Contextualising Metal-Detected Discoveries: The Staffordshire Anglo-Saxon Hoard

(Project 5892)

Revised Project Design

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Contents

	Preface		iv
	Preface April 2013		v
	Preface June 2013		v
1	Project Name		1
2	Summary Description		1
3	Background		
	3.1	Introduction	1
	3.2	Organisation of this document	3
4	Assessment		
	4.1	Introduction	3
	4.2	The Assessment tasks	6
	4.3	Checking the records	7
	4.4	Database and secure website planning	8
	4.5	Aerial photography and fieldwork assessment	10
	4.6	Background information on the area	14
5	The Hoard		
	5.1	Introduction	15
	5.2	The contents and quantities	16
	5.3	Scientific analysis	20
	5.4	The date of the Hoard	22
6	The Potential of the Hoard to aid knowledge		
	6.1	Introduction	23
	6.2	The Hoard as an artefact - exploring depositional practices	23
	6.3	The Hoard as art – re-writing decoration	25
	6.4	The Hoard as history – the origins of Mercia	26
	6.5	The Hoard as economy – the gold standard	27
	6.6	The hoard as worth – value then and now	28
7	Research aims and objectives		
	7.1	Introduction	29
	7.2	What does the hoard consist of?	30
	7.3	When was it deposited?	30
	7.4	Why was it deposited?	30
	7.5	What does it tell us about seventh century life?	30
	7.6	What can we learn from the experience	31
	7.7	Progress made by the end of Part 1 of the project	31
8	Business case		31
9	Project scope		32
10	Interfaces		33
11	Communication		
	11.1	Introduction	34
	11.2	The secure website	34
	11.3	The newsletter	34
	11.4	Project team meetings	35
	11.5	Communication with the Executive	35
	11.6	Communication with the public	35
	11.7	Highlight reports	35
12	Project review		

	12.1	Introduction	35
	12.2	Review timetable	36
13	Health and safety		36
14	Project team structure		
	14.1	Project Executive	36
	14.2	The project team	37
15	Methodology		
	15.1	Introduction	40
	15.2	Background information	40
	15.3	Stratigraphic narrative	40
	15.4	Development and maintenance of database and website	41
	15.5	Conservation	46
	15.6	X-radiography	49
	15.7	Work on the impressed foils	51
	15.8	Materials analysis	52
	15.9	Cataloguing, typology and research	55
	15.10	Statistical Analysis	61
	15.11	Background studies	62
	15.12	Legacy	64
	15.13	Final report – editing	64
	15.14	Project management	65
	15.15	Grouping exercise	66
16	Stages, products and tasks		66
17	Ownership		79
18	The Budget		79
19	Bibliography		84
20	Acknowledgements		88

Figures

3.1	Location Plan of the Staffordshire Hoard	2
4.1	A comparison of the Hoxne and Staffordshire Hoards	5
4.2	Hoard database entity relationship diagram	9
4.3	Results of the air mapping	11
4.4	Vertical air photograph showing the curvilinear cropmark	13
5.1	The gold items analysed in Table 5.5	21
5.2	Ternary diagram illustrating the data in Table 5.7	22
6.1	Sixth and seventh century gold and silver finds	27
15.1	Examples of the proposed illustration formats	59
15.2	Example of the proposed scaled photograph format	60
16.1	The tasks from March 2012-March 2013	76
16.2	The tasks from April 2013-March 2014	77
16.3	The tasks from April 2014-May 2014	78

Tables

4.1	Summary of when and how the items were found	8
5.1	Hoard contents quantified by database entry	16
5.2	Hoard contents quantified by weight	17

5.3 Sword or seax elements present 18
5.4 Weights of gold and silver items 19
5.5 Sword or seax hilt plates by decoration 19
5.6 Sword or seax pommel caps by decoration 20
5.7 Metal composition of six gold items analysed by PIXE 21
16.1 Summary table of tasks and costs 68
16.2 Detailed summary of task, timetable and costs 70

Appendices

1 Extracts from the Assessment project design 89
2 Specification of the Database – Bryan Alvey 95
3 Assessment of the Aerial Photographs – Alisan Deegan 117
4 Organisational Chart of the Hoard Programme – Keith Bloor 134
5. Protocols relating to Handling and Security 137
6 Publication outline 140
7 Product descriptions 142
8 Risk log 150

Preface – March 2012

The document that follows provides a programme of work that will lead eventually to a timely publication of the Staffordshire Hoard. Initially a project design was submitted in December 2011 that costed and programmed the full project which would have run from March 2012 to the summer of 2015. Unfortunately this would have cost nearly two-thirds of a million pounds. Such a sum in these time of austerity is currently beyond the combined resources of English Heritage and the Owners of the Hoard.

The project was always designed to run in two stages with the first stage aiming to provide a secure foundation on which to base the more extensive research of the second stage, and to allow an interim publication of an illustrated catalogue via the internet as an aid to fellow researchers and everyone interested in the Hoard. After discussions between English Heritage and the Owners it was decided to formalise this staged approach. Barbican Research Associates was asked to revise and cost a first stage which will allow choices to be made about what can be achieved in the second stage within whatever budget is then available.

This document provides that. We believe it will provide secure foundations not only for the second stage, but will also provide much data for people wishing to use the evidence of the Hoard to explore the seventh century. There will be a robust research archive that will allow research to move forward without the need for repeated handling these fragile and often tiny fragments.

Some aspects of the work will go far beyond laying the foundations. We have chosen at this point to concentrate a considerable amount of the available budget on analytical work that will be carried out at the British Museum. The Department of Conservation and Scientific Research is uniquely qualified to contribute to the scientific work on the Hoard because of the expertise within it, the range of analytical techniques that can be carried out there and the long standing experience with contemporary finds from Sutton Hoo and other places. Due to re-developments at the British Museum, the department would not be available to carry out this work in 2014. Despite the very heavy workload of the staff there, they have most generously agreed to undertake an ambitious programme of work over the 2012/2013 period that will be core to any future research.

As a result of concentrating the available resources on the scientific and conservation aspects of the research during the first stage, the advanced studies of typological, art historical and other aspects of the Hoard will be reserved for the second stage. We believe it is important that the project be judged as a whole over both stages and so this project design describes all the work we wish to carry out. This first stage will provide the key to help us unlock the riches that will come from the second stage, and it will allow us to prioritise the aspects which have the most promise.

Many parts of the document thus remain relatively unchanged from the December 2011 document. There have been only minor changes to section 1-14 with the following exceptions. There is a new sub-section (**7.7**) that assesses the progress towards achieving the research aims by the end of this first stage of the research. There are changes in sections 11 and 12 which reflect timetabling issues of this

shorter project. The major changes start in section 15 (methodology) where it is explained whether the different aspects of the work will be carried out in this first stage or the second. Section 16 now outlines only the products and tasks to be carried out during the first stage and the budget (section 18) has been completely re-worked. Sections 17, 19 and 20 are unchanged.

Appendices 1-6 are unchanged but the Product Descriptions and the Risk Log (Appendices 7 and 8), now relate only to the first stage.

Preface – April 2013

In January 2013 the Hoard Management Group and English Heritage decided that a revised project design would be appropriate. Various organisational changes had been put in place in the wider Hoard programme, and it was felt needed to be reflected in the design as they impinged upon the workings of the Research project. These included the appointment of a Programme co-ordinator and the merging of the Research and Conservation Advisory Panels. The relationship of the conservation work at Birmingham, which was under new management from that date, and the research project had also been clarified. Furthermore it had been agreed that Stage 1 would be extended to include a grouping exercise that would mean that all of the Hoard would be brought together in one place after the Stage 1 cataloguing had been completed, necessitating a later completion date. There had also been two Variations to the project

This revised project design has been written at the end of April 2013 so that the impact of the extra resources which English Heritage had granted in the final quarter of the financial year 2012/3 could be assessed. A new timetable has been drawn up and the budgets adjusted to take into consideration the two Variations. A revised methodology section has been drawn up for the conservation work (**15.5**) and a new methodological section has been included to describe the grouping exercise (**15.15**). The new organisation of the programme as a whole is reflected in Appendix 4. The timetable has been adjusted to reflect the grouping exercise, the changes in the conservation regime and various other changes that have been brought about by issues surrounding the conservation and exhibition needs. The body of the text has been adjusted as a consequence where appropriate. No attempt has been made to up-date the changes in our knowledge about the Hoard that has been gained as a consequence of the first year of the research project. The new design makes no attempt to scope in any detail the work that will be needed on the new finds of Hoard pieces made by Warwickshire Archaeology in November 2012 as the ownership of these does not yet reside with Stoke-on-Trent or Birmingham City Councils. It does, however, note the scale of the resources that might be needed in the Risk Logs and considers the cleaning requirement to absorb them into the research work should the councils obtain these additional pieces.

Preface – June 2013

Following the submission of the revised Project Design to Stoke-on-Trent City Council at the end of April 2013, Barbican was notified that the new Hoard finds had

been acquired by the Owners much earlier than had been anticipated. As the revised PD had not at that point been submitted to EH, Barbican was requested to revise it again to reflect the costs of incorporating the new finds into Stage 1. This has now been done. The budget now reflects the original agreed funding, the funding from the two variations and the costs of incorporating the new finds. As the last-mentioned costs have not previously been seen by EH, additional sections have been written which are incorporated into the notes to the budget to allow them to be considered separately from all of the already agreed cost. This section also explains how the movement of certain costs between the financial years has been arranged now that the Stage 1 of the project has extended into a new financial year (see pages 74-5, notes 15, 26, 27).

1 Project name

Contextualising Metal-Detected Discoveries: Staffordshire Anglo-Saxon Hoard

2 Summary Description

This project will carry out the first stage of the research and analysis of the Staffordshire Hoard with the aim of publishing its contents in a definitive manner, and placing it within the context of seventh century English life.

3 Background

3.1 Introduction

The Staffordshire Hoard is a treasure find which weighed just under 7kg when originally found. Of this, approximately 5kg of the items were gold and 1.5kg were of silver. The bulk of the material belongs to the seventh century and much is richly decorated with intricate interlace patterns carried out using a variety of techniques including cloisonné garnet and filigree. The Hoard is military in character with the bulk of the identified pieces coming from the handles of edged weapons. There is also a small but significant number of explicitly Christian items. The precise composition is not yet known as most of the pieces are fragmentary and many are torn and bent; but fragments from one or more helmets have been identified and there are a number of items for which there are currently no known parallels.

It is exceptional, and nothing like it has ever been found in Britain before. It was discovered by Mr Terry Herbert on 5th July 2009 whilst metal detecting in a field situated to the south of the modern A5 (T) Watling Street centred on NGR SK 406328/306396 (fig. 3.1). Excavation on the site with a view to full recovery was carried out first by Staffordshire County Council (SCC) and then by Birmingham Archaeology (BA) in conditions of great secrecy. When it was publicly announced on 24th September 2009 following the inquest conducted by the South Staffordshire coroner, it attracted worldwide attention.

Treasure finds are not unusual in England where metal detecting is a popular and legal hobby, but the Staffordshire Hoard fascinated the general public in a way that has not been seen before. People queued for hours to see the temporary exhibitions that took place from September 2009 to April 2010 at the Birmingham Museum and Art Gallery (BMAG), at the Potteries Museum and Art Gallery (PMAG - Stoke-on-Trent), and in the British Museum (BM). They also donated £900,000 to the appeal to keep the Hoard in public ownership after a value of £3,285,000 was placed on it by the Treasure Valuation Committee.

Within the West Midlands the Hoard evokes a strong feeling of pride and ownership. This is demonstrated by the Mercian Trail Partnership which consists of PMAG, BMAG, Lichfield Cathedral, Lichfield District Council, Tamworth Borough Council and Staffordshire County Council. These organisations spearheaded the fund-raising to buy the Hoard for the nation and continue to collaborate to ensure that the necessary research and conservation is carried out. Following the successful appeal, joint ownership of the Hoard passed to Birmingham City Council and Stoke-on-Trent City Council (henceforth designated as the Owners). Since March 13 2010 PMAG and BMAG have always had parts of the Hoard on display, and during the summer of 2011 a travelling exhibition of selected items went to Lichfield Cathedral, Tamworth Castle and the Shire Hall in Stafford. This tour was extremely successful and fully booked. By the time it closed it was estimated that half a million people had seen parts of the Hoard since September 2009. Another exhibition took place at the National Geographic Museum in Washington D.C. in the U.S.A. during 2011 where it continued to attract large crowds with over 1000 people visiting during the first weekend.

The find has also attracted much professional interest. The Portable Antiquities Scheme (PAS) hosted

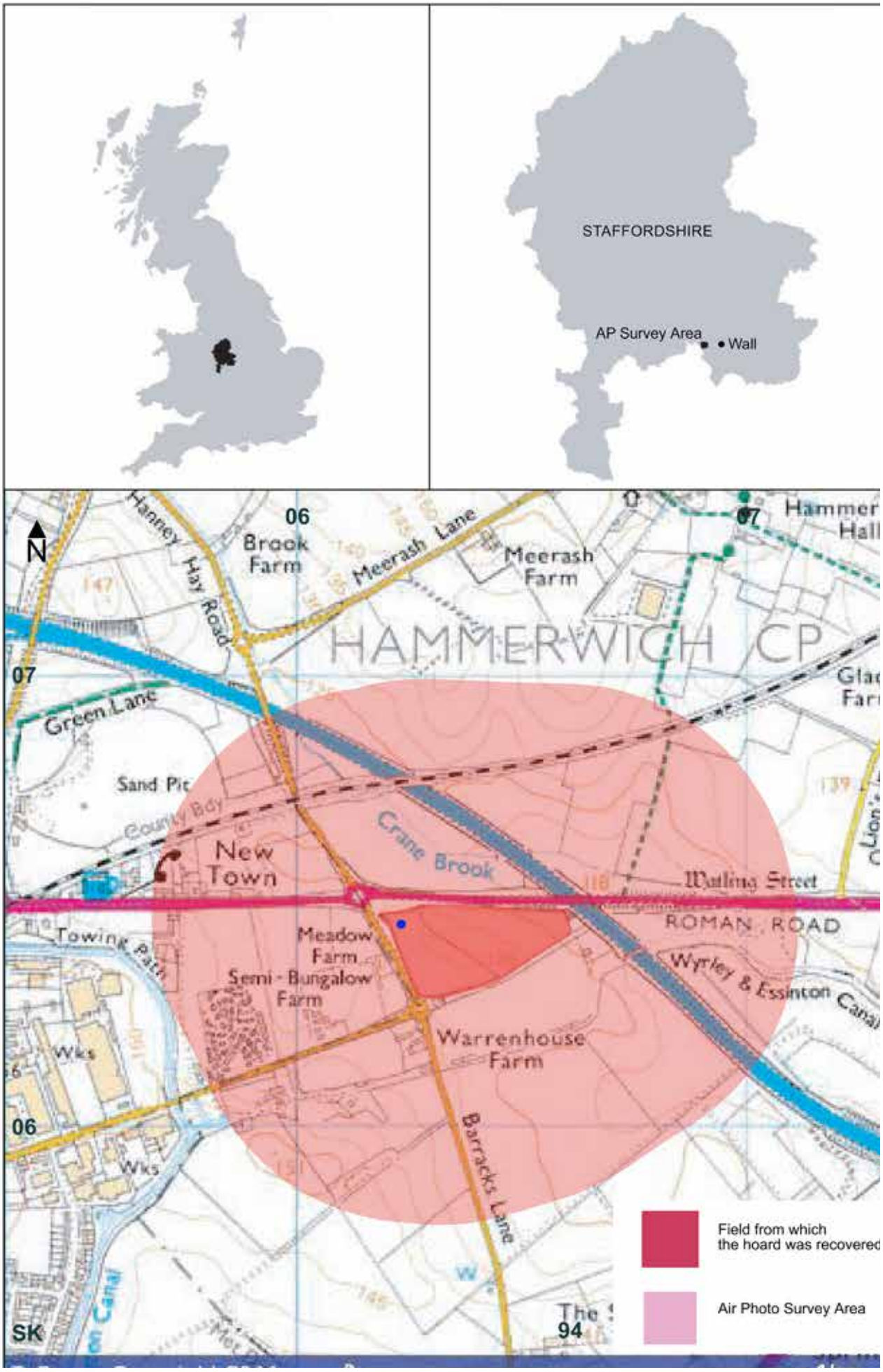


Fig. 3.1. Location plan of the Staffordshire Hoard find spot (Alison Deagan)

a two day symposium on it in March 2010 at which there were 27 speakers[1]. The journal *Antiquity* had three articles, with a total of ten authors, about the Hoard in its March 2011 edition[2], and another in its September 2011 issue considering the Hoard within that perennial question 'who owns the past?'[3]. It is already starting to be referred to in scholarly books[4] which demonstrates a remarkably rapid absorption into debate given the normal lead-in time for producing such books. The relevant volume of the new Penguin History of Britain not only discusses it but uses an image of one of the pieces on its front cover.[5]

Once Mr Herbert had shown the local PAS Liaison Officer the material he had been finding in the field over a period of five days, the importance of the find was immediately appreciated. English Heritage (EH) made funding available to Staffordshire County Council under SHAPE sub-programme 32144.110 so that the rescue excavations conducted by Birmingham Archaeology could be undertaken. It was decided that a major integrated research programme would be needed to ensure the conservation, analysis and timely publication of the find. To this end EH made a grant to Stoke-on-Trent City Council that allowed a Project Manager to be appointed in December 2010 with a view to the development of a project design for a rapid Assessment stage. Subsequently Barbican Research Associates were commissioned in June 2011 to carry out the assessment and develop the project design for the full Analysis Project. This document is the result of that commission[6].

3.2 Organisation of this document

As will be explained in section **4.1** below, the Assessment stage was much more narrowly focussed than would normally be the case for an analysis project of this size. As a result much information remains at the same stage it was in January 2010 when the Assessment project design was written[7]. In these circumstances, it would be redundant to repeat the information and so this document will proceed by reference to the Assessment project design in places. Information given there will be briefly summarised here, and where appropriate the relevant sections of the Assessment project design will be reproduced here as Appendix 1 for ease of reference. The section numbering in Appendix 1 is that of the original document.

A summary hand list and working photographs of the pieces are now available via the Hoard web site[8], and so illustrations of items mentioned will only occasionally be included here.

4 The Assessment

4.1 Introduction

The intense public interest in the Hoard outlined in **3.1** has meant that the Owners have had to satisfy expectations that this find, or at least parts of it, would be exhibited constantly from the time of the Inquest. No other Treasure find has had to deal with expectations on the same scale. It is useful to compare what happened in the case of the Hoxne late Roman treasure found in November 1992. This was another spectacular find of gold and silver coins, tablewares and jewellery with a bullion weight far in excess of that of the Staffordshire Hoard. It too had been found by chance through the use of a metal detector. In its day, prior to the changes to news dissemination brought about by the worldwide

1 http://finds.org.uk/staffshoardsymposium
2 Carver 2011, Leahy *et al* 2011, Webster *et al* 2011.
3 James 2011.
4 e.g. Brown 2011a, 53-5, 95 fig. 10.
5 Fleming 2010, 207-8.
6 Additional items belonging to the Hoard were found during November 2012 as part of a planned metal-detecting and surface survey project consequent to the field being ploughed again (Palmer 2013). The Owners are in the process of purchasing them - see Risk Log 4.
7 Cool 2011.
8 http://www.staffordshirehoard.org.uk/gallery or see http://www.flickr.com/photos/stokemuseums/sets/72157627233574538/ (checked 23:04:13).

web it attracted an equal degree of media interest. The day after the announcement a picture of the finder, Mr Eric Lawes, occupied much of the front cover of the Sun; not a newspaper much given to having heritage issues on its front page. This interest was partially due to the scale of the find; and partially to the exemplary behaviour of Mr Lawes which had allowed its almost complete excavation under controlled circumstances initially by archaeologists from Suffolk County Council, and later in the conservation laboratory at the British Museum.

As Johns in her study of the Hoxne (non-coin) finds makes clear[9], the demands of exhibitions were not so great and the time allowed for conservation, recording and documentation of the Hoxne Hoard was much longer than anything experienced in the case of the Staffordshire Hoard.. The Inquest did not take place until 3rd September of the following year, i.e. nearly ten months after the discovery.

A comparison of what happened in the case of the Hoxne Hoard and what has happened so far with the Staffordshire Hoard is shown in Fig. 4.1. Whilst the Hoxne team probably felt that it was a very rushed experience, they did have what was in effect a ten month period for preliminary conservation and typological assessment. The equivalent period for the Staffordshire Hoard from the start date of the archaeological involvement on site (22nd July 2009) to the Inquest was at most two months, though a more reasonable comparison would be the one month between the conclusion of the excavation of the Hoard site and the inquest. Within that time Dr Kevin Leahy, and his wife Mrs Dianne Leahy, heroically completed the catalogue of the material for the PAS under whose aegis the Hoard then fell[10]. As can be clearly seen in Fig. 4.1, the Staffordshire Hoard team had successfully raised the purchase price two months before Hoxne had even had its Inquest on a month by month comparison.

Since the Inquest parts of the Staffordshire Hoard have been on almost constant display, first as exhibitions during the fund-raising phase[11], and following that as effectively permanent exhibitions at BMAG and PMAG. There has also been a tour in the summer of 2011 to the three venues which are part of the Mercian Trail Partnership and exhibition in Washington DC (see **3.1**). This is part of agreements in place between the Owners and National Geographic that has resulted, to date, in two major television programmes and a generous grant towards the conservation of the Hoard. To fulfil all of these demands there was a need for the full conservation to exhibition standard to be started. This has been carried out at BMAG with aid and advice being supplied by the BM Dept. of Conservation and Scientific Research. Dr Leahy had up-dated his catalogue in the summer of 2010 with material that had not been available during the initial cataloguing prior to the material moving to BMAG and PMAG [12], but prior to the start of the EH-funded research project there had been no opportunity for any systematic research assessment.

9 Johns 2010, 1-7 recounts the discovery and subsequent work and exhibitions.

10 See Appendix 1 section 3.1iii. Some updating took place in March 2011.

11 See Appendix 1 Section 3.1iv

12 Appendix 1 section 3.4ii.

HOXNE				STAFFORDSHIRE				
		Exhibitions				Exhibitions		
Date	Event	BM	Other	Date	Event	BMAG	PMAG	Other
2/11/92	First aid & investigative conservation Preliminary catalogue			5/7/09	PAS Cata-logue			
12/92				8/09				
1/93				9/09 **I**		3 weeks		
2/93				10/09				
3/93				11/09				BM
4/93				12/09				
5/93				1/10				
6/93				2/10			3 weeks	
7/93				3/10*	PAS update			
8/93				4/10				
9/93 **I**		? weeks		5/10				
10/93				6/10**A**				
11/93				7/10				
12/93				8/10				
1/94				9/10	Exhibition conservation ongoing			
2/94				10/10				
3/94				11/10				
4/94 **A**	Exhibition conservation ongoing			12/10				
5/94				1/11				
6/94				2/11				
7/94				3/11				
8/94				4/11				
9/94				5/11				
10/94			Ipswich	6/11				
11/94				7/11				Stafford
12/94				8/11				Lichfield
1/95				9/11				Tamworth
2/95				10/11				
3/95				11/11				Washington
4/95				12/11				

Fig. 4.1: A comparison of the initial timetables for work on the Hoxne and Staffordshire Hoard. The data for Hoxne is taken from Johns 2010. In each case the date column gives the date of initial discovery, each row thereafter gives a month. Months when important events took place are shaded. Key: **I**. = the respective Inquest dates, **A** = the respective months when the respective museums acquired the hoards, * = the month when the full purchase price was raised in the case of the Staffordshire Hoard.

The Owners were very aware of their responsibilities to ensure that the conservation methodology was appropriate and that a full research programme should eventually go forward. To that end they put in place both a Conservation Advisory Panel (CAP) and a Research Advisory Panel (RAP)[13], the latter specifically tasked to represent the interests of the scholarly and academic community within the wider

13 These panels have now been united into a single Research Project Advisory Panel (RPAP)

Staffordshire Hoard Programme and to the Hoard Management Group (HMG) who act on behalf of the Owners[14]. After discussions between the HMG and EH, and with the approval of RAP who acted as the quality assurance body for the project, it was agreed that the Assessment should be a rapid scoping exercise. Various tasks would be undertaken during it with the aim of allowing the development of a project design for the full analysis. This would be MoRPHE-compliant[15] and would integrate the conservation that was already ongoing within the full research project that would also deal with typological, historical and scientific analysis. During the Assessment there would be no attempt to put in place a full research potential assessment, as it was felt that the overwhelming need was to have a project design that would integrate various strands of work so that elements would not proceed in isolation.

Section **4.2** outlines what the tasks were and why they were needed. The results of most of the work are presented in sections **4.3** to **4.6.** The results of the cataloguing protocol task (see **4.2iii**), have been incorporated in the methodology section (**15.9**).

4.2 The Assessment Tasks

4.2i Record checking

It became apparent during the development of the Assessment Project Design that, prior to ownership being transferred to Birmingham CC and Stoke-on-Trent CC, the concordance between all the various numbering systems had become compromised[16]. As explained in detail in Appendix 1 section 3.1iii there are four different sets of numbers attached to the Hoard items. The PAS numbering known as the K number, a short run of small finds numbers issued by the archaeologists of SCC at the beginning of the fieldwork, a much longer run of small find numbers issued by BA during their excavations, and a set of numbers relating to Mr Herbert's initial finds. The re-establishment of the correct concordance between these numbers was clearly vital as, without it, there was no contextual evidence for any items in the Hoard.

4.2ii Database and secure website planning

It was clear from the outset that the Analysis Project would have teams working at different venues on different aspects of the research. At the very least there would be the conservation team at BMAG and the typology team at PMAG. As a consequence there would be a need for a secure web environment where team members could access all the different strands of information no matter where they were working. There was also the need to develop a specification for the database where the information about each item could be stored in a systematic fashion. This database would eventually be the source of the catalogue entries in the final publication, be a major tool in the analysis of the Hoard items, aid the development of such new typologies that were needed and in the long term be the major source of information for the curators. The development of a specification for this was to be done during the Assessment so that building and testing it could start as soon as the full Analysis Project was commissioned.

4.2iii Cataloguing protocols

It was essential that during the Assessment consideration needed to be given to how the items would eventually be catalogued and recorded in the full analysis, and how those data would be used. Decisions about these matters had obvious implications for the design of the database (**4.2ii**). The work would also allow a detailed costed programme of work to be drawn up.

4.2iv Aerial Photography and fieldwork assessment

In Appendix 1, section 3.1ii outlines the progress of the original excavations to recover the Hoard and section 3.3i describes the further evaluation of the Hoard site in March 2010. These were undertaken

14 The membership of the RPAP and their terms of reference are available on the Staffordshire Hoard web site http://www.staffordshirehoard.org.uk/conservationandresearch .

15 MoRPHE – Management of Research Projects in the Historic Environment.

16 See Appendix 1 section 3.4ii

with the aim of providing the immediate archaeological context of the material and recovering any further items associated with it. In both cases it was found that the Hoard had little immediate context as the pieces were all found in the topsoil and no man-made features were found that might have been the original burial place or provided a clue to why the Hoard had been deposited where it was. There were some slight indications from an inspection of aerial photographs that there might have been ploughed-out features that might aid analysis[17].

At the time when the Assessment project design was being written, Birmingham University had already indicated that BA in its long-established form as a contracting archaeological unit would be closing during the academic year 2010/11. This had implications for the staff there who had directed and been involved with the Hoard site excavations and for the archive from those excavations. The latter needed to be fully documented and deposited with the relevant authorities with all due speed.

It was therefore decided to commission an assessment of the available aerial photograph records and to oversee the safe deposition of the fieldwork records as part of the Assessment project. This would enable the site narrative for the final publication to be commissioned from the director of the excavations as a matter of urgency at the start of the full Analysis stage. By that stage he and his colleagues would no longer be employed by BA, and it was felt to be important to complete this aspect of the work with all possible speed.

4.2v Background information on the area

In order to be able to plan accurately for the level of research that will be needed to place the Hoard in context within the region during the analysis, a rapid survey of the available records would be undertaken.

4.3 Checking the records

The work involved in this was as follows. During the writing of the Assessment project design, the present author compared all of the various databases and spreadsheets with details of the Hoard that had accumulated during the period up to January 2011. By doing this she was able to identify the point at which the concordance between the numbers was still correct, before it became compromised . This was checked against a small selection of the original bags of the items in both BMAG and PMAG and found to be correct for those numbers[18].

As part of the Assessment this partially-checked and probably correct concordance was then checked against the original finds record sheets at Birmingham Archaeology. As described in more detail in section 3.1ii in Appendix 1, during the BA excavations it had been found that the Hoard might be confined to a 20m square area centred on the test pit initially dug by archaeologists from SCC. A grid corresponding to this area was laid out and divided into 1m squares labelled from A1 to I20. During the excavation the finds were bagged according to these one metre squares, and both the bags and the finds record sheets record this location data as well as the date when the item was found and the initials of the person responsible for the record. This location data and the date of discovery was entered into a concordance table in the Access database used during the writing of the Assessment project design. Scans of the sheets have now been placed in the project archive kept by the project manager.

Following the checking of the records and the creation of what was considered to be an accurate concordance table, Chris Fern visited both BMAG and PMAG and, over a period of three weeks, checked all of the bags against this. During the original PAS recording Dr and Mrs Leahy had used raffle/cloak room tickets as labels for each number and these had been stored with the finds. From the information written on the bags and from these tickets, Fern was able to check that the table was correct and make any alterations necessary. He also noted any additional annotations on the bags. These generally related to those items found by Mr Herbert prior to his informing the PAS of his discovery. Occasionally

17 Appendix 1 section 3.3ii.

18 see Appendix 1 section 3.4ii.

it is noted which search they related to and sometimes the date is given. So for example, 37 of the records note that they came from 'Day 3, search 1'.

We can now be certain that the database record is a true reflection of who found what, when and where in as far as it is possible to know. Table 4.2 summarises our knowledge. In it the database records have been divided into three categories. The first row shows the material found by Mr Herbert prior to informing the PAS of the discovery. The second row reflects the material found by SCC and BA to which a grid reference is attached. The third row shows the material found during and after the period of the archaeological excavation for which there is no location information. During this time Mr Herbert was continuing to detect and many of these unprovenanced items are recorded against his initials. There are also a small number of pieces for which we have not been able to locate any records that would enable us to assign them to one of the three categories and these are tabulated as 'unknown'.

Origins	**Exhibition**	**Other**	Total
Detected material pre 21:07:09	79	815	894
Excavated material with grid reference	23	416	439
Other material recovered 22:07:09 +	7	336	343
Unknown	1	10	11
Total	110	1577	1687

Table 4.2. Summary of when and how the items were found. (Quantified by database record; for explanation see text.)

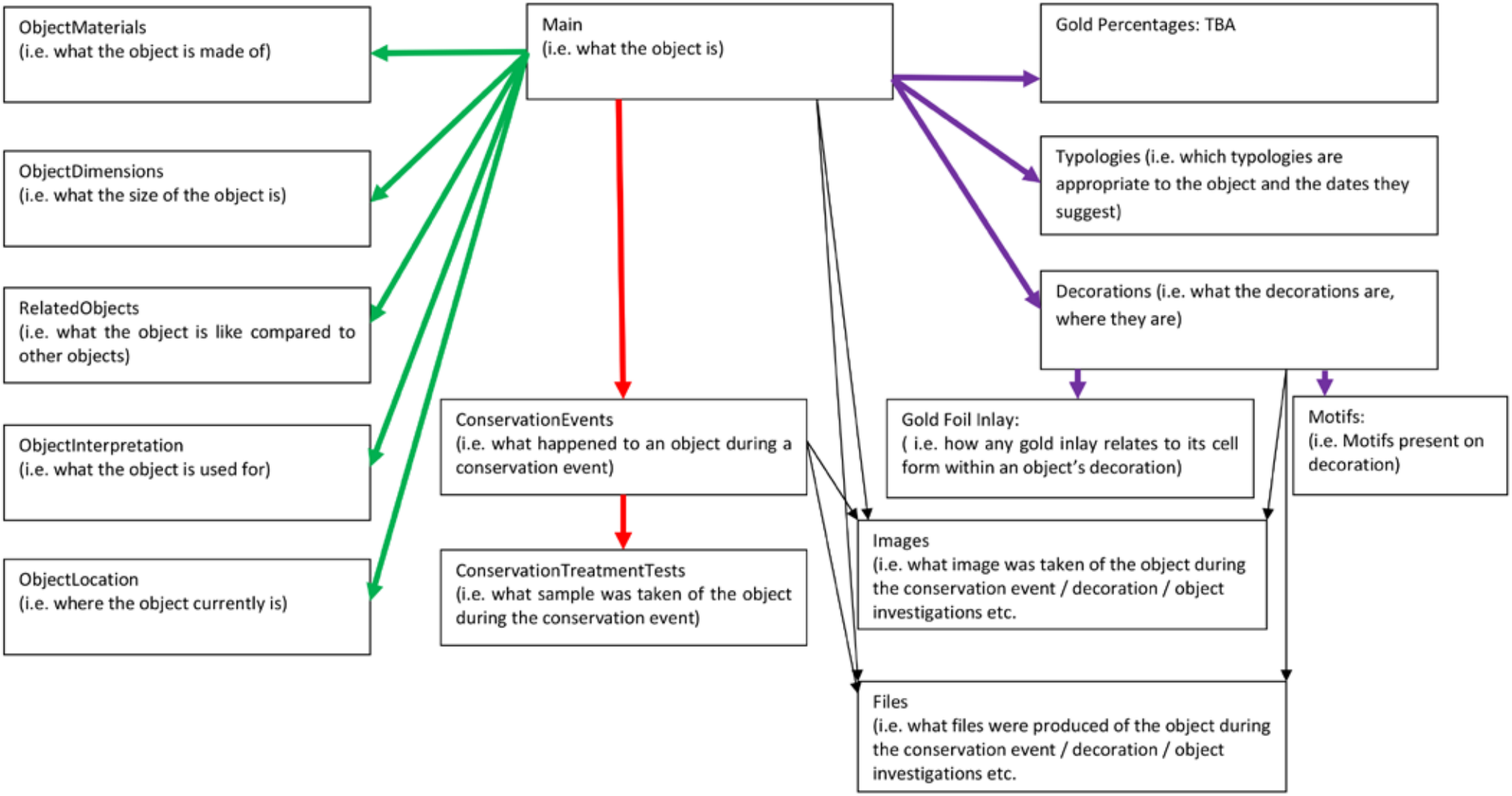
In the table the records have also been divided between those that were sent to Washington DC for exhibition (*Exhibition*) and those which remained in the UK (*Other*). The former include all the most spectacular pieces that the Hoard is famous for, colloquially known at BMAG and PMAG as 'the top 100'. Whilst it is not normally felt to be appropriate to apply value judgements such as this to archaeological finds, here it is helpful. Table 4.1 clearly shows that for c. 74% of the records there is no information about where an item came from. For this material there are only a few hints of any possible associations such as being found on the same day or as part of the same search. Equally, 79% of the records of the most spectacular finds also fall into this category. Clearly this has to affect how we approach the analysis of the Hoard and this will be returned to in **7.4**.

