The Submerged Palaeo-Yare: New Middle Palaeolithic Archaeological Finds from the Southern North Sea

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APPENDIX S1: LITHIC RECORDING METHODOLOGY

All artefacts; qualitative variables relating to condition

These observations are recorded for all artefacts and are used to assess the taphonomic histories of assemblages. The physical effects of movement and re-arrangement are recorded (abrasion, edge damage, battering, and scratching) and used to assess the degree to which assemblages have been subject to such processes. Chemical alteration to artefact surfaces is also noted (patination and staining). Although the interpretation of such surface alteration is as yet poorly understood, it may relate to contrasts in surface exposure or burial environment and could therefore potentially be indicative of different taphonomic histories of artefacts within collections.

1. Abrasion:
    0. Unabraded.
    1. Slightly abraded.
    2. Moderately abraded.
    3. Heavily abraded.
2. Edge damage:
    1. No edge damage.
    2. Slight edge damage.
    3. Moderate edge damage.
    4. Heavy edge damage.

Where more than one phase of edge damage is noted (eg, a patinated and less heavily patinated phase) each is recorded separately.

3. Staining:
    0. Unstained.
    1. Slightly stained.
    2. Moderately stained.
    3. Heavily stained.
4. Patination:
    0. Unpatinated.
    1. Lightly patinated.
    2. Moderately patinated.
    3. Heavily patinated.
5. Surface scratching:
    0. No scratching.
    1. Light scratching.
    2. Moderate scratching.
    3. Heavy scratching.
6. Battering (characterised by incipient cones visible on artificially flaked surfaces):
    0. No battering.
    1. Light battering.
    2. Moderate battering.
    3. Heavy battering.

All artefacts; qualitative variables relating to raw material and technology

1. Raw material type. This is determined macroscopically.
    1. Flint.

2. Probable raw material source. This is determined for artefacts on flint blanks through examination of any remnant cortex. Flint obtained directly from a chalk outcrops retain unrolled cortex that is frequently thick and chalky, while flint derived from river/beach gravel retains thin, rolled cortex, often with chatter marks resulting from clast collision.
    1. Fresh.
    2. Derived.
    3. Indeterminate.
3. Mode of percussion:
    1. Hard. Hard-hammer products exhibit a pronounced bulb of percussion and a thick butt; hard hammer scars exhibit the same features in negative.
    2. Soft. Typical soft-hammer products tend to be relatively thin, exhibit a curved profile, a diffuse bulb, and a thin, wide butt, which is frequently lipped. Soft-hammer scars exhibit the same features in negative.
    3. Mixed. An artefact which retains both hard and soft hammer scars was recorded as mixed.
    4. Indeterminate. Although the features described above are characteristic of typical hard and soft hammer products and scars, artefacts often exhibit a mixture of features indicative of either mode of percussion. Where mode of percussion cannot be definitively stated, artefacts are recorded as indeterminate.

Flakes (non-Levallois)

In the absence of any refitting studies and given that non-Levallois flakes may result from a variety of reduction strategies, analysis of such material is directed towards recording taphonomically informative attributes (eg, dimensions as reflective of size distribution) and technological criteria relating to lithic reduction in a general sense (eg, cortex retention as a reflection of broad reduction stage), rather than the specific methods employed.

QUANTITATIVE VARIABLES

1. Length (mm) measured along the axis of percussion.
2. Breadth (mm). Refers to the maximum width of a flake at 90° to the axis of percussion.
3. Maximum thickness (mm).

QUALITATIVE VARIABLES

1. Measured (as a percentage) of the total surface area of the dorsal face of a flake that displays cortex, or consists of a natural surface:
    0. 0%.
    1. <50%.
    2. >50%.
    3. 100%.
2. Portion:
    1. Whole.
    2. Proximal.
    3. Distal.
    4. Mesial.
    5. Siret; flake has split along or parallel to the axis of percussion.
3. Butt type:
    1. Plain.
    2. Dihedral.
    3. Cortical.
    4. Natural (but non-cortical).
    5. Marginal.
    6. Soft hammer.
    7. Mixed (eg, combination of natural and flake surfaces).

8. Facetted.
9. Missing.
10. Trimmed; characterized by small flake scars running into dorsal surface along same axis as flake itself.
11. Obscured (eg, by damage).

4. Retouch:
    1. Yes.
    2. No.

Cores (non-Levallois and non-blade)

Non-Levallois are grouped according to the general method which characterizes their reduction (eg, migrating platform, discoidal, etc), whilst analysis is geared towards establishing whether any clear technological factors — such as reduction intensity or raw material size — can account for the characteristics exhibited by such cores.

