Excavation: the Role of Archaeology

David Cranstone

Summary *The author, a professional archaeologist, describes some techniques of late twentieth century archaeological excavation on industrial sites, drawing on his own experience on mining and metallurgical sites; it is hoped that the conclusions will be more widely applicable. He highlights the importance of detailed factual recording, high-quality excavation methods where appropriate, the study of process residues, and the integration of detailed building recording with the process of excavation.*

Introduction

The discipline of archaeology has developed over a period of some 150 years, though for much of this period its focus in Britain has been very much on the Prehistoric and Roman periods; only recently has our industrial heritage been recognised as a proper (indeed crucial) field for the deployment of fully-developed archaeological methodology, and this recognition is still not universal within the archaeological world. In mirror image of this situation, the discipline of Industrial Archaeology has grown up with (until recently) a disappointingly limited input from archaeology, and a limited understanding of the potential of, and need for, archaeological approaches to industrial sites. In particular, archaeological excavation to professional standards has until recently been all too rarely applied to industrial sites.

The role of excavation on industrial sites has been previously surveyed in these pages by White,[1] and the purpose of the present article is to describe some of the techniques of the 1990s in more detail, rather than to repeat White's polemic. However his basic point still needs stressing: excavation is be definition destructive of its own evidence, and should not be undertaken lightly or without the skills and facilities to do it properly. To 'clear' or 'excavate' a site without full record of the deposits removed and exposed is an act of vandalism, every bit as destructive as the bulldozing of a standing structure.

The following article therefore seeks to achieve two aims: firstly, to illustrate the information gained by applying good excavation techniques to industrial sites and monuments; and secondly, to highlight some of the ways in which industrial sites tend to differ from more conventional archaeological excavations, and the modifications of normal methodology that may result. The article is based on the author's own experience of excavating on a number of mining and metallurgical sites, including ore-washing floors, blast furnaces, lead smelters, forges and steel furnaces; it is hoped that some at least of the conclusions can also be usefully applied to industrial sites outside the mining and metallurgical fields. For present purposes, Industrial Archaeology is defined as the archaeology of technology (of any period); other aspects of the Industrial Revolution period are not considered.

Principles

Before considering the practical methodology of excavation, it is necessary to consider the decision of principle: should this excavation be performed? It should be stressed again that, unlike historical research, building recording, or field survey, excavation is a destructive act that cannot be repeated; the deposits removed cannot be replaced with their information value intact.

Archaeological excavation is normally performed for one of three reasons: rescue, display or research. The first of these, involving the excavation of a site (or part of site) that is threatened with unpreventable destruction (normally, though not invariably, by development), needs little justification, since without excavation the evidence will be destroyed without record. Under current Government policy[2] excavation necessitated by development should normally be funded by the developer, and Annex 2 of this document contains a list of County Archaeologists, who should be willing to undertake negotiations and arrange excavations.

Excavation for display has been widespread in Industrial Archaeology, though it has not always been performed to any adequate standard. Typically, post-abandonment and 'late' deposits are removed, to expose structures for consolidation; the prime motive may be either the conservation of the site, or its development as a tourist/educational resource, or a combination. Even this limited degree of excavation *is* destructive, and should not be undertaken without adequate recording.

Excavation for research is the hardest category to justify, since it involves the sacrifice of otherwise-unthreatened deposits. There are some archaeologists (though fewer than in the 1970s) who would consider that research excavation should only be undertaken on rescue or display sites, pure research excavation never being justified. The present author does not hold to this extreme view, accepting the need for, and value of, research excavations for carefully-considered aims, undertaken to a high standard. At the other extreme, the disturbance of a site out of curiosity, without the skills to record properly, has no justification.

It should also be pointed out that increasing numbers of industrial sites are being Scheduled as Ancient Monuments. In these cases, excavation without formal Scheduled Monument Consent (from the Department of the Environment, advised by English Heritage) is illegal, and may well result in prosecution. Again, a local County Archaeologist will normally be able to advise on Scheduled Ancient Monuments in his/her area.

Before undertaking an excavation, the after-effects also need to be considered. The first of these is on the site itself, if the excavation is for display or research. Exposed structures are generally much more vulnerable to damage and decay than they were before excavation, and the more fragile materials (such as timber) will deteriorate very rapidly after exposure. It is therefore necessary to ensure either that the excavation is carefully backfilled on completion, or that adequate facilities are available to conserve the site as excavated.

Similar stipulations apply to the finds from excavation; these will need identification and cataloguing (with perhaps drawing for publication), and may also need expensive conservation; this will often apply to metalwork, and almost always to any timber, leather, or other waterlogged materials recovered.