4.4 Database and secure website planning.

The database specification was developed by Bryan Alvey of Cultural Heritage Information Consultants following consultation with the conservators, curators and registrars at BMAG and PMAG, Chris Fern (who will lead the typology team and who will be responsible for the catalogue entries), and the Project Manager. The full specification is given in Appendix 2. The main points of how it will work are summarised here. The system will be a fully relational database and the various entities (tables of data) and how they relate are shown in fig. 4.2. At its simplest the tables on the left provide the mandatory museum accession information; the central part provides the information generated by the conservation team; and the part on the right that which will come from the research team. The two museums use different accessioning software, and the conservation team at BMAG are currently inputting their records into the MINISYS system there. The conservation strands on the Hoard database have thus been designed so that this information can be imported directly. The system has been designed so that whilst everyone who works on the team will have access to the different data strands only particular individuals will be able to edit, delete or alter data in any way. For example, the conservation team will be able to view and download typological research data, but not edit it. Only the typological research team would be able to do that, and vice versa. There will also be the opportunity for non-team members to view the data. People included in this category would include senior museum managers, members of RAP and CAP etc.

FIG. 4.2 HOARD DATABASE ENTITY RELATIONSHIP DIAGRAM

Green relationships arise from the museum catalogue; red relationships arise from the conservation requirement; purple relationships arise from the research requirement.



The database will support a number of different file formats for exporting data or sub-sets of data and there will be the opportunity for users to develop report styles that fit particular needs. There will also be the possibility of exporting the data to an Access format. When the research moves from data entry to analysis of the data this will allow much more flexibility as the researchers will be able to generate the appropriate queries themselves without having to request them from the database developer each time.

This database will not be for public use but will provide the basis for a public access database once the research is completed.

It has been agreed by the individuals concerned that, prior to the Analysis project starting, the Project Manager will create a trial database in Access for the typology strand, mimicking the database structure proposed. Chris Fern will spend a day at PMAG testing data input using this. This will allow fine tuning of the design prior to the full build of the web database. Having the trial one available in Access will also enable data to be input whilst the web system is being built with such data being imported once it is available. It is hoped that a trial version of the entities for the typological work will become rapidly available for testing and data entry.

4.5 Aerial Photography and fieldwork assessment

During the Assessment the digital part of the excavation archive from 2009 and 2010 including the GIS files etc was successfully lodged with the Staffordshire Hoard where it will be available for consultation and safely curated. The paper archive is still at Birmingham University but is in the process of being transferred to PMAG (the regional depository for archaeological material).A report on the aerial photo mapping of the field where the Hoard was found, and the surrounding 500m of land was commissioned from Alison Deegan and completed in May 2012. Her full report forms Appendix 3 and a summary of the results is presented here. The area surveyed covered 135 hectares of land and fourteen air photographs of the area dating from 1948 to 2007 were available for inspection in the National Monument Record, in Staffordshire's Historic Environment Record and Record Office, and on Google Earth [19]. Fig. 4.3 shows the map of the results. The Hoard was found near the north-west shoulder of the ridge that runs across the field (marked O), in the area marked N.

From the photographs it was possible to tell that the field in which the Hoard was found had originally been divided into two by a hedgerow that ran along the ridge. The division is recorded on a map of 1884 and the north-south boundary could continue to be seen on the air photos up to 1968. The hedgerow had been removed by the time of the 1971 photograph, and thereafter remained as a diffuse crop and soil mark. Deegan notes that on the 1968 air photograph there 'was a perceptible difference in the ground level between the west and the east side of the field boundary, but this seems to have been reduced by ploughing once the field boundary was removed'[20] Further discussion has established that the ground was higher on the west than on the east, probably due to the downslope migration of soil. This hedge boundary had been located on the magnetometer survey undertaken at the time of the excavation of the Hoard[21]. During the excavations in March 2010, part of it had been excavated, and had been found to be of probable medieval origin as a 13th to 14th century potsherd was found in a layer associated with it[22]. This field boundary is of interest as it bends just to the east of the Hoard site, as if to avoid a surface feature. The difference in soil height either side of the field boundary probably accounts for the 'bump' observed on the 1968 photograph by Alex Jones[23].

The air photograph survey was also able to map a curvilinear cropmark at the point where the Hoard

19 Appendix 3 Section 3.2.1.
20 Appendix 3 Section 3.3.6.
21 Appendix 1, section 3.1i.
22 Appendix 1, section 3.3i.
23 Appendix 1 Section 3.3ii.

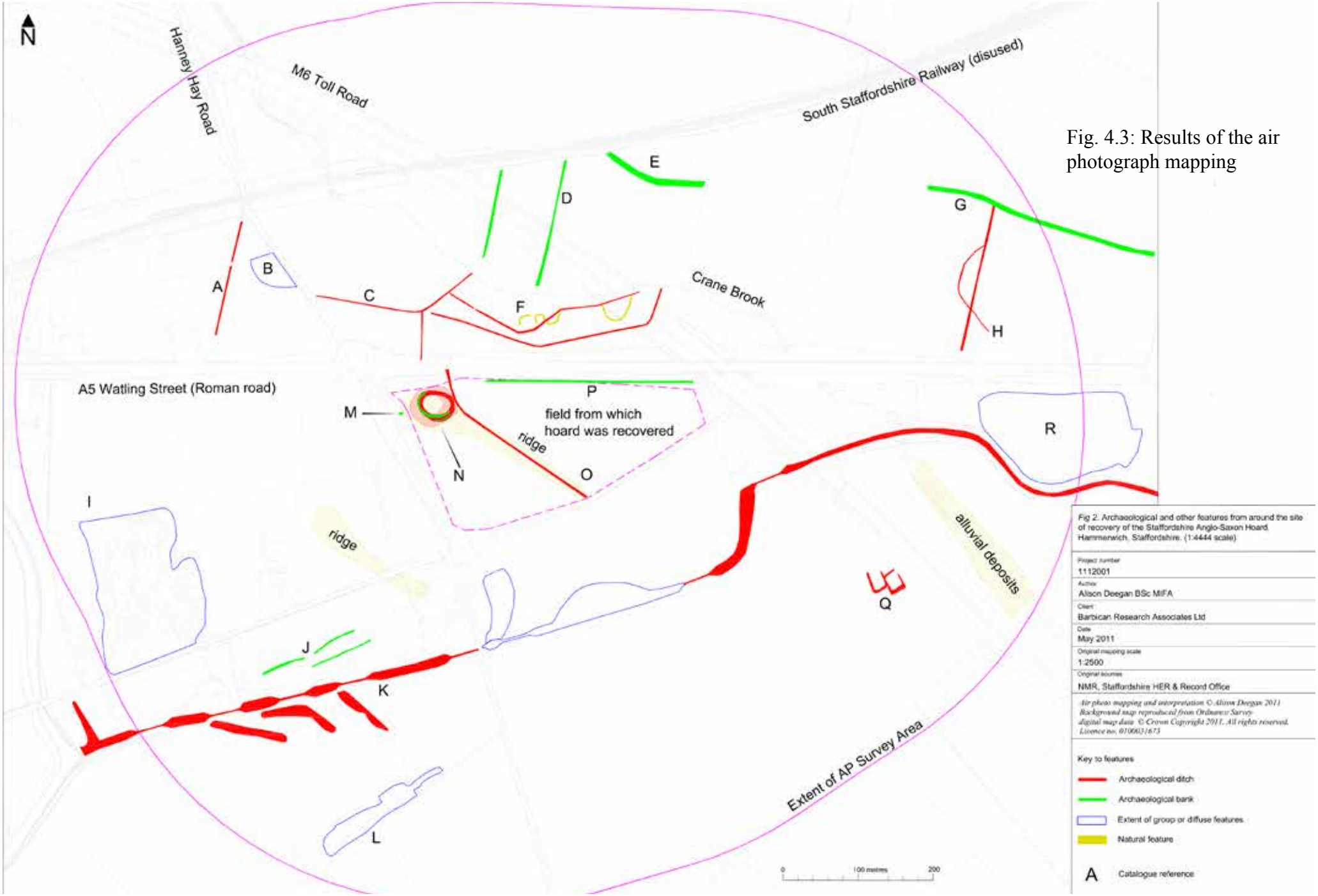


Fig. 4.3: Results of the air photograph mapping

was found (Fig. 4.3 N, fig. 4.4) and which had been noted by Jones on the 1971 photograph[24]. It measured approximately 50 by 40m and varied between photographs. On the photograph of March 1971 it could be seen as an amorphous halo of faster ripening crops, on that of June 1963 it was a narrow ring of darker crop, and on that of July 1992 it was two partial circuits of lighter-toned crop. In the first case the soil of the field was bare, in the others that part of the field appeared to be under grass. In such circumstances, given the different months of the photographs, differences are to be expected. This cropmark had been picked up as a curvilinear anomaly in both the magnetometer survey of 2009 and the resistivity survey of 2010. During excavation in March 2010 it was found to correspond to a band of clay of likely natural origin, possibly an ice wedge. The interesting suggestion was made in the report that the clay could have promoted the growth of different vegetation which could have been a prominent landscape feature given its proximity to the natural ridge[25].

The other features picked up by the air photographs in the region appear to belong mainly to medieval or post-medieval activity. There are two possible medieval plough headlands (marked E and G); and banks and ditches likely to relate to post medieval enclosure (D and G), one of which was still marked as in use on the Ordinance Survey Map of 1884. The field boundary F appears to be that depicted on the 1834 Ordinance Survey Map and is in an area known to have been enclosed from a map of 1775. The areas marked I, L and R are 19th century or later sandpits. K marks the course of the Wyrely and Essington Canal. This was built in the late 18th century, it was extant in 1948 but the photographs show a gradual process of infilling and re-landscaping over the following decades. The points P and M each occurred on only one photograph and are not thought to be of archaeological origin. Other than that, Deegan notes the marks A, H, J and Q are undated and draws attention to Q which suggests a pair of conjoined rectilinear enclosures which lie close to an excavated Romano-British aisled building.[26]

Why the Hoard was found where it was has provoked debate and sometimes doubt. It lay on the downslope of the ridge, adjacent to a Roman road in an area that the place name and documentary evidence suggest was sparsely populated in the early medieval period[27]. Even in 1775 the Hoard find spot and its environs were still classified as waste[28]. The excavations found no evidence of any cut feature in which the Hoard could have been originally placed and all the fragments with a grid reference were from the topsoil. This has even led some people to assert that the Hoard was not originally deposited where it was found[29]. As can be seen from fig. 4.3 the landscape in this area is singularly devoid of crop and soil marks other than those that can be attributed to relatively modern activity. If the Hoard arrived on site relatively recently it would be, to say the least, a singular coincidence that the place chosen to deposit it was so close to the oval feature and to a hedgerow line that has not been in existence for 40 years. These features, so clear on Fig. 4.3, are not ones that are obvious if one is standing in the field.

It has also been noted that the site formation process is unclear, and it has been questioned as to how deep ploughing can be equated with the appearance of the objects which seems to suggest they entered the plough only a short time before the Hoard was discovered[30]. Here the differential height between the two fields noted in 1968 might be a useful aid to understanding, as the added depth to the west could have provided some measure of protection to the items. It can also be noted that the air photograph evidence does not suggest the area has been regularly ploughed recently. Of the nine years with photographs since the hedge was removed, four show the relevant area of the field under pasture (1992, 2003, 2005, 2006), and one year it was primarily under grass (1989). The two earliest years (1971, 1981) and 1993 showed it either as bare soil or under a crop, both indicative of ploughing, and the 2007 image shows it under cereal.

24 Appendix 1, Section 3.3ii.
25 Burrows and Jones 2010.
26 Appendix 3 section 3.3.19.
27 Dean *et al* 2010, 148.
28 Appendix 3 section 4.1.1.
29 Tim Tatton-Brown in Current Archaeology 250 (January 2011), 4.
30 Carver 2011, 231.

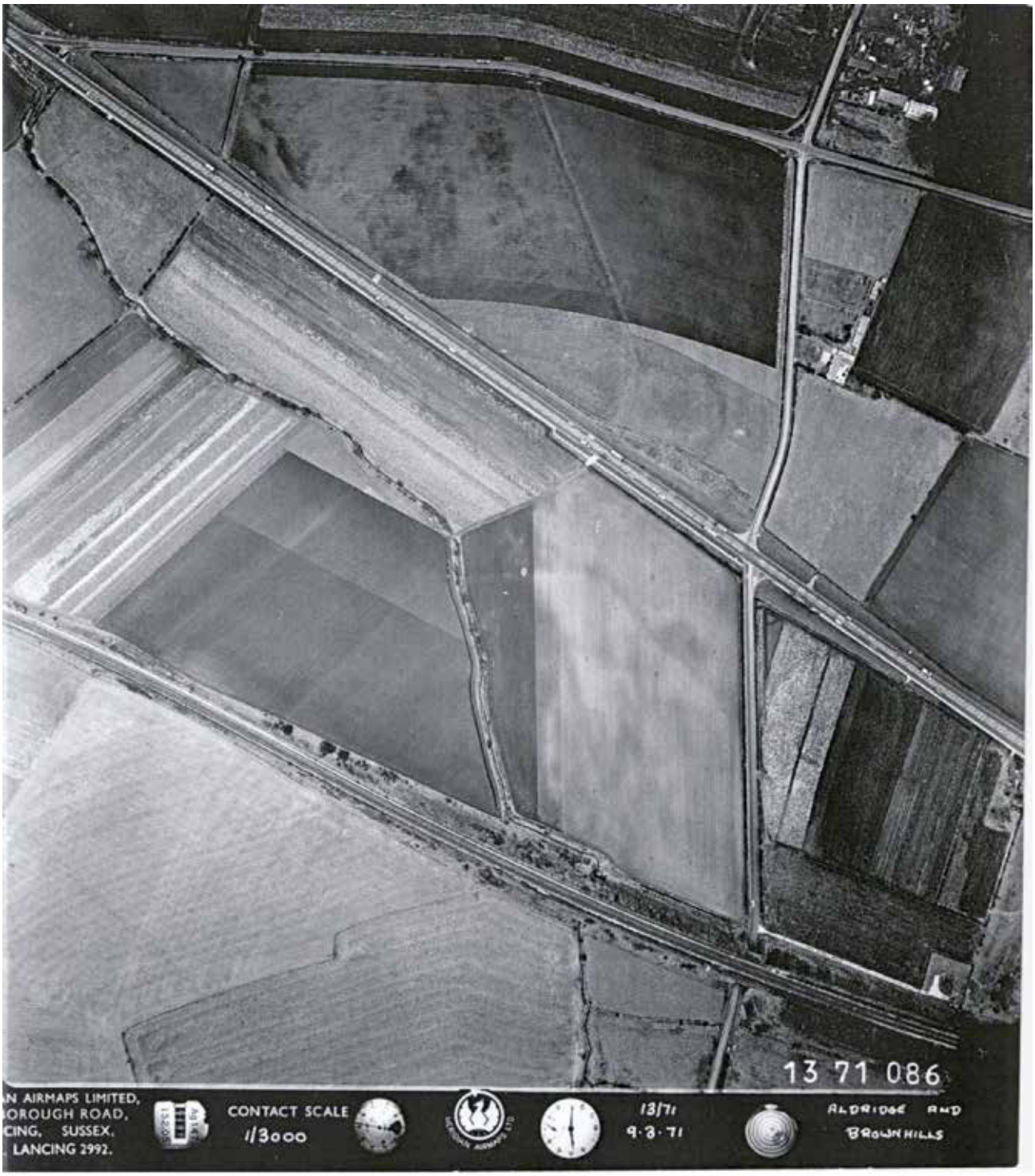


Fig. 4.4: Vertical air photograph showing the curvilinear cropmark AP N in the field where the hoard was discovered (MAL/71013 86 09-mar-1971)

As noted above. Deegan's assessment was carried out in May 2012. At that time the Cambridge University Unit for Landscape Modelling's collection of aerial photographs were unavailable for inspection. This collection has now re-opened and it is known that there are photographs of the Hoard find spot for two other years. There is at least one oblique photograph of the find spot taken in 1966, and some vertical coverage taken in 1984. As Alison Deegan has pointed out to me the fact that the 1966 photograph(s) are oblique and not vertical "suggests that there was something interesting to see there at least". Early in the Analysis project she will visit Cambridge and update her report using the 1966 and 1984 coverage. The former will be especially useful as it dates to before the boundary line was removed.

Clearly there is potential here for further research in addition to the up-dating of the information with the Cambridge holdings. The first question that needs to be asked is whether the oval form of the curvilinear enclosure is normal for an ice wedge formation. The second is to establish whether the husbandry regime in the part of the field where the Hoard was recovered can be more closely described since 1971.

4.6 Background information on the area

One of the reasons why the discovery of the Hoard caused such surprise is that Staffordshire has not hitherto been a noted focus of Anglo-Saxon seventh century activity. In the fifth to sixth centuries the West Midlands were part of the British west with only limited 'Anglo-Saxon' material culture recovered[31]. As Hooke in her paper in the West Midlands frameworks volume notes, the early medieval period is one of the least visible archaeologically[32]. A glance at the distribution maps in her paper, however, quickly confirms that even amongst the West Midland counties Staffordshire and the area around the Hoard find spot tends to be a singularly empty landscape. The county does have the only substantial early medieval settlement to have been excavated in the area at Catholme[33] but that lies to the north-east on the border with Derbyshire.

Clearly there will be a need to collect such evidence as does exist in the area for occupation contemporary with the Hoard, and there are four main sources. These are the Staffordshire Historic Environment Record (SHER); PMAG itself[34], the OASIS database of grey literature reports available via the ArchSearch facility of the Archaeological Data Service and the database of finds maintained by the PAS.

A rapid scoping exercise has revealed that work will have to be done during the analysis project to draw all these sources together as currently, whilst the information in them overlaps to a certain extent, there is no single reliable source. PMAG has records of the material that enters its collections, but does not collect OASIS or PAS records in any systematic way. There has been no guarantee that the paper archives of the sites, which PMAG holds the finds for, will have been deposited. Certainly there is no guarantee that a copy of the final report will have been deposited in the museum if it has been published. Given that the research project will be based in PMAG, it is also worth noting the following. Over the past decade pressure on resources has meant that the curators have had much less time than in the past to research the collections. Whilst it has been possible to keep up journal subscriptions for both local and national series, relevant books published during that period are present in a much less systematic way. It will be appropriate, therefore, to include a book budget for the Analysis programme both for relevant recent works not in the PMAG library and certain core texts. The museum library does not, for example, have a copy of the final reports on the Sutton Hoo ship burial[35] which is a key source that will need to be regularly consulted.

Information about current excavations does reach the SHER but clearly both it and OASIS will need to be consulted and compared to extract relevant records to be followed up. A search[36] in ArchSearch using the terms 'Staffordshire' and 'Early Medieval' returns 184 records whereas the SHER has 76 records of proven Saxon sites[37].

The SHER has 141 records of find spots that have produced Saxon finds. These include both early and late Saxon material and a rapid inspection suggests that the early medieval material probably consists of less than ten records, but that would need to be checked. The PAS database returns a total of 559

31 Hamerow 2002, 128.
32 Hooke 2011.
33 Losco-Bradley and Kinsley 2002.
34 The main museum collecting archaeological materials for all of Staffordshire.
35 Bruce Mitford 1975-1983.
36 Carried out 24th November 2011.
37 As of 24th March 2010.

records for a search on the terms 'Staffordshire' and 'Early Medieval'[38]. Inspection of these, however, shows that most of these are from the Hoard itself. There are 102 non-hoard items but possibly only four of these are early medieval in the sense of being contemporary with the Hoard. The majority would be better described as Late Saxon or Anglo-Norman.

The SHER records includes PAS finds but sometimes has finds with PAS identification numbers which cannot be matched with the records returned by the PAS database[39]. The numbers would indicate they were recorded in the early days of the PAS. Clearly there will need to be discussions with the local PAS Liaison Officer to establish precisely what the PAS has recorded, including any items that have not yet been added to the publicly available database. This should pose few problems as the Liaison Officer is based in BMAG .

In general, putting in place a portfolio of background information about occupation in the area contemporary with the Hoard should not be difficult, but will require collation of the records. It does not seem likely that this portfolio will be very large.

The rapid survey of relevant local *comparanda* has shown that PMAG itself holds several of the items that will be of direct relevance to the Hoard research. These include a sixth century copper alloy bridle fitting with gilding and silver tinning and Salin Style 1 ornament found in the Staffordshire Moorlands area (Acc. No. 2005.LH.27); a late sixth to seventh century copper alloy die for making decorative foils for drinking cups/horns from Swynnerton (Acc no. AR.1990.K6); and a seventh-century gold necklace pendant inlaid with square-cut garnet (Accession number: 2006.LH.67). The pendant was found in the same parish as the Hoard, less than a mile from the find spot. The most directly relevant item to the Hoard previously found in Staffordshire is a coin pendant decorated with cloisonné garnets in a Salin Style II pattern from near Forsbrook in the Staffordshire Moorlands[40]. This was sold to the BM in 1879 where it remains. Interestingly its recovery too was associated with the leveling of a hedgerow[41]. The fragmentary copper alloy mount that was found by Mr. Herbert whilst metal detecting in the field where the Hoard was found, has been given to BMAG and will also be available for study. It is decorated with interlace that is very similar to some found on Hoard items, Gaining access to other regional collections with useful *comparanda* may be more difficult. The Bateman collection with its contemporary gold finds from the Peak District housed at Weston Park, Sheffield would be an obvious starting point to look for similarities in foil patterns, interlace styles etc. Currently however, the post of curator of Archaeology is vacant there due to reductions in funding, and the collections are not available for study. It is to be hoped that this situation will alter during the life of the Analysis Project.

5 The Hoard

5.1 Introduction

This section summarises what we currently know about the Hoard. It is based on the survey carried out for the Assessment project design (Section 4 there) up-dated by observations that Chris Fern made during his work on checking the records (see **4.3**). He was not tasked with assessing the Hoard in any formal way but his observations have allowed a closer dating and section **5.4** below up-dates what was offered in the Assessment project design. It has also been possible to draw on the results of the analyses carried out in Paris in November/December 2010. These were described in the Assessment project design[42] but at that time the preliminary results had not been circulated. Some additional information also arose from the sorting and assessment for re-packaging carried out at BMAG in March 2011 by the curator and conservators of that institution with aid and advice provided by conservators from the

38 Carried out 24th November 2011.
39 E.g. SHER record 60027-MST11761 with the PAS identifier WMAD 675004 .
40 Speake 1970 6-7, pl. Ic.
41 Victory County History Staffordshire Volume 1, p. 212.
42 Appendix 1 section 3.4iv

BM.

5.2 The contents and quantities

The Hoard consists in the main of gold and silver items. A minority of pieces are made of copper alloy, in some cases providing a base metal core for gold. Many pieces are inlaid with garnets and there is some glass inlay including millefiore. At least one amber inlay has been observed, and other materials may be present. Many pieces are gilded, and niello decoration is also present. The surfaces of many are richly decorated not only with inlays but also with cast, incised and filigree patterns.

The evidence clearly shows that these pieces were removed from the objects they decorated, so they are frequently fragmentary and often show signs of damage, folding etc. This makes quantification a major problem. It is estimated that currently there are between three and four thousand separate pieces ranging from complete items to multiple tiny fragments. Establishing just how much or how many of a particular thing there is will be a major issue during the full analysis. In the Assessment project design the unit of database record was used because it was felt to be a useful timetabling tool in the sense that it quantifies how many bags need to be opened, looked at etc during particular stages. Weight would be another valid option but does not give the timetabling advantages. Fragment count is unhelpful given the varying degree of fragmentation observed. In this document the database record quantification continues to be fit for most purposes and so is maintained. Since January 2011, when the Assessment project design was written, an additional eight records have been added These consist of thin impressed foil fragments. They have been included in the tables below where appropriate[43].

Table 5.1 presents what is known to be in the Hoard at present in a simplified form[44]. Table 5.2 presents the same data quantified by weight so that the broad quantities of the different materials can be seen. It should be noted that these weights are pre-cleaning, and those for gold items include the weights of the garnets where these are present on the items. The titles of the row heading give the principle element for simplicity. In reality of course all are alloys.

Category	Gold	Silver	Copper	Iron	Mixed	Garnet	Glass	Stone	Total
Other	383	674	55	2	16	2	-	-	1141*
Sword fitting	346	101	13	-	8	-	-	-	468
Inlay	-	-	-	-	-	58	4	-	62
Helmet fitting	-	6	-	-	-	-	-	-	6
Cross	5	-	-	-	-	-	-	-	5
Buckle	3	-	-	-	1	-	-	-	4
Bead	-	-	-	-	-	-	-	1	1
Total	737	781	66	2	25	60	4	1	1687

Table 5.1: The Hoard contents by material and broad functional categories quantified by database record. The total given for the other category includes 9 items of uncertain material.

43 This was the state of affairs in early December 2011 when the original Project Design was written. The on-going X-radiography of the dirty items has produced more material since then which has not been incorporated into the tables. Equally this section does not up-date the identifications that have been made in the first year of the Research Project's existence.

44 The processing of the data is described in Appendix 1 section 4.1iii.

Category	Gold	Silver	Copper	Iron	Mixed	Garnet	Glass	Stone
Other	1941.03	1114.02	77.43	114.68	50.54	1.4	-	-
Sword fittings	2899.80	246.66	189.7	-	73.81	-	-	-
Inlay	-	-	-	-	-	9.24	4.37	-
Helmet	-	99.59	-	-	-	-	-	-
Cross	250.49	-	-	-	-	-	-	-
Buckle	7.81	-	-	-	6.78	-	-	-
Bead	-	-	-	-	-	-	-	5.5
Total	5109.62	1459.78	279.18	114.68	124.35	10.64	4.37	5.5

Table 5.2: The Hoard contents by material and broad functional categories quantified by weight (g) (see text for categories).

Approximately two-third of the objects in the Hoard have not currently been assigned with any certainty to broad categories of items ('other' in Tables 5.1 and 5.2). These will be returned to below. Overwhelmingly the identified pieces belong to swords or seaxes, i.e. edged weapons. The inlay category consists primarily of the loose garnets lost from the metal items. Sixteen of those were catalogued during the initial cataloguing stage by Dr and Mrs Leahy before the Inquest, the rest have come from the subsequent investigation of the soil blocks in the laboratory. It should be noted that this recovery pattern suggest some loose garnets may have been missed during the investigation on the site. During that it was not possible to maintain the wet sieving regime on site after the first two days[45], and tiny translucent reddish fragments of garnet such as these would be difficult to spot in the clay soil during hand sorting. They would not have been found during the metal detecting scanning either.

At the time of the Assessment Project Design, helmet fittings have only been identified with some degree of certainty by a single cheek piece (K453) and the silver-gilt animal head terminal from a helmet crest (K678), the other items included here are plausibly rather than securely allocated to helmets. It was felt likely, though, that additional helmet-related items would eventually be separated out of the 'other' category. There are, for example, 110 records relating to *Pressblech* silver foil, two of which are gilded. These are fragments of die-impressed panels of the sort found on helmets. There are also 39 records of 'C'-sectioned edgings and nine records of reeded silver strips; again types of fittings found on helmets. During sorting in March 2011 approximately 300 records equating to c. 1,200 fragments were identified as falling into these categories. Since then the conservation team at BMAG have identified fragments which fit the extant cheek piece and a strip that would have come from a second matching cheek piece[46]. This has confirmed the belief that the number of items in this category will rise.

The cross category includes both definite Christian crosses and cross-shaped objects that may or may not have a Christian significance. Included in the category is a folded gold strip, possibly from another cross, that has a Latin biblical inscription on both sides. The text was taken from either Psalm 67.2 or the Book of Numbers 10.35[47].

A curious feature of the Hoard composition is the scarcity of buckles. These are normally a regular feature of equipment at this period and fragments from them would be easily recognisable. Originally

45 Appendix 1 section 3.1ii

46 K nos. 97, 594, 1223. This is a recent discovery and so in Tables 5.1 and 2, they are still tabulated as 'other',– for a detailed explanation see the conservators' blog - http://www.staffordshirehoard.org.uk/k453

47 *Rise up , O Lord, and may thy enemies be scattered and those who hate thee be driven from thy face.* Numbering cited is for the Vulgate Bible.

Kevin Leahy identified two. Chris Fern has suggested that K959 may be an additional buckle loop and K1314 may be a buckle plate. That would still only account for four items in this very large group, and it is extremely unlikely therefore that the future analysis will uncover a substantial additional number of pieces for this category as has been suggested for helmets. Equally there was only one item originally described as a possible brooch fragment (K786). Further inspection has suggested that the fragment is very unlikely to be a brooch. This too is a common category in contemporary material culture with fragments easily recognisable. So, had they been encountered in the original cataloguing, they would have been identified

As it currently stands, therefore, this Hoard consists of military fittings relating to weaponry and armour, but not to the belts the individuals would have worn. The 'other category', whilst including many tiny fragments that may never be assigned to an object type, also has many unusual and currently unparalleled pieces, consisting of decorated mounts and panels etc., and it must be suspected that many of these could well have come from items such as shields and scabbards.

Quite how many items are represented is currently extremely difficult to calculate. Table 5.3 shows the different elements of the sword / seax fittings present. Any particular handle would have a pommel cap, four hilt plates in two pairs connected with rivets, rings at the junctions of the handle grip with the hilt plates and decorative collars. The number of swords the contents of Table 5.3 represent is therefore unknown at present, but is clearly considerable.

Element	Gold	Silver	Copper	Mixed	Total
Pommel cap	75	12	5	2	94
Pommel ring	1	3	-	-	4
Hilt collar	71	1	3	-	75
Hilt plate	113	36	5	1	155
Hilt ring	24	5	-	-	29
Hilt Rivet	54	43	-	4	101
Pyramid	8	1	-	1	10
Total	346	101	13	8	468

Table 5.3: Sword or seax handle elements by material quantified by database records.

This breakdown of the edged weaponry elements also draws attention to the fact that some elements appear to be under-represented. The initial cataloguing suggested there were three fittings associated with sword rings. Chris Fern suggests that there may be even less (one or possibly two). He further notes that this 'is in contrast to finds from graves and raises interesting questions about their absence'. This suggests that even within what appears to be a prolific category of find (edged weaponry) there may have been selection for deposition.

As will be noted from Table 5.1 and 5.2, the bulk of the find consists of gold items. A breakdown of the weight of the individual records is instructive and is summarised in Table 5.4. Again, the provisos that these are pre-cleaning weights and for the gold sometimes include decoration such as garnets should be kept in mind.

Weight (g)	Gold	Silver
0.01 - 1	172	465
1.01 - 2	112	125
2.01 - 3	99	53
3.01 - 4	44	33
4.01 - 5	37	15
5.01 - 6	36	20
6.01 - 7	23	6
7.01 - 8	15	13
8.01 - 9	15	2
9.01 -1	16	4
10 and above	173	23

Table 5.4: Weights of gold and silver items by database record[48]. (NB this table only includes items identified as 'gold' or 'silver' in the original cataloguing and not 'gold?' etc.).

As can be seen the distribution of the weights, and by implication the size, of the items means that for much of the silver it will be unlikely that it will be possible to assign it to anything more than a broad category of find. There is a much greater likelihood that we will be able to identify many more of the gold fittings currently in the 'other' category because the fragments are larger. This has implications for how much information can be extracted from them and will be returned to in **6.5**.

As already noted the items are frequently lavishly decorated. A taste of this can be seen in Tables 5.5 and 5.6 which summarise the types of decoration used on two of the prolific elements of the edged weapon category. It is this decoration that will be key to assessing the date of the Hoard and this will be considered further in section **5.4** below.

Weight (g)	Gold	Silver
0.01 - 1	**172**	**465**
1.01 - 2	**112**	**125**
2.01 - 3	**99**	**53**
3.01 - 4	**44**	**33**
4.01 - 5	**37**	**15**
5.01 - 6	**36**	**20**
6.01 - 7	**23**	**6**
7.01 - 8	**15**	**13**
8.01 - 9	**15**	**2**
9.01 -1	**16**	**4**
10 and above	**173**	**23**

Table 5.5: Sword or seax hilt plates by decoration (quantified by database record). (This table excludes K837 and K884 where the decoration has not been described.)

48 It should be noted that in a few cases the weight recorded for the largest items in some categories has been found to be suspiciously large when summarised by minimum, maximum, mean and the interquartile ranges. It is likely that these are wrong by an order of magnitude due to the misplacing of a decimal point , e.g. 13 instead of 1.3. This will have slightly inflated the figures in the 10g and over category.

Weight (g)	Gold	Silver
0.01 - 1	172	465
1.01 - 2	112	125
2.01 - 3	99	53
3.01 - 4	44	33
4.01 - 5	37	15
5.01 - 6	36	20
6.01 - 7	23	6
7.01 - 8	15	13
8.01 - 9	15	2
9.01 -1	16	4
10 and above	173	23

Table 5.6: Sword or Seax pommel caps by decoration (quantified by database record).

5.3 Scientific analysis

Data have been accumulating about the composition of the metal for the past two years. First as part of the Treasure process and then to aid the conservation team. The PIXE analyses carried out in Paris are particularly useful as they show the range of composition that can sometimes be seen in the same items depending on which element of these multi-piece items was being analysed. A subset of the data is presented in Table 5.7 and the pieces it relates to are illustrated in Fig. 5.1. As can be seen from the table different pieces from the same object can have different compositions. This is illustrated in Fig. 5.2 where the compositions are shown as a ternary diagram. In some cases an item was made of approximately the same composition of gold in its different elements. The pectoral cross K303 falls into this category. In others such as K1425, the different elements have noticeably different compositions. This has implications for the design of the analytical programme which will be returned to in section **15.8iii**.