QUANTITATIVE VARIABLES

1. Maximum dimension (mm).

QUALITATIVE VARIABLES

1. Characterisation of overall core-reduction method:
    1. Migrating platform. Such cores are characterised by *ad hoc* exploitation of multiple platforms as they become available throughout the reduction sequence.
    2. Single platform unprepared. These are cores worked from a single unprepared platform.
    4. Bipolar unprepared. These cores are worked from two opposed, but unprepared platforms.
    5. Discoidal. Such cores display evidence of alternate/alternating flaking from a single, peripheral platform into the volume of two non-hierarchically related surfaces.
    6. Other. When other methods of core reduction are encountered, these are described
2. Blank type. This is inferred from distribution of cortex/natural fracture surface, or relict ventral/dorsal. The following categories can be recognised:
    1. Nodule.
    2. Flake.
    3. Thermal/frost flake.
    4. Shattered nodule.
    5. Indeterminate.
3. Measure (as a percentage) of the total surface area of core which displays evidence of cortex or retains other evidence of a natural surface:
    0. 0%.
    1. >0-25%.
    2. >25-50%.
    3. >50-75%.
    4. >75%.
4. Retouch:
    1. Yes.
    2. No.

Levallois cores and simple prepared cores

Levallois cores are identified following a six point volumetric definition of the Levallois technique. These six criteria are:

1. The volume of the core comprises two surfaces separated by a plane of intersection.
2. The two surfaces are hierarchically related and non-interchangeable; one acts as a flaking surface and the other as a striking platform surface.
3. The configuration of the flaking surface predetermines the morphology of the products through the management of the distal and lateral convexities.

4. The fracture plane for the removal of predetermined blanks is parallel to the plane of intersection between the two surfaces.
5. The point at which the striking platform surface and flaking surface intersect is perpendicular to the flaking axis of the predetermined flakes.
6. Hard hammer percussion is employed.

Cores which conform to all six criteria are classed as Levallois cores, while those which possessed the distal and lateral convexities of a Levallois flaking surface but no consumptive Levallois removal (making it impossible to determine the fracture plane or axis of the pre-determined blanks; criteria 4 & 5) are treated as unstruck Levallois cores. Furthermore, cores which exploit the natural convexities of a nodule and therefore do not retain evidence of deliberate configuration of a flaking surface (criterion 3) but do fulfil the other five of criteria are classed as simple prepared cores.

QUANTITATIVE VARIABLES

1. Length (mm). This is measure along the primary axis of Levallois flake removal, except in the case of unstruck cores, or cores subject to centripetal recurrent exploitation, in which cases the core is orientated in relation to the distal and lateral convexities.
2. Breadth (mm). This refers to the maximum width at 90° to the axis along which the length is measured.
3. Maximum thickness (mm).
4. Number of preparatory scars visible on the flaking surface with a minimum dimension of at least 5 mm.
5. Number of preparatory scars visible on the striking platform surface with a minimum dimension of at least 5 mm.
6. Number of definite Levallois products detached from the final flaking surface.
7. Dimensions of final Levallois products:
    1. Length (mm).
    2. Breadth (mm).

INDICES

These are generated using quantitative variables taken from Scott (2011).

1. Elongation (Breadth/Length).
2. Flattening (Thickness/Breadth).

QUALITATIVE VARIABLES

1. Type:
    1. Levallois.
    2. Simple prepared.
2. Blank type. This is inferred from distribution of cortex/natural fracture surfaces, or relict ventral/dorsal surfaces. The following types were recognised:
    1. Nodule.
    2. Flake.
    3. Thermal/frost flake.
    4. Shattered nodule.
    5. Indeterminate.
3. Method of preparation of final flaking surface. This is defined according to the orientation of the removals which precede invasive, volumetrically consumptive removals interpreted as the result of the removal of Levallois products. The core is orientated along the dominant axis of Levallois flaking or relative to the position of the distal and lateral convexities if unexploited. If the core has been subject to re-preparation, the orientation of all previous scars is taken into account. Given that Levallois cores only provide direct information concerning the final phase of preparation and exploitation before discard, it is recognised that such techniques are not fixed and may have varied throughout the cores productive 'life'. The following categories are recognised:

1. Unipolar.
2. Bipolar.
3. Convergent unipolar.
4. Centripetal.
5. Unidirectional lateral. This could reflect centripetal preparation, or the shifting of the striking platform after unipolar preparation or unipolar recurrent exploitation, however, in the absence of clear evidence indicative of one of these options, preparation is recorded as unidirectional lateral.
6. Bipolar lateral.
7. Unipolar from distal.
8. Indeterminate, ie, it is a core fragment or the flaking surface is obscured.