Finally, the need to publish should be recognised. Standards and levels of detail vary widely, depending among other factors on the importance of the excavation. As a minimum, all excavation records should be written-up into a coherent typescript, all drawings converted to ink versions on drafting film, these records and the original site records should be deposited in a safe store, and an outline report should be published (which should state where the detailed 'archive' is housed). Only then is the irreplaceable information from the excavation safe for posterity.

Clearly, it is impossible to predict in every detail before excavation what conservation and publication problems a site may pose. However, it is possible to predict most problems in outline, and excavation on a non-threatened site should not proceed unless these predictable problems have been considered and (where necessary) budgeted for.

Excavation Methods

The essence of archaeological excavation can be summarised as the clear, factual, and detailed recording of the evidence contained within the below-ground layers and structures, this evidence being clearly separated from any interpretation placed upon it. The principles and methods of high-quality excavation have been well described by Philip Barker,[3] though the limitations of finance and deadlines (especially where excavation is in advance of destruction) often enforce lower standards that the ideal.

The mechanics of excavation and recording will obviously vary according to the type of site, the circumstances of excavation, and the training and interests of the excavator; there is no universally-used system. Typically, each layer, structure, feature, and 'cut' is identified by a unique *context number*. A written record is made of each context, including location, dimensions, detailed factual description, stratigraphic relationships (see below), cross-references to drawings and other records, and interpretative notes. In the ideal world, every