One of the main aims of the Paris analyses was to look at the composition of the garnets. The laboratory at which it was being carried out has been conducting garnet analyses for some time and so has an extensive bank of reference material from Merovingian items to which a selection of the Hoard garnets could be compared. The analyses showed that the garnets came from a range of sources with alamandine and pyrope forms as well as indeterminate compositions being identified. The stones showed similar groupings to those identified previously, but some differences between the objects in the Hoard and continental Merovingian artefacts possibly suggest other sources may be have been being exploited. This may make any provenancing studies difficult as there is little data to compare the Hoard data to. It was observed that though inclusions were present, there were fewer than was normally the case for the Merovingian material. There also seems to be a link between the choice of garnet type used and a link to pattern/colour in the artefact. This is another difference between the Hoard pattern of use and that seen in the Merovingian material, and aligns the Hoard cloisonné work with that seen in the Sutton Hoo jewellery[49].

As is normal the garnets are underlain by decorated foils to enhance their effect by reflecting light. No systematic work has yet been carried out on the foils but at least three different 'waffle' patterns have been noted. The combinations of different colours of garnets and different foils has the potential to be a useful analytical tool when trying to group the fragments and elements that may have come from the same artefact. Such grouping will be one of the major challenges of the analysis project.

49 See for example Bruce Mitford 1978, 603.

Fig. 5.1. The gold items whose analyses are detailed in Fig. 5.5

Paris sample number	*K number*	*Cu (%age)*	*Ag (%age)*	*Au (%age)*
7	303	3.3	10.9	85.5
8	303	2.3	11.5	85.9
9	303	2.6	11.0	85.9
10	303	3.0	12.0	84.4
13	21	2.1	18.8	78.8
14	21	2.6	20.8	76.1
15	21	2.0	17.7	79.7
44	1425	5.3	29.0	65.5
45	1425	3.7	26.9	57.1
46	1425	3.9	27.9	60.7
47	1425	3.7	28.1	60.7
48	1425	5.3	14.0	79.6
49	1425	6.1	16.7	71.8
50	1425	7.8	26.0	65.6
51	1166	2.2	18.4	79.0
52	1166	1.7	15.3	82.6
53	656	1.1	24.4	74.2
54	656	5.4	25.8	68.5
111	560	1.6	15.2	83.0
112	560	1.9	17.7	78.2
113	560	2.4	18.1	78.7
114	560	2.2	18.1	78.2

Table 5.7: Metal composition of six gold items analysed by PIXE (November 2010)

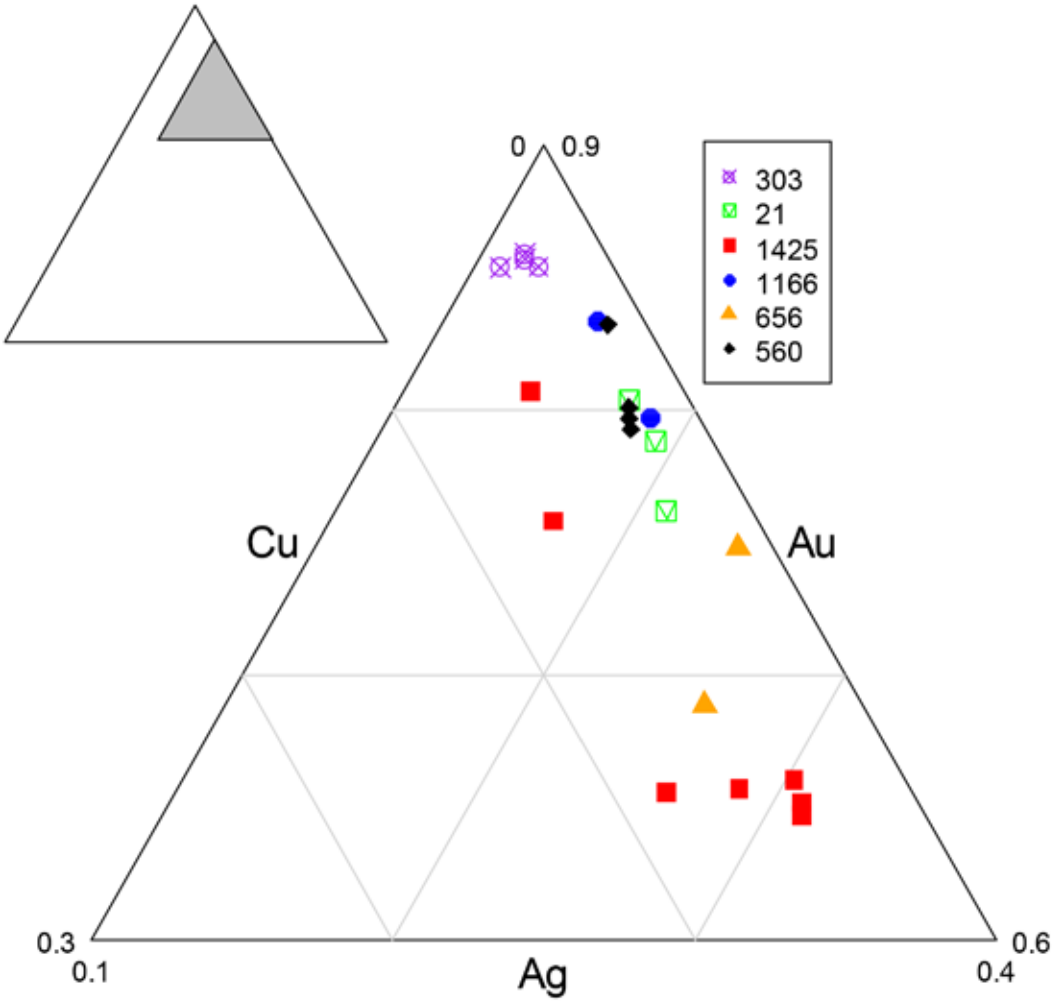


Fig. 5.2: Ternary diagram il;ustrating the data in Table 5.7 (Created by M.J. Baxter in the statistical package R)

5.4 The date of the Hoard

As the material was found in the plough soil there is no contextual information that could help date the deposition date and so all of the dating evidence has to be provided by the objects themselves. One item has been found to be associated with wood which is currently being assessed to see whether it has any potential for ^{14}C analysis. Even if such dating can be carried out, the value of a single ^{14}C date is negligible, though it may allow the item to which it is attached to be confidently assigned to the Hoard, as originally it was thought to be of relatively modern date before it was found to be of silver. The modern strength of ^{14}C to provide narrow dates comes about when there are a series that can be placed in stratigraphic order and the results modelled using Bayesian statistics. In an unstratified group such as this, such an option is not possible even if more suitable material is found. Chris Fern therefore contributes the following summary of what the typology of the objects currently tell us about the date of the Hoard.

The artefact forms and art styles focus on the seventh century. A single object with Style I (c. 475–550/75) animal art may be present (K1542) but Style II (c. 550–650) predominates. The silver pommel K711 is one of the earliest examples, showing considerable wear, and may be a Scandinavian import. It is comparable in its chip-carved execution and motifs with the buckle from Åker, Norway[50], for which a later sixth century date may be possible. The garnet cloisonné is equally an aesthetic mainly of the seventh century, with much of the Staffordshire Hoard workmanship closest in character to the 'workshop' traditions of Sutton Hoo (c. 620–40), and those in Kent in the same period. The more simplistic cellwork characteristic of later pieces, such as Cuthbert's pectoral cross (c. 680)[51] and the 'Ripon jew-

50 Speake 1980, Pl. 2i.

51 Webster and Backhouse 1990, no. 98.

el'[52], as well as other later brooches[53] is not represented, hinting at a *terminus ante quem* of *c*. 650/675. This date agrees too with the animal art.

Critical to understanding the chronology of the collection will be the sword-fitting types. Their variety exceeds the limits of Menghin's (1983) typology, including some unknown forms, but generally they are types of the late sixth to seventh century. The small seax pommel (K376) is comparable to that from Ford, Wiltshire[54], which like the Staffordshire Hoard example is associated with Style II-decorated fittings; on current understanding it is unlikely to date much beyond the mid seventh century. The earliest may be from 'heirloom' weapons (K286, K559) manufacture in the earlier part of the sixth century[55].

The Christian inscription from the Hoard has been variously dated[56], from the mid seventh century to early 8th century by one authority[57], but *confidently* post-700 by another[58]. However, as discussed above, a date beyond the last decades of the seventh century seems out of keeping with the Hoard as a whole, and since 'it is not easy to date any Anglo-Saxon inscribed text on the basis of script alone'[59] it may be suspected that it is the inscription that is the anomaly, and earlier rather than later.

6 The Potential of the Hoard to aid Knowledge

6.1 Introduction

There can be no argument over the fact that this Hoard is indeed a spectacular and entirely unexpected find. Many claims have already been made for and about it including the suggestion that it will revolutionise our understanding of Anglo-Saxon England. It will undoubtedly continue to be researched and re-interpreted for many years after the Analysis Project which this document is proposing, is completed. To a certain extent the potential could at present be viewed as limitless. Whilst I believe we should be ambitious in our analysis plans, we also need to be realistic about designing a project that will put the basic information about it into the public domain in a timely manner. So some of the perceived potential outlined below will not be fully explored in the Analysis Project, but we will aim to give other people the tools to continue the research in the future.

6.2 The Hoard as an artefact - exploring depositional practices

A hoard is always more than the sum of its individual parts, spectacular though those may be in their own rights. We often talk of objects having cultural biographies[60]. A hoard can be viewed as the sum of those biographies developing a new one by the very bringing together of its contents. In the case of the Staffordshire Hoard with its focus on sword fittings, the idea of an object biography becomes not just a useful theoretical standpoint to help us think about material culture, but a very real concept. Swords were important items to early medieval people. They had their own identities. Whilst it would be wise to treat with some caution accounts in literature that give swords names and recount their deeds[61], the same picture arises from, admittedly later, wills. Brooks at the PAS Symposium quoted the will of Ælfgar of c. AD 950 which explains that he had been told he could make a will because he had given his lord a sword. But this was not just any sword, and the fact that it had been given to him by King

52 Hall *et al*. 1996.
53 see Scull 2009, 88–91.
54 Musty 1969.
55 Fischer and Soulat 2010.
56 Leahy and Bland 2009, 10.
57 Brown 2011b; see also Ganz 2010.
58 Okasha 2011.
59 *op cit.*
60 Kopytoff 1986.
61 Such as the sword Unfirth lent to Beowulf for his battle with Grendel's mother. Beowulf 1455-64 and 1519-28 .

Edmund is stressed first, before the weights of gold and silver on it and its sheath[62]. That sword had history of its own. Equally in the will of Athelstan in AD 1014 a number of swords are bequeathed to different people, most are distinguished individually and in one case it is recalled that originally it had been the sword of King Offa[63]. A hoard with so many fittings removed from so many objects, which would all have had their own biographies, obviously asks many questions about the motivation for the bringing together and the deposition.

For a long time hoards of precious metals were regarded in a fairly functional way. These were valuable items gathered together and hidden with the intention of retrieving them later either by the legitimate owner or by a thief. The motivation was primarily safekeeping in the face of danger, and the classic account of such hoarding activity is provided in the diaries of Samuel Pepys. He had long been anxious about how to store his accumulating wealth. When the Dutch invasion fleet arrived in the Thames in 1667, the gold was taken to the country and hidden. It was eventually recovered, leaving him with the thought that the keeping of money was sometimes as painful as the getting of it[64]. As well as the safekeeping hoards of people like Pepys consisting of complete items, be they coins, plate or jewellery; there are also hoards that appear to consist of scrap metal as well as finished items. These have often been interpreted as the stock of craft-workers intended to be melted down and recycled, classic examples of these being the founders hoards of the Bronze Age which have played such an important part in establishing chronologies for the period[65]. In all these types of interpretations the hoards we find are failed acts because, unlike the gold of Samuel Pepys, they were not recovered. If we look on the gold and silver in the Staffordshire hoard as bullion, then it could be interpreted within the functional safekeeping model; though the very specialised nature of the artefacts the gold came from with all the associated layers of meanings to their users, might counsel against such a reading.

Hoards of treasure made of precious metals can be regarded as a particular type of the special deposits which have been increasingly recognised as having a very long history in Britain, stretching from prehistory to beyond the Roman period. There has been a growing realisation that items previously categorised as simple rubbish had frequently been deliberately placed, often in rites of termination and with some form of votive or placatory intent. This activity is now known in the archaeological record as structured deposition. J.D. Hill (1995) is often given the credit for introducing this way of looking at material within an Iron Age milieu[66]. Merrifield's earlier but equally penetrating work is often overlooked[67], but what can be agreed is that for 15 years or more it has been commonplace to accept that such behaviour was extremely common in later prehistory and the Roman period. The archaeologists working in the early medieval period within England have been slower to recognise the phenomenon but recent work has suggested that this was a habit that continued and was not abandoned by a population that was increasingly Christian[68].

To the modern mind the idea that one would dispose of bullion in a way that put it beyond human use is a very alien concept. Many people are much more comfortable with the motives of Samuel Pepys. This has resulted in heated debate within scholarship in the Roman world where metal detecting has produced a considerable increase in Treasure hoards. On the one hand there is the view that these were safekeeping hoards designed to be retrieved, on the other that they are one facet of a pervasive pattern of behaviour that we call structured deposition. A taste of this may be seen in the papers of Millet and Johns in a conference proceedings published in 1994[69], and it has continued since. The two final Hoxne Hoard publications being good examples. Johns, publishing the jewellery and tablewares, adopts a

62 Brooks 2010, 3 quoting Whitelock, D. 1930. *Anglo-Saxon Wills* (Cambridge) no. 2.
63 Keynes 2010, 6, 8 quoting Whitelock (*supra* note 57), no. 20.
64 Latham and Williams 1983, 134 with references to relevant diary entries.
65 For a recent reappraisal see Yates and Bradley 2010.
66 e.g. Fulford 2001, 199
67 Merrifield 1987.
68 Hamerow 2006; Thomas 2009
69 Millett 1994; Johns 1994.

functional view stating:

> 'I find myself quite unable to believe in the regular, voluntary and *permanent* renunciation of wealth as a widespread cultural custom'[70].

Guest publishing the coins reviews the hoarding patterns in late Roman Britain and concludes:

> 'What appears to be the most likely explanation is the one that at first seems most implausible, that the population in certain areas of Britain buried hoards fully intending to leave them in the ground.'[71]

This debate has not really taken place in the early medieval period for finds from England, though sometimes features in considerations of the hoards from southern Scandinavia[72]. In part the debate has not had to take place because bullion hoards have not been a feature of sixth and seventh English archaeology. Wealth of that period appears to have more frequently been consigned to the grave when there was a desire to put it beyond use. The Sutton Hoo ship burial being an extreme example of this. By the time that bullion hoards do start to appear again in the late Saxon period, the menace of the Vikings is frequently invoked to explain them, either as Viking loot or Anglo-Saxon safekeeping, even when the watery findspots of hoards such as that found at Trewhiddle[73] show a remarkable similarity with earlier patterns of deposition in prehistory and the Roman period. It has been suggested that the deposition of wealth in the sixth and seventh century graves should in itself be seen as a form of votive deposit[74], though others take a different view[75].

The Hoard provides the opportunity to explore whether what was going on in the sixth and seventh century was really such a major disruption with the past. It too, like the grave goods, represents in Crawford's words 'a deliberate and committed policy of artefact destruction'[76]. By situating the Hoard in the wider chronological landscape of votive and special deposits we shall not only be providing useful data for future studies of what sixth and seventh century people might have thought they were doing when they consigned their richly attired dead to the grave; we should also gain insights that will enable us to explore what motivated its deposition, be it safekeeping or a way of putting the artefacts and their biographies beyond use. Though the Hoard is currently one of a kind, it may be noted that the PAS has now recorded 10 early Anglo-Saxon gold pommel caps which could represent the abandonment of these objects, albeit on a much smaller scale than is seen in the Hoard[77]. It is possible that metal-detecting is uncovering a hitherto unknown aspect of early medieval life in Britain.

What is certain is that given the increasing and regular recovery of Treasure finds due to the popularity of metal detecting as a hobby, this exploration will also have the potential to cast light on the issue in other periods.

6.3 The Hoard as art – re-writing decoration

As noted in **5.2** and especially in Tables 5.5 and 5.6 many of the items in the Hoard are covered with complex decoration. It provides a corpus of material found in a single place that is unrivalled. At the 2010 PAS symposium Høilund Nielsen observed that only 124 objects with Salin Style II zoomorphic ornament from Anglo-Saxon England were used in the large survey of metalwork conducted in the

70 Johns 2010, 202.
71 Guest 2005, 32.
72 Hines 1989 – though the focus of the paper is elsewhere.
73 Webster and Backhouse 1991, 268, 272.
74 Crawford 2004, 97.
75 Scull in Hamerow *et al* 2011.
76 Crawford 2004, 97.
77 Leahy pers comm.

1980s and 1990s[78]. At the time of writing the Assessment project design this figure had already been augmented by approximately 70% and the figure continues to rise as more material is cleaned. In the absence of coinage, decorative styles are often used as a key dating tool (see section **6.4**), and Høilund Nielsen's seriations of the different motifs has been used both to date items and to suggest whether they were coming from a Kentish or an Anglian area[79]. Interestingly some of the pieces she looked at during the symposium contained both 'early' and 'late' features according to current understanding[80]. It is very likely that the *corpus* of decoration information derived from the Hoard will re-write our current understanding of the subject, and that will have implications for the dating not only of metalwork, but also of items such as illuminated manuscripts.

The information derived from the Hoard will also of course have relevance for the study of later metalwork decorative styles as well. Webster has defined a style that can be associated with the eighth to early ninth century and which can be associated with the Mercian kingdom territories of that period[81]. As it is based on distinctive zoomorphic patterns, the Hoard has the potential to show if various of these have antecedents in the heartland. This opens up the area of potential considered in section **6.4**.

Closely linked to the potential the Hoard has for art styles is the potential it has to inform us about Anglo-Saxon craftsmanship at its highest level. It is likely that it will be possible to recognise techniques that allow workshops to be recognised. It may be possible to make some estimates of the time involved in the production of objects and suggest levels of production. All of this will inform studies of the topic both in England and on the continent.

6.4 The Hoard as history – the origins of Mercia

The Hoard has been found at a location that does not lie within the perceived heartlands of Anglo-Saxon England in the east where items decorated in these ways are common. This is well illustrated by the distribution of sixth and seventh century gold and silver finds recorded by the PAS (fig. 6.1). If the material from antiquarian finds and archaeological excavations were to be added, the marginal position of the Hoard would be even more marked. As noted in section **4.5** the West Midlands in the fifth to sixth centuries was predominantly part of the British west.

Where the location does lie is within the perceived Trent basin heartlands of the Kingdom of Mercia which during the eighth century was to expand to occupy much of central England[82]. The origins of this kingdom, like those of other Anglo-Saxon kingdoms, have been described as 'shrouded in the mists of time and in the myths of origin promoted by the ruling dynasties'[83], but there are some ground for thinking that the entity (or entities) that were to become known as the Kingdom of Mercia was already established early in the seventh century[84] It is was clearly a force to be reckoned with in the second quarter of the seventh century given the battles of Penda (d. 655) that Bede records and possibly Welsh poetic sources also refer to[85].

People will undoubtedly use the Hoard to illustrate the rise of Mercia. The concentration on military gear after all seems to fit well with a growing and aggressive power. Within the confines of this project though, it will probably be difficult to make substantive contributions to the debate. Generally one cannot write history from small finds. Should the decorative styles prove to be distinctive and different to those commonly found in the Kentish and the Anglian areas, then arguments could be made for it demonstrating the demand from a princely elite based elsewhere, presumably in Mercia. Equally

78 Høilund Nielsen 2010, 1.
79 Høilund Nielsen 1999.
80 Høilund Nielsen 2010, 7.
81 Webster 2001, see especially p. 274.
82 Hooke 2001, Map 4.
83 Brown and Farr 2001, 2.
84 Yorke 2001, 19.
85 Bede II.20, III.7, 16, 18; Dean *et al* 2010, 146.

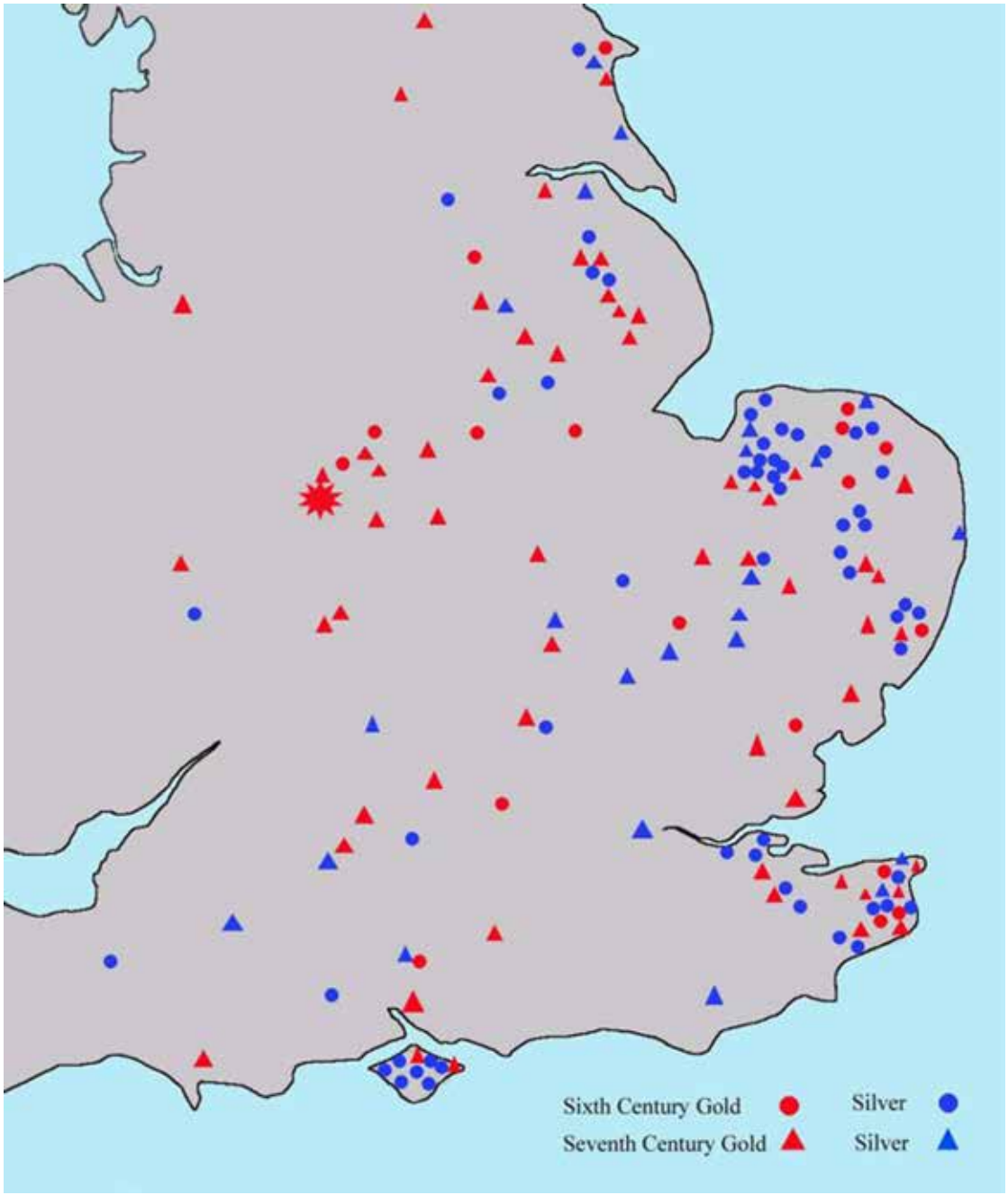


Fig. 6.1. Sixth and seventh cntury gold and silver finds recorded by the Portable Antiquities Scheme (Source Leahy 2010)

if the styles do prove to be predominantly Kentish or Anglian, then it could be argued the items were derived from those areas and arrived as loot, or tribute or by some other mechanism. The probability is that there will be a mixture but until the cataloguing has been carried out we shall not know.

6.5 The Hoard as economy – the gold standard

In England the influx of Byzantine and Merovingian coinage during the Conversion period was used as bullion to make jewellery, with the different working properties of gold allowing the jewellers to develop different styles and effects[86]. Prior to the discovery of the Hoard it had not been suspected that so much of it was lavished on military fittings as well. By the late seventh century gold jewellery has a noticeably paler colour than that of earlier in the century, possibly reflecting debasement of the coinage from which the gold was derived[87]. This may well provide a useful dating tool for elements of the Hoard when the fineness of the gold is analysed. Work ongoing on the metal content of contemporary coinage suggests the picture is not as clear-cut as was presented in the report on the Sutton Hoo mate-

86 Webster and Backhouse 1991, 47.

87 Webster and Backhouse 1991, 47; Hines 2010, 161.

rial[88]. It will be possible to compare the results of the analyses of the coins to those of Hoard items with their typological dates and explore relationship in much more detail than has been done previously.

The large number of analyses of the gold will also provide important data for exploring the recent proposal that a bimetallic system was in place in seventh century England. It was proposed that there was a fixed relationship between gold and silver and that this can be used to explain the vocabulary used for coinage or 'worth' values used[89]. Such a proposal would only work if the fineness of the gold at any one time was fairly standard. The Hoard may demonstrate whether this was so.

It will also be possible to combine the weight, fineness measures and any incidence of deliberate cutting on the artefacts to see if in part the fragmentation is due to the desire to have units of a known worth ,which would help cast light on the motivation of the depositor(s).

As noted in **5.2** and Table 5.4 the potential to include the silver in explorations of this kind is more limited because the extreme fragmentation will make it difficult to assign them to a particular item, and so there will be a much smaller pool of items that can be analysed for their composition in the confident knowledge that this will represent one single item and not a duplicate measurement.

6.6 The Hoard as worth – value then and now

What is the Staffordshire Hoard worth? The Treasure Valuation Committee thought they knew and set the price at £3,285,000, but worth is different than price. If something is thought to be worth doing, it normally implies a set of values that go beyond the monetary. As described in section 3.1, the Hoard is valued by its local community; and also by others as during the fund-raising period it received donations from all over the country and beyond. People thought it worthy of support.

The Hoard is spectacular and people responded to it in a spectacular fashion, queuing for hours to see it and donating large amounts of money to keep it in public ownership. This is one area where the reaction to the Hoard mirrors patterns of behaviour that have often be seen in response to other finds. In section **4.1** the difference between the timescales available to the teams dealing with the Staffordshire and Hoxne Hoards was contrasted. One area where they have much in common is the interest of people who live in the areas in which they were found. When the Hoxne Hoard returned to Ipswich for a six month exhibition in 1994 record crowds came to look at it[90]. For a more recent and more unfortunate example the case of the Crosby Garrett Roman sports helmet can be considered[91]. This too was found by metal detecting, but as an isolated copper alloy find it did not fall within the terms of the Treasure Act and the finder chose to consign it to public auction in 2010. Again the public responded in a spectacular manner, and again the local community felt it was 'theirs' and should stay in Cumbria. The Tullie House Museum and Friends of Tullie House at Carlisle raised pledges of £2 million in less than one month with the public donating £100,000[92], but sadly it was not enough as the purchase price at auction was £2.3 million and the helmet has now disappeared into a private collection[93]. At the time of writing this document, Leeds Museum is trying with some success to raise the money to purchase another seventh century gold jewellery hoard because of a feeling locally that it is theirs[94].

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88 Bruce Mitford 1978, 611-4. I am grateful to Dr Gareth Williams for discussing this with me.

89 Hines 2010.

90 Johns 2010, 4.

91 Brewer – unnumbered editorial *Britannia 42* 2011; Worrell and Pearce 2011, 402-7

92 There was three and a half weeks between the announcement of the sale and the auction. The museum had been in preliminary discussions with some large trusts earlier than this. I am most grateful to Andrew Mackay discussing the fund raising with me.

93 http://www.guardian.co.uk/science/2011/jun/14/nijmegen-helmet-carlisle-museum ; http://www.bbc.co.uk/news/uk-england-cumbria-11420850 (checked 26:11:2011)

94 http://www.guardian.co.uk/uk/the-northerner/2011/nov/15/leeds-hoard-west-yorkshire-anglo-saxon-jewellery-kat-baxter-jimmy-savile ; http://www.nhmf.org.uk/LatestNews/Pages/RareAngloSaxongold.aspx (checked 26:11:2011)

Clearly there has been a major shift in public opinion. It is no longer thought acceptable as it was in the case for the Hoxne Hoard in the early 90s, that finds thought to be of national importance are automatically acquired by the British Museum. There is a much stronger sense of local ownership. Whilst the Staffordshire Hoard is probably the most obvious example of this change of attitude, another Staffordshire metal detecting find can be seen as the precursor. The Staffordshire Moorlands pan, an enamelled second century vessel with an inscription relating to the sites on Hadrian's Wall[95], was jointly acquired in 2005 by PMAG, the BM and the Tullie House Museum, Carlisle,[96] reflecting the feeling in both regions that this item belonged in some way to them.

The strands of work that will attempt to explore the potential outlined in sections **6.2** and **6.4** will demonstrate what the worth of the Hoard was to the people who deposited it in the seventh century. The Hoard, however, also has the potential to be the starting point of an exploration of what worth is placed on these finds from the past by people of the twenty-first century. It is uniquely placed to be this starting point as already a regional identity not shared by people before has developed because if it. Who, prior to the discovery of the Hoard and outside of narrow scholarly circles, remembered the kingdom of Mercia? Gone and forgotten for over a millennia, but now a focus of regional pride courtesy of a metal detecting find[97]. It is a phenomenon that that is likely to be repeated elsewhere whenever the next spectacular and unexpected find emerges, and it is something that we in the archaeological community need to understand.

7 Research Aims and Objectives

7.1 Introduction

The overarching aim of this project is to make details of this unusual find available to both the scholarly community and the general public as promptly as possible within the bounds of good scholarship. The research project is part of an overarching Hoard programme that includes museum exhibitions and projects associated with display such as digital imaging, tourism and regeneration initiatives[98]. Permanent museum exhibitions in specially designed galleries are being planned at five different venues of the Mercian Trail. The locations and themes they will address are as follows:

- Lichfield – the Christian heritage, probably including aspects of paganism.
- Tamworth – Kingship and Warfare.
- Stafford – Excavation and Recovery.
- PMAG – the Kingdom of Mercia and Mercia within Britain.
- BMAG – the Hoard within its national and international context; the conservation and scientific aspects of the work on it; the craft aspects.

Underpinning the planned research is the desire to ensure that as well as providing the lasting foundation for all future research on the Hoard, it also contributes to these public displays so that they can be informed by the highest possible level of scholarship. In this way the partnership between the general public and the scholarly community that started so successfully with its acquisition, can continue with the Analysis Project answering some of the many questions that the public ask about it.

The research aims are very simple and can be summarised as aiming to answer the five questions itemised below by means of the objectives that relate to them. As explained in the Preface, the Analysis Project is now formally to be divided into two parts, the overview at the end of this section provides an appraisal of the likely progress towards achieving the aims that will have been made by the end of

95 Worrell 2004, 326 no. 8, Tomlin and Hassall, 344-5.
96 http://finds.org.uk/news/stories/article/id/159/?newsID=159 (checked 26:11:2011)
97 see section 3.1 - The Mercian Trail..
98 The organisational chart summarising this is provided as Appendix 4.

7.2 What does the Hoard consist of?

The objectives here are to identify the different types of artefacts, how many there are, what the decorative styles are, what they were made of, and how they were made. Much of this is straightforward involving typological work and scientific analysis. As noted in **5.2** answering the question 'how many are there' of anything is likely to be the most difficult. The ongoing conservation work has been able to group a few of the pieces (see **5.2**). Grouping is likely to continue from this work but equally systematic recording, metal analysis and the interrogation of those reports by multivariate statistical analysis techniques should greatly speed up the process.

7.3 When was it deposited?

The objectives will be to date the artefacts using decorative style (see **5.4**) and possibly by gold content (see **6.5**) and to consider the evidence of whether any items had been in use for a considerable time judged by wear marks or repair. The script of the inscription may be helpful in refining the date but, given the current disagreement over the date (see **5.4**), this might not be possible. As discussed in section **5.4** the likelihood of scientific methods such as radiocarbon dating being of use is small.

7.4 Why was it deposited?

This is the very big question and it can be broken down into three sub-questions of increasing complexity. Why there? Why then? What was the motivation?

For answering the immediate location part of the 'why there' question, it will be possible to call upon the evidence of the excavations and aerial photographs (see. **4.5**). The suggestion that it may have been near a band of noticeably different vegetation, and that there may have been landscape features now no longer present will help here. The distribution of the fragments may enable us to understand a little more of the formation processes. As Table 4.1 makes clear, however, for three-quarters of the database entries there is no location information so we know neither where they were found not how they relate to each other. The distributional information is thus likely to make only a small contribution to answering this question and indeed the groupings that will aid us to answer the 'what does it consist of' question.

Answering 'Why there' in a slightly broader landscape context can be done in part and work has already started[99]. To answer it fully would need more fieldwork and none is proposed as part of this project. It will be possible, however, to draw on the information and records outlined in **4.6** to start to answer the 'why there' question and they may also provide insights into the 'Why then' one. The historical records are another area that can contribute to the latter, though for Mercia these are patchy, written by supporters of other regimes and will only be of the broadest help.

The motivation question is of course the most difficult one but, as has been discussed in **6.2**, can be approached through broadening out the focus both to depositional habits relating to special deposits and hoards seen in other periods and places, and to contemporary ones in both domestic and sepulchral environments.

7.5 What does it tell us about seventh century life?

If the potential outlined in **6.3** and **6.5** is fully developed, as should be straightforward to do, then we should understand more about regional groupings (through the decorative styles). We will be able to help refine dating schemes (through decoration and gold content) with all that implies for dating other sites and objects and via them helping to refine our understanding of the period. We may be able to identify the products of different workshops and via that learn about the economies of the elite and how they distributed their treasures. We should be able to cast light on economic matters and units of value

99 Dean *et al* 2010, 148-51.

(through gold content). If the potential in **6.2** is fully explored we may well understand more about people's belief systems. Section **6.4** indicates the potential for adding to historical understanding.

Knowledge of the Hoard will also allow the reappraisal of other aspects of seventh century life. At the 2010 PAS symposium, for example, it was suggested that it would contribute to a long-running debate about the size of early medieval armies and the nature of warfare at the time[100]. In the same venue the importance of the decoration on the Hoard items for interpreting the contemporary manuscripts was also discussed[101]. As noted in **7.1** though, it is necessary to acknowledge that the potential the Hoard has to contribute to such wider topics is probably best left to others to pursue once we have put the data into the public domain, though naturally we can provide pointers and would hope to maintain a dialogue with the wider scholarly community during the life of the Analysis Project. We do not aim to produce a definitive statement with regard to all the potential. To attempt that would certainly be a recipe for delay, and possibly for disaster. This Project is a first stage to allow others to use the Hoard as part of further research in an ongoing process.