Methods of Levallois core preparation, based upon the location of preparatory flake scars. The following categories are recognised:

1. Unipolar.
2. Bipolar.
3. Convergent unipolar.
4. Centripetal.
5. Unidirectional lateral.
6. Bipolar lateral.
7. Unipolar distal.

4. Method of exploitation of final flaking surface. This is based upon the orientation of invasive, volumetrically consumptive flake scars interpreted as resulting from the removal of Levallois flakes. The following categories are recognised:
    0. Unexploited. The core conforms to the Levallois concept but the flaking surface does not retain evidence of volumetrically consumptive scars resulting from Levallois flake production.
    1. Lineal. A single Levallois flake has been removed from the flaking surface of the core and was not preceded by an earlier Levallois flake from the same surface.
    2. Unipolar recurrent. Two or more Levallois flake scars have been removed from one striking platform on the same flaking surface.
    3. Bipolar recurrent. Two or more definite Levallois flake scars have been removed from opposed platforms on the same flaking surface.
    4. Centripetal recurrent. Two or more definite Levallois flakes scars have been removed from various locations around the periphery of the same flaking surface.
    5. Re-prepared but unexploited. Such cores differ from those which display an unexploited flaking surface in that there is clear evidence for repreparation of the core following the removal of one or more invasive, volumetrically consumptive scar(s) interpreted as resulting from Levallois removal(s) from a previous surface.
    6. Failed final removal. These are cores which display evidence of a single attempted Levallois removal that has failed to detach or has overshot the core edge.
    7. Indeterminate. A core fragment or core which possesses a flaking surface that is obscured (eg, by damage).
5. Morphological description of Levallois products from final flaking surface:
    0. Unexploited
    1. Flake.
    2. Point.
    3. Blade.
    4. Debordant flake — has removed one or both lateral core edges.
    5. Overshot distal end.
    6. Debordant and overshot.
    7. Failed removal(s).

6. Measure (as a percentage) of the total area of the core's striking platform surface which displays evidence of cortex or retains other evidence of a natural surface:
    0. 0%.
    1. >0-25%.
    2. >25-50%.
    3. >50-75%.
    4. >75%.
7. Retouch:
    1. Yes.
    2. No.

Levallois products

Products are identified as being the result of Levallois reduction if they displayed characteristics indicating that they have been removed from the flaking surface of a Levallois core. Based on the attributes defined by Scott (2011) the following features are considered to be indicative of Levallois products:

- Struck using a hard hammer.
- Display a relatively large number of dorsal scars, and potentially a complex dorsal scar pattern.
- Are removed from a surface, rather than biting into the volume of a core, and are therefore relatively flat in longitudinal section.
- Exhibit the distal and lateral convexities which controlled detachment along the flaking axis, reflecting the fact that such flakes preferentially consume the flaking surface of the Levallois core.
- May retain evidence of deliberate platform preparation, such as faceting.
- May also retain evidence of deliberate convexity accentuation, in the form of relatively small peripheral flake scars.

As there is a degree of uncertainty in the identification of Levallois products, the probability of an individual product being deliberately produced from a Levallois flaking surface was noted as degree of confidence; definite, probable, and possible. Although probable and possible Levallois products were recorded as Levallois products, analysis was concentrated on definite Levallois products alone in order that only technological actions definitely associated with Levallois flaking are discussed.

QUANTITATIVE VARIABLES

1. Length (mm) measured along the axis of percussion.
2. Breadth (mm). Refers to the maximum width at 90° to the axis of percussion.
3. Maximum thickness (mm).

QUALITATIVE VARIABLES

1. Confidence of being a deliberately detached Levallois end product:
    1. Definite.
    2. Probable.
    3. Possible.
2. Measure (as a percentage) of the total surface area of the dorsal face of a Levallois product which displays cortex, or consists of a natural surface:
    0. 0%.
    1. <50%.
    2. >50%.
    3. 100%.
3. Portion:
    1. Whole.
    2. Proximal.
    3. Distal.
    4. Mesial.
    5. Siret; product has split along or parallel to the axis of percussion.