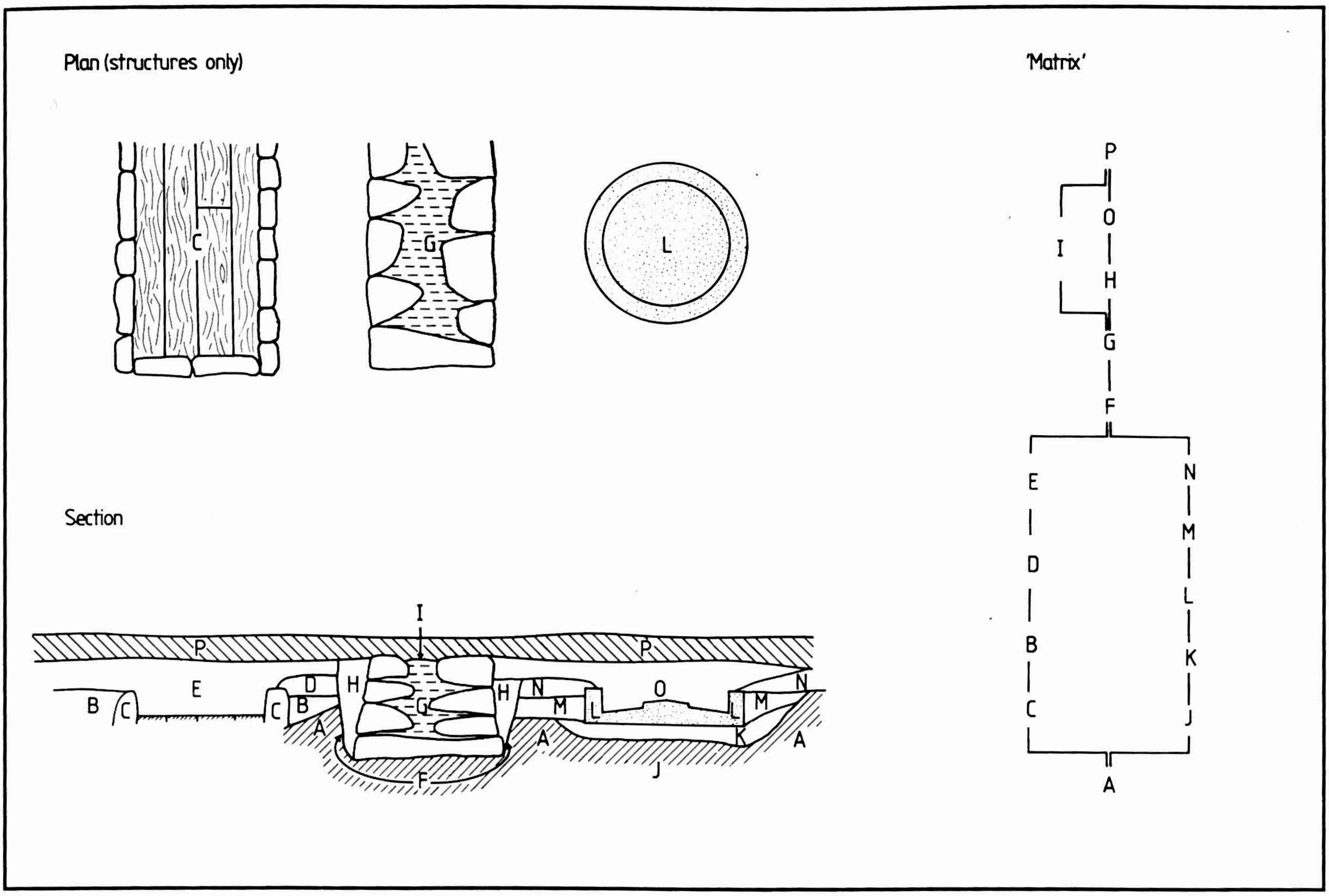

Fig 1 Plan, section, and *matrix* of a washing floor; see text for detailed description. (Matthew Watson)

context would also be drawn in plan (normally at 1:20) and section (normally at 1:10); in practice, many excavators would accept this as overkill for the less important layers, but detailed drawings will be prepared for the more important layers (and all structures) at least. Heights will also be surveyed in, normally to the nearest centimetre.

Considerable importance is attached to recording the relationships of contexts to each other, and using this information to establish the overall sequence of the deposits, the *stratigraphy*. Within each excavation area, soil layers (and solid structures, if these are being removed) are excavated in the reverse order to that in which they were deposited. In principle (and normally in practice), if two contexts **A** and **B** touch each other in the ground it is possible to establish whether **A** is earlier than **B** (because it is underneath, cut by or abutted by **B**) or later than **B**, or the two contexts are contemporary to each other (because they are physically continuous with each other). If this information is collated, it becomes possible to prepare a diagram, often called a **matrix**, for the whole site, showing the full sequence of the contexts (insofar as this can be recovered), and indicating which contexts can and cannot be contemporary to each other.

For example, Fig 1 shows the plan, section, and matrix of part of a hypothetical mine washing floor. The plan shows the stone and timber structures only, as they would be revealed by clearance of soil layers without stratigraphic recording; many workers on this evidence would interpret jigger base **C**, wall **G**, and buddle **L** as being contemporary to each other. However the section and matrix, which include the soil layers, reveal a more complex picture: jigger **C** and buddle **L** may well have been built at the same time as each other, but wall **G** was built later, at a time when jigger **C** was disused and infilled (since the construction trench **F** for the wall cuts the infill **E** of the jigger); while buddle **L** remained open (and perhaps in use) until after the construction of wall **G** (since its infill **O** overlies the top of the construction trench, and abuts the face of the wall). It is not possible to show whether the buddle was infilled before or after the wall was demolished, since infill **O** does not intersect demolition surface **I** on the top of the wall.

The finds from excavation are kept, cleaned, recorded, and where necessary conserved. They are recorded according to the context from which they came, so that their setting on the site is known, and so that, if they are datable, they can be used to date the context from which they came. Samples for scientific analysis will also be identified by context (and, if appropriate, their location recorded precisely on plan or section), so that their information can be related clearly to the phase and structure from which it derives.

In practice, it is necessary on any excavation to decide what level of detail in both excavation and recording is desirable, given the nature of the site and any constraints of time and budget. For example, the use of a mechanical excavator to remove post-abandonment overburden is often fully justified, whereas its use to remove detailed stratigraphy is an act of gross destruction. Clearly, on many industrial sites, collapsed rubble and/or recent topsoil can be removed rapidly (by hand or machine), with only outline recording. However this should *not* be uncritically assumed. For example at Old Gang Smeltmill, North Yorkshire (NY 974 005) examination of a rubble deposit (during excavations for Yorkshire Dales National Park) suggested that it was structured in some way, and it was therefore cleaned up rather than being removed by pickaxe. This revealed that it had been produced by the toppling of a wall, and that the stones were sufficiently *in situ* for a timber beam within the rubble to be identified as a strapping beam, and its original location determined (Plate 1).

Similarly, the presence on most industrial sites of solid stone, timber, or concrete structures should not lead to the assumption (often made, however unconsciously) that the presence of such *obvious* structures implies the absence or non-importance of more ephemeral

Plate 1 Old Gang Smeltmill: the rubble behind the scale is the collapsed face of the wall to its right, and cleaning has revealed a strapping beam within it (above the centre of the scale).

evidence, perhaps requiring high standards of excavation. For example, robbed timber structures, or parts of structures, may be indicated only by stains or wear-patterns on the underlying surfaces, or (if the timbers have rotted) by the locations of nails derived from the joints.