7.6 What can we learn from the experience?

The MoRPHE project management process always expects an End-of-Project report where useful lessons that have been learnt are reflected upon, so that that they can be used to inform future projects. With this project there is an opportunity and a need for these reflections to go beyond the mere management tool. Section **6.6** outlined the potential of using the Hoard to explore changing attitudes in modern society towards objects from the past. Metal detecting continues to produce substantial quantities of material that fall within the remit of the Treasure Act[102]. By exploring the issues raised in **6.6** and keeping the question of 'what are we learning' constantly in our minds, we should be able to leave a lasting legacy for dealing with ones to be made in the future.

7.7 Progress made by the end of Part 1 of the project

By the end of Part 1, we will be able to answer most of the questions surrounding what it consists of (**7.2**) and when it was deposited (**7.3**). It is to be anticipated that further refinement will occur during the second part from the detailed art style studies that will be deferred until then. Most of the work relating to why it was deposited (**7.4**) will be deferred until Part 2. We will have some answers about what it tells us about seventh century life by the end of Part 1, most notably those relating craft and manufacturing issues. Importantly in relation to this is the fact that much of the information BMAG will need to inform its new permanent gallery will be in place. This is due to open 2014 in and is concentrating on the scientific and conservation aspects of the Hoard. Some of the aspects that will feed into **7.6** will be in place but clearly work on that aspect can only be completed at the end of the full project.

8 Business Case

The English Heritage funding for the excavation which recovered the Hoard was agreed under SHAPE sub-programme 32144.110: Heritage at Risk: Recording historic sites, buildings and monuments under imminent threat outside the planning process. Assessment, analysis and dissemination are the normal next stages under the MoRPHE approach and thus this proposal falls within the normal project cycle for projects which English Heritage has invested in. Given that the immediate threat has now passed it may also be noted that the assessment and analysis stages will have much to contribute to the sub-programme 'Understanding artefacts and material culture' of the 'Research' activity type. (Sub programme number 11111.510).

It also falls with the scope of EH's National Heritage Protection Plan (NHPP) for 2011-2015[103]. Sec-

100 Halsall 2010.

101 G. and I. Henderson 2010.

102 Portable Antiquities and Treasure 2008, p. xi, Table E.

103 Version 1 Published 23rd May 2011. (checked 15:03:2012).

tion 8A5 notes EH has a continuing commitment to offsetting loss through a knowledge dividend where nationally significant, unforeseen discoveries are made. The analysis project will also be very well placed to inform decisions when the next NHPP is being drawn up in 2013-4 as outlined in **6.6** and **7.6**.

To date National Geographic TV have donated £150,000 (for conservation and research) plus aid in kind. In addition, the funds from the public subscription both during the appeal and subsequently are being used to support condition reporting and conservation (£100k) and wider outreach, access and educational initiatives (£200k) including travelling displays, replicas, educational resources, and a heritage trail (The Mercian Trail Group). Of the conservation funding, £50k is being spent on investigative conservation expertise and material science work at the BM that needs to be undertaken to support the conservation work at BMAG. Of the money raised the Owners are able to provide match funding of £66,000 in cash and £45,000 in kind through staffing to support the Analysis Project described in this document.

These are large sums of money but will not be sufficient to realise the full public benefit of the investment so far in the purchase of the Hoard. That will only be achieved after study and analysis of the material to release the potential outlined in section **6** and achieve the research aims of section **7**. Funding from English Heritage would enable this to be done and would provide the framework to make best use of the other funds within an integrated and cost-effective project design as will be outlined in section **14**. This will be the best and most rapid way to make information about the Hoard available to the widest possible public – both scholarly and general. The latter community have a large stake here. The intense interest and generosity of the general public has already been noted[104].

SHAPE is introduced by a diagram called the Heritage Cycle which sets out how English Heritage sees itself achieving its objectives. The cycle goes:

From enjoying the historic environment comes a thirst to understand;
By understanding the historic environment people value it;
By valuing it they will want to care for it;
By caring for it they will help people enjoy it.

The general public have shown that they value, care for and enjoy the Staffordshire Hoard. By funding this project EH will help them understand it and so complete the virtuous circle.

The considerable amount of public interest that the find has generated, and the consequent amounts of money that have been raised for conservation, display and research argue for proceeding with the Analysis project as quickly as possible. As noted in **3.1** the Hoard is already featuring in scholarly debate, sometimes in a somewhat ill-informed way. The Analysis Project will allow the publication of authoritative information about the find, both during the life of the Project and at the end in the final publications. This can only be to the benefit of all stakeholders.

9 Project Scope

The full Analysis Project will consist of the analysis and publication of the site archaeology; the formal, stylistic and chronological analysis of the material culture items both individually and as an assemblage. This will be aided by technological, scientific, contextual and historical analysis. The final results will be published both in letterpress and digital form.

The first stage of the project which this document scopes will deliver all the essential elements of the project in terms of completing a robust research archive which will minimise future handling requirements and put all elements in place for subsequent interpretation and publication. It will effectively

http://www.english-heritage.org.uk/content/imported-docs/k-o/nhpp-plan.pdf

104 Sections **3.1** and **6.6**.

deliver the post-excavation assessment which is required in order to firmly focus any second-stage work on the core research questions and with fully tested and costed methodologies. At the end of it there will be the basis of the digital release of an interim catalogue early in Stage 2 to aid external debate and scholarship.

The Analysis Project during both stages will provide information for the curators of the Hoard to inform both the permanent exhibitions at five venues and any future travelling exhibitions. It will also form the basis of any future popular publications developed by the Owners.

The Project does not include any additional fieldwork to contextualise the Hoard site or examine the wider landscape. Nor will it be responsible for any conservation to exhibition standard though investigative conservation is within scope.

10 Interfaces

The Analysis Project Stage 1 follows the EH and SCC funded fieldwork (EH project 5892), the Treasure process, the work to acquire the Hoard, the up-dated recording (see section **3**) and the formal Assessment project (see section **4**). It will be followed by Stage 2 where selected aspects of research will be taken further to inform the final publication.

Within the overall Hoard management strategy and programme, its place can be seen in the chart included in Appendix 4. As part of this it will interface with the other parts of the programme, most notably that focussing on the exhibition strategy. This will allow it to benefit from strands of that such as digital reconstruction of items, laser scanning of the impressed foils etc whose primary aim is to help the interpretation of the often tiny items in the galleries. The interaction with the rest of the programme will be via the Programme Co-ordinator whose role description will also be found in Appendix 4.

There are also a number of other projects with which useful research synergy can be anticipated.

- The analysis of the Prittlewell prince burial[105] will be ongoing at the same time as that of the Hoard. Some personnel will be common to both[106] and it is anticipated that information will be exchanged between the teams.

- Dr Leahy is currently conducting research into early medieval treasure deposition patterns based on PAS data. As a member of RAP he will be involved in the Hoard research project and we would hope to exchange data to mutual advantage.

- We will benefit from access to the results of the EH-funded project *Anglo-Saxon England c. 570-720: the chronological basis*[107]. It is anticipated it will be published in 2013. Professor Hines has very kindly offered to make the draft available to the typology team prior to publication.

- A survey of the gold content of Anglo-Saxon coinage from the BM, the Fitwilliam Museum Cambridge and in private collections has been completed and is due to be published in 2012. Dr Gareth Williams has agreed to make the data available and liaise with us about this and possible future work (see **15.8iiie**).

105 Hurst 2004.

106 George Speake will work on the animal art for both projects. Chris Scull acts as the academic advisor for the Prittlewell project and will be both team member and academic editor for the Hoard project.

107 EH Archaeology Commissions Grants 2131 and 2281.

11 Communication

11.1 Introduction

The first stage of the Analysis Project will take place over 26 months and will be based at a number of different centres with teams working on different strands. In addition the second stage will have other team members who will need to be kept informed of progress from the beginning of Stage 1. Good communications will be vital to a successful integrated project. To explain how this will be achieve, the teams and other interested parties will be briefly summarised. Full details are available in section **14**.

The core team will consist of the conservators based at BMAG, the research / typology team based at PMAG; the conservation / metals analysis team based at the BM. For the purpose of this section it also denotes the project management.

In the first year X-radiography will be undertaken by the Lincolnshire County Council's Collections Access Team at Lincoln.

In the second stage of the project various invited specialists will be contributors to thematic discussions.

A small number of specialists will be invited to act as commentators. It is anticipated that these will generally be people whose main interests lie in areas which have been excluded from the core focus of the project (see **7.5**).

The Executive is defined in **14.1.** It will normally interact with the Research Project via the Programme Co-ordinator.

The editors are the two individuals who will act as the academic editors of the final volume.

The main communication lines will be as follows.

11.2 The secure website

As described in **4.4** all the primary data will be stored on a research database on a secure web site. This site will also be the repository of other material generated during the work (tables of analytical data, images etc). All members of the core team, the contributors, the editors and the Executive will have access to this to see the data and download items as and when required. Commentators may be given access as appropriate.

11.3 The newsletter

The website will rapidly become the repository of large quantities of data which people may find difficult to assimilate. In an attempt to make sure that all the strands know what is happening and what will be happening, it is proposed to circulate a brief newsletter regularly. This will report what the different strands have achieved, will highlight any significant activity due to take place in the coming month and attempt to keep track of any external publications that have appeared and which the people working on the project need to know about. This newsletter will be circulated to all the strands noted in **11.1** and any others who may be interested. The Newsletters are posted to Barbican's web site, and may be placed on the Hoard web site. The conservation team already contribute to a blog on that where interesting activity is recorded[108]. From the comments left, people are obviously interested in this and it is anticipated that the wider research undertaken during the Analysis Project would also generate interest and provide a good line of communication with one of the main stakeholders in the project – the general public.

108 http://www.staffordshirehoard.org.uk/blog/research (checked 27:11:2011),

11.4 Project team meetings

It is anticipated that there will be regular interchange both by email and physical meetings between the core teams based at all three venues, but in addition three formal meetings will be scheduled, all at PMAG where the research project is based for administrative purposes.

October 2012. The first project meeting for all core team staff took place in October so that everyone could meet each other, discuss how all of the various parts of the project intermeshed, and report on results so far. The editors also attended and chaired the meeting.

May 2013. A project seminar with core team and editors. The Programme Co-ordinator will also be invited. This will up-date the team on the alterations to the timetable that have necessitated this revised PD, review the results of the core team work carried out during the first year of the first stage, contribute to any fine-tuning needed in the current project design and start to discuss the priorities where resources should be concentrated for the second stage. Consideration will be given to how to invite external input into the design of the second stage.

April 2014. A project seminar with core team, editors, and invited contributors. The Programme co-ordinator will also be invited. This will allow the discussion of the draft project design that will have been developed following the Grouping Exercise, together with the results of the work completed during the first stage.

11.5 Communication with the Executive

The interaction between the Project Manager and the Executive is dealt with in **14.1.**

11.6 Communication with the public

The Analysis Project will attempt to present the new information as it emerges in an accessible way during the life of the project. The main vehicle for this will be the Hoard website[109]. The conservation team at BMAG already post articles there and it is anticipated that the typology/research team will do likewise (see **11.3**). The conservators have also been running very popular 'behind the scenes tours' at BMAG on a monthly basis which will continue. It is felt that this is not appropriate at PMAG for the research team as in the first stage much of the work will not be being carried out on site. If possible the typology team will contribute to gallery events due to take place whilst PMAG holds the major Hoard exhibition there between July 2012 and September 2013.

11.7 Highlight reports

These will be produced at the intervals set by English Heritage.

12 Project Review

12.1 Introduction

As explained in **3.1** the Hoard has not undergone the rigorous research potential assessment that would normally be expected for a project of this size. To overcome this the Analysis Project has been designed as a two-stage process. The first stage lasting approximately 26 months will generate data that will be of use during the full analysis, but will also act as the basis of a vigorous assessment over the final part of it. This will take the form of an up-dated project design that realistically re-appraises the potential of the various strands of work. At that point work planned here for Stage 2 can be prioritised. Strands within the cataloguing and analysis may change when the results of planned pilot studies become known. It may, for example, be decided that resources from one area which is not yielding the anticipated type of information would more usefully be redirected to another area that had not previously been thought to be of much potential. For this reason also no fine divisions of tasks have been attempted in the timetabling section **15**.

109 http://www.staffordshirehoard.org.uk/

12.2 Review timetable

There will be two major reviews, each timetabled to include a project seminar so that the team can discuss the draft review document and agree on how best to proceed to the next stage. These reviews will take place in April / May 2013 and April 2014. The first has resulted in this revised Project Design and has started the consultation process for the second stage research and prioritise resources. The second will assess this against the information gained in the final six months of the first stage and will result in the final up-dated project design for the second stage. It will decide whether any additional work needs to be commissioned to ensure a well-rounded, final publication.

The reviews will be conducted by the Project Manager with input from the team. They will be discussed with the Programme Co-ordinator who will present them to the project executive, and with English Heritage.

The system put in place for circulating monthly newsletters (**11.3**) and up-dating the Programme Co-ordinator (**14.1**), will also allow the Project Manager to keep the Project under constant review and should alert her very rapidly to any developing problems.

13 Health and Safety

The project will be run in accordance with the Health and Safety Policies BMAG, PMAG, the BM, Lincolnshire County Council's Collections Access Team and Barbican Research Associates Ltd. Copies of these have already been deposited with EH.

14 Project Team Structure

14.1 Project Executive

The Hoard Management Group forms the Project Executive. Where the HMG considers it need not be directly involved with an operational matter, it will delegate decision-making to its representatives at officer level.

Reporting of Research Project matters to the Project Executive is via the Programme Co-ordinator. The HMG meets every two months: the Project Manager will provide brief written reports for each meeting to be delivered by the Programme Co-ordinator. The HMG will also receive the Highlight Reports prepared for EH as part of the contractual arrangements between EH and Stoke-on-Trent City Council as a normal part of a MoRPHE project. These will be sent via the Programme Co-ordinator. There is allowance in the project management time for the Project Manager to attend one HMG meeting per year if issues arise where the HMG might need to question her directly. Matters arising between HMG meetings can be updated via email or telephone exchange between the Project Manager and the Programme Co-ordinator.

The Research Project Advisory Panel (RPAP) advises and supports the Project Executive on priorities, planning and implementation matters for the Research Project. The panel meets four times a year: the Programme Co-ordinator attends both RPAP and HMG meetings to ensure close liaison between the Executive and the Advisory Panel, and the Chair of RPAP attends HMG meetings when either deem it necessary.

Appendix 4 provides more details about the HMG, the RPAP and the Programme co-ordinator.

14.2 The project team

14.2i Introduction

The Analysis Project team has been put together on the basis both of the individual expertise and experience of the individuals, and to build on relationships already ongoing at the time of the initiation of this project. Thus the conservators at BMAG have been working with those at the BM since the discovery of the Hoard. The Owners have put in place various protocols that relate to the handling of the material and its security. These may be seen in Appendix 5. The Analysis project has thus been designed around these, and they have dictated certain approaches. The first is that for care of the items as well for security and insurance purposes, items from the Hoard will travel as little as possible and also to as few venues as possible. Secondly the protocols surrounding condition checking when an item leaves or enters BMAG or PMAG have meant that additional administrative assistance has been built into the PMAG strand.

This is a project of several different strands and for ease of description the team is described below according to which one an individual belongs to and/or where they will be based. As the aim is an integrated project, this is merely a convenience. It should not be understood as implying barriers between the strands. Equally though this document only timetables and budgets the first stage of the Analysis Project, the full team is presented here irrespective of the stage they will be involved in.

Brief biographical details of the members, including, where appropriate, links to their web pages have been gathered together on the Barbican web site via the Projects/Staffordshire Hoard links[110].

14.2ii Project management and central services

This will be run through Barbican Research Associates who will also administer those parts of the team who are self-employed. One of the directors - Hilary Cool - will act as the Project Manager and another – Stephanie Rátkai - will assist. Both are experienced project managers. The project manager for a project with several different strands as this one is a key one. By running the project management through Barbican and building in the assistance in this way it means that role will always be covered even if Hilary Cool is indisposed or out of the country.

The secure website and database (see **4.4** and **15.4**) will be built by Bryan Alvey of Cultural Heritage Information Consultants. He will also maintain it during the life of the project and provide training where necessary.

Copy editing and proof reading of the database entries, interim catalogue, web site contributions etc will be provided by Val Kinsler. Many of these will form part of the final publication that will appear digitally, and they will be the main way in which we communicate with the public (see **11.6**). Having them professionally dealt with during the life of the Analysis Project, will not only speed up our ability to release information, but will also present a high quality product that will reflect well upon the Analysis Project and all its stakeholders.

Statistical advice and analysis will be provided by Michael Baxter. He will write such new routines as will be required for the analysis (see **15.10**) and train people to implement them.

14.2iii X-radiography

The bulk of this will be carried out in the studios of Lincolnshire Museums and Collection Care at Lincoln (see **15.6**). The team there is Rob White and Michelle Johns with one technician. The first two will be responsible for quality assurance. The rest of the X-radiography will be completed at the BM and the individuals concerned are listed there. Digitisation of the Lincoln plates will be by Dr Jo Buckberry at the Division of Archaeological, Geographical and Environmental Sciences.

110 http://www.barbicanra.co.uk/section.php?xSec=42

14.iv Conservation at BMAG

The main conservation strand is based at BMAG (see **15.5**). Deborah Cane was the Conservation Manager from when the owners took possession of the Hoard until the end of 2012. Pieta Greaves was appointed to the post in January 2013 and is now the designated Conservation team leader for this project. The other two conservators working full time on the Hoard are Deborah Magnoler and Cymbeline Storey who are employed on fixed-term contracts (2011-2014) funded by other income strands for the Hoard. In addition two fixed-term, three month posts were funded by EH for the period January to March 2013 as a result of Variation 1. During the Analysis Project the conservators are providing the cleaning and investigative conservation at the request of the typology team alongside their ongoing work of providing exhibition standard conservation for selected items. They will also liaise with the team members working at the BM.

The conservators are responsible for condition checking BMAG and no additional arrangements have to be put in place there.

The Conservation Studio at BMAG is also running an Intern Programme which allows student and professional placements to work on the hoard.

Pieta Greaves is now responsible for all the quality assurance tasks that arise from the work at BMAG.

14.2v Conservation and Archaeological Science at the BM

The existing arrangements for the Dept. of Conservation and Scientific Research to provide analysis back-up for the Conservators at BMAG, currently funded by an income stream from the National Geographic monies, will be subsumed within the analysis project. The Department will also be responsible for the X-radiography, metal analysis, investigative conservation and grouping work on the pressed foils, and the broad metal analysis programme.

Two fixed term posts were appointed[111] within the Department to help carry out this work. Duygu Camurcuoglu is a conservator working with the pressed foils for 18 months from July 2012 to December 2013. Eleanor Blakelock is a metals scientist working on the analysis for a year from the end of September 2012. These two posts are supported and overseen by permanent members of the department. Susan La Niece will act as the team leader for the BM providing a single contact point for the Project Manager to deal with.

The X-radiography work will be carried out by Janet Ambers, Susan La Niece, Aude Mongiatti. Fleur Shearman and Eleanor Blakelock, with the permanent staff providing quality assurance.

The pressed foils conservation and grouping work will be carried out by Duygu Camurcuoglu with Marilyn Hockey and Fleur Shearman providing quality assurance.

The metal analysis work will be carried out by Eleanor Blakelock under the direction of Aude Mongiatti with Duncan Hook and Susan La Niece providing the additional quality assurance.

The personnel carrying out analytical work to support the BMAG conservators will depend upon the materials being analysed. It is likely that the National Geographic income strand will be used to fund a three month fixed-term post to analyse amorphous organics e.g. pastes, resins or other adhesives. Other individuals likely to be involved are Sue La Niece, Caroline Cartwright, Aude Mongiatti, Andrew Meek, Duncan Hook and Janet Ambers.

14.2vi Typology and Research at PMAG

The lead in the typology and research strand will be Chris Fern who will be supported by a fixed-term

111 See Risk Log 2

appointment in the second stage directly appointed by PMAG. The person appointed will be expected to have experience of material culture research and knowledge of the early medieval period, together with IT skills. Guy Evans will take photographs of the objects during Stage 1 and will be based at PMAG. David Griffiths will provide one month's work as a general assistant (see for example **15.4xii**) in the period March to May 2013.

The work on compiling the relevant records on sixth to seventh century occupation in the region will be carried out by Jon Goodwin , Senior Planning Officer (Archaeology/HER) Stoke-on-Trent.

Condition checking at PMAG is carried out by the Registrar (Sam Richardson) and curatorial staff. The amount of additional work that the Analysis Project will generate due to unavoidable movements back from Lincoln, to BMAG etc will put a heavy burden on an already over-stretched workforce. The project will therefore pay for one additional day per week for all of the first stage to do the condition checking and to provide administrative back-up for the Analysis Project within the PMAG organisational structure. Again relieving the additional pressure which would otherwise fall on the Museum staff.

To assist the core staff working on this strand epigraphic and palaeographic guidance on the inscribed strip will be sought from[112]

David Ganz,
Elizabeth Okasha
Michelle Brown

The Project Manager will act as the team leader for this strand and quality assurance will be provided by Chris Scull.

14.2vii The excavation narrative

It was originally anticipated that the team for this would be Alex Jones who directed the excavations with input from Alison Deegan for the aerial photography. The illustrations would be completed by Nigel Dodds who would also be commissioned to produce any other non-finds illustrations needed for the final volume (maps etc). Suzy Blake from the Staffordshire HER will provide the GIS data needed now that it has been incorporated into the HER (see **4.5**). All of this work is due to take place during Stage 2. Given the new discoveries in November 2012[113], appropriate Warwickshire Archaeology staff will also be invited to contribute.

14.2viii The invited contributors and commentators

The final volume will have a number of specially commissioned sections which will provide the background for interpreting the Hoard. The authors of these will be

Svante Fischer – Continental hoarding patterns (northern Europe).
Peter Guest – Late Roman Gold hoarding UK/Empire.
Matthius Hardt - Continental hoarding patterns (central Europe).
Colin Haselgrove – Prehistoric UK hoarding.
John Hines – gold value and military background.
Chris Scull – early medieval material culture background / modern worth.
George Speake – animal and other art.
Alan Thacker – Religious and historical background .

As noted in **11.1** we propose to invite other specialists and authorities on areas that are not seen as part of the core project to act as commentators. Who will be invited will depend on how the research

112 Richard Marsden has also agreed to assess the Merovingian sources.
113 Palmer 2013, see also Risk Log 4.

evolves as it will probably not be evident as to how best the research on the Hoard can benefit other areas until the end of the second year. Two individuals can be named in this role from the outset however, as they are responsible for important projects which the analysis project will interface with (see section **10**). They are Gareth Williams and Kevin Leahy. Depending on how the various research streams progress it may be appropriate for them to contribute small sections to the final Hoard publication. Personnel from the other two main interfacing projects are already part of the team and so no special arrangements have to be made to ensure the Analysis Project benefits from their knowledge.

14.2ix The editors

The academic editors of the final volume will be Chris Scull, Leslie Webster and Chris Fern with assistance from the Project Manager if needed.

15 Methodology

15.1 Introduction

How we aim to achieve the project aims is set out below but as a preliminary two observations will be made.

The first is that the whole project will be run on the principle of continuous review. As explained in earlier sections of this document, the Hoard has never benefited from a full research assessment. The first stage of the project can thus be planned in some detail. For the second part it is possible to set out the broad avenues of research, but the detail and precise direction has to be planned in the light of the results of the first stage.

The second is that the methodology is designed to deliver a four year programme of work ending in a publication that will provide a firm foundation for future research, and will attempt to start to answer some of the many questions that people ask about it. We do not aim to produce the definitive work on the Hoard on the model of the volumes that finally published the Sutton Hoo ship burial. That was a magnificent achievement but it took nearly 40 years to produce. Our work will be the first step on the road to such a definitive statement, though we suspect that for this curious group of material definitive conclusions may never be reached.

In what follows the proposed methodology for the whole Analysis Project is presented with the indications of which parts will be completed in the first stage (costed and timetabled here) and the proposed second stage which will be the subject of an updated project design to be developed in 2013.

15.2 Background information

The aim of this work is to provide, in effect, a portfolio of information that the rest of the team can draw upon to explore avenues that may be useful for their strand of research. The sources outlined in **4.6** will be interrogated and useful information extracted. The Hoard lies close to a modern administrative boundary and so the HERs of the neighbouring region will also be consulted. The work is being carried out by the Stoke-on-Trent HER officer and so the project will benefit from the local knowledge this will bring. It will be carried out at the beginning of the second stage of the project.

15.3 Stratigraphic narrative

15.3i Introduction

The account of the discovery underpins all of the rest of the work, and the aim will be to lay the evidence out clearly so the readers of the final publication can easily assess what the known facts are. Birmingham Archaeology produced two grey literature reports on their excavations at the Hoard site[114]

114 BA 2010 and Burrows and Jones 2010.

and two articles have already appeared summarising the excavations and the landscape context[115]. These will form the basis of the stratigraphic narrative together with the site archive and the GIS data now lodged with the Staffordshire HER. The narrative will include the survey of the aerial photographs produced during the assessment (see **4.5**) and the up-dated information due to be researched at Cambridge. It will also benefit from the background information gathered as part of the work described in **15.2**. The original Birmingham Archaeology work will be augmented by the survey project in November 2012[116].

15.3ii Content and timetabling

The narrative will provide the introduction to the Hoard site, including descriptions of the topography and geology, the archaeological and historical context and the land use of the field as it affected archaeological recovery.

It will lay out the chronological sequence of the work by all individuals and organisations from the discovery to the Treasure Inquest, including the protocols under which the excavators were working and the methodology adopted. It will describe the features and the non-Hoard finds, the distribution of the excavated Hoard material, the geophysical surveys, the environmental information and the aerial photograph evidence. A discussion will consider the archaeological and historical sequence, including alternative interpretations and that sequence within its archaeological and historical landscape context, including later land-use history as it affected recovery.

It will be illustrated by c. 15 line figures providing location maps, aerial photograph mapping, geophysical mapping, geological mapping, historical feature mapping; plans of the excavations, sections and a composite feature plan. Eight plates will show the details of the site and recovery. As with all illustration for this project the illustrations will be provided in formats that are suitable for use in both a letterpress and a web-based format.

Most of this work is timetabled for early in the second stage to allow up-dates to the consideration of the distribution of the excavated material after all the different research strands that will group the fragments/pieces have been completed. The small amount of work needed on the aerial photographs held at Cambridge that were not available during the assessment will be carried out during the first stage.

15.4 Development and maintenance of database and website

15.4i Introduction

The secure website and database is central to the successful outcome of the Analysis project. It will be where all the data is entered and stored during the cataloguing and data collection stage. Once the project moves to analysis, data sets will be extracted from the database for further work. It will generate two catalogues, the first an interim release early in Stage 2 and the second the one for the final publication. For the long term, once the Analysis Project has finished, it will remain the primary source of all information on the Hoard. As with any database on a long research project, it will need to be flexible and develop in a way that will respond to the research demands. For that reason it has been decided to have the developer (Bryan Alvey – CHIC in what follows) as a full core team member rather than sending the specification out for third party tender. It is felt that over the life of the project this will produce the best research outcome and will probably be more economical.

The functional specification for the database has been developed during the Assessment (see **4.4**) and full details are available in Appendix 2. The sections below, therefore, focuses on implementation and timetabling.

The software requirements for purchase are itemised in the budget (see section **18**). It should be not-

115 Dean *et al* 2010; Leahy *et al* 2011.

116 Palmer 2013; Risk Log 4.

ed that where two copies are specified it is to ensure that both Owner organisations have the correct software to ensure that they have access to the data, the software development capabilities, back-up facilities etc both during and after the lifetime of the Analysis project.

15.4ii Software

Microsoft SQL Server will be used as the database engine for the relational database outlined in the functional specification. It is a commonly used database (so many developers will be familiar with it), uses the Standard Query Language (SQL) to call the data, and interacts easily with MS Access which is familiar to many archaeologists. It is also the standard software for English Heritage.

MS SQL Server's Reporting Services (SSRS) will be used to provide the reporting facilities for this database. SSRS is not suitable in all scenarios, but for a small number of users requiring occasional reports as here, this software will be adequate for our needs. SSRS provides an environment for developing reports through MS Visual Studio, and reports distributed on the web can be downloaded as hard copy, Excel, .DOC, .PDF, .CSV and XML formats at run time. SSRS is supplied with the developer version of MS SQL Server at no extra charge (see below).

Adobe Creative Suite will be used for the design elements in the creation of the application.

15.4iii Hosting

An Internet Services Provider (ISP) will be needed to provide the platform for the database and the servers for the application files, report designs and database. A domain name (StaffordshireHoardResearch.net is available) will be purchased to give ourselves full flexibility with domains, and site can be used for testing the application before Go-Live.

There are a wide number of ISPs with various levels of performance and access; we have chosen DiscountASP is it is reasonably priced and provides the full repertoire of services for our needs: through this provider we are able to set up the database, upload our reports (the database for SSRS is dedicated to the report function and separate from the data), facilitates the upload and download of the application and backup files. There is no installation fee; annual charges are made for the components that will make up our requirements.

In addition since Stage 1 started there have been of the increasing level of cyber attacks on secure sites such as that being used for the hoard, with consequent damage to the data. We therefore propose to add an additional layer of security to the secure database. The encryption has the welcome effect of speeding sites up which will be useful to the team.

15.4iv Initial data capture and upload

One of the largest costs outside the development of the database itself is the capture of data already in place at BMAG by the conservation team, and the on-going costs should data continue to be inputted into that database rather than on-line.

Costs will be kept to a minimum, as the conservation aspects of the MINISYS database at BMAG are largely reflected in the structure outlined in the functional specification, but there will be some problems (in the preparation of suitable material lists, and where entities are slightly different etc.) and so time needs to be set aside for the preparation of the data download, a test download of data (which will then be used as the test data during the development of the application), and the 'live' download, which be used for the launch of the website.

The download of the data and images from the conservation work proved more problematic than either CHIC or BMAG anticipated and it was found that four visits by CHIC to BMAG to achieve this were necessary rather than the planned four.

15.4v Database development

The following is based upon those entities and relationships outlined in the functional specification. Thought will given to the overall appearance of the whole website in order to establish a common look and feel – a corporate style - to the system which will encourage users and facilitate data input and general use. As this database is just for the project team at this point, resources will not be expended on creating multiple cascading style sheets to make it accessible to all browsers. The browser to be used will be chosen after discussions with the team but it will be one of the ones freely available for download (e.g. Firefox, Explorer 8 and above).

Users of the Hoard website will encounter a number of screens, but many of them will do the same things: to move to the area of the database where you want to input or find data in (menu pages); to find the record you want to add to or edit (list/search pages); to accomplish the changes (form pages). For reports you could e.g. move to the report area, find the report, execute the report. The costing is based on the type of screen that must be developed.

Screens are developed in ASP or ASP.NET; the SSRS Reportviewer control requires that pop-ups for our site are allowed on the user's browser (hence the need for the project to have its own domain name).

- Design work. The corporate look and feel of the database system will be established, and the .CSS file will be developed that will be used throughout the site.

- Login Page. There will be a login page that will allocate the access of users to the site. This page is mentioned in isolation only because it does not conform to the standard menu/list/form page format.

- Home Page. There will also be a home page (where the users first alight upon entering the system). This area will welcome the user and outline the basic procedures for the user to get started with the system.

- Menu Page. There will be 3-4 menu pages in the system (data management/reports/data entry).

- List pages are pages of a website that allow users to browse the records of a table, and to filter out and search for a particular record. It is from the list pages that a user will find a particular record from where data may be added/edited/deleted through the form pages. There will be about 30 list pages

- Form pages are the pages of a website that allow users to actually insert or edit information. It is from these pages too that the user is able to delete records. There are about 30 form pages.

- File upload/download. Files may be associated with all or part of a particular record; the area to house the files will accommodate this requirement; file upload and download of up to 3Mb should be handled with little difficulty; for files larger than this (such as video if required), users may need to contact CHIC to confirm the upload.

- Image upload/download/display. Files may be associated with all or part of a particular record; the area to house the files area will accommodate this requirement; file upload and download of up to 3Mb should be handled with little difficulty. We do not anticipate having videos within the database structure so this means that we should not have the problems that large file uploads can bring. Users (of the required access level) will be able to download images at will; display of the images can be obtained from the form page of the images area. During the database development it will be discussed whether there is a need to display thumbnails in other parts of it and whether the cost/benefit it appropriate.

- Additional datasets. Cultural Heritage Information Consultants is aware that other entities may be required to complete the database system: these include the datasets generated by the material analysis work (see **15.8**), and other aspects of information that may prove to be important during the research process. Some time will need to be set aside for this table and other new datasets if required. This aspect will be costed for the second stage.

- Additional Coding. As in all database development, there are particular areas of the database where users may need additional controls in place to ensure that data is entered correctly, or will need extra facilities to view specific datasets or images. Furthermore, the application itself will require mechanisms in place to control access to the facilities, and to control user error and attempted duplications etc., the glue to ensure that the application works seamlessly.

15.4vi Report Development

Reports will be available to users according to their access level, accessed by clicking a 'Reports' option within the application.

Reports will be handled through Microsoft's SQL Server Reporting Services application (SSRS). Reporting Services is able to directly access the database entities in MS SQL Server and is able to download the outputs in .DOC, .XLS, .CSV and .PDF file formats.

Three requirements have been outlined in the functional specification: the costs for these can be estimated only, since the exact items for display on the reports and the fields that will be used as selection criteria have not yet been established. These three requirements have similar development strategies, since the user is able to determine the output at runtime.

A fourth requirement, the ability to download the data as an MS Access database, will be included as part of the training process.

There will need to be additional development time once the first stage is completed and the precise range of report types required is known. This will be a second stage task and cost.

Reports will be accessed from the reports section. They will be stored in their own reports table and be presented as a list to the user. The user will choose the type of report they require from the list, which will then be displayed in the ReportViewer. From the ReportViewer, the user may choose from a variety of selection criteria to create the report output, which may then be exported to a variety of formats or to the printer.

The ReportViewer is a 'pop-up' window; users of the website will need to set their security settings to allow pop-ups for this website.

15.4vii Testing

We envisage setting up the database environment online at an early stage in the process, so that the Analysis Project will be able to test the environment and try out entering, adding, and deleting data as screens become available.

