4] Rockman, M. 2003. *Landscape Learning in the Late Glacial Recolonization of Britain*, unpublished PhD dissertation, University of Arizona.
[5]Williams 2009, 10.

Research Objective 1G
Elucidate from terrestrial sources the changing Pleistocene environment

Summary:
Further mapping and visualisation of the Pleistocene landscape is recommended in order to elucidate further the relationship between human populations and changes in climate, vegetation and landscape[1]. This should be accompanied by the inclusion of further detail in regional Historic Environment Records, which at present often lack necessary information on the Pleistocene environment. There is significant scope in the East Midlands for further investigation of the changing environment, particularly from the evidence of palaeochannels preserved in the major river valleys[2-3] and from cave deposits of the Magnesian and Carboniferous limestones. Unpublished archive information from Creswell Crags, notably data acquired during excavations at Pin Hole cave from 1984 to 1989, has particular potential for elucidating changes in the Pleistocene environment, and would merit detailed assessment and further study in combination with excavations of new *in situ* deposits[4]. Organic deposits associated with the Bytham drainage also provide a critical resource for reconstruction of the environmental conditions of the earliest hominin colonisers, of significance within and beyond the region. The enormous potential of Bytham deposits is exemplified by the discovery of organic remains associated with temperate deposits at Brooksby Quarry in Leicestershire[5] and, from just outside our area, by organic finds retrieved from Waverley Wood, Warwickshire, in association with Lower Palaeolithic lithic artefacts[6].

Agenda topics addressed: 1.5.1-1.5.3; 1.6.4-1.6.5.

East Midlands Resource Assessment and Research Agenda: 42, 264.

SHAPE 2008 sub-programme: understanding ancient environments and ecologies (1111.420) and understand the impact of climate change (11111.410).

Other specialist period/subject research strategies:
EH & Prehistoric Society Research and Conservation Framework for the British Palaeolithic 2008: Primary Research Theme 1; Strategic Research/Conservation Theme 1.
EH Research Strategy for Prehistory 2010: Theme PR6 (Understanding human interactions with the environment, Topics 32 and 33).
Research Framework for the Archaeology and Palaeontology of Creswell Crags and the Limestone Heritage Area (June 2010), especially Sections 6.1.1, 6.1.4 and 6.2.1.
Williams, J. 2009. The use of Science to Enhance Our Understanding of the Past, *National Heritage Science Strategy* Report 2, English Heritage, Section 3.3.1.

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[2] e.g. Howard, A.J. and Knight, D. 2004 The Pleistocene Background, in Knight, D. and Howard, A.J. *Trent Valley Landscapes,* Kings Lynn: Heritage Marketing & Publications, 12-23.
[3] Compare Lynford, Norfolk: palaeochannel associated with Mousterian artefact and mammalian fauna: *Research and Conservation Framework for the British Palaeolithic* 2008, 17.
[4] Research Framework for the Archaeology and Palaeontology of Creswell Crags and the Limestone Heritage Area, Sections 6.1 and 6.2.2.
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Research Objective 1H
Explore the submerged Pleistocene landscapes of Doggerland

Summary:
Sea-level rises between around 13,000 to 7,500 years ago, following the melting of ice sheets after the Last Glacial Maximum, have inundated vast tracts of the low-lying plains that for much of the Pleistocene and early Holocene would have extended from eastern England to the Continent. Some 23,000km^2 of this submerged landscape, known as Doggerland, have been mapped as part of the North Sea Palaeolandscapes Project, revealing through 3D seismic data a striking image of a lowland landscape subject to continuous and dynamic change[1]. Large areas of the North Sea floor are the products of sediment reworking following submergence of low-lying areas, and may in many places seal preserved Pleistocene (and early Holocene) landscapes[2]. Seismic interpretation techniques have permitted the identification of buried river channels with the potential for preservation of cultural and environmental remains that may elucidate landscape developments and changing lifestyles - both in the Palaeolithic and Mesolithic (Objective 2H). For both periods, therefore, there is a clear need to identify, target, date and sample submarine palaeochannels and pre-inundation land surfaces, and to record and date artefact, faunal and botanical material retrieved principally through dredging[3]. There is also an opportunity to recover palaeoenvironmental data and artefacts from the assessment and development of further wind-farm locations[4], and from continuing liaison with the fishing industry.

Agenda topics addressed: 1.4.4-1.4.5; 1.5.1-1.5.3; 1.6.2; 1.6.3.

SHAPE 2008 sub-programmes: New frontiers: mapping our marine heritage (11112.110); understanding the impact of past climate change (11111.410).

Other specialist period/subject research strategies:
EH & Prehistoric Society Research and Conservation Framework for the British Palaeolithic 2008: Primary Research Theme 1; Strategic Research/Conservation Theme 1.
EH Research Strategy for Prehistory 2010: Themes PR1 (Landscape perspectives, Topic 8) and PR6 (Understanding human interactions with the environment, Topic 32).
North Sea Prehistory Research and Management Framework 2009, 28: Themes B and G.
Canti, M. 2009. *A Review of Geoarchaeology in the Midlands of England*. London: English Heritage Research Department Report Series 17-2009, 55: Priority 3.2 (marine sediments).
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