A cautionary tale from the author's own experience reinforces this point. At Killhope Lead Mine, excavations on the washing floor[4] in 1985 revealed a large expanse of timber flooring, seemingly devoid of important detail. Since the excavation was behind schedule, it was decided to record this without detailed cleaning. It was only when a colleague drew attention to a pair of pegholes, at a spacing corresponding to that of the pegholes in the rail 'chairs' used on the site, that a detailed cleaning was undertaken. This revealed a two lines of paired pegholes across the floor forming the only surviving evidence of a narrow-gauge tramway, which had up to that point been missed by excavation!

The problem of interpretation of machine bases is a major one on many excavatons (especially, perhaps, to the archaeologist unfamiliar with industrial archaeology, rather than the converse), even if substantial traces do survive. Problems arise from two causes. Firstly, the evidence often survives in the form of a stone or timber base, with perhaps mounting bolts, or the sockets that held them, and/or associated water channels or pipes. It is often difficult or impossible to deduce logically from this evidence the form of the machine or structure that produced it. The problem is compounded by the fact that site reports within the 'industrial archaeology' tradition tend to present an interpretation of the structures, rather than the detailed factual evidence on which this is based. Thus for most industries there is still only a very limited corpus of fully described and interpreted machines and structures. Secondly, the archaeological traces of a machine can depend drastically on the exact mode of construction, as well as on the quality of survival. For example, a buddle constructed as a timber-lined pit is likely to leave considerable archaeological evidence, whereas a functionally-identical buddle constructed on an above-ground timber frame is unlikely to leave more than ephemeral and hard-to-interpret traces.

Process Residues

A final aspect of excavation relates to process residues. Within the mining and metallurgical fields, most processes leave residues (slags, waste metal, refractory materials, tailings tips etc) that will survive in visually-identifiable form under most archaeological circumstances, and most investigators would undertake some sampling of these. However for these to be of maximum value, three points should be born in mind.

Firstly, the precise stratigraphic context of a sample is of crucial importance to its interpretation. A sample of slag merely recorded as originating from a specific site, when identified, can only indicate that the process involved was probably undertaken somewhere on the site, at some stage of its life (and even this information is not reliable, as extraneous slags can be introduced onto a site for use as road metalling, or even by industrial archaeologists discarding samples from elsewhere). However a sample from a well-chosen context will indicate the process used at a precise phase of a site's history, and/or in a specific structure.

Secondly, interpretable process residues are not always visually obvious. Even on an iron-working site, important information on smithing processes can be obtained from the distribution and size of slag globules, most of which are close to the limit of visibility. Many other industries will leave few macroscopic residues, but microscopic or chemical examination may yield vital interpretative information (for example, the presence of specific fibres in waterlogged contexts, or of chemical residues). These residues will normally be detectable only by laboratory examination of samples, and the need for a sampling programme to ensure that the appropriate samples are taken, despite the lack of obvious visual evidence, needs stressing.

Thirdly, the spatial variation within a residue, both vertically and horizontally, may prove far more informative than a single sample. For example, a column of samples taken through a silt deposit may reveal changes with time in the pattern of pollution, and a similar series from a deep slag tip may reveal the detailed development of smelting procedures, or the timing of specific changes or problems. Similarly, the spatial variation within a deposit may be of importance, and can be investigated by sampling at specified locations on a grid. For example, the distribution of smithing globules may reveal the location of an anvil that does not itself survive, and the composition of residues in a buddle may be graduated from 'heads' at one end to tailings at the other.

It should hardly need stressing that on an industrial site, process residues are likely to be the most direct source of detailed information on the process, and that a well-designed sampling strategy is therefore an essential aspect of a good excavation programme. Wherever possible, this should be discussed and budgeted for, with the appropriate specialist(s) before the start of the excavation.

Building Recording

It may seem perverse to discuss building recording in an article on excavation. However, the point needs making that above-ground ruins, where they survive, are just as important as the below-ground stratigraphy, and should be recorded to the same standard of detail (preferably in close conjunction with the excavation programme). Obviously building recording is not (and should not be) the sole preserve of archaeologists, but they have a contribution to make here just as much as in the field of excavation in the narrowest sense.

Archaeological approaches to building recording differ in some respects from the more traditional architectural approaches[5]. The archaeologist will study a building as a process, which has developed to its present form over a period of time, rather than as a single designed event, and is unlikely to concentrate especially on the external facade. This has important implications for the understanding of technology. The external facade of an industrial building, and its architectural design, do not necessarily bear any close relationship to the processes carried on inside (though clearly they have their importance in assessing the social setting of the building). It is often the internal wallfaces that contain the technologically-vital information, in the form of sockets, openings, iron fittings, and wear-marks. These are altogether more time-consuming (and at times tedious!) to record than the design of the external elevation, but arguably of greater importance to the student of technology.