As outlined in **15.4iv**, there will need to be two processes of capturing the data from the Birmingham system, and so users will be able to 'play' with the first captured set whilst the database is being developed. This will enable the developer to catch any problems at an early stage and edit the code accordingly.

At the end of the development process, a formal stage of testing needs to take place, whereby the users 'sign-off' each screen as being fit for purpose by carrying out a series of test sequences. When all the

screens have been passed by the users, the second data set can be uploaded to the website for Go-Live.

15.4viii Training

There will be a variety of training requirements. The first and most obvious is in the training of the users in the use of the website itself: how to find their way around the system, how to search for particular items of information and how to add, edit and delete information. The second is in the use of reports: how to retrieve the required data, and how to save the information in the desired format. A third training requirement for the business is in the training of users of the highest access level to download data from the database itself using the SQL Server software.

The website database system is quite simple and straightforward, and all screens operate in exactly the same way. Once the user is used to how the system works and how to move around the system, there will be little need to have reference to a user manual or documentation.

Such documentation will be necessary for new arrivals however, and CHIC is able to supply a user manual both as hard copy and as context-sensitive online help if required. Context sensitive online help allows the users to click on a help icon and receive information and help based on the page they are currently viewing. In addition, they will be able to search the entire manual online for further help (see **15.4x**).

There will be a single session for the training of users before go-live, where users will be trained in the use of the system, and receive a hard copy of the manual.

In addition, some training will be given to users of the highest access level in the basic use of SQL Server 2008 and be limited to the creation of an MS Access database download of the latest data, and the creation of queries (which SQL Server calls *views*) to minimize the intervention of the consultant for one-off datasets for submission to stats software etc.

We will be dealing with quite a complex dataset, and CHIC will not responsible for queries created incorrectly that as a result generate strange or significant statistical outputs. Datasets that will be used for statistical analysis will be checked with both CHIC and the Project Manager, who has extensive experience of using complex databases such as this for material culture research.

Training may also be given to the same users in the development of reports if required.

15.4ix Ongoing development and support

The following sets out the requirements to ensure that the application development is successful, and to ensure the data and application code is available to the project and up-to-date.

There will need to be a number of meetings with the Project Manager and team members to ensure that the application is on the right track. This is particularly relevant in this application, where some team members may not initially be familiar with databases, and where new datasets may become available.

Backing up will be carried out regularly. DiscountASP offers a simple backup procedure that creates backup files of the database as .ZIP files on the ISP's application server. Back-up of the data will take place on a weekly basis and an archive of the datasets will be stored on the ISP provider's website as .ZIP files; this area is also available to the project, who will be able to download the backups as required.

The project will be given a CD with Version 1.0 of the application directly after Go-Live. Each subsequent version release will be treated in the same way. .

All report files (.RDL) will be copied to CD and sent with each version change to the business.

CHIC will keep a backup of all versions of the application.

CHIC will be available to help with any aspect of work concerned with the database, the ISP, and any of the material stored in the database. If the users have any difficulty with any area of the database, they may contact CHIC by email, and CHIC will respond to their request. Any bugs/errors will be fixed by earliest endeavour, and new requirements will be estimated and agreed with the business before carrying out the work.

15.4x Documentation

All code is the property of the business, although CHIC retains the intellectual property rights. All code will be documented; also, a user manual will also be supplied to the project with version 1.0 of the code. All report formats (.RDLs) will accompany the code. All subsequent versions of the code will be sent on a CD to the Analysis Project, together with any amendments to the user manual and any new report formats.

15.4xi Timetabling

Work on the development will start as soon as the Analysis Project is commissioned subject to suitable contractual arrangements being in place with Barbican Research Associates Ltd. It is hoped that Go-Live might take place by May 2013. There will be resources in second stage budget for CHIC to continue in a support and development role ((if necessary). Eventually they will be responsible for overseeing the transfer of all the digital data to the ADS as part of the EDIT project.

15.4xii Initial data entry and uploading of images

Due to the longer than anticipated development time caused by difficulties in capturing various part of the data kept on the BMAG servers, Chris Fern now has a substantial amount of catalogue material in a word processed state (currently over 1000 entries). This can easily be used to populate the catalogue field, but there are a considerable number of other fields that need entries derived from the catalogue. Examples of these include measurements, type and nature of decoration present etc., and the fields are already set up as drop down menus from which a selection is made. These are fields that will need to be completed for the useful preliminary analysis that will be needed in order to scope the second stage. In order not to deflect Chris Fern from his ongoing work of cataloguing, David Griffiths will work through the catalogue populating the additional fields. Chris Fern will ultimately be responsible for checking that the population of the fields is correct by the end of Stage 1 as he produces his assessment of the material for the up-dated project design.

The conservation that has been undertaken so far has resulted in c. 10gb of images, many of them duplicates. These will need to be systemised prior to upload and this is dealt with in section **15.5v.**

15.5 Conservation

15.5i. Introduction

As noted in **4.1** conservation for exhibition has been ongoing at BMAG since September 2010. As a result a full set of protocols and documentation are already in place. Up to the start of the Research project there had been no opportunity for a conservation assessment in a formal sense. The following methodology statement reflects revisions it was found to be appropriate following the collaboration between the conservation and typological teams during the earlier part of Stage 1. As this revised project design reflects more integrated approach between the research and the conservation strands, a new section (**15.5v**) has been added which reviews the work programme for the financial year 2013-4.

The current aims are to photograph, condition report, fully clean and conserve all objects for display/ research. A pictorial loan-out report for all objects selected has been produced. This enables items to travel to Lincoln (see **15.6**) and the BM (see **15.7-8**). In the sub-sections below, definitions of the

different types of conservation are provided, together with a summary of the protocols that have been used and will continue to be used. This work will take place in the first stage, though there may be the need for additional work to be scoped in the second as well.

15.5ii Definitions

There are four different levels of conservation.

Full clean – cleaning the inside and outside of the objects. Removal of soil for as long as it does not significantly structurally weaken the object. Consolidation of areas may be necessary to secure components of the objects but only so far as not to affect possible analysis.

- Investigative conservation - processes used to examine and record artefacts, by non invasive means, by removing accretions or by sampling for analysis. The conservation team will conservation clean the requested area of interest only; in order to reveal the area or material of interest.

- Remedial Conservation – treatments used to stabilise an objects for handling and storage; this includes the repair and consolidation of broken and fragile objects.

- Display conservation - any further work that is required for display. The conservation team will conservation clean the exterior surfaces to allow the decoration to be viewed. Internal areas will retain the soil as this is not necessary for display.

The practical treatment process is the same for each request, and the level of intervention is dependant on the level of conservation has been requested and the condition of the object. Some elements of the recording vary between full, investigative and display conservation. For example, the latter requires Loan-out documentation whereas the former does not.

15.5iii Liaison between the PMAG and BMAG teams

There are currently 53 objects at PMAG still requiring conservation. The conservation needed by the typology research team will be undertaken by the BMAG conservators in the PMAG lab. The aim will be to establish a programme of work so that the leader of the conservation team (Pieta Greaves - PG) can timetable it amongst the ongoing needs of the exhibition and display programmes.

The PMAG lab will be equipped with basic requirements for this. This will avoid movements of the objects to and from BMAG during the cataloguing to some extent. Some aspects of the investigative conservation will need the full gamut of equipment only available in the Conservation Studios at BMAG. This includes a Keyence 3D digital microscope bought for the Hoard programme through fundraising and public donation[117]. In those situations the item will go to BMAG and the investigations will be carried out there after the current large PMAG exhibition closes..

15.5iv Conservation protocols

The following is a summary of the full documentation in use at BMAG. All documentation was drawn up in line with the Professional Guidelines of ICON, The Institute of Conservation, the representative body for conservation in the UK and ECCO the European Confederation of Conservation Restorers Organisations. All of the following stages are always discussed with PG prior to being carried out. The conservators always use gloves when handling the items.

- The item is first photographed before conservation with views of the front, back, side, points of interest and damage. The scale and accession number are in at least one shot, and the accession number is in all if possible.

- A condition report for the object is produced using a *proforma.*

117 http://www.staffordshirehoard.org.uk/fundraising-success-to-buy-the-keyence-3d-digital-microscope

- Treatment generally involves the use of a thorn in a pin vice, soft brush and solvents introduced with a brush or swab, the aim being to avoid any scratching that could be brought about by tools. The solvents used are appropriate to the material being investigated, thus de-ionised / pH neutral water for garnet and IMS for gold. The work is carried out under magnification with the item placed on Plastazote (polyethylene foam) or soft material to ensure all parts are supported during cleaning. Soil is removed in layers by micro excavations. Photographs are taken as appropriate during the investigation and always at the end of it. Following the treatment the condition report is updated. Detailed protocols are in place to cover approaches to particular types of items, e.g. the gold work with garnet cloisonné, the impressed foils, the taking of samples, mineralised organics etc.

- Soil and other material (rootlets etc) which have been removed are collected and stored in separate sample bags and label with K number and description, and then numbered Kn. 1…n. They are then stored with the objects

- Finally a small paper accession number is adhered to the item using Paraloid B72 in acetone and the packaging of the item is checked and improved as necessary.

- Any physical joining of fragments uses reversible adhesives. Treatment may include the reconstruction of cell-work where it is loose and the remedial and minimal consolidation of weak or friable surfaces where it will not interfere with possible analysis.

15.5v Timetable and tasks for 2013-4

As of the end of the financial year 2012/3 with the uplift provided by the two EH-funded conservators, a total of 784 items had been cleaned by the BMAG conservators. A further 87 were completed in April If all the items being dealt with at the BM as part of impressed foil work (see **15.7**) are disregarded, that leaves 528 items to be worked on. Chris Fern has catalogued 367 of these and requested cleaning work on 189 of them. He has also requested work on a further 16 items that are variously part of the NG strand of work at the British Museum, were too dirty to even attempt cataloguing or had had some previous conservation input but which only returned to BMAG from Lincoln in late March. We therefore know that as of the end of April 2013 cleaning is known to be still required on at least 200 items and there are c. 140 other items (disregarding loose garnets) that are neither catalogued nor cleaned. Not all of the latter will probably need to be cleaned but at this stage it is probably wise to assume they will be. During the writing of the second variation for the project (28th February 2013) it was anticipated that by the end of March 2013 there would be 450 items still to be cleaned and by the end of May there would be 322. It was further anticipated that cleaning should be completed by the end of January 2014. Given that the conservators are now two to three weeks ahead of this, completion of the cleaning this calendar year is now likely, probably in November. This will allow the new items found by Warwickshire Archaeology to be cleaned in advance of the Grouping exercise (see **15.5**) should the Owners acquire those objects.

During this financial year the conservators will also systemise the 10gb of images stored at Birmingham that have arisen from the conservation work so far. These do not appear to have been systematically catalogued and many of the images are duplicates. These will rigorously sorted catalogue with the best image of each photographic event selected for the database. This means that by the end of Stage 1 the conservation images will be ready to be part of the planned interim catalogue that is due to be released early in the life of Stage 2 of the research project.

The conservation manager and the project manager will also develop plans for the conservation studio at BMAG to become responsible for more of the analytical work on the Hoard during Stage 2, building upon the pilot projects and other work currently being carried out in the British Museum (see **15.7-8**).

15.6 X-radiography

15.6i Introduction

X-radiography is an essential tool for any conservator or small finds specialist working with metalwork, and good practice is for the plates to form part of the archive[118]. They not only provide a very cost-effective way of seeing obscured detail, but they can also sometimes be used as more informative illustrations in the final publication than line drawings or photographs. Some X-radiography of Hoard items has already been undertaken to facilitate the excavation of the soil blocks[119], but there has been no systematic work. That will be an early task in the first stage of the Analysis Project.

Currently there are two types of end product for X-radiography, traditional film plates or born-digital images. The advantages and disadvantages of both have been evaluated and discussed with RAP, CAP and other specialists in the field. Whilst the born-digital route is appealing, and it is admitted that the equipment and end products have improved since the EH Guidelines on X-radiography were written[120], such images still require specialist workstations and/or viewing software to gain the most benefit. In the Analysis Project it is intended that the X-radiographs should form part of the final publication available via the web. The intended audience will not necessarily have access to the specialist workstations etc required to look at these images. In these circumstances it has been decided to commission high quality film plates that will then be subsequently digitised. It is felt that this will be provide the best solution for the greatest number of people. It also has the advantage of providing physical plates for the archive.

15.6ii Organisation of the work

In order to have X-radiographs as early as possible in the Analysis Project the work will be done at two venues because of the size of the task. The Department of Conservation and Scientific Research at the BM will carry out the X-radiography associated with the pressed foils (see **15.7**) and on the items selected for work relating to inlays etc (see **15.8v**). The rest of the material will go to the studios of Lincolnshire Museums and Collection Care at Lincoln. Before work starts a meeting will be held at Lincoln between everyone carrying out the X-radiography at both venues and the BMAG conservators to ensure standardisation of the X-ray production. Digitisation of the BM plates will take place at the BM, and in the Division of Archaeological, Geographic and Environmental Sciences at the University of Bradford for the Lincoln ones. There will be liaison between the BM and Bradford to ensure standardisation of the digitisation.

The Lincoln team will visit BMAG and, in collaboration with the BMAG conservators, decide on appropriate batches to ensure the most cost-effective use of the machinery.

15.6iii Machinery

For the majority of the pressed foils (see **15.7**) and some of the items selected for work relating to inlays etc (see **15.8v**) The BM will use a using a Torrex TRX 5200 radiation-shielded cabinet x-ray unit. The x-ray tube has a current of 3 mA, with a maximum output of 150Kv and incorporates a fine-focus beryllium window for voltages down to 10Kv. The upper end of the voltage scale is suited for denser material and metals with the capability of penetrating the equivalent of 15cm of aluminium. The BM department can also use a Siefert 320 kV X-ray set in the science labs for any material not suitable for their Torrex or Lincoln's Faxitron emerge. This is an open beam system in a dedicated enclosure and kV can be varied as required (as can filters, exposure time and film speed).

Lincoln will use a Faxitron cabinet inspection system, model 43804. It has a kvp range of 10 – 110 & tube current of 3mA. The equipment is maintained by an annual service contract delivering six

118 Fell et al 2006, 3.

119 See Appendix 1, section 3.1iv.

120 Fell et al 2006, 10.

monthly maintenance inspections.

The BM department can also use a Siefert 320 kV X-ray set in the science labs if problems not suitable for their Torrex or Lincoln's Faxitron emerge. This is an open beam system in a dedicated enclosure and kV can be varied as required (as can filters, exposure time and film speed).

At the BM digitisation will be via the Department's Agfa Radview Alara radiograph scanner and software. All films are normally scanned at the maximum resolution of the equipment (12 bits and 50 µm resolution [c.512 dpi]). At Bradford the digitisation will be via a Radview FS50B X-ray film digitiser and results are normally saved to an external USB data storage device as DICOM or 16 bit tiff files and as lossless jpeg files. As noted in **15.6ii** there will be discussions between the two locations to ensure standardisation.

15.6iv Materials and procedures

The details in this section relates to the work at Lincoln which will be carrying out the bulk of the X-radiography and have the largest range of material to deal with

The film which will be used for screening is Agfa Structurix D4 Industrial X-Ray film. This is an extra fine grain film with very high contrast, suitable for a wide variety of critical applications, and suitable for use with lead intensifying screens. Film size will be 18 x 24cms and 24 x 30cms. Films will be directly marked with white ink (details marked will conform to project requirements), and processed films will be held within transparent polyester sleeves, which will in turn be stored inside inert acid-free paper sleeves, which will be marked with all exposure details.

Processing of exposed plates will be undertaken manually using Structurix G128 Developer & G328 Fix, and Kodak Max Stop with indicator, and will be in direct accordance with the manufacturers instructions.

For all X-radiographic screening undertaken, film will be loaded from interleaved storage into x-ray cassettes incorporating lead intensifying screens. The front screen will be 0.1mm thickness and the rear 0.15mm. Experience of the use of Structurix D4 film in these circumstances, and within the exposure facility provided by the Faxitron unit, has shown significant recovery of the effects of back scattered longer wavelength radiation, and some image intensification, resulting in clear, high resolution images.

Based on the known information around thicknesses of items, along with experience of the x-radiography of similar non-ferrous assemblages, suggests that meaningful imaging of all selected items should be possible within this methodology.

Exposure of items selected for investigation will be based on a rigorous methodology combined with scrupulous attention to detail, in order to elicit as great a level of morphological clarification as possible. Judgement will be applied on a bespoke basis in relation to whether specific items may or may not benefit from being subject to the whole methodology but, as an underpinning expectation, the assemblage (or that component selected for attention within this report) will be imaged in accordance with two main criteria, multiple variable exposures and precise object rotations through recorded elevations, designed to interrogate all aspects of morphology. This will include:

- clarification of any surviving corrosion "envelope" (it is acknowledged that corrosion removal has already been undertaken on a proportion of the objects), to potentially identify associated remains;
- clarification/archive recording of the form/dimensions of objects;
- clarification of surviving surface decoration where this is currently obscured;

- clarification of other technological/manufacturing detail.

It is anticipated that all exposures will fall within the range 100 – 110 KVp although this will depend on bespoke judgement in relation to objects/groups of objects, and subject to the considerations outlined above.

All work will be specified/supervised by the department's Accredited archaeological conservators, and delivered by its Technical Assistant with experience in this area of work. Image Quality Indication will be provided in direct accordance with clear specification/requirement of the project. All exposed plates will be checked for quality before sign off. Incorrect object orientations/exposures (including presence of misleading exposure artefacts such as "flashing" from imprecise lead masking), integrity of development/fixing (via the use of Structurix PMC strips for monitoring the performance of processing chemical solutions for high quality processing), incorrect marking & labelling etc, will be repeated as necessary, at no additional cost.

At the BM the X-radiography undertaken in support of the impressed foil work (see **15.7**) will involve the use of a step wedge in order to gather data about the thickness of the foils to help with the sorting process.

15.7 Work on the impressed foils

15.7i Introduction

The very large number of pressed foil fragments pose a considerable challenge (see **5.2**), but the work on them is very important for Research Aim **7.2** (what does the Hoard consist of). Without it, it will not be possible to confirm whether they are indeed from helmets or from other items.

The items are extremely fragile and so it has been decided that all of the work will be concentrated in one venue (the BM). The BM team will lead but there will be close liaison especially with the BMAG conservators, and also with the typology/research team. The latter will conduct such background research as is necessary to place the items in context and facilitate the conservation work. The BM conservators will conduct such investigative conservation as is needed, and make such joins as is felt appropriate following discussion with the BMAG conservators.

If the Owners decide to pursue any form of formal reconstruction, that will be carried out by BMAG conservators at BMAG / PMAG where it could be the focus of public events. This would happen after the material had returned from the BM when the fixed term contract expires, i.e. probably at the beginning of the fourth quarter of 2013. This would provide a useful focus of publicity during the period between the closure of the PMAG exhibition (September 2013) and the opening of BMAG's new gallery in 2014. It would be beyond the scope of the Analysis Project and would not be a cost on it.

All of this work has been included in the first stage of the Analysis Project because of timetabling constraints. The department is due to move premises in 2014 and so its input into the project has to be completed in 2013. As a result the work on the impressed foils and the metal analyses described in **15.8** will be further advanced than the other strands of the project at the end of the formal first stage. As a result this work will be the subject of regular review to ensure the best use of resources.

15.7ii Approaches

The main aim of the work will be to gather the pieces into likely groups that belong together and then engage in the painstaking work of discovering the joins that will allow the shapes and the patterns to be identified. To aid this the pieces will be X-radiographed (see section **15.6iv**) and the metal content analysed (see **15.8iiid**). Optical microscopy and the measurement of weight and thickness will also aid the work. The background information provided by the typology team may also aid this, and they will be responsible for the final catalogue entries with the input of the conservators. The writing of the final

catalogue will be a second stage task

It is appreciated that within the time available, it may not be possible to complete all the work that could be carried out on this material. As noted the progress will be constantly evaluated, and the Project manager in association with the full team will prioritise what we will aim to complete in the available time.

15.8 Materials Analysis

15.8i Introduction

Analysis and identification of the materials in the Hoard will be central to understanding it. It contributes directly to research aim **7.2** (the Hoard composition) in many ways. The gold content may contribute to helping to date it (research aim **7.3**). For the exploration of seventh century life (**7.5**) it will be central to the question of units of value and to the exploration of craft practices and workshop groupings. The sub-sections below describe the approaches and techniques that will be taken and why they are necessary. A description of the equipment to be used is given in **15.8vi**. The work will be carried out in the Department of Conservation and Scientific Research at the BM. This is a strand of work that involves two income streams (EH and NG – see 15.8v) but which will be managed as a single strand with the Analysis Project.

The Owners have purchased two sets of certified multi-element standards that will be used when the gold is being analysed. It is intended that any future research projects that use Hoard items will also use, allowing comparability of results.

These analyses will generate a considerable volume of quantitative data. The statistical methodology that will be used to analyse these is described in section **15.10**.

The work is subject to the same timetabling constraints as that on the impressed foils (see **14.7i**) and so again all of this work will be part of the first stage of the project.

15.8ii General Approach

The approach is governed by knowledge that resources are finite and the best use has to be made of the available time. A number of pilot projects are therefore planned to explore how best to obtain the data required. The results of these will be evaluated and the main research will be based on this. The evaluation will form part of the major project review timetabled for the end of the first stage (see **12.1**). The up-dated methodology will be described in that and given the timetable it should be possible to report on the first results then.

In the following sub-sections suggested analytic methods are mentioned, but one of the advantages of taking this work to the BM is that the department has a wide range of instrumentation and expertise which can be used. If it is decided after consultation that different methods are better suited to answer particular questions, these will be pursued.

15.8iii Pilot projects

The following pilot projects are planned to help better define the full analyses.

a. c. 16 items representative of the known spatial distribution of the Hoard will be tested to check whether there is any surface enrichment/depletion. This will be carried out using surface and sub-surface μXRF and SEM-EDX. The items selected consist of plain items such as hilt guards with no surface decoration. This pilot will allow us to decide whether surface XRF (the preferred non destructive technique) can be used as a reliable indicator of bulk composition. If it can, all the other metal analysis will use surface XRF unless otherwise stated.

b. A second pilot study will concentrate on taking items of composite construction and will look at the range of compositions used in the same piece. These might either be pieces that have been shown were originally on the same handle, e.g. the seax handle that consists of several discrete pieces, hilt guards with rivets still in place etc; or items that have a composite construction on the same piece, e.g. the data presented in Table 5.1 and fig. 5.2. It is anticipated that it will look at 20 objects with between two and five analyses each. This will allow us to gauge the variability in gold composition on the same items and help us to decide how many points on an object need to be analysed in the full analysis. These results will also be helpful in deciding whether metal composition is a useful aid in group different items /pieces that might come from the same object. They will also have obvious benefits when looking at issues of technology and construction.

c. A small pilot study will conduct repeat measurements for items analysed in BMAG using XRF (see **15.5i**) and Paris using PIXE (see **5.3**) and then compare the results to see if they are the same. This will provide useful information about the inter-comparability of the data, and allow us to plan where analysis for strands such as value can take place. From a logistical point of view there would be very great advantages to being able to use the facilities at BMAG as it would reduce the amount of movement that the items would undergo. Equally if the measurements were taken routinely there, the time of the metal scientist and the more extensive range of the instrumentation available at the BM could be used to investigate other areas. This, however, will partially depend on what equipment is available at BMAG by the time the Analysis Project starts as it is anticipated that equipment with more focussed beam spots may be needed.

d. To support the work outlined in **15.7**, a selection of fragments of the impressed foils where joins have already been identified will be analysed. This will show the likely range of any variability to be expected within fragments from the same foil and whether there is sufficient compositional difference between different foils to inform the grouping within the wider body of material that has not been joined.

e. With the involvement of Dr Gareth Williams a small number of contemporary continental gold coins from the BM collection would be analysed by both Specific Gravity (SG) and XRF (after surface cleaning). These would be selected from ones analysed by SG in the 1970s. This would build on the methodology used for the Anglo-Saxon coin project (see section **10**) and provide both a small sample of reliably dateable coins and a measure of how useful Oddy's existing data may be for the purposes of the Analysis Project. It can also be compared with a recent study of material in French collections.

15.8iv Second stage analysis

The results of these pilots will be used to scope what is achievable within the budgetary and time constraints. This review will be undertaken by the Project Manager following discussions with the conservators and scientists at the BM and BMAG and with John Hines who will be conducting the gold value strand of the discussion section (see **15.11iii**). As noted in the methodology there, it may be appropriate to focus particularly on the sword fittings. In which case the choice of which ones will be most appropriate for analysis will need to be a joint decision.

15.8v Analysis of technology, construction and inlays

The BMAG conservators in collaboration with BM conservators and scientists have already identified 46 items that need analysis to aid the identification of unusual corrosion products, types of inlays, adhesives, backings etc being used. These have been transferred to the BM for further work as part of the National Geographic funding support income strand. It can be anticipated that more material such as this will be identified as work progresses. Both investigative conservation and exhibition standard conservation will be carried out by BM conservators so that conservation and analysis can proceed in tandem. The number of items that will be investigated is governed by this income strand. A total of 360 hours of conservation and 240 hours of analysis have been agreed between the owners, the latter to include the report that will document the ALGAE work on the garnets in Paris (see section **5.3**).

This work is being integrated into the full Analysis Project. It feeds directly into the conservation work at BMAG, allowing the conservators to apply appropriate treatments. It will also have a large role to play in reconstruction the craft aspects of the Hoard and contribute to that strand of the Hoard research. It may be anticipated that the following types of analyses will be involved in this work, in addition to radiography (see **15.6**)

- XRD for pastes, corrosion, inlays etc
- FTIR/GC-MS for amorphous organics e.g. pastes, resins or other adhesives
- SEM for macro-organic remains
- SEM EDX for other material types and construction studies
- XRF – garnets, metalwork, glass, other
- Raman analysis – garnets, pastes, corrosion, inlays etc

It is anticipated that the result of this work will mainly take the form of case studies of particular objects and will focus on materials, technological aspects and construction.

It should be noted that as of April 2013 the NG funding for this strand of work has come to an end. The consequences of this are considered in Risk Log 5.

15.8vi Techniques and machinery to be used

- SEM-EDX: Hitachi S3700 Variable pressure-scanning electron microscope with Oxford Instruments INCA energy dispersive X-ray spectroscopy (VP-SEM-EDX). Quantitative analysis calibrated using mineral and metal standards; detection limits calculated using a spectrum synthesis programme on Oxford Instruments INCA Analyser software. As is standard practice the SEM-EDX measurement would be taken in-situ but from lightly abraded areas to provide data about the sub-surface composition.

- XRF: X-ray fluorescence analysis using a Brüker ARTAX spectrometer fitted with a molybdenum X-ray tube and operated at 50 kV and 0.5 mA. A variety of collimators are available down to 0.2 mm. Quantitative analysis calibrated using mineral and metal standards.

- Raman Spectroscopy: Dilor Infinity Raman spectroscope with green (532 nm) and near infrared (785 nm) lasers operating at a maximum power of 4 mW at the surface with a spot size of a few microns. Spectra are collected for total times of between 2 and 10 minutes (including multiple repeats to avoid the effect of cosmic rays). Spectra are identified by comparison with an in-house database of reference spectra. Measurements can be taken in-situ or from microsamples as appropriate

- Fourier transform infrared (FTIR) microscopy is performed using a Nicolet 6700 spectrometer attached to a Continuum IR microscope equipped with liquid nitrogen-cooled MCT/A detectors. Samples may be analysed using the bench prepared as KBr disks or using an ATR accessory. Using the microscope, microsamples can be analysed using an ATR objective or in transmission or reflection mode (which can also be used to make in-situ measurements in some instances). Wherever possible, microsamples are analysed in transmission mode, flattened in a diamond micro-compression cell. When using the microscope the field of view is controlled by the sliding aperture which, when fully open, gives a maximum area of analysis of 100 x 100 μm. The spectra produced are identified by comparison with reference spectra from an in-house data base and the IRUG database.

- X-Ray diffraction (XRD) with a Philips PW112Q, operating at 40 kV, 40 mA employing the Cu-Ka radiation. Samples are mounted on a capillary in a Debye-Scherrer camera and diffraction patterns recorded on X-ray film

- Agilent 6890N gas chromatograph (GC) coupled to an Agilent 5975C mass spectrometer (MS) (GC-MS). System control and data collection/manipulation were achieved using Chemstation (G1701EA) software. Sample preparation and derivatisation method and the choice of injection mode and column can be matched to the type of material being analysed. A procedural blank (no sample) is always prepared alongside to monitor for laboratory contamination. A pyrolyser is also available should this be required.

15.9 Cataloguing, Typology and Research

15.9i Introduction

The production of an accurate catalogue and an informed typology will be the foundations upon which all of the other strands of work on the Hoard are based, and will probably be the most long lasting legacy of the Analysis Project. To ensure the best possible product we propose a two stage approach as described below. To aid clarity in this methodology statement cataloguing, typology, research and analysis have been divided into separate sub-sections, though in practice they will proceed in an integrated manner. The lead typologist lives at some distance from PMAG and so to make the best use of the resources and to facilitate the work in a timely manner. It has been decided that in the first stage he will do a preliminary scan of all the items working from high resolution images that will form part of the publication at the end of the first stage of the project (see **15.9ix**), the X-radiographs and the records produced by the BMAG conservation team. This will allow his visits to inspect items to be carefully targeted on the more problematic items. In the second stage when he will be joined by an assistant, the full final catalogue can be completed with personal inspection of each piece.

15.9ii First stage cataloguing

The first stage catalogue can be viewed as an extended assessment catalogue. The foils described in **15.7** will not be included within this work as it is expected that the initial investigation, grouping and joining work on those, described in that section, will still be ongoing. For the foils the results of **15.7** will, in effect, be the assessment catalogue. For all the other items (c. 1350 database records) the aim will be to complete the basic descriptions and develop a systematic naming strategy. Investigative conservation will be specified by the PMAG finds researcher and carried out by the BMAG conservators (see **15.5i**). The different types of decoration will be briefly recorded but no detailed work on the decoration styles, motifs etc will be carried out. Evidence for craft processes and wear will also be noted but will not be explored in detail at this point, other than to specify investigative conservation if warranted. For many items, e.g. the sword rivets etc, it can be anticipated that this first stage cataloguing will be sufficient to fully catalogue the item with only details such as the weight and measurements to be checked in the second stage.

In order to produce the interim catalogue within the budgetary constraints the number of trips that Dr Fern will pay to PMAG has been reduced from our original estimate, and his initial work will focus on the high resolution photographs and X-radiographs. This will allow him to target the more problematical pieces during his visits. From a finds specialist point of view this is not ideal and is an untried methodology. The implications are further considered in Risk Log 3.

The timetabling of this work will in part be dictated by exhibition requirements. The Washington DC exhibition closed on March 5th 2012 and the items on display (the top 100) have returned to PMAG. It has been agreed that the BMAG conservators will aid the PMAG curatorial staff in the necessary condition checking on arrival. This will mean that the items will rapidly become available to be worked on. They will not be required for public exhibition again until the main PMAG exhibition opens in July. This gives the Dr Fern the opportunity to catalogue these items without disrupting the display schedule. As they have been conserved to exhibition standard, the absence of X-radiographs will not be a problem. The concentration on these at the beginning of the process means that the first batch of X-radiography, which will be ongoing at the time, should have already produced plates that he can can use when he turns to the unconserved items. For these the X-radiograph images will be valuable tools

for both the finds research team and the conservators if investigative conservation is needed to clarify detail or explore particular points. There may thus be a gap in his work over the summer of 2012 whilst we wait for the X-radiographs and the high resolution photographs.

The end product of this stage will be an interim catalogue which can be published via the website to replace the handlist currently available there. This will provide more robust data for other researchers who may have need of it. It may also open up a useful dialogue with people outside the team. In order to ensure that this data is as accurate as possible, it will undergo professional copy editing and review before being posted to the web. This editorial work will be completed at the beginning of the second stage.

15.9iii First stage typology

Whilst the cataloguing is proceeding and knowledge of the items is being gained, existing typologies can be assessed for their usefulness. The sword and seax fittings provide a good example of the approach that will be taken as their number greatly increases and enriches the known body of material.

The current key studies of the Anglo-Saxon material are by Evison[121], though these are somewhat out-dated as a considerable number of finds have been added by archaeological discoveries and the Portable Antiquities Scheme since they were written. Menghin's *Das Schwert*[122] remains the main work for early-medieval Europe as a whole, but seventh century material comprises a relatively small component of this study. Added to this is the short study by Fischer and Soulat[123] presented at the 2010 symposium about the Hoard. This identified four classes of pommel cap by material and decoration: Type A – copper-alloy; Type B – silver; Type C – gold with cloisonné ornament; Type D – gold with filigree ornament. Even from the very rapid appraisal conducted by Fern during the Assessment (see **5.4**), it is obvious that there is much more variation by form and ornament within the Hoard than is covered by this. For example, the filigree can be either zoomorphic or geometric, and in rare cases cloisonné and they can occur together; whilst other decoration is cast. There are also technological factors – some pommels have evidence for a base metal (copper-alloy) core, whilst others are solid. This variation extends to the other sword elements (grip fittings and hilt guards).

The database has been set up so that all of these attributes for each item can be quickly recorded. The first stage cataloguing will thus scope the range of variation, enabling the finds researchers to assess to what extent the existing typologies can be adapted or whether a new approach is necessary.

It will also be possible at this stage to start identifying the number of items for which no formal typology will be appropriate as they currently appear to be unique.

15.9iv The cloisonné pilot project

The large quantity of items decorated with gold and garnet cloisonné pose a special problem. There is considerable potential in these pieces to explore whether different patterns were coming from different workshops. The combination of the cell shape, the types of foil and the colour and type of garnet (see **5.3**) need to be recorded. This will be a time consuming task as the number of cells on a single item can be large; for example, approximately 400 separate cells have been recorded on one item.