4. Butt type:
    1. Plain.
    2. Dihedral.
    3. Cortical.
    4. Natural (but non-cortical).
    5. Marginal.
    6. Soft hammer.
    7. Mixed (e.g. combination of natural and flake surfaces).
    8. Facetted.
    9. Missing.
    10. Trimmed; small flake scars running into dorsal surface along same axis as the product itself.
    11. Chapeau de Gendarme.
    12. Obscured (e.g. by damage).
5. Type of Levallois product in morphological terms:
    1. Flake.
    2. Point.
    3. Blade.
    4. Debordant flake (lateral edge of core removed).
    5. Overshot.
    6. Debordant and overshot.
    7. Indeterminate; partial end product which cannot be classified.
6. Method of preparation. This is based upon the orientation of preparatory flake scars, including previous Levallois flakes scars, since these are viewed as pre-determining as well as pre-determined.
    1. Unipolar.
    2. Bipolar.
    3. Convergent unipolar.
    4. Centripetal.
    5. Unidirectional lateral, ie, all preparatory scars run in from the one edge. This could reflect the shifting of the striking platform after unipolar preparation, unipolar recurrent exploitation, or centripetal preparation when only part of the flaking surface was removed. Unless there is unequivocal evidence for one of these options, preparation is recorded as unidirectional lateral.
    6. Bipolar lateral, ie, preparatory scars run in from both edges. This could reflect the shifting of the striking platform after bipolar preparation or bipolar recurrent exploitation, or centripetal preparation when the flake did not actually reach the end of the core. However, if there is no unequivocal evidence for one of these options, preparation is recorded as bipolar lateral.
    7. Unipolar from distal.
    8. Indeterminate; fragmentary, or the flaking surface is obscured.
7. Method of exploitation. This is based upon the orientation of any previous Levallois flake scars retained on the product's dorsal surface, and whether the product itself can be definitively stated to have been the only Levallois product removed from a particular flaking surface. The following categories were recognised:
    1. Lineal. The product does not retain any previous Levallois product scars and would clearly prevent the removal of a subsequent product, ie, it has obviously completely consumed the volume of the entire flaking surface, necessitating complete re-preparation before another product could be removed.
    2. Single removal. The product does not retain any previous Levallois product scars but could potentially have been followed by another removal, so cannot definitively be stated to reflect lineal exploitation.
    3. Unipolar recurrent. One or more previous Levallois products have been struck along the same axis as the product itself.

4. Bipolar recurrent. One or more Levallois product scars removed in opposition to, or in opposition to and in the same direction, as the product itself.
5. Centripetal recurrent. One or more Levallois product scars removed in various directions in relation to the product itself.
6. Indeterminate. It may not be possible to classify the exploitation phase even if a previous Levallois product scar is present. For instance, if a previous product scar is located slightly tangentially to the removal itself but was struck from the same platform, the product may have formed part of either a centripetal recurrent or unipolar recurrent sequence.

8. Retouch?
   1. Yes.
   2. No.

Handaxes

All the handaxes are recorded following established and widely used methodologies which documents variability in handaxe form (Bordes 1961; Roe 1964; 1968). Additional technological features were noted.

QUANTITATIVE VARIABLES

1. Length (mm). This refers to the maximum distance from butt to tip parallel to the long axis of the handaxe.
2. Breadth (mm). This is measured as the maximum distance between the lateral margins of the handaxe perpendicular to the long axis.
3. Maximum thickness (mm) measured perpendicular to the long axis of the handaxe.
4. T1 (mm).Thickness of the handaxe at one fifth of the length from tip.
5. T2 (mm). Thickness of the handaxe at one fifth of the length from butt.
6. B1 (mm). The width of the handaxe at one fifth of length from the tip.
7. B2 (mm). The width of the handaxe at one fifth of length from the butt.
8. L1 (mm). The length of the handaxe measure from the point of maximum width.
9. N (mm). The width of the handaxe measure halfway up the handaxes length.
10 M (mm). The width of the handaxe measure at three quarters of the maximum length from the butt.
11 Length of cutting edge (mm).

INDICES

The following indices are based on Roe (1964; 1968) and White (1996):