The archaeologist will also be looking closely for evidence of sequence. Some of this evidence will be obvious, whereas some will be subtle. For example, if the socket for a floor joist appears in the blocking of a doorway, it is obvious that the floor was inserted (or at least altered) after the door went out of use. However whether this insertion was contemporary to, or later than, the blocking will depend on careful determination of whether the socket was built into, or inserted into, the blocking. This is not always an easy distinction in practice, and the careful objective recording of the actual evidence is important to enable any future worker to re-assess the reliability of the interpretation! Similarly the interpretation of the iron nails, spikes etc driven into the wall may well depend on recording which ones predate any repointing or limewashing of the wall, and which are driven through the coatings.

Recording methods will normally rely on building up a record from context-by-context detail, rather than by describing the complete building as a unit. As with excavation, techniques vary, but a summary of those used by the present author may be of use.

Where possible, record drawings are based on rectified photography. This technique involves the use of a medium-format camera to take photographs at a precise 90° angle to the plane of the wall face. The resultant negatives form a dimensionally-accurate record of the face (for the central part of the frame; distortion is inevitable towards the edges, the amount depending on the quality of the camera), from which prints can be developed to a specified scale, using scales on the wall. The scale photomontage is then used as the base for detailed drawings on draughting film; much of the information can be traced from the montage, though checking and augmentation on site is always necessary. An important decision in this process is the level of detail required in the drawings. In the ideal world, full stone-by-stone drawings will be prepared of every face of every wall, and used as a base for interpretative overlays demarcating the archaeological contexts, types of stone/brick, inserted iron objects, etc. In practice, the information gained from full stone-by-stone detail may not justify the extra time and cost (which may be considerable for walls of small rubble masonry, especially if the condition of the wall renders stone-by-stone detail indistinct on the photos), and it may be necessary simply to prepare the interpretative drawings as direct outlines over the photographic base.

The aim of the drawn record (including plans as well as wall elevations) is to record in detail exactly what does survive, rather than the design or interpretation. Thus ruled lines are rarely used (except for sawn timbers and ruler-straight metal objects), and features which do not survive, or are conjectural, are rigorously excluded from the primary site drawings (though they can be added to the simplified and more interpretative drawings prepared for publication, so long as the distinction between observation and interpretation is made clear).

The written record is prepared in a very similar format to the excavation record; for all but the simplest structures a context-by-context record is prepared, rather than a single free-form text. Each identifiable unit of the wall is identified by its own context number, and the form, location, size, stratigraphy and description are recorded in detail. Careful attention is paid to evidence for sequence, in the form of butt joints, keyed joints, broken ends, tusked joints, block-keyed joints, and changes in the mortar bedding and/or the style of the masonry. It may be noted that the block-keyed joint seems to be much more common on industrial buildings than elsewhere, and is sometimes used deliberately to allow thermal movement between the parts of a building (for example on the buttresses of the early eighteenth century cementation furnace at Derwentcote, Co. Durham (NZ 130566)[6]

It should also be borne in mind that any furnace or other structure exposed to severe heating is likely to have been designed with a removeable inner lining, so that this can be replaced without disruption to the outer casing. The observed stratigraphy of these linings can be confusing, and is often poorly exposed (due to its location sealed inside an intact outer casing, and/or to the coating of its surfaces with vitrified material); the author's experience is that such linings, unless an early stratigraphic date can be positivelely demonstrated, should be assumed to date from the last use of the furnace.

A final aspect of the archaeological approach to building recording is that the small features on and in the face of the wall will be recorded in detail, and accorded as much importance as the more 'architectural' features. This will include the concentric scoremarks produced by a waterwheel on the side of its wheelpit (often the best surviving indicator of the precise axle position), the various nails, spikes and bars driven into the faces of the walls (for purposes which may or may not be recoverable, but which may be crucial to the interpretation of the technology), and the various slots and marks cut or worn into the wall.

Conclusion

Industrial Archaeology has developed from the (polygamous) marriage of numerous disciplines and enthusiasms, among which archaeology has not (until recently) been to the fore. The purpose of this article is not to suggest that archaeological approaches should supercede those more traditional to the subject, but that they should be understood, employed wherever appropriate, and used to enrich the theory and methodology of Industrial Archaeology. In particular the excavation of an industrial site (an activity that by definition involves an element of destruction, however skilfully it is undertaken) should always be performed with an awareness of the methods and standards of good archaeological excavation.

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Notes and References

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