It is proposed that during the first stage cataloguing and typology, a pilot project will be carried out to assess the length of time it will take to record all of this data and whether the result is likely to justify the input of time. A small selection of items will be selected, including some where the garnets were analysed during the Paris 2010 work (see **5.3**). Each cell will be given a unique number with a key provided by marked-up photographs of the object. A cell-shape typology will be developed, again using existing studies if appropriate, and each cell will be assigned to this. Here we anticipate using

121 Evison 1967, 1987.

122 Menguin 1983.

123 Fischer and Soulat 2011.

Arrhenius (1985) which remains the main published study for garnet cloisonné. The work of Adams[124] will also greatly inform this study as will the work on the Sutton Hoo Ship burial[125] . The patterns on the foils will be recorded following the standard protocols[126] for counting the lines per cm and noting any additional patterns within the chequerboard. Here the finds researchers will be greatly aided by the quality of the images that the BMAG conservators can achieve using the Keyence 3D miscroscope[127] and by the photographs being taken by Guy Evans. The microscope has a grid option which can be set at varying measured grid sizes and so may well be found to make the counting process quicker. It is likely that most of this pilot project will be carried out using images on screen rather than having the actual object under a microscope. Appropriate tables have already been specified in the database to allow effective and rapid data entry.

The BMAG conservators have been developing a project to characterise the garnets using visual examination of the inclusions (aided by microscopes). The aim is to explore whether or not it is possible to confidently identify the different types (almandine, pyrope, indeterminate) without recourse to PIGE/PIXE analysis and Raman spectroscopy as was done in Paris[128]. This work is being carried out in collaboration with professional gemmologists. In addition during 2012 Deborah Magnoler produced a picture book resource that gathered together all the cloissoné pieces. This will be used to help select the sample for this pilot project.

The pilot project will provide the opportunity to integrate the strands of work on cell shape, foil type, and garnet type and colour (from both visual and analytical perspectives) and assess the most cost effective way of taking the work further. This is a complex data type (mixed mode as described in section **15.10ii**); and it is felt that a small detailed pilot project to establish the best approach that will give useful results within the lifetime of the Analysis project is a very necessary first step. From it, for example, we should be able to assess to what extent a sample of foils from any one object can be taken as representative of those of the whole object.

15.9v Second stage cataloguing

The first stage cataloguing will have produced a robust data set from which coherent groups of material can be extracted so that fragments that might have come from the same thing, or items of the same general type (e.g. pommels) can be worked on at the same time. The pilot studies on metal composition may also aid the selection of items in any particular group (**15.8iiib**). It is at this point that detailed work will be carried out to record the evidence the items have for how they were made, the degree of wear that they show and the decoration (styles, motifs etc). The end product of this will be the final catalogue and considerable amounts of data to inform the research aims. The work detailed in **15.7** will also be completed in as far as possible within its time and budgetary constraints, and so the impressed foils will at this stage be re-absorbed into the overall cataloguing project.

15.9vi Second stage typology

By the end of the first stage a formal assessment will have been made of what elements of the Hoard can be typologised using existing typologies; which will justify the development of completely new ones and which are the items that stand apart from any typology by being currently unique. It is anticipated that the hilt fittings, for example, will probably have provided so much new information to extend (and possibly contradict) established ones that a Hoard-based typology would be justified. To what extent the decorative motifs it contains will have superseded earlier systems[129] will have to await

124 Adams 1991, 2000..

125 Bruce Mitford 1978.

126 Avent and Leigh 1977

127 for a selection of these see http://www.staffordshirehoard.org.uk/fundraising-success-to-buy-the-keyence-3d-digital-microscope

128 http://www.staffordshirehoard.org.uk/wp-content/uploads/2011/03/FIXLAB-AGLAE-experiment-report_garnet_final_update-Dec20112.pdf

129 e.g. Høilund Nielsen 1999, 2010

the conclusion of the earlier stages.

Where new typologies (of form or decoration) are needed, these will be drawn up and illustrated appropriately for the final publication.

The garnet cloisonné pilot project will have led on to additional cataloguing work in the second stage. The analysis of all the data may have indicated it would be useful to commission a small number of additional analyses, probably by Raman spectroscopy in the Department of Conservation and Scientific Research at the BM. Should this be needed the work would take place within the third year of the project, after the department has moved premises[130].

15.9vii Research

The background research on relevant aspects of the seventh century and its material culture will be a second stage task. This will involve both standard library work to identify useful *comparanda* and synthetic works, and visits to other museums to catalogue relevant items if the published information is not sufficient. It will, for example, be appropriate to conduct a survey of the known seventh century helmets and some of these may require detailed inspection.

15.9viii Analysis

The final analysis of the data will take place in the second stage. It will combine not only all of the work outlined in this section (**15.9**), but also that outlined in **15.7** and **15.8** and such observations that the BMAG conservators will have been making during their ongoing work of preparing the objects in the Hoard for permanent exhibition. This will be a complex and very large data set. To gain the most from it, a wider range of multivariate analysis techniques will be needed than has generally been used in association with artefacts of the early medieval period. For this reason a statistician has been included in the team to provide advice and training, and to carry out requested analyses if needed (see section **15.10**).

Whilst much of the analysis will occur late in the second stage once all of the strands of data collection are completed, it can be anticipated that some will be ongoing from the first stage. It may well be appropriate, for example, to complete the analysis of some of the relatively simple artefact types at an early stage. The numerous sword hilt rivets are a good example of this. Having the work on them completed early would probably be beneficial for when their associated and frequently fragmentary fittings are being worked on.

15.9ix Illustration

The main illustration medium for the objects in the final publication will be photography. The laboratory at PMAG will have a dedicated photography installation of camera[131], adjustable camera stand and dedicated work station able to process the images. We propose to use the program Helicon Focus[132] which can compile multiple images of the same view taking the best focussed part of each producing excellent images with good focus throughout the depth of field. The project will have use of PMAG's macro lens for 1:1 images, and will acquire a MPE 65mm macro lens for images that need a more detailed magnification (up to 5X). Use will also be made of the microscope images being produced by the BMAG conservators. A considerable amount of this work will be completed in stage 1 providing a good photographic record to join the catalogue which will be released as an interim statement early in the second stage of the project. Some additional photographic work may also be appropriate in the second stage following the investigative conservation. This work is further considered in Risk Log 3.

130 see Risk Log 1

131 Canon EOS 5D mk II, or its successor if it's been released, coupled to a Canon 24-70 f2.8 lens.

132 http://www.heliconsoft.com/heliconfocus.html

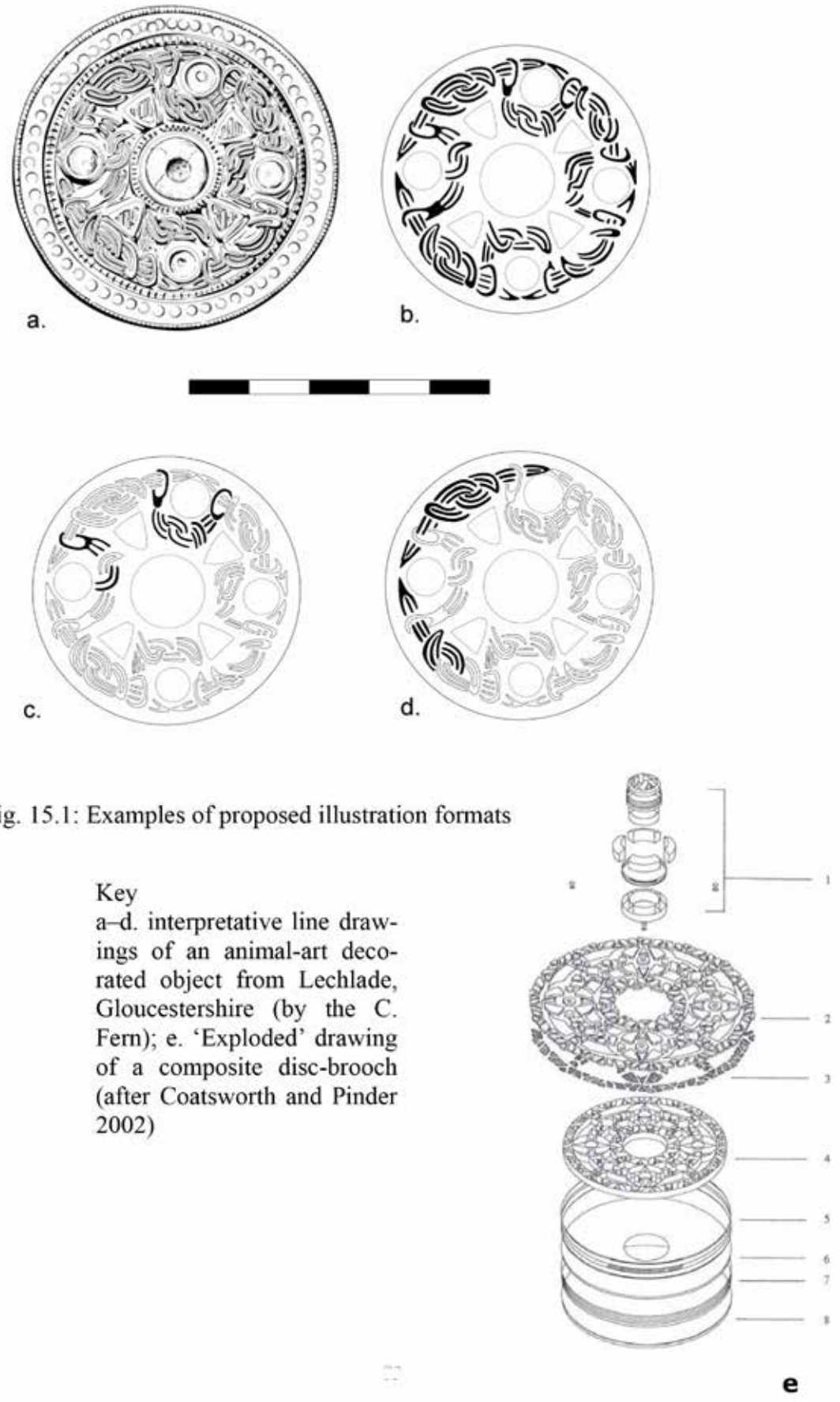

Fig. 15.1: Examples of proposed illustration formats

Key
a–d. interpretative line drawings of an animal-art decorated object from Lechlade, Gloucestershire (by the C. Fern); e. 'Exploded' drawing of a composite disc-brooch (after Coatsworth and Pinder 2002)

The photography will be supplemented with archaeological line drawing for key pieces, together with interpretative, scaled drawings for all the animal art and garnet cloisonné work. The animal art drawings should be based on Speake (1980), as per fig. 15.1 *a–d*. The cloisonné cellwork will also require similar interpretative, formal, drawing. In addition, reconstructions will be needed for key object types, and schematic explanatory drawings such as that in fig. 15.1e to show construction. For the final

Fig. 15.2. Example of the proposed illustration model of scaled photographs and sections.
Source Booth, P., Simmonds, A., Boyle, A. Clough, S., Cool, H.E.M. and Poore, D. 2010. *The Late Roman Cemetery at Lankhills, Winchester. Excavations 2000-2005* Oxford Archaeology Monograph 10 (Oxford). (fig. 3.248—grave 1846)

publication sections will be drawn and combined with the scaled photographs as illustrated in fig. 15.2. In some cases the X-radiograph images will be used, especially in the cases where no investigative conservation has been needed. All of this aspect of the illustration will be a second stage task.

It is possible that the final publication will also benefit from work being carried out in other strands of the overall Hoard programme to aid the exhibitions (see **10**). Preliminary experiments with laser scanning of the impressed foils has produced very useful images and there are plans for digital 3D reconstructions of some items.

15.10 Statistical Analysis

15.10i Introduction

The scientific analysis and the cataloguing work will produce considerable amounts of data and it is anticipated that statistical analysis will be a very useful tool both in aiding the grouping of objects as work progresses and for analysing the final results. The sub-sections below outline the general principles that will be adopted, the methodology that is most likely to be used, and how it will be implemented[133]. The statistician will be available for consultation during the first stage of the project and will play an active role in the garnet pilot project (**15.9*iv***). His main active involvement will be during the second stage.

15.10ii General principles

In as far as possible the aim will be to adopt simple methodology as a lot can be achieved with basic descriptive statistics, graphical analysis, and 'standard' inferential statistics (e.g. chi-squared tests). Obvious groups or anomalous data, if identified early, can be removed from 'global' analyses for separate treatment. This may ease analysis and interpretation. For large and complex data sets an approach that has been termed 'peeling' is often useful[134]. Initial analyses are likely to reveal the more obvious patterns or structure in a data set (if it exists). If this is stripped from the data set (e.g. by separating out clear groups) subtler structure may then become apparent on further analysis.

For the project, three broad classes of data will be available. They are:-

- quantitative which includes data of the type produced by all the analytical pilot projects and similar ones that will derive from them (**15.8iii)**;
- qualitative such as that derived from the cataloguing of the objects with the different decoration techniques, motifs etc (**15.9v**)
- mixed-mode such as the garnet and gold foil work (**15.9iv**) and any attempt to combine the typological work with the metal analysis (**15.9viii**).

Beyond simple methodology, methods of multivariate analysis immediately suggest themselves as potentially suitable for most of the areas of analysis identified.

15.10iii Technical details

The type of analyses needed for comparing data produced by different methods as in **15.8iiia**, **c** and **e** involve the same statistical problem. Simple graphical statistical techniques are readily available to investigate the agreement between two sets of measurements[135].

Ternary diagrams, which are widely used in specialised areas of archaeology, are an obvious first step for investigating metal composition (see **15.8iiib**) if three-part compositions are envisaged (e.g. Au, Ag, Cu) and have already been used in this document for that purpose (see fig. 5.2). Essentially the same, results can be obtained using correspondence analysis or log-ratio analysis. The latter methods may be more suitable for displaying results for large data sets, and generalise readily to compositions with more than three parts.

For looking at metal analysis data to see if it aids groupings (e.g. **15.8iiic**) principal components analysis (PCA) and cluster analysis, widely used in the archaeometric literature, are an obvious first choice. If grouping information is available, then discriminant analysis and other supervised pattern

133 Unless otherwise stated the methodologies suggested are illustrated in one or both of Baxter 1994 and Baxter 2003.

134 Cool and Baxter 1999.

135 Altman and Bland 1983.

recognition methods are available. This would require reasonably large groups.

Using the data to explore whether any gold standards can be identified (see **15.11iii**) requires the exploration of quantal methods, and is interesting as it counts as a non-standard problem. The mathematical methodology was developed in an archaeological context by Kendall (1974); developments since then, including archaeological applications, have been reviewed recently[136]. Pakkanen (2004) has developed computer intensive methodology to assess the reality of quanta, in building units of ancient Greek structure that can be drawn on if this line of research is pursued.

For the qualitative data multiple correspondence analysis (MCA) is an obvious first approach to explore, supplemented by chi-squared tests for pairwise comparison of variables.

Analysis of the mixed-mode data, is less standard, more difficult, and several options are open. Cluster analysis using Gower's similarity coefficient has sometimes been used, but is not a preferred option. Quantitative variables can always be converted to categorical variables (e.g. 'large', 'medium', 'small') and MCA then applied, as in several morphological/typological studies in the French and Scandinavian literature dating from the 1970s. It is easy to apply. Another option, and the preferred one at present, is to analyse the qualitative and quantitative data separately, using MCA and an ordination method such as PCA for the two data types, then synthesise results from the separate analyses[137]

As a general comment it is worth noting that correspondence analysis is probably one of the more advanced statistical techniques familiar to Anglo-Saxon archaeologists, frequently in the context of burial studies and for the purposes of seriation. The approach is exemplified in publications by Neilsen and others in collections edited by Madsen (1988), Jensen and Nielsen (1997), and Hines *et al.* (1999).

15.10iv Computational requirements

The open-source (i.e. free) software R[138] will be used. This is a state-of-the-art, regularly updated, powerful statistics package much superior to the commercial software typically used in archaeological publications.

It enjoys widespread user support from a host of professional statisticians who have contributed a large number of 'libraries' of functions to undertake analyses not included in the libraries distributed with R. This means that most of the analytical tools that might be initially needed are readily available. There are, for example, at least six libraries containing functions to produce ternary diagrams, and at least that number to undertake different forms of correspondence analysis.

As R is programmable, if anything not already there is needed, existing functions can be modified to do what is needed, or functions can be created from scratch. The graphics are of high quality publication standard and can be 'fine-tuned' where necessary to get the appearance desired (for an example see fig. 5.2).

15.11 Background studies

15.11i Introduction

All of the methodology outlined so far has been narrowly focussed on the Hoard. When the work described in them has been successfully completed, we will have fulfilled research aim **7.2** (what does the Hoard consist of). The work will have provided much information that will help to explore the other research aims. To enable them to be successfully addressed it is proposed to widen the team to include the contributors. These are individuals with specific skills who can provide background information

136 Çancaya and Fieller 2009

137 Cau *et al*. 2004

138 R Core Development Team, 2011

that can contextualise the Hoard. They will be available both to discuss aspects of the research with the core team and to contribute themed essays which will form part of the second part of the publication. The order of the sub-sections below can be seen as the progressive development of the background contextualisation working from those themes that draw most closely upon the Hoard data to the broader but still essential background. All of these aspects will be carried out in the second stage, but the contributors will be kept informed of what is happening during the first stage and will be involved in the project meetings and associated discussions that will take place during the first stage.

15.11ii Art

This is a cross-over area that will be deeply imbedded in the work outlined in section **15.9**. The Hoard will provide many new insights into art styles and this was one of the key areas of its potential noted in section **6.3**. An over-arching section to place this in its broadest context will be needed. To achieve this George Speake, the acknowledged authority on the animal art that forms such a conspicuous part of the Hoard, has been invited to collaborate with Chris Fern (the lead material culture specialist in the core team). This work will be ongoing throughout the lifetime of the project and a small allowance for Dr Speake's time has been included in the first stage budget.

15.11iii Gold Value

In section **6.5** it was noted that the Hoard had considerable potential to contribute to the debate over whether a bimetallic value system was in place during the seventh century. John Hines has been invited to develop his theories with the aid of the data generated during the cataloguing and material analysis. Whilst he will draw on all of the data, a particularly useful avenue may be to concentrate on the sword fittings as within these there are complete items that will provide weight and gold fineness data which can be used for the exploration of quantal values within them (see **15.100iii**). Work on the typology and art styles also ought to enable them to be grouped according to broad date (e.g. early and late), so that changing patterns may be picked up.

Some work on this can be done early in the second stage but most will take place in the middle to later part when all the data strands become available. During its creation in the first stage Professor Hines will liaise closely with the teams at the BM and BMAG producing the gold analysis data, and a small allowance for his time has been included in the first stage budget..

15.11iv Seventh century life and mindset

To understand the Hoard we need to explore the mindset of the society in which it was created. To do this we need to know first how material culture was habitually used as it is only by understanding the everyday and mundane that exceptional and rare events can be placed in context. Chris Scull who has wide experience of both settlement and burial archaeology in the seventh century will provide this. To a great extent the Hoard is male and military and we need to know how these aspects were expressed in other aspects of life and how the elite manipulated such trappings. As this is likely to overlap with the work being carried out in the gold value strand, John Hines will oversee this aspect. The Hoard also contains the much remarked-upon overtly Christian items. For these we need to understand how seventh century people perceived Christianity and how its trappings may have been used and expropriated by the ruling elite. In part this is the territory of the historian rather than the archaeologist and Alan Thacker has agreed to collaborate with us on this. He will also provide the necessary historical background against which the Hoard needs to be understood.

15.11v Special Deposits

As discussed in section **6.2**, a Treasure hoard can be seen as just a particular type of a special deposit. To understand the Hoard we need to understand this aspect of human nature as demonstrated by the deposits that are regularly found. To do this properly we need to take a long view both in time and space. The British patterns that can be seen in the proceeding 1,500 years will be reviewed. Colin Haselgrove will deal with the prehistoric into Roman periods and Peter Guest will deal with the late Roman material where spectacular gold hoards are not uncommon. These are especially relevant if, as

seems likely, some were actually deposited at a period that post-dates the formal 'end' of Roman Britain conventionally placed in the early fifth century. Both of these contributions will also be extremely useful for the wider research aim of contextualising metal-detected discoveries more generally.

To contextualise the Hoard specifically it will also be useful to look at the contemporary continental patterns of deposition where hoards have been more frequently encountered in early medieval contexts than they have been in England. To do this two eminent continental scholars have agreed to help us. Svante Fischer will look predominantly at the northern European material and Matthius Hardt at that from central Europe.

15.12 Legacy

15.12i Introduction

Section **6.6** outlined the potential the Hoard and all the details around its discovery and purchase for exploring changes of attitude within modern society to Treasure and other major finds from the past, and this was expressed as research aim **7.6**. To achieve this the methodology will take two approaches.

15.12ii Social history of the Hoard

The records relating to the impact of the Hoard's discovery will be collected, documented and archived. The two museums have considerable amounts of press cuttings, web references and other documentation relating to this. They also have physical artefacts which companies and others have made, sometimes with a view to commercial exploitation. As the Hoard has already been the subject of two TV programmes for National Geographic, the production company (Fulcrum TV) also has an archive of relevant material including interviews with key individual. This archiving work will ensure that much that may otherwise be ephemeral will be safely preserved for future researchers, and will also inform the final discussion of the research report. As the material is primarily lodged within the museums, the Registrar for PMAG will conduct the archiving work and the two respective curators will provide a commentary. The archiving work will start during the first stage of the project.

15.12iii The wider picture

Data will be collected from published and unpublished sources to trace the changing attitudes to Treasure and other finds over the past century. That date range has been chosen as it takes the survey back to one of the first spectacular treasure discoveries of modern times, the Mildenhall late Roman hoard. The circumstances surrounding the discovery has been the subject of a recent publication which will provide a good starting point[139]. This survey will proceed by focussing on a number of significant finds over the period and analysing their reception and ultimate destination in the manner that has been done earlier in this document for the Hoxne Hoard.

The work will be conducted late in the life of the second stage as that will allow us to include any significant and relevant discoveries made during the lifetime of the Analysis project. As such it will be possible to see the reaction to the Hoard, documented by the work in **15.12iii**, as part of a process and not as an end point.

15.13 Final Report – Editing

At the end of the first stage there will be the basic assessment catalogue which, with a small amount of editing, can be released as an illustrated digital resource. It should also be possible to release interim statements about progress on the various aspects of the project that have been completed in the first stage, as these will be easily available in the up-dated project design.

The final report to be produced during the second stage, will consist of a letterpress volume and a substantial digital component of supporting material including all methodologies used and the final

139 Hobbs 2008.

version of the database. The structure will be one of three parts. Full details are available in Appendix 6. A summary is presented here.

- Section 1: Discovery, Recovery and fund raising; approaches to its study.
- Section 2. The Hoard itself and its direct research outcomes[140].
- Section 3 The Hoard in its wider background[141].

The academic editors will provide the links and glosses which will help the reader navigate the work. They will provide overall introduction and conclusions and an introduction to each section. It is anticipated that as one goes through the book multiple and possibly conflicting narratives exploring and explaining the Hoard will be encountered from the different authors. It is expected that the sections written by the editors will assess these.

15.14 Project Management

15.14i Introduction

This project will only be successful if the team is forged into a coherent whole and collaborates regularly despite major strands being physically based in different centres. Communication and timetabling will be important so that the Analysis Project team can liaise successfully with the wider Hoard programme. The project management is central to a successful outcome and the various aspects of the work are itemised below. In addition to these, the Project Manager will often be involved in the project assurance of tasks as the proceed, and helping with the co-ordination of the final publication in the later stages. The anticipated workload is large and for the duration of the Analysis project the team will be augmented by as described in **14.2ii**. In addition Sam Richardson, the PMAG Registrar, will carry out the day to day liaison between the external project management team and the PMAG staff as well as condition checking etc.

15.14ii Liaison with the executive

The work involved in this has been dealt with in section **14.1**. In addition it has been noted that the Executive is likely to be approached by external research projects seeking access to the Hoard. The Project Manager will liaise with the Programme Co-ordinator over these.

15.14ii Organising and communicating with the team

The project management will organise and monitor the progress of the work, organise the project meetings and seminars (see **11.4**) and have face to face monitoring meetings with the different parts of the team at suitable points during the progress of various tasks. All these will be documented in the two monthly reports (see **11.7**). They will also compile and circulate the newsletter (see **11.3**). The budget includes a sum under materials to pay for the miscellaneous expenses associated with meetings such as refreshments, the travel costs of commentators etc.

15.14iii Review and communicating with EH

As explained in Section **12**, the project has been designed in a two-part format so an up-dated project design assessing the first stage and refocusing for the second stage will be written at the end of the first stage by the Project Manager. Normal monitoring reports will be produced as and when EH requires them, and when the Project Manager thinks additional ones would be useful.

15.14iv The website

The Hoard website will be the main communication link between the Analysis Project and the public

140 Including: Composition of hoard, new typologies; the epigraphy, new light on art styles; new understanding of value placed on gold derived from gold fineness studies.

141 Including: Consideration of special deposits over time and space and how the hoard fits within them, comparison to normal seventh century culture, role in our understanding of the history and mindset of the period, role in understanding our own reaction to finds from the past.

and scholarly community. The project management will oversee and supervise the copy that is added to this from the Analysis Project. From time to time more thematic essays will be added that particularly address particular aspects of the research. The work leading to most of these will be a second stage task, but it is anticipated that a certain amount of information will be available for some first stage essays as well.. It is hoped to timetable these to coincide with events that may be taking place elsewhere in the Hoard programme such as the opening of exhibitions. It is probable that these will be drafted by the project management from the information being regularly collected, then checked and altered by team members, and then copy edited prior to upload. In this way a library of information and text will accumulate that can be the basis of popular booklets linked to the exhibitions in future. Material will also be posted to the Barbican website.

15.14v Conferences

Another route of communication with the scholarly world during the life of the Analysis Project will be via conference presentations. The first of these will be at the International Medieval Congress in Leeds in July 2012 where an entire session is being devoted to the presentation of the Hoard. Other obvious conferences where it would be useful for team members to attend are *Saschensymposium* series held annually. In 2012 it will be in Durham, in 2013 in Paderborn and in 2014 in Warsaw. The project management will administer a modest annual conference budget in the second stage and some resources *may* be available in the first stage. Team members may apply for funds to pay for conference fees, accommodation and travel. As it is anticipated that demand may exceed the budget, the project management will also help team members apply to outside bodies for bursaries if appropriate.

15.15 Grouping Exercise

15.15i Background and timing

Throughout most of the life of Stage 1 of the project, items from the Hoard have been dispersed in six separate venues, and during the first year of work it became obvious that pieces from the same item could often be in different locations. It became apparent once Chris Fern had started his work, that having the Hoard all together on one place for an intensive programme of grouping after he had completed the Stage 1 catalogue would be essential. Such an exercise would only be appropriate after the material has been cleaned so that joins can be made. As can be seen from **15.5v**, the cleaning is currently expected to be completed by the end of 2013. Should the Owners acquire the new items of the hoard found by Archaeology Warwickshire at the end of 2012, they will need to be included in a clean condition in the exercise.

The timing of the exercise has to centre around Chris Fern's availability for an intensive two weeks of consecutive work in either Stoke-on-Trent or Birmingham. For family reasons this would have to centre around school half-term holidays. It is therefore proposed to timetable this exercise in February 2014. The venue has yet to be decided.

15.15ii Organisation

Chris Fern will plan in advance the best groupings for the laying out and then there will be an intensive two week grouping exercise to make the joins if possible and establish which pieces are parts of the same item. This will enable a coherent interim catalogue to be prepared early in Stage 2 (see **15.9ii).** The planning for this exercise will start once the Owners have decided the venue. He will be aided by another typologist to provide a second set of eyes and the BMAG conservators will also provide support.

16 Stages, Products and Tasks

This Analysis Project is a two stage project. The first stage lasting for 26 months provides a usable outcome and the up-dated project design will scope the second stage. The relationship of the tasks and their timing for the first stage is shown in fig. 16.1-2. This has been colour-coded according to the

different strands.

As the first stage of the project has several different strands, there are two tables summarising the tasks, methods, aims, personnel, timetabling and cost. In Table 16.1 each task is summarised by a single line giving the main methodology section only and omitting the staff. The cost column shows the cost for the number of days worked. The cost sundry column shows the additional costs associated with tasks. Table 16.2 provides references to the detailed methodology sub-sections, the personnel, more detailed of the aspects of the task each will undertake and a breakdown by financial year where tasks span the whole project. Detailed notes about the cost break down of the sundry elements will be found on the pages following Table 16.2.

In these tables the numbers of days being worked by personnel on tasks where staff costs are not directly funded by the budget in this document are shown with the cost as zero. The amount of work being carried out during them has been itemised in Section 15. These tasks can accrue sundry costs which have been included in the budget and this is shown in the relevant columns.

The detailed product descriptions will be found in Appendix 7 and the Risk Log in Appendix 8.

Detailed costings and budget are not provided in this version and so pages 68-83 have been removed.

19 Bibliography

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Appendix 1 – Extracts from the Assessment Project Design

3.1 Discovery, recovery and the Treasure process

3.1i Place and Circumstances

The initial discovery was made by Mr Terry Herbert on 5th July 2009 whilst metal detecting in a field with the permission of the landowner. The field is situated to the south of the modern A5 (T) Watling Street centred on NGR SK 406328/306396. At the time of discovery it was under pasture but had been ploughed in 2008. It lies on the down slope of a northwest/southeast ridge and is visible from the main road (see fig. 3.1)[143]. Over the following five days he recovered over 200[144] further items of gold together with 21 blocks of soil that gave a positive response to the metal detector.

He reported the find to Duncan Slarke, then Finds Liaison Officer (FLO) of the Portable Antiquities Scheme (PAS) who was hosted by the Birmingham Museum and Art Gallery (BMAG). Mr Slarke in turn notified Mr Andrew Haigh, the Coroner in whose area the find was made, Staffordshire County Council (SCC), the officers of the PAS based in the British Museum, and the Principle Collections Officer of PMAG. The finds were transferred to BMAG.

At a meeting on July 21st 2009 where representatives of SCC and PAS/BMAG were present, it was decided that SCC would excavate a 1m square test pit to explore the archaeological context of the hoard. English Heritage (EH) was notified of the find the same day and agreed to fund an emergency excavations under SHAPE sub-programme 32144.110.

Birmingham Archaeology (BA) was commissioned to carry out fieldwork according to an agreed project design drawn up by SCC (EH Project 5892) whose aims were to recover the hoard and place it within its immediate archaeological context.

The SCC and the BA work was carried out with the assistance of Mr Herbert and the FLO. The BA work was monitored by regular visits by representatives of SCC and the EH Inspector also visited. The finds were removed from site each night and either delivered to the BMAG that evening or stored at the offices of BA overnight and delivered the next day.

3.1ii Excavation

The following details are drawn from the Birmingham Archaeology report on the rescue excavation undertaken to recover the hoard (*BA 2010*)

The initial test pit dug by the SCC starting on 22nd July showed that the hoard items were confined to the plough soil. All the finds from this stage of the work were 3D plotted using a GPS[145]. BA continued the excavation of the test pit on 24th and 27th-29th July. During this time it was expanded to a pit of 2m square. All the finds from the test pit were individually numbered.

Scanning the area around with a metal detector indicated that the hoard might be confined to a 20m square area centred on the test pit. A grid corresponding to this was laid out and divided into 1m squares labelled from A1 to I20. Each grid square was excavated separately by hand to ensure that there was no confusion as to which square they had come from. The squares were dug in 0.1m deep spits, and scanned by metal detector for finds. The finds were bagged by grid square and given a unique small find number. This information is marked on the bag together with the date items were found on. The finds derived from the test pit were retrospectively assigned the appropriate grid number.

143 See Fig. 3.1 in this document (p. 2) as well.

144 Additional note November 2011. Dr Leahy informs me that these 200 'objects' were in fact 200 bags, containing multiple objects.

145 At the time of writing there are some problems with recovering these data from the later part of the excavation.

For the first two days of this stage of the BA excavations (30th-31st July) the methodology followed was to bag the spoil by grid square and wet sieve it through a 0.01m sieve. The finds recovered continued to be labelled in the same way as those recovered by hand excavation.. After two days this methodology was reviewed because the wet sieving was making very slow progress due to the wet clay soil and poor water pressure. Given the threat of illicit metal detecting activity because of the visibility of the site (see **3.1i** and fig. 3.1-3), the rest of the excavation continued without the wet sieving. The soil from each metre square was spread over plywood sheets to enable hand sorting for the finds with the aid of metal detecting. When hand excavation stopped an area 9m by 13m had been excavated.

Between 10th and 14th August BA provided archaeological assistance for a metal detector survey of a 50m square area in the north-western corner of the field with the hoard. The area was divided into 5 x 5m squares which were systematically walked by Mr Herbert who marked any metal detector anomalies with a cane. These were hand excavated by BA staff but the artefacts recovered proved to be of post-medieval date.

A number of additional items from the hoard were recovered by Mr Herbert when he scanned the excavated topsoil prior to backfilling. During the course of the excavation Mr Herbert found, some 100m away from the hoard, a gilt copper alloy disc bearing the interlace decoration. This is of a similar date to the hoard and suggests activity on the site in addition to the deposition of the hoard.

The main excavation revealed part of a possible ditch in the extreme south-western corner; two possible post-holes and a gully. No artefacts were recovered from them.

A magnetometer geophysical survey of the field (5.3h) was undertaken which revealed a curvilinear ditch-like feature near the focus of the hoard and a straight feature that correlates with an historic field boundary (see **3.3i**). The curvilinear feature corresponded in alignment to the possible ditch seen in the main excavation. Three test pits were excavated to explore other geophysical anomalies but no features were identified in any of them. The excavations were completed on August 21st 2009.

The final stage of the fieldwork consisted of a small metal detector survey undertaken by the Home Office Scientific Investigation Branch immediately before the Coroner's inquest.

3.1iii Initial recording of the objects

The objects were initially assigned one of three reference numbers. The SCC excavations assigned the code SSA and a number. Once BA became involved unique small finds numbers were assigned in the normal way indicated by a number in a triangle on the bags. In the recording these series were given SCC and BA prefixes and both start at 1. The finds found by Mr Herbert also have numbers prefixed by TH. The prefix in this case is often not indicated on the bags. These sets of numbers are sometimes referred to as 'finders numbers' and sometimes as 'other refs' in the documentation available at the start of the work to write this project design[146].

The 21 blocks of soil found by Mr Herbert fall outside of the initial numbering systems.

A fourth set of numbers were issued during the PAS cataloguing which was carried out in BMAG. If there was found to be more than one item in a bag these were separated. The intention was to give each one a unique number and consolidate existing listings. A set of pink/apricot raffle/cloak room tickets was used to identify the finds, with a ticket corresponding to the correct recording number placed within the relevant bag. Once the numbers rose above 1000 a second set of these tickets were used, initially prefixed by M and later by 1. This cataloguing did *not* include the material from the soil blocks. This set of numbers is referred to as the 'Kevin numbers' as the catalogue was prepared by Kevin Leahy and his wife Dianne. In the existing documentation they were be expressed as either an

146 6th January 2011

integer number rising to 4 digits or that number prefixed with K and without the leading zeros. It is intended that this series of numbers will become the unique reference for each item and be incorporated into the accession codes of the relevant museums.