1. Refinement. This expresses the relative thickness of a cross section of a handaxe compared to its width. It is calculated by dividing the maximum thickness by the maximum width (Th/B). This results in a value between 0 and 1, with the lower values expressing greater refinement.
2. Elongation. This expresses the relative length of a handaxe compared to its width. It is calculated by dividing the maximum width by the maximum length (B/L). This presents a value between 0 and 1, with the lower value expressing higher elongation (ie, they are narrower).
3. Tip shape. This provides an index of the relative 'pointedness' or 'bluntness' of the tip of a handaxe. It is calculated using B1/B2, which provides a figure between 0 and 1, with lower values indicating that the tip is more pointed.
4. Cross sectional uniformity. This expresses the thickness of a handaxes tip relative to the thickness of its butt. It is calculated using T1/T2 and provides a value between 0 and 1, with higher values indicating more uniform cross sections.
5. Planform. This divides handaxes into three basic shapes based on the relative position of width. It is calculated by dividing the butt length by total length (L1/L). This results in a value between 0 and 1, with lower values expressing lower positions of maximum widths. Furthermore, these values provide a ratio of the position of the butt in relation to the tip, with low values indicative of a handaxe with a short butt and a long tip, and higher values showing handaxes with longer butts and short tips. Roe (1964; 1968) used these measurements to divide handaxes into three broad groupings reflective of their planform:

1. Points; L1/L not exceeding 0.350.
2. Ovates; L1/L value greater than 0.350.
3. Cleavers; L1/L value greater than 0.550.

Following Roe (1964; 1968) the variation in the specific outline shape exhibited by these three groups can be illustrated through the mechanism of the tripartite diagram. This uses the planform, elongation, and tip shape indices generated for individual handaxes to provide an illustration of the range of handaxe planforms present in an assemblage.

The following indices are based on Bordes (1961):

1. Location of maximum breath. Expresses the position of the maximum breadth in relation to maximum length.
2. Roundedness. Express the curvature of the lateral edges by relating width of handaxe halfway up length (N) to maximum width.
3. Pointedness. Expresses the pointedness of the handaxe tip by relating width at three quarters of the length of the handaxe from the butt (M) to maximum width.
4. Elongation. This expresses the relative length of a handaxe compared to its width. It is calculated by dividing the maximum width by the maximum length (L/B).
5. Flatness. This expresses the 'thickness' of the handaxe by relating maximum thickness of the handaxe to maximum breath:
   If the indices is <2.35 the handaxe is classed as thick;
   If the indices is >2.35 the handaxe is classed as thin.

QUALITATIVE VARIABLES

1. Portion:
   1. Whole.
   2. Tip.
   3. Butt.
   4. Other Portion.
2. Measure (as a percentage) of the total surface area of the handaxe which displays evidence of cortex or retains other evidence of a natural surface.
   0. 0%.
   1. >0-25%.
   2. >25-50%.
   3. >50-75%.
   4. >75%.
3. Position of cortex or natural surface:
   0. None.
   1. Butt only.
   2. Butt and edges.
   3. Edges only.
   4. On face.
   5. All over.
4. Blank type:
   1. Nodule.
   2. Flake.
   3. Thermal/frost flake.
   4. Shattered nodule.
   5. Indeterminate.
5. Edge position. For this observation the handaxe is divided into three sectors: the butt, the tip, and the edges. The butt is considered as the portion of the handaxe below B2, the tip the sector above B1, while the edges (or margins) equate to the three-fifths between these two points. The following categories are recognised:
   1. All round.
   2. All edges sharp, dull butt.

3. Most edges sharp, dull butt.
4. One sharp edge, dull butt.
5. Irregular.
6. Most edges sharp, sharp butt.
7. One sharp edge, sharp butt.
8. Tip only.

6. Shaping. Determined by a phase of non-invasive, final phases of removals dedicated to shaping the handaxe:
   1. Yes.
   2. No
7. Presence of tranchet removal:
   1. Yes.
   2. No.
8. Secondary working. Examination for the presence of primary and secondary phases of working, with the latter reflecting reconfiguration of a previous handaxe form:
   1. Yes.
   2. No.

Retouched pieces

For retouch pieces a description of the location and form of retouch is provide following the terminology of Inizan *et al.* (1992).

BIBLIOGRAPHY

Bordes, F. 1961. *Typologie du Paléolithique ancien et moye*. Bordeaux: Institut de Préhistoire Mémoire l

Inizan, M.-L., Roche, H. & Tixier, J. 1992. *Technology of Knapped Stone*. Meudon: Prehistoire de la Pierre Taillee 3

Roe, D.A. 1964. The British Lower and Middle Palaeolithic: some problems, methods of study and preliminary results. P*roceedings of the Prehistoric Society* 30, 245–67

Roe, D. 1968. *A Gazetteer of British Lower and Middle Palaeolithic Sites*. London: Council for British Archaeology research Report 8

Scott, B. 2011. *Becoming Neanderthals: the Earlier British Middle Palaeolithic*. Oxford: Oxbow Books

White, M.J. 1996. *Biface Variability and Human Behaviour in the Earlier Palaeolithic: a case-study from South-Eastern England.* Unpublished PhD Thesis, University of Cambridge