The original PAS cataloguing was carried out on an Access database. Within the standard recording practice for archaeological projects this would be described as an augmented Assessment level catalogue. It records simple name, there are a large number of presence/absence fields providing information about material, type of decoration etc, details of height, length, width and weight and a brief notes field. When the initial cataloguing was completed prior to the Treasure inquest the database consisted of 1381 records including non-hoard (recent) material found during the excavations[147].

It should be noted that the assessment of the records prompted by the writing of the project design has uncovered inconsistencies in the information in different parts of the documentation. This will be considered in section **3.4ii** below as it has important implications for the analysis.

3.1iv The Treasure process

The inquest on the find was conducted by the South Staffordshire coroner on 24th September 2009 and the hoard was declared to be Treasure according to the Treasure Act 1996. This was the first day that news of the hoard had been publicised and public interest was intense. It also attracted considerable media interest worldwide. A small selection of items from it were put on display at BMAG from 24th September to 13th October. This exhibition attracted 42,000=visitors and the museum had to extend its opening hours to accommodate them.

It was at this point that the earth blocks noted in **3.1iii** were dismantled following X-radiography in the conservation studios at BMAG at the insistence to the Treasure Valuation Committee (TVC).

After the exhibition in Birmingham closed, the hoard was moved to the British museum so that the valuation could take place and the opportunity was taken to display another small selection. This exhibition ran from 3rd November 2009 to 17th April 2010.

The TVC invited valuations from four independent sources and on 25th November 2009 announced that a value of £3,285,000 had been placed on the hoard. This valuation had been agreed by the finder, the landowner, the Secretary of State, BMAG and PMAG.

3.3 Additional exploration of the site

3.3i Stage 2 Evaluation 2010

In February 2010 BA was commissioned by SCC to carry out a further evaluation of the hoard site with the aim of providing the immediate archaeological context of the hoard and recovering any further items associated with it. The work was conducted in March 2010 and carried out according to a project design approved by EH. A full report can be found in the Birmingham Archaeology report[148], and what follows is a brief summary.

A resistivity survey was conducted over an area of 1ha in the north-western angle of the field in which the hoard was located. This, together with the results of the magnetometer survey (see **3.1ii**), provided the basis for the positioning of a total length of 100m of trial trenches and ten 1.6m square test pits. The latter were excavated to provide the profile of the ploughsoil and subsoil across the long axis of the natural ridge.

The excavations demonstrated that a number of the resistivity anomalies were the result of changes in the composition of the natural subsoil which showed considerable variation. The curvilinear anomaly

147 Information derived from the database Marindex6 (7) – supplied by Kevin Leahy 13th January 2011.
148 Burrows and Jones 2010.

noted in both the 2009 and 2010 surveys was found to correspond to a band of clay of likely natural origin, possibly an ice wedge. The interesting suggestion was made in the report that the clay could have promoted the grown of different vegetation which could have been a prominent landscape feature given its proximity to the natural ridge.

Parts of two palisade trenches were recovered but retained no dating evidence. No material of Roman or Anglo-Saxon date was found in any of the excavated trenches and pits, and no archaeological features could be associated with the hoard.

The field boundary noted in the magnetometer survey (**3.2ii**) may be of medieval origin given the presence of a 13th-14th century sherd found in a layer associated with it. This is of some interest as, though the line of this boundary follows the course of the ridge, there is a deviation in it suggesting it may have been respecting an above-ground feature in the approximate location of the hoard that no longer survives.

3.3ii Aerial photographs

Alex Jones has carried out a very rapid and selective scan of some aerial photographs and has found two features of possible relevance . They are a 'bump' shown in 1968 and a possible oval ditch shown in 1971. A systematic search for all available relevant aerial photographs and inspection by a specialist has the potential to add more information. Such a task is proposed for the assessment stage. Dr Booth of Oxford Archaeology has kindly inspected the archive of the aerial photograph plotting from the M6 Toll project and informs us that it does not contain anything relevant to this project.

3.4ii Updating the catalogue

During the summer of 2010 Kevin Leahy updated his original catalogue (see **3.1iii**) to include the items from the soil blocks (see **3.1iv**) that had not originally been included as they had only be been seen in X-radiograph images during the summer of 2009. This resulted in a new Access database[149] with 1735 record excluding the non-treasure material. The structure was more coherent than the previous one with a smaller number of fields, relying less on a large number of presence/absence ones. There is some correspondence in format and entries between this and the Excel spreadsheet entitled 'Staffordshire Hoard Handlist 25th October', though the hoard element of that only numbers 1627 entries.

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As part of the work involved in preparing this project design, the author compared all the various databases and spreadsheets prepared at different stages of the project to date. It became apparent that at some point the concordance between the original numbers of the items (i.e. those of Mr Herbert, SCC and BA) and the cataloguing numbers (i.e. those assigned by Dr Leahy) had been lost. This was confirmed by checking a sample of the finds and their raffle ticket numbers (see **3.1iii**) which remained in their original bags with the site numbering. A database from BA[151] which retained what is thought to be the correct concordance between the BA and SCC numbers and the Leahy numbers, was known to be correct on 12th October 2009. This information has been checked against another small sample of items in their original packaging and has been found to correspond.

149 Database file name SHfromExcel 200 4 – supplied by Kevin Leahy 10th January 2011.

150 Database file name SHfromExcel 200 4 – supplied by Kevin Leahy 10th January 2011.

151 Database file name HoardInfo – supplied by Alex Jones 12th January 2011.

This muddle seems appears to have happened after the end of the initial cataloguing. It is thought that it will not affect the concordance between the items from blocks catalogued in the summer of 2010.

In what follows it has been assumed that the concordance between the K numbers and the BA/SCC numbers with their associated distributional information has now been corrected. It must be stressed though that this is an assumption. There has not been time during the writing of this document to physically check all the bags against the database records, nor the original BA finds records against the database. There are currently many BA find numbers that do not have grid references. Discussions with Alex Jones of BA indicates that this should not be the case. As it is of great importance that the distribution information is accurate, such a check against the bags and the original hand-written records made on site will need to take place as the first task of the Assessment project. Although the hoard was found in the ploughsoil, a preliminary study of the distribution has shown that it is consistent with relatively recent plough disturbance with some of the larger items being dragged away from the centre whilst the smaller items show a more concentrated distribution[152]. This refutes the suggestions that are surfacing that the hoard was buried recently[153]. The location information will also be of importance for devising some of the checks needed for the proposed scientific work (see **14.3**)

3.4iv Scientific analysis

As part of the original work prior to the hoard being declared Treasure, X-ray fluorescence (XRF) measurements were taken from ten gold items at BMAG and the gold content was found to range between 88.9% to 57.9%. The latter is the analysis of a 'dark patch' on an item and so may not be typical. The bulk of the measurements lay between had a gold content in the 70 to 78.9% range with only one item higher at 88.9%[154]. Subsequent analysis was undertaken at the British Museum as part of the Treasure valuation process on a small number of objects where there was some uncertainty about the alloy composition and this confirmed that a number of pieces were gilded silver rather than gold alloy. Additional surface XRF measurements of the gold, silver and copper content have been made on a larger group of objects (47) at BMAG during the conservation work.

In April 2010, two successful applications were made for beam time at the AGLAE (Accélérateur Grand Louvre d'Analyse Elémentaire) ion beam analysis (IBA) facility at the Centre de Recherche et de Restauration des Musées de France (C2RMF) made possible under the FIXLAB transnational access programme of the EU-funded FP7 CHARISMA project[155]. The focus of the applications was the use of PIXE and PIGE (proton induced X-ray or gamma emission) analysis to

(i) study the inlays (glass, garnet and niello) and garnet provenance and
(ii) to study the gold composition, provenance and technology of a selected group of objects.

In addition to having the necessary analytical facilities and security for the study, undertaking the work at the C2RMF allowed each study to be carried out in collaboration with a leading expert in the subject and to draw on their reference databases (as well as those of the British Museum). Beam time was allocated in late November/early December 2010 when a group of 60 items were taken to Paris (after preliminary conservation work to ensure that the pieces were stable to travel and to reveal clean surfaces for analysis). In addition to PIXE and PIGE analysis offered as part of the transnational access, colleagues at the C2RMF (as a CHARISMA networking activity with British Museum partners) additionally undertook X-radiography and tomography on a number of objects and Raman spectroscopy on some of the garnets and associated inclusions. The resulting data have not yet been fully analysed but it is anticipated that, by the time the full analysis project design comes to be written,

152 *BA 2010*, 9-10

153 See, for example, the very carefully worded letter from Tim Tatton-Brown published in the January 2010 *Current Archaeology* (Issue no. 250, p. 4).

154 Leahy undated, 2-3

155 http://www.charismaproject.eu/home-page.aspx checked 17:01:11.

the results can be used to help develop the scientific strategy for dealing with the hoard.

4.1 The contents and quantities

extract

Table 4.1 presents what is known to be in the hoard at present in a simplified form. It is derived from the database records discussed in **3.4ii**. There are some inconsistencies in that with regard to nomenclature, material etc. It has been generated by simplifying the material categories – so for example, 'silver', 'silver ?' and 'silver gilt' are all termed silver; 'gold and garnet', 'gold?' are all regarded as gold. Items which are recorded as being of 'gold and silver' or 'silver and copper alloy' in the material field have been included as 'Mixed'. Row categories have been derived from the information in the Classification field as these are not consistently translated into simple names (the Description field). For example the different types of sword hilt plates identifiable in the Classification field are currently variously described in the Description field as 'sword hilt fitting', 'fragment(s)', 'Edging', 'Sword hilt rivet', 'rivet' and 'sheet metal' as well as 'sword hilt plate'. In the tables in this section therefore, the categories may appear different to those that have appeared in previous publications. Table 4.2 presents the same data quantified by weight so that the broad quantities of the different materials can be seen. It should be noted that these weights are pre-cleaning, and that for gold items include the weights of the garnets where these are present on the items. The titles of the row heading give the principle element for simplicity. In reality of course all are alloys.

Appendix 2: Functional Specification for the Database Hoard

Bryan Alvey

1 INTRODUCTION

1.1 THE PURPOSE OF THE DOCUMENT

The purpose of this document is to provide a functional specification towards the delivery of a system to capture the Research and Conservation Requirements for the Staffordshire Hoard.

1.2 THE SCOPE OF THE DOCUMENT

This document will:

- *Highlight the drivers behind the project*
- *Document the functional requirements of each of the user levels*
- *Provide an Entity – Relationship Diagram of the entities required*
- *Provide a list of entities and their fields to support the functional requirement*

1.3 THE STRUCTURE OF THE REQUIREMENTS

In accordance with the remit given to Cultural Heritage Information Consultants, the document will give an outline of the data requirements, report specifications and upload/download capabilities for the conservation requirements of the Staffordshire Hoard database system. It does **not** attempt to analyse the requirements for a public website for dissemination to the General Public.

Our brief has isolated the approximate number and classes of user who will need to have access to this system, the different levels of access required to the system, and the requirements of the system as a whole.

The data will also have to be imported from an existing database system, and exported to a number of database systems upon completion.

This document has therefore been divided up as follows:

1.1.1 ENTITIES

In this section, an entity – relationship diagram will be displayed followed by a list of the entities and their fields. The nature of each entity is explained, together with a list of its relationships with other entities. Each field will be explained also, together with a number of attributes that will describe the level of access, the data type of the field, and the required sizes etc.

1.3.1.1 ENTITY ILLUSTRATIONS

Entities and their relationships will be shown using boxes and arrows in black; arrows in blue will denote relationships with other entities from different modules.

Arrows are representations as follows:

1:n relationship 1:n relationship 1:1 relationship

1.1.2 FUNCTIONAL REQUIREMENTS

In this section the requirements for access are outlined, the requirements for importing and exporting are set out, the requirements for dissemination are outlined and any other aspects necessary for the functional operation of the system.

Where necessary, attention is drawn to any factors that may not be straightforward, and therefore may have a bearing on the costs for the development of the product. This will include the current database configurations at the institutes where the data will eventually be housed, the frequency and nature of any backup processes.

Since the Staffordshire Hoard follows the structures of the current databases in place at the museums, all requirements - except where stated - are mandatory.

1.1.3 NON□ FUNCTIONAL REQUIREMENTS

This section will deal with maintenance and legal issues, open issues and the security requirements of the Staffordshire Hoard system.

2 PRODUCT DRIVERS

2.1 PURPOSE OF THE PRODUCT

The Staffordshire Hoard database will provide a consistent management information system to underpin the management of all conservation, research and analysis carried out on the Staffordshire Hoard discovered by Mr Terry Herbert on 5th July 2009, and now jointly owned by the Potteries Museum and Art Gallery at Stoke on Trent (PMAG) and the Birmingham Museum and Art Gallery (BMAG).

The system will be made available to the staff of the above museums and external clients, and will provide the information necessary to inform researchers and analysts that will help to contextualize this important group of finds within the Anglo Saxon period. The collection of information for the hoard is currently already taking place at one venue (BMAG) and will eventually take place independently in a number of locations. As the nature of this information will be so varied, a unified system for data input is urgently required. This will allow all users to input the information using standard vocabularies and numbering systems, thus ensuring the integrity of the data that is so vital for future analysis.

The database system will provide the facility to:

- Capture the conservation information for the hoard in a standardised format, enabling users to ensure all materials have been conserved and to a consistent standard
- Capture the most significant images and video material that is associated with the material
- Record the publications associated with the material
- Extract significant information according to selected criteria

- Provide appropriate web-enabled access to all elements of the database to selected analysts and researchers
- Provide a base of information that will permit web-enabled access to elements of the database in support of public dissemination of information about the hoard to fulfil Modernising Government objectives.

2.2 CLIENT, CUSTOMER AND OTHER STAKEHOLDERS

The businesses directly involved with the project are the Potteries Museum and Art Gallery (PMAG) and of Birmingham Museum and Art Gallery (BMAG); whilst the project itself is funded by English Heritage. There are a number of other interested parties and individuals that include the British Museum (BM) and the other partners involved with the Mercian Trail.

The following people will be involved with the product:

- Client/Customer: The Hoard Management Group
- Senior Users: Hilary Cool, Deborah Cane, Deb Klemperer, Others
- Project Manager: Hilary Cool
- Business Analyst: Bryan Alvey

2.3 USERS OF THE PRODUCT

This database is designed to capture and report on a consistent body of data collected from the conservation of the hoard material. The users of the product are likely to be:

- The conservators carrying out the conservation of the material
- The museum staff who curate the material

- Analysts who perform analysis on the material
- Researchers who carry out research using the material captured from the conservation and analytic processes.

This is a select group: the database is not, at this stage, designed for dissemination to the general public. In the future, this database may form the basis of a database that drives the Staffordshire Hoard website for the general public, but the requirement is for a system designed to capture a subset of the data that would normally form the basis of a museum object. The conservators are simply not capturing a complete record at this stage.

3 Product Constraints

3.1 Mandated Constraints

- The product must be developed using disability access guidelines
- The product must be produced using commonly available software (ASP, ASP.NET, PHP, C#.Net, VB.Net etc.) and use a database platform that can be used directly by staff members (MS SQL Server, MySQL etc.)

3.2 Support and Maintenance

All support and maintenance will be undertaken by the third party supplier (TPS). In the event of the TPS stopping trading, support and maintenance will be taken over in-house or by another appointed TPS.

All support and maintenance procedures will be agreed with the business, and documented by the TPS. In the event of the TPS stopping trading, support and maintenance documents will be submitted to the business free of charge.

3.3 Source Code Ownership

All source code will be the property of the business (BMAG & PMAG).

3.4 Version Control and Documentation

Source code will be deposited with the business when it reaches version 1.0. Each new version will likewise be sent to the business. Each new version will be accompanied by documentation stating what changes have been included in the new version.

System documentation will be logged with the business prior to the system going live.

3.5 Standards

All software developed will be fully documented, and submitted to the business at each version submission.

All software development should be developed using one of the following tools: ASP, ASP.Net, C#.Net and VB.Net.

3.6 Relevant Facts and Assumptions

The product assumes the use of a relational database (MS SQL Server or equivalent).

Weekly backups will be carried out by the supplier and copied on a weekly basis to the business.

1.1.1 Import and Export of Data / Current Systems

The ability to import and export all data is a requirement.

Data is currently being entered into the database system at BMAG, and the import of this source data will be required at the commencement of the data going live. Export of the data will be required both during the life of the database and once the data entry has been completed to populate the databases currently in place at the business.

It is necessary therefore at this point to outline the current systems in place at the business:

1.1.1.1 PMAG database system

The Potteries museum run the Modes XML database system.

The Potteries database doesn't yet carry out its own conservation of the objects at the moment, and is more likely to be using the online database to track the objects and to enter research and analytic results rather than the conservation data.

As its name suggests, this system is at its happiest importing and exporting files in XML format.

It is therefore a requirement of the proposed database application to be able to import and export in XML format, though it can also import and export data in XLS format.

1.1.1.2 BMAG Database system

BMAG runs the MINISYS database system.

Most of the current primary conservation of the objects comes from the BMAG site, and the data is added to this database currently as each object is conserved.

The MINISYS system is proprietary software and does not use a SQL database engine to drive the system, though the system itself does appear to be a relational database. It can export data in a variety of formats including XLS.

For the import of data, it is necessary to contact the MINISYS group to accomplish data import.

1.1.2 Issues with the Import and Export of Data

It seems that the import of data to the BMAG database will require the input of the supplier of the MINISYS system.

Because of this, the export of data from the GoldHoard database to the PMAG and BMAG systems has been excluded from the tender.

4 The User Groups

4.1 Who are the Users?

At this stage, the users of the system are likely to be the museum staff and researchers concerned with the conservation of the hoard material and those interested in using the material from the hoard for purposes of research and analysis.

The system therefore will be through password controlled access only, and all screens and fields in the system will use the user's level of access to determine display/edit access of the item.

The following outlines the proposed access levels, and notionally identifies an 'access level' against each group. These levels are then used in the chapter describing the entities used in the system.

Both the name and the access level will have to be retained by the system during sessions, as it proposed that for research and analytic material, only the author of the record or a user with management access will be able to edit or delete records of analysis or research origin (for more information on this, please see below and the entities chapter).

4.2 Access Level Groups

So far, four access levels have been recognized. This is based on the understanding that there WILL be add/edit access to the conservation material, and that research adding/editing/viewing will be undertaken either by the management or by the author only.

A fifth may be added (see project manager – root data access only , names, descriptions etc.)

1.1.1 Management Access

Management access (level 1 in the entities chapter below) is for those users who will have overall control of the database. Typically, these will the database managers of PMAG and BMAG, the Project Manager and the consultant. These users will be able to control all aspects of database input and display, and will be able to add users to the system etc. – the 'top' level of access.

1.1.2 Conservation Access

Users with Conservation Access (level2 in the entities chapter below) will have edit/access to the areas of the database concerned with conservation data input (but not the controlled vocabularies for these – see chapter on entities below), and will have view only access to the research and analytic material.

1.1.3 Research/Analysis Access

Users of this level (level 3 in the entities chapter below) will have view-only access to the conservation material areas of the database, and view only access to the research and analysis areas of the database.

They will, however, be able to add material in these areas, and have full access (add/edit/delete) to the records they create.

1.1.4 Browse Only Access

Some parts of the database may be made available to museum staff who may however have no rights over the content of the database (such as senior museum staff etc.). This access level (level 4 in the entities chapter below) will give display access to chosen parts of the database.

5 Entities

5.1 Introduction

The following sections outline the entities required for the web-enabled hoard database. These entities have been drawn from the existing work carried out by staff at BMAG, and take many of the fields and entities from the current structure of that database. This will ease the burden of export and import of data, and minimize structural changes to the nature of the data. Entities are equivalent to tables in a relational database.

This is not a complete museum catalog of a record, since at this stage the emphasis has been placed upon

the conservation of the material; it is rather a 'subset' of the overall requirement of a museum catalogue record.

Where additions / changes have been made to the BMAG structure, because of the nature of the database currently in place at PMAG, these will be noted in the text.

Where changes have been made to the structure to streamline input or display of the data, these will be noted in the text.

5.2 *Main Catalogue*

Entity Description: The main catalogue record, describing the nature of the object recorded Entity Rela-

tionships:
Notes:

Name	Access	Type	Description
(ObjID)	123	No	The key field used by the system to uniquely identify the record.
AccessionNo	123	Text	For BMAG this is in the format YYYY.0138.K1771 (with leading zeros); YYYY is year, 0138 is the group number for the gold hoard; K1771 is the Kevin number given to the object on discovery if it had one.
KNo	123	No	Kevin Number
ObjectFullName*	123	Text	Pull-down list - to ObjectNames entity (equivalent to ObjectTitle in BMAG system)
ObjectSubCategory Name*	123	Text	Pull-down list – to ObjectParts entity
ObjectSimpleName	123	Text	(all fields have the entry: Gold Hoard)
ObjectStatus	123	Text	Status of Object (equivalent to ObjectCertainty in BMAG db – but need to work out **exactly** a formal definition of Status values)
ObjectDescription*	123	Text	Full description of the object (Is this the same as Object Title?)
ObjectPrimaryMaterial*	123	Text	Primary material of object; full list in ObjectMaterials table. Pull-down list from materials table.
PommelProportions*	123	No	Pommels Only: percentage of height /depth to length
Weight*	123	No	Weight
TechCopperAlloyCore*	123	Text	
TechRivets*	123	Text	

TechComment*	123	Text	
ObjCount*	123	No	
CollectionType	123	Text	
DisplayYN	123	Bit	Whether or not this object record is on display
Style	123	Text	
DateFrom	123	Text	
DateTo	123	Text	
Period	123	Text	
DateComment	123	Text	Free text discussion about the date data entered in the field above
AcquisitionInfo	123	Text	Free text describing how the data was acquisitioned
DataEnteredBy	123	Text	Who entered the data (user-name entity from login)
DataEnteredOn	123	Date	Date and time the record was last edited

5.3 OBJECT MATERIALS

Entity Description: The materials that make up the object described in the main catalogue record, describing the nature of the object recorded

Entity Relationships:

n: 1 with the main catalogue record.

Notes: The material field should be taken from the materials entity

Name	Access	Type	Description
(ObjMatID)	123	No	The key field used by the system to uniquely identify the record.
ObjID	123	No	The foreign key to access the unique main catalogue record that this material record is associated with
Material	123	Text	The material that the object is made from (from materials entity)

5.4 MATERIALS

Entity Description: The materials that make up the object described in the main catalogue record, describing the nature of the object recorded

Entity Relationships:

N:1 with the object materials record.

Notes: This should be taken from the BMAG MINISIS Materials DB, but this is a real dragbag mixture of uncontrolled entries; perhaps this should be taken from a controlled list compiled from the material object records of just those records present in the Staffordshire Hoard.

Name	Access	Type	Description
(MaterialID)	1	No	The key field used by the system to uniquely identify the record.
Material	1	Text	The material that the object is made from.

5.5 Related Objects

Entity Description: The objects that are directly associated with this catalogue entry; this comprises simply the k number of the other record involved

Entity Relationships:

n: 1 with the main catalogue record.

Notes: whether this entity represents a physical or stylistic association is unclear; perhaps this extra element – i.e. whether physical (attached to a piece of dirt next to the object)) or stylistically (having similar decoration or form) could be entered at a later stage.

(This entity has been amalgamated with the 'UsefulComparanda' entity from the research requirement)

Name	Access	Type	Description
(ObjRelationID)	123	No	The key field used by the system to uniquely identify the record.
ObjID	123	No	The foreign key to access the unique main catalogue record that this record is associated with
Physical/Stylistic relationship*	123	Bit	Whether physically or stylistically related
K number*	123		K number of associated object (if appropriate)
SiteName*	123	Text	Site name of associated object (if appropriate)
RelatedObjectSimple name*	123	Text	As for master object associated object
RelatedObjectSub-category*	123	Text	As for sub category of associated object
RelatedObjectMaterial*	123	Text	Primary material of associated object
RelatedObjectDate*	123		Date of associated object (This could be derived from the context date in publication)
EH project phase/date*	123	Text	EH project/date of associated object (if appropriate).
Continental phase/date*	123	Text	Continental phase/date of associated object (if appropriate)
Comment*	123		Free text comment
Bibliographic reference*	123		Free text comment

5.6 Object Dimensions

Entity Description: The dimensions of the object. Entity Rela-

tionships:
n: 1 with the main catalogue record.

Notes: NatureOfDimension could be from a fixed list; we could also agree on a standardized form of mea-

surement and stick to it, thereby cutting out the unitofmeasurement field (this can default to the agreed unit and be present for the facility of uploading data back to the Birmingham museum system)

N

o

5.7 INTERPRETATION

Entity Description: The interpretations of the object. This interpretation record relates to the object of the catalogue entry only. Since the interpretation of an object can change through time according to the discovery of new objects/ advancement in our understanding of a period, many interpretations can be offered against a single catalogue record.

Entity Relationships:

n: 1 with the main catalogue record.

Notes: ? Is there/should there be an interpretation record against the group?

Name	Access	Type	Description
(ObjInterpretationID)	123	No	The key field used by the system to uniquely identify the record.
ObjID	123	No	The foreign key to access the unique main catalogue record that record is associated with
InterpretationDate	123	Date	The date when the interpretation was made
Author	123	Text	Who made the interpretation
ProjectName	123	Text	Name of the project that was the driver behind the interpretation
Notes	123		The interpretation as free text.

5.8 OBJECT LOCATION

Entity Description: The locations of the object (of the catalogue record). This record relates to the object of the catalogue entry. This entity outlines the movement of an object both to a new location within a museum and to new locations as part of an exhibition..

Entity Relationships:

n: 1 with the main catalogue record. Notes: ? Is

there an exhibition record?

Name	Access	Type	Description
(ObjLocationID)	123	No	The key field used by the system to uniquely identify the record.
ObjID	123	No	The foreign key to access the unique main catalogue record that record is associated with
Location	123	Text	The location that the object will be sent to.
MoveDate	123	Date	Date the move will take place

DateAuthorised	123	Date	Name of the object was authorized for moving
WhoAuthorised	123	Text	The name of the person who authorised the movement
DateDueForReturn	123	Date	Date Due for Return
DateReturned	123	Date	DateReturned
Building	123	Text	The building where the object will be housed
SubDiv	123	Text	Sub Division of the building (eg room where it will be housed)
LocationType	123		? Permanent Exhibition/ temp Exhibition/ permanent display etc, from entity location types
MoveRefNo	123	No.	The reference number of the movement
OnDisplayYN	123	Bit	Whether or not the object is displayed
InsuranceValuation	123	Currency	GBP Valuation of the object

5.9 CONSERVATION EVENT

Entity Description: A conservation event is a treatment to or record of the object described in the main catalogue record. A number of treatments can be made to an object, and each treatment can initiate a number of tests, reports, drawings, photos.

Entity Relationships:

n: 1 with the main catalogue record. 1:n with the

DrawingRefs entity I:n with the Photos entity

1:n with the XRefs entity 1:n with the

Tests entity Notes:

Name	Access	Type	Description
(ObjTreatmentID)	12	No	The key field used by the system to uniquely identify the record.
ObjID	12	No	The foreign key to access the unique main catalogue record that record is associated with
TreatmentType	12	Text	The type of treatment the object was subjected to
TreatmentReference	12	Text	A reference number for the treatment. (Where does this come from?)
TreatmentDate	12	Date	Date that the treatment took place (completion date)

ReportDescription	12	Text	The treatment as free text.
Priority	12	No	The priority (?) of treatment – no one seems to know what exactly this is and how the numbers (1-5) are defined.

5.10 CONSERVATION TREATMENT TESTS

Entity description: A conservation treatment test occurs when a test made on all or part of an object. These can occur during conservation treatments.

Entity Relationships:

n: 1 with the conservation treatment record. n:1 with the

TestTypes entity

I:n with the Photos entity Notes:

Name	Access	Type	Description
(TreatmentTestID)	12	No	The key field used by the system to uniquely identify the record.
ObjTreatmentID	12	No	The foreign key to access the unique main catalogue record that record is associated with
SampleSentYN	12	Bit	Whether a not a sample was taken for analysis.
DateOfTest	12	Date	Date the test was made
Method	12	Text	One of the items of the TreatmentType entity
Notes	12	Text	Free text notes concerning the test made on the object
Sample Reference Number	12	Text	Unique code of the sample taken

5.11 FILES

Entity Relationships:

n: 1 with the conservation treatment record. n:1 with the

catalogue record
Notes: The filename needs to be uploaded and downloaded by the users with view/edit status.

This differs from the conservation reports entity in the BMAG database. There may be files and image (see below) that are not part of a conservation event; users may wish to see/download all files and images at the same time. So I have added more than one foreign key in this db table and others may be added after discussion with the business.

Name	Access	Type	Description
(DataFileID)	123	No	The key field used by the system to uniquely identify the record.
ObjID	123	No	The foreign key to access the unique main catalogue record that this material record is associated with
ObjTreatmentID	123	No	The foreign key to access the unique conservation treatment record that the record is associated with
FileType	123	Text	Reason for uploading file (treatment, research etc.) from FileTypes entity
FileLocation	123	Text	The location of the file on the server
FileName	123	Bit	The filename of the report uploaded
DateFileUploaded	123	Date	Date the file was uploaded

5.12 IMAGES

Entity Relationships:

n: 1 with the conservation treatment record. n:1 with the

catalogue record
Notes: The image needs to be uploaded. They may be downloaded by the users with view/edit status. As with the reports entity, files and images may or may not be part of a conservation event. This should be discussed with the business, but I feel we should include more than one foreign key field in this table, as with the Files entity.

Name	Access	Type	Description
(ImageID)	123	No	The key field used by the system to uniquely identify the record.
ObjID	123	No	The foreign key to access the unique main catalogue record that this image record is associated with
ObjTreatmentID	123	No	The foreign key to access the unique conservation treatment record that the record is associated with
ImageType	123	Text	Reason for uploading image (treatment, research etc.) tb discussed
FileName	123	Bit	The filename of the report uploaded
FileLocation	123	Text	The location of the file on the server
DateFileUploaded	123	Date	Date the file was uploaded

5.13 FILE TYPES

Entity Description: The type of file/image (treatment, research) that forms the content of the Files record. There may need to be a different image types entity – discuss with the business.

Entity Relationships: N:1 with the

Files record.
N:1 with the Images record

Notes: This element is not part of the BMAG db record.

Name	Access	Type	Description
(FiletypeID)	1	No	The key field used by the system to uniquely identify the record.
FileType	1	Text	The type of file or image that constitutes the image or file record.

5.14 TREATMENT TYPES

Entity Description: The type of conservation event – treatment, condition report etc. Entity Relationships:
N:1 with the Conservation Event record.

Notes: Part of the BMAG db record (to be confirmed).

Name	Access	Type	Description
(FiletypeID)	12	No	The key field used by the system to uniquely identify the record.
TreatmentType	12	Text	The type of treatment that constitutes the conservation event record.

5.15 DECORATIONS

Entity Description: Part of the Research element: the type of decoration on an object.

Entity Relationships:

N:1 with the MainResearch record. 1:N with the

Motifs record
1:N with the Gold Foil Inlay record

Name	Access	Type	Description
Object Decoration ID	13	Number	Key field uniquely identifies the record
K number	13	Number	Foreign key
Decoration Location	13	Text	The location of the decoration. One of the items of the DecorationLocations entity
Primary DecorationYN	13	YN	Whether or not this is the primary decoration of object as a whole.
Decoration	13	text	The decoration element: from a pull-down list of decorations from the Decorative-Forms entity
Decorative form description	13	Free text	Free text description of decoration

Zoomorphic decoration	13	Text	Zoomorphic decoration: from a pull-down list – See ZooDecorations table.
Geometric decoration	13		Geometric decoration: Pull-down list – see GeoDecorations table
Gilding	13	YN	Whether or not there is gilding: checkbox
Inlay: garnet	13	YN	Whether or not there is garnet inlay: checkbox
Inlay: glass	13	YN	Whether or not there is glass inlay: checkbox
Inlay: bone	13	YN	Whether or not there is bone inlay: checkbox
Stone Forms	13	Text	Free text description of stone forms.

5.16 TYPOLOGIES

Entity Description: Typologies to which an object has associated attributes. There may be more than one typology associated with an object, hence the need for this table.

Entity Relationships:

N:1 with the MainResearch record. N: 1 with the

Typology types record

Name	Access	Type	Description
Object Typology ID	13		Key field that uniquely identifies the record
K number	13		Foreign Key field linking back to the MainResearch record
Typology	13	Text	Pull-down list taken from the From the Typology Types record
Ref	13	Text	Pull-down list taken from the From the Typology Types record
Date	13	Text	Based on typology used.

5.17 GOLD FOIL INLAY

Gold Foil Inlay

Entity Description: Gold Foil Inlay and Cell Form data of decorative elements on an object. Entity Rela-

tionships:
N:1 with the Decoration record.

N: 1 with the Cell types record

N:1 with the Gold Foil Inlay Types record

Name	Access	Type	Description
Gold Foil Inlay ID	13	Number	Key field uniquely identifies the record
Object Decoration ID	13	Number	Foreign Key (to Object Decorations)

Cell Type	13	Text	The cell form, from a pull-down List populated by the Cell Types record
Cell Description	13	Memo	
Cell Location Code	13	?	A Cell Number or Code to show the position of the cell in the decoration (from a photo mark-up). For stray gold foil, this field and the one above can be left blank; 'absent' or 'unknown' can be a term for the cell type for stray gold foil.
Gold Foil Inlay Type	13	Text	The type of gold foil inlay: a pull-down list populated by the Gold Foil Inlay Types record.
Gold Foil Inlay Description	13	Memo	Free text description of the gold foil type. Here we have one type of inlay that can be described each time.
Gold Foil Inlay Position	13	Text	Drop down list, shows the way the foil was placed in the cell (from the GoldFoilInlayTypes record).
Gold Foil Inlay Vertical	13	Number-decimal	This counts the number of lines per mm using a binocular microscope fitted with a graticule
Gold Foil Inlay Horizontal	13	Number - decimal	As for vertical but at 90 degrees to first measurement. I have used 'vertical' and 'horizontal' to describe these as a naming convenience
Gold Foil Inlay Special	13	Text	Observation of other foils Sutton Hoo / Avent & Leigh has shown that within the grids marked out by the vertical and horizontal lines there can be other patterns. Eventually the pilot should produce the full list. At present if the drop down could be of a form that we can just build up as we go that would be best.

5.18 MOTIFS

Entity Description: Motifs present on decorative element of an object. Entity Relationships:

N:1 with the Decorations record. N:1 with the

Motif Types record

Name	Access	Type	Description
Motif ID	13	Number	Key field uniquely identifies the record
Object Decoration ID	13	Number	Foreign Key from the Object Decorations record
Motif Type	13	Text	The type of Motif: from a pull-down list populated by the Motif Types record

5.19 OBJECT NAMES

Entity Description: Terms describing the nature of an object, to populate the 'Simple Name' item.

Entity Relationships:

1:N with the MainResearch record. 1:N with the

Useful Comparanda record

Name	Access	Type	Description
(ObjectNameID)	123	No	The key field used by the system to uniquely identify the record.
Term	123	Text	The object name that describes the nature of the object record.

5.20 OBJECT PARTS

Entity Description: Terms describing the sub-category of the nature of an object, to populate the 'SubCategory' item.

Entity Relationships:

1:N with the MainResearch record. 1:N with the

Useful Comparanda record

Name	Access	Type	Description
(ObjectPartID)	123	No	The key field used by the system to uniquely identify the record.
Term	123	Text	The object name that describes the sub-category of the nature of the object record.

5.21 TYPOLOGY TYPES

Entity Description: Terms describing the existing typologies for an object. Entity Relationships:
1:N with the MainResearch record.

Name	Access	Type	Description
(TypologyTypeID)	13	No	The key field used by the system to uniquely identify the record.
Term	13	Text	The name of the typology
Sub-Div	13	Text	The division of the typology

5.22 DECORATIVE LOCATIONS

Entity Description: Terms describing the whereabouts of a decorative form on an object Entity Relationships:
1:N with the Decorations record.

Name	Access	Type	Description
(DecorativeLocationID)	13	No	The key field used by the system to uniquely identify the record.
Term	13	Text	The object name that describes the location of a decorative form on the object record.

5.23 DECORATIVE FORMS

Entity Description: Terms describing the nature of an object, to populate the 'Decorative Form' item of the Decoration Entity.

Entity Relationships:

1:N with the Decorations record.

Name	Access	Type	Description
(DecorativeFormID)	13	No	The key field used by the system to uniquely identify the record.
Term	13	Text	The object name that describes the decorative Form of the Decoration on an object record.

5.24 ZOOMORPHIC DECORATIONS

Entity Description: Terms describing the zoomorphic decoration on an object where present. Entity Relationships:
1:N with the Decorations record.

Name	Access	Type	Description
(ZoodecorationID)	13	No	The key field used by the system to uniquely identify the record.

Term	13	Text	The object name that describes the zoomorphic decoration on an object record.

5.25 GEOMETRIC DECORATIONS

Entity Description: Terms describing the geometric decoration on an object where present. Entity Relationships:
1:N with the Decorations record.

Name	Access	Type	Description
(GeodecorationID)	13	No	The key field used by the system to uniquely identify the record.
Term	13	Text	The object name that describes the geometric decoration on an object record.

5.26 GOLD FOIL INLAY TYPES

Entity Description: Terms describing the nature of the different types of gold foil inlay to populate the 'GoldFoilInlay' item.

Entity Relationships:

1:N with the GoldFoilInlay record.

Name	Access	Type	Description
(GoldFoilInlayTypeID)	13	No	The key field used by the system to uniquely identify the record.
Term	13	Text	The object name that describes the gold foil inlay in the decoration of an object record.

5.27 MOTIF TYPES

Entity Description: Terms describing the Types of Motif found in the decoration of an object Entity Relationships:
1:N with the Decorations record.

Name	Access	Type	Description
(MotifTypeID)	13	No	The key field used by the system to uniquely identify the record.
Term	13	Text	The term that describes the type of motif on the decoration of an object record.

5.28 CELL TYPES

Entity Description: Terms describing the cell form of a decoration. Entity Rela-

tionships:
1:N with the GoldFoilInlay record.

Name	Access	Type	Description
(CellTypeID)	13	No	The key field used by the system to uniquely identify the record.
Term	13	Text	The term that describes the cell forms within the gold foil inlay decoration on an object record.

6 REPORTING REQUIREMENTS

6.1 INTRODUCTION

What are the reporting requirements?

A great deal of time has been spent in the identification of the items of data needed for capture of the data: however, there has been very little discussion of the outputs required for the analysis.

The following therefore is an outline for 2 possible report requirements for the research team based on the captured data, and an estimate of time for the development of further reports based on the requirements of the report team for statistical analysis output.

6.2 THE REPORTING MODULE

Reports will be available to users according to their access level, accessed by clicking a 'Reports' option within the application.

One example of a reports system that may handle the reporting requirements of the business is Microsoft's SQL Server Reporting Services application (SSRS). Reporting Services is available is able to directly access the database entities in MS SQL Server, and those tendering are advised that it will be a requirement to use a system that will allow access to the database by the business for their own report development.

It is also a requirement for users to be able to download the output in: .DOC, .XLS and .PDF file formats.

6.3 REQUIREMENT 1: THE XLS REPORT STYLE

The first requirement that is envisaged is an XLS output. This output will have a fixed number of columns (to be agreed), that will outline the most pertinent fields for investigation: these fields may be of any data type, and will not be limited to any page size, since the output for this report will be in the XLS format for import to a spreadsheet application.

A list of selection criteria will be made available to the users at runtime in order for them to be able to filter the objects held in the database by addressing at least 10 of the fields of the database for their selection criteria. These fields will be chosen by the business, and will include data from the main, conservation event, decoration, gold foil inlay and motif tables.

The template for this output is to be made available to the business in order for them to develop their own similar XLS style reports in the future.

6.4 REQUIREMENT 2: THE A4 REPORT STYLE

Similar to the first requirement, the second requirement that is envisaged is a .DOC/hard copy output. This output will have a fixed number of columns (to be agreed), that will outline the most pertinent fields for investigation: these fields may be of any data type, and

will be limited to an A4 landscape page size, since the output for this report will be in the .DOC format for import to a word processing application, or directly to the printer.

A list of selection criteria will be made available to the users at runtime in order for them to be able to filter the objects held in the database by addressing at least 10 of the fields of the database for their selection criteria. These fields will be chosen by the business and will include data from the main, conservation event, decoration, gold foil inlay and motif entities.

The template for this output is to be made available to the business in order for them to develop their own similar .DOC style reports in the future.

6.5 Requirement 3: Statistical Output (.CSV)

The business shall be using the statistical package **R** which is commonly used by most professional statisticians. **R** does have certain naming conventions for variables and though it will take in either text or numeric variables, it will treat the first a factor and the second as a number.

The Stats package does not easily read Excel spreadsheets; it does however read .CSV files easily, and therefore a report should be developed for the purpose of outputting data of required fields for output to a .CSV format.

A list of selection criteria will be made available to the users at runtime in order for them to be able to filter the objects held in the database by addressing at least 10 of the fields of the database for their selection criteria. These fields will be chosen by the business, and will include data from the main, conservation event, decoration, gold foil inlay and motif tables.

The template for this output is to be made available to the business in order for them to develop their own similar .CSV style reports in the future.

6.6 Requirement 4: Output of the entire dataset to MS Access

The business is not at a stage at this moment to be able to define every report format they may require for their analysis. They may wish to develop further reports (see following section), but they may also wish to follow their own lines of investigation using data in a relational database format.

It is also a requirement therefore that at the end of the input process, the data is exported to an MS Access database for use by the business.

6.7 Requirement 5: Additional Report Development

The business is not at a stage at this moment to be able to define every report format they may require for their analysis. They may wish to develop further reports and may wish to call on the supplier in further development of reports specific to the lines of their own research.

It is therefore required that the supplier includes 10 days of developer time in the tender for further report development work to take place during and after the completion of data input.

7 Reporting Requirements

7.1 Introduction

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It is also a requirement for users to be able to download the output in: .DOC, .XLS and .PDF file formats.

7.3 Requirement 1: The XLS report style

The first requirement that is envisaged is an XLS output. This output will have a fixed number of columns (to be agreed), that will outline the most pertinent fields for investigation: these fields may be of any data type, and will not be limited to any page size, since the output for this report will be in the XLS format for import to a spreadsheet application.

A list of selection criteria will be made available to the users at runtime in order for them to be able to filter the objects held in the database by addressing at least 10 of the fields of the database for their selection criteria. These fields will be chosen by the business, and will include data from the main, conservation event, decoration, gold foil inlay and motif tables.

The template for this output is to be made available to the business in order for them to develop their own similar XLS style reports in the future.

7.4 Requirement 2: The A4 report style

Similar to the first requirement, the second requirement that is envisaged is a .DOC/hard copy output. This output will have a fixed number of columns (to be agreed), that will outline the most pertinent fields for investigation: these fields may be of any data type, and

will be limited to an A4 landscape page size, since the output for this report will be in the .DOC format for import to a word processing application, or directly to the printer.

A list of selection criteria will be made available to the users at runtime in order for them to be able to filter the objects held in the database by addressing at least 10 of the fields of the database for their selection criteria. These fields will be chosen by the business and will include data from the main, conservation event, decoration, gold foil inlay and motif entities.

The template for this output is to be made available to the business in order for them to develop their own similar .DOC style reports in the future.

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The business shall be using the statistical package **R** which is commonly used by most professional statisticians. **R** does have certain naming conventions for variables and though it will take in either text or numeric variables, it will treat the first a factor and the second as a number.

The Stats package does not easily read Excel spreadsheets; it does however read .CSV files easily, and therefore a report should be developed for the purpose of outputting data of required fields for output to a .CSV format.

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The template for this output is to be made available to the business in order for them to develop their own similar .CSV style reports in the future.

7.6 Requirement 4: Output of the entire dataset to MS Access

The business is not at a stage at this moment to be able to define every report format they may require for their analysis. They may wish to develop further reports (see following section), but they may also wish to follow their own lines of investigation using data in a relational database format.

It is also a requirement therefore that at the end of the input process, the data is exported to an MS Access database for use by the business.

7.7 Requirement 5: Additional Report Development

The business is not at a stage at this moment to be able to define every report format they may require for their analysis. They may wish to develop further reports and may wish to call on the supplier in further development of reports specific to the lines of their own research.

It is therefore required that the supplier includes 10 days of developer time in the tender for further report development work to take place during and after the completion of data input.

Appendix 3: Assessment of the Aerial Photographs

Alison Deegan

Summary

This report concerns the results of interpretation and mapping of archaeological features from existing air photographs around the site of recovery of the Staffordshire Anglo-Saxon Hoard, Hammerwich, Staffordshire.

This survey has identified fragments of medieval and/or post medieval agricultural landscapes, a section of a post medieval canal system and the remains of post medieval and 20th century extraction pits. In addition features of natural cause and several features of uncertain origin have been observed and recorded.

This work was commissioned from Alison Deegan, 6 Wain Close, South Milford, Leeds LS25 5AH for the *Contextualising Metal-Detected Discoveries: Staffordshire Anglo-Saxon Hoard* project. This project is funded by English Heritage and operated by Barbican Research Associates Limited, 16 Lady Bay Rd, West Bridgford, Nottingham NG2 5BJ. This work is the copyright of the author, Alison Deegan. Licence to use this work is extended to the Staffordshire Anglo-Saxon Hoard project team and associated researchers and curators. This work is supplied in digital format as well as hard copy and the above named parties may manipulate and/or reproduce the work as they wish providing the archaeological integrity of the work is not compromised. All reproductions of the work either in part, whole or combined with other works should clearly identify Alison Deegan as the author of the air photo interpretation and mapping.

Contents

1	Introduction
2	Methodology
3	Results
4	Concluding remarks
Appendix 1	Archaeology from black and white and colour air photographs
Appendix 2	Soures consulted
Appendix 3	Catalogue of features
Appendix 4	Structure and content of digital map dataset
References and resources cited	
Figure 1 = 3.1	Location plan of the Staffordshire Hoard air photo survey
Figure 2 = 4.3	Archaeological and other features from around the site of recovery of the Staffordshire Anglo-Saxon Hoard, Hammerwich, Staffordshire. (1:4444).
Figure 3 = 4.4	Vertical air photograph showing the curvilinear cropmark **AP N** in the field where the hoard was discovered. (MAL/71013 86 09-MAR-1971).
Figure 4	An extract from the Ordnance Survey 1 inch to 1 mile 1834. Features that may correspond with those **AP F** are highlighted in red, the field from which the hoard was recovered is shaded yellow. Reproduced from http://visionofbritain.org.uk

1 Introduction

1.1 Client details

1.1.1 This air photo survey was commissioned for the *Contextualising Metal-Detected Discoveries: Staffordshire Anglo-Saxon Hoard* project. This project is funded by English Heritage and operated by Barbican Research Associates Limited.

1.2 Specification

1.2.1 Mapping of levelled and upstanding archaeological features that are visible on the available air photographs, at a nominal scale of 1:2500 was required.

1.3 The Survey Area (see Figure 1)

1.3.1 The air photo survey area (hereon the Survey Area) consists of approximately 135 hectares of land centred at SK0637 0641 (406370, 306410).

1.3.2 The Survey Area is centred on the field from which a substantial hoard of Anglo Saxon metal work was recovered by metal detectorists and archaeologists in 2009. The Survey Area covers the field and the surrounding 500m of land.

1.3.3 The field in which the hoard was found is bounded by the A5 to the north, Hanney Hay Road to the west, Lichfield Road to the south and the M6 Toll Road to the east. It lies approximately 1.5km to the south-west of the village of Hammerwich.

1.3.4 The A5 follows the course of Watling Street Roman road and Roman Letocetum (Wall) is situated on the road, approximately 3.6km to the east of the field.

1.3.5 The field and most of the Survey Area lie within the modern parish of Hammerwich, but the historic township of Hammerwich lay to the north of the A5 Watling Street, land to the south being part of Ogley Hay until 1834.

1.3.6 Crane Brook runs in a small valley north-west to south-east across the Survey Area.

The land to the north-east of the brook rises gently towards Hammerwich. To the south-west there are discrete high points or ridges. One such ridge runs north-west to south-east across the field where the hoard was recovered.

1.3.7 The Survey Area lies mostly on Wildmoor Sandstone Formation; some of those higher points are capped with Devensian till (Geology of Britain viewer). The overlying soils are slightly acidic and vary between slow to drain loamy/clayey, and more freely draining sandy textures (Soilscapes viewer).

1.3.8 As well as the communications routes mentioned above the Survey Area is traversed by a section of the South Staffordshire Railway line (disused) and part of the Wyrley & Essington Canal (disused). Much of the remainder of the Survey Area is under pasture or arable cultivation, with the exception of a small housing development to the west.

1.3.9 Appendix 1 provides a brief overview of the uses of air photographs for archaeological remote sensing.

2 Methodology

2.1 Data sources

2.1.1 The air photograph collections of English Heritage's (EH) National Monuments Record (NMR), Staffordshire Historic Environment Record (SHER) and the Staffordshire Record Office (SRO) were consulted for this survey.

2.1.2 The digital photographic images delivered freely online by the Google Earth website were examined on screen.

2.1.3 Lists of the individual air photographs and image datasets consulted are provided in Appendix 2.

2.2 Image capture, rectification and mapping

2.2.1 All of the available air photographic prints were systematically examined at the NMR, SHER and SRO, using x2 magnification where necessary and stereoscopically where possible. At the NMR selected prints were photographed

with a hand-held digital camera. The SHER and SRO kindly provided scans of selected air photographs.

2.2.2 Current and historic Google Earth imagery was captured and georectified using Airphoto 3.44.

2.2.3 The copies of photographs were rectified to ground control points derived from the Ordnance Survey 1:2500 scale map obtained for the purposed of this project.

2.2.4 Image transformation was undertaken using the Bradford Aerial Photographic Rectification Programme, AERIAL5.14. Archaeological features were mapped to a scale of 1:2500 in accuracy and detail. The accuracy tolerance indicated in the Ordnance Survey map data is ±1-2.5m. AERIAL5.14 gives error readings for each control point, where 5 or more control points are used. In all cases errors of within ±3m were achieved for the control points. However this may not reflect the on-the-ground positional accuracy of the features mapped since these tend to be between rather than at the control points.

2.2.5 All of the georeferenced photographs were then collated in MAPINFO Professional

10.5 where the archaeological features were digitised, with reference back to the source photographs where possible. Features that are depicted on the Ordnance Survey base map were generally not duplicated. Data pertaining to each feature was recorded in the MapInfo table. The vector plots were then exported to Autodesk MAP 2004.

3 Results

3.1 The air photographs

3.1.1 For this Survey Area the NMR holds 43 black and white vertical air photographs from 10 different sorties flown between 1948 and 1993. Together these cover the whole Survey Area and provide good coverage for most decades. These vertical photographs were taken by the Royal Air Force, Meridian Airmaps Ltd and the Ordnance Survey for military, civil engineering and cartographic purposes rather than to record archaeological sites, however these photographs often incidentally record earthwork, soilmark and crop-marked archaeological features.

3.1.2 The NMR does not hold any specialist oblique or military oblique air photographs of the Survey Area.

3.1.3 The SHER holds just one set of vertical air photographs covering the Survey Area, these were taken in 1963. Although the SHER does also hold a collection of oblique air photographs taken for archaeological purposes, it does not contain any coverage of the Survey Area.

3.1.4 The SRO holds 10 vertical air photographs covering the Survey Area, from four different sorties. Although several of these sorties are duplicated in the NMR, in some instances the NMR only holds every other print in a sequence so this collection provided an opportunity to re-examine these with the advantage of stereo-overlapping pairs.

3.1.5 The Google Earth website displays imagery from 2003 and 2007, which provides a valuable snapshot of recent land use and monument condition.

3.2 Land use on the site of recovery during the period of air photography

3.2.1 At the beginning of the period of photography the field from which the hoard was recovered was two fields divided by a near north-west to south-east hedgerow. The table below summarises the landuse on those two fields and subsequently the single large field, in so far as it is possible to deduce this from the available air photographs.

3.2.2

YEAR (SOURCE)	Landuse		Direction of sowing/ploughing (where applicable)	
	west field (including hoard find-spot)	east field	west field (including hoard find-spot)	east field
1948 (CPE/UK/2555 4099)	?GRASS	?GRASS	NE-SW	NE-SW
1952 (RAF/540/813 5056)	ROOT OR LEAF CROP	GRASS OR CEREAL	NE-SW	NE-SW
1959 (RAF/58/2695 F21 76)	?GRASS	?CEREAL	NE-SW	NE-SW
1963 (HSL UK 6362 5992)	?GRASS	BARE SOIL	NNW-SSE	NE-SW
1968 (MAL/68075 012)	ROOT OR LEAF CROP	BARE SOIL	Mostly NNW-SSE	NE-SW
1971 (MAL/71013 96)	BARE SOIL		NE-SW across both fields	
1981 (MAL/81032 188)	ROOT OR LEAF CROP & BARE SOIL		crop planted in NNW to SSE rows but northern half ploughed in NE-SW	
1989 (OS/89342 027)	mainly GRASS but also some ROOT OR LEAF CROP		MIXED N-S AND E-W	
1992 (GEONEX 92121 48)	west & north-east GRASS, south-east ROOT OR LEAF CROP		west NNW-SSE, north-east E-W & south-east NE-SW	
1993 (OS/93284 40)	BARE SOIL		NE-SW	
2003 Google Earth (OCT)	GRASS		NE-SW	
2005 Google Earth	GRASS		NE-SW	
2006 Google Earth	North half GRASS, southern half BARE SOIL		NE-SW	
2007 Google Earth	CEREAL		NE-SW	

3.2.3 The available air photographs only show a snap shot of the land use on the field for 14 of the 61 years up to the time of th4e hoard's discovery. This small sample suggests that the cultivation of an arable crop in 2007 followed several decades of grass and a root or leaf crop on the field.

3.3 Archaeological and other features (Figure 2)

3.3.1 The results of this survey are catalogued in Appendix 3 by archaeological feature or groups of archaeological features. The mapping is reproduced in Figure 2 within this report at an approximate scale of 1:4444. This report is supplied in conjunction with a digital version of the air photo mapping data which can be viewed and interrogated at up to 1:2500 scale.

3.3.2 Details, including the type, period and sources for individual archaeological features, can be accessed in the digital version of the mapping (see Appendix 4).

3.3.3 In the absence of direct archaeological evidence all attributions of date and type are open to re-interpretation. The following is a brief discussion of the results.

3.3.4 The following observations from the air photographs concern the field in which the hoard.

3.3.5 A low natural ridge runs north-west to south-east across the field; this feature is not recorded in the catalogue. A small area of Devenian till caps the southern part of this ridge (Geology of Britain viewer). The hoard was recovered near the north-west facing shoulder of the ridge. The northern end of the ridge was truncated when the A5 was widened at some time between 1959 and 1968 and by further road alterations at some time between 1993 and 2003.

3.3.6 The field was divided by a near north-west to south-east aligned boundary from at least 1884 (the date of the earliest large scale map consulted). This field boundary (**AP O**) survived as a hedgerow on post war air photographs but it was removed by 1971. Thereafter it appeared as a diffuse cropmark and soilmark. This field boundary ran along the upper eastern flank of the ridge. On the 1968 air photographs there is a perceptible difference in the ground level between the west and east side of the field boundary but this appears to have been reduced by ploughing once the field boundary was removed. This feature corresponds with the field boundary (4404/4403) identified in Trench 5 during the 2010 excavations (Jones and Burrows 2010. para 6.6.4-6.6.5).

3.3.7 The 1952 air photographs show a line of parched crop running along the northern edge of the field (**AP P**). It is off-set by approximately 27m south of the centre line of the A5 Watling Street (as it was at that time, before subsequent alterations). This feature did not show on any other photographs and it is unlikely to have been of archaeological origin. The area of this feature was significantly truncated when the A5 was widened, sometime between 1993 and 2003.

3.3.8 The 1971 air photographs show a small bright mark in the soil to the immediate west of the hoard findspot (**AP M**). It is not visible on any other photographs and so it is unlikely that this mark was of archaeological origin and it may instead have been of superficial cause. The area of this mark was truncated when the cutting for Hanney Hay Road was widened, sometime between 1993 and 2003.

3.3.9 Several air photographs show a curvilinear cropmark close to the hoard findspot (**AP N**) (see Fig. 3). This feature lies on one of the highest points of the natural ridge and just 50m to the south of the course of the Roman road. The appearance of the cropmarks varies between the air photographs but the consistency of their position indicates that they are caused by the same underlying feature. Taken together these cropmarks suggest an oval feature measuring approximately 50x40m.

3.3.10 The 2010 geophysical survey identified an anomaly which appears to correspond with the western side of the curvilinear feature **AP N** (Jones & Burrows, fig. 5). The anomaly was targeted by trial trenching and concluded to be the remains of an ice-wedge (Jones & Burrows 2010 para. 6.3.2).

3.3.11 There are some parallels between this curvilinear feature and the site known as Knave's Castle, which lies approximately 1.3km to the west, again to the immediate south of the course of the Roman road. Knave's Castle was depicted on Yate's map of 1775. This cartographic source indicates Knave's Castle and the hoard findspot were both located on and surrounded by extensive waste (part of Cannock Chase) at that time. Knave's Castle has been suggested to be a Roman barrow, a Roman signal station or a medieval castle mound. However, it is also reported that when the area was impacted by the A5 widening this site was deduced to be a natural hillock (information from NMR 304465).

3.3.12 Most of the features in the wider Survey Area probably date from the medieval and subsequent periods. There are some features for which no date is suggested because of lack of evidence.

3.3.13 The two sections of possible plough headlands (**AP E** & **G**) running near parallel to the north side of Crane's Brook may have their origins in the medieval period. Yate's map of 1775 suggests that in this area Crane Brook marked the divide between the cultivated ground around Hammerwich and the waste to the south-west (but see para. 3.3.15 below). These headlands may be the remains of an open field landscape associated with medieval *Humerwich* (Hammerwich).

3.3.14 The banks and ditches running perpendicular between the brook and the putative headland (**AP D** & **G**) are more likely to relate to post medieval enclosure than the medieval landscape. At least one of these boundaries was still in use on the Ordnance Survey map of 1884.

3.3.15 Land to the north of the A5 Watling Street, between Hanney Hay Road and Crane Beck survived as rough pasture until at least 1952. A field boundary ditch, water channel and a palaeochannel were visible as earthworks on some of the earliest air photographs (**AP F**). The field boundary and water channel appear to coincide with features depicted on the 1834 Ordnance Survey map (see Fig. 4). This map also shows a possible building on the northern side of the water channel. Yates map of 1775 also indicates that this small area on the south side of Crane Brook was enclosed when much of the surroundings were still waste.

3.3.16 A section of the Wyrely and Essington Canal (**AP K**) crosses the Survey Area through a series of locks and basins. Construction of this feature, which linked the Birmingham Canal with the Birmingham and Fazeley Canal, began in the late 18th century (information from NMR 1340363). The canal was extant in 1948 but the air photographs show a gradual process of infilling and re-landscaping over the following decades.

3.3.17 There are several areas of extraction within the Survey Area. **AP I** is a sand pit dating from at least 1884. In the mid-twentieth century it was re-landscaped and now contains a small housing estate. **AP L** and **R** appears to have been started later, the latter was still active in 2007.

3.3.18 In addition there are several undated cropmarks, including **AP A, H, J** and **Q**.

3.3.19 The cropmarks in **AP Q** suggest a pair of conjoined rectilinear enclosures, but it is not certain that the marks are of archaeological origin. However it should be noted that that they lie close to Site 34, West of Crane Brook Cottage, where a Romano-British aisled building was excavated (Jones and Burrows 2010. para 3.3).

4 Concluding remarks

1.1.1 The table below summarises the key events associated with the hoard and the area from which it was recovered.

Date/Period	Event description
Roman	Construction of road (Watling Street). Military and subsequently civilian occupation at Letocetum (Wall)
Anglo – Saxon (7th century or later)	Deposition of the hoard within 60m of Roman road (Watling Street)
Medieval	Land to the north of Crane Brook towards the settlement of *Humerwich* (Hammerwich) probably cultivated, the hoard findspot was possibly not cultivated at that time
Post medieval	Gradual enclosure of waste land and open fields (Welch nd)
1775	The hoard findspot and its environs are demarcated as waste rather than productive land. (Yates 1775)
Late 18th century	Construction of the Wyrely & Essington Canal, passing 300m to the south of the hoard findspot
1846-49	Construction of the South Staffordshire railway line passing 300m to the north of the hoard findspot
Prior to 1884	Extraction from sand pit approximately 450m to the west of the hoard findspot

1948	Date of earliest air photograph available to this project
Between 1959 and 1968	A5 Watling Street (Roman road) widened, bring the road cutting closer to the find spot

By 1971	Field boundary (**AP O**) that had divided the two fields was removed
Between 1993 and 2003	A5 Watling Street (Roman road) further widened, Hanney Hay Road widened and roundabout between the two constructed. Bringing both routes closer to the hoard findspot
Up to Dec 2003	M6 Toll Road constructed taking a path to within 385m east of the findspot
Aug 2007	Latest available air photographs of the Survey Area were taken
July 2009	Hoard discovered by metal detectorist
July to Aug 2009	Geophysical survey and archaeological excavation around hoard findspot
March 2010	Resistivity survey and archaeological excavations

1.1.2 In the absence of other evidence the main feature of interest arising from this air photo investigation would be the curvilinear cropmarks described in **AP N**. However the results of geophysical survey and excavation strongly suggest that whilst these marks do indicate a sub-surface feature, this feature is of likely geological origin.

1.1.3 The absence of cropmark, soilmark or earthwork evidence in any part of the Survey Area should not be interpreted as the absence of archaeological features.

Appendix 1 Archaeology from black and white and colour air photographs

Air photographs taken in appropriate conditions can record crop marks, soilmarks and earthworks of archaeological origin.

Crop marks result from variations in leaf and stalk colour and plant height and vigour. Crop marks occur where there are anomalies below the ground: in-filled hollows, palaeochannels, frost cracks, archaeological pits, ditches, surfaces and banks or modern disturbances such as land drains. Crop marks can also be created by variations in the treatment of the topsoil and ground cover, for example the uneven application of fertilizers, pesticides and herbicides or damage.

Crop marks that delineate buried and levelled archaeological features are the effect of differential growth and ripening between the vegetation on the archaeological deposits and that on surrounding undisturbed ground. Variations in growth and ripening are most visible when there is a significant difference in the water and nutrient availability between the archaeological and natural deposits. Crop marks can form at any stage from germination to ripening but the optimal conditions are during periods when precipitation is exceeded by transpiration. This results in potential soil moisture deficit (SMD) and water-stressed plants (Jones and Evans 1975). Prolonged periods of SMD halt plant growth and then cause wilting of the plant leaves, stem and finally root. Water-stress is exacerbated by free-draining sub-surface deposits such as archaeological walls or road surfaces but mitigated by rich and humic ditch and pit deposits. Even after ripening, differences in crop height and bulk can indicate the presence of buried features where there are no tonal differences. Crop marks can be seen most clearly in large areas of homogenous, fast-growing plants such as cereal crops and, less frequently, in root crops and grass. Crop marks produced in arable and grass at times of significant moisture stress, usually over buried structures or other highly permeable archaeological deposits, are often referred to as parchmarks.

Soilmarks are the colour and tonal differences between archaeological deposits and the plough or subsoil. The action of ploughing, which can penetrate the ground to a depth of 45cm, brings to the surface previously

buried material. The rotation of the plough exposes the cut surface uppermost. Where the plough cuts buried and infilled archaeological features such as banks and ditches it brings to the surface slices of these deposits. If these slices are sufficiently differentiated from the natural plough or subsoil they can be visible from the air.

Archaeological earthworks that are visible on the ground can also be seen from the air. Detection and recording of earthworks from the air is determined by their survival and visibility. The survival of earthworks depends on past and present land use; natural erosion processes, deliberate destruction and ploughing can all reduce upstanding features to ground level. Earthworks can be revealed by the pattern of sunlight and shadow, differential frost or snow cover or the distribution of standing and flood water. Large and subtle variations in ground relief are further accentuated when viewed stereoscopically. Most stereo images are vertical photographs taken in long, regular sorties but stereo-overlapping can also be achieved from correctly set-up oblique views.

Appendix 2 Sources consulted

National Monuments Record

English Heritage, National Monuments Record Centre (NMRC), The Engine House, Fire Fly Avenue, Swindon, SN2 2EH. Enquiry reference no. AP 60505. The vertical air photographs listed below were consulted at the NMRC on the 3rd May 2011. This collection does not hold any specialist (oblique) or military oblique air photographs of the Survey Area.

Vertical air photographs

Sortie number	Frame number	Date	Scale 1:
RAF/CPE/UK/2555	4099	27-MAR-1948	10000
RAF/CPE/UK/2555	4100	27-MAR-1948	10000
RAF/540/813	5464	16-JUL-1952	5300
RAF/540/813	5465	16-JUL-1952	5300
RAF/540/813	5466	16-JUL-1952	5300
RAF/540/813	5055	16-JUL-1952	5000
RAF/540/813	5056	16-JUL-1952	5000
RAF/540/813	5057	16-JUL-1952	5000
RAF/540/813	5058	16-JUL-1952	5000
RAF/58/2695 F21	75	28-JAN-1959	18000
RAF/58/2695 F21	76	28-JAN-1959	18000
MAL/68075	12	24-NOV-1968	3000
MAL/68075	13	24-NOV-1968	3000
MAL/68075	18	24-NOV-1968	3000
MAL/68075	19	24-NOV-1968	3000
MAL/68075	20	24-NOV-1968	3000
MAL/71013	85	09-MAR-1971	3000
MAL/71013	86	09-MAR-1971	3000
MAL/71013	87	09-MAR-1971	3000
MAL/71013	95	09-MAR-1971	3000
MAL/71013	96	09-MAR-1971	3000
MAL/71013	97	09-MAR-1971	3000
MAL/71013	124	09-MAR-1971	3000
MAL/71013	125	09-MAR-1971	3000

MAL/71013	126	09-MAR-1971	3000
MAL/71013	127	09-MAR-1971	3000
MAL/71013	153	09-MAR-1971	3000
MAL/71014	90	09-MAR-1971	3000
MAL/71014	91	09-MAR-1971	3000
MAL/71014	93	09-MAR-1971	3000
MAL/71014	94	09-MAR-1971	3000
MAL/71014	95	09-MAR-1971	3000
MAL/71014	115	09-MAR-1971	3000
MAL/71014	116	09-MAR-1971	3000
MAL/71014	117	09-MAR-1971	3000
MAL/71014	118	09-MAR-1971	3000
MAL/71134	25	08-SEP-1971	12000
MAL/81032	188	02-AUG-1981	10000
OS/68277	23	12-AUG-1968	7000
OS/68277	24	12-AUG-1968	7000
OS/89342	27	04-JUL-1989	8400
OS/93284	40	01-AUG-1993	8000
OS/93284	41	01-AUG-1993	8000

Staffordshire Historic Environment Record (SHER)

Development Services Directorate, Riverway, Stafford, ST16 3TJ. The following vertical air photographs of the Survey Area were consulted on the 10th May 2011.

Vertical air photographs

Reference nos.	Date	Scale 1:
Hunting Surveys Ltd UK 6362 5991	09-JUN-1963	c. 10000
Hunting Surveys Ltd UK 6362 5992	09-JUN-1963	c. 10000

Staffordshire Record Office (SRO)

Eastgate Street, Stafford. ST16 2LZ. The following vertical air photographs of the Survey Area were consulted on the 10th May 2011.

Vertical air photographs (* - duplicate air photographs consulted at NMR)

Reference nos.	Date	Scale 1:
RAF/CPE/UK2555 4099*	27-MAR-1948	10000
RAF/CPE/UK2555 4100*	27-MAR-1948	10000
RAF/CPE/UK2555 4101	27-MAR-1948	10000
MAL/71134 25*	08-SEP-1971	12000
MAL/71134 26	08-SEP-1971	12000
MAL/71134 27	08-SEP-1971	12000
MAL/81032 187	02-AUG-1981	10000
MAL/81032 188*	02-AUG-1981	10000
GEONEX/92121 (RUN 38) 47	20-JUL-1992	10000
GEONEX/92121 (RUN 38) 48	20-JUL-1992	10000

Other imagery consulted

The following resource was consulted between 19th April 2011 and 23rd May 2011.

Resource	Link/Source	Date(s)
Google Earth	http://earth.google.com/	26 OCT 2003 31 DEC 2003 12 SEP 2005 02 NOV 2006 10 AUG 2007

Appendix 3 Catalogue of features (see Figs 2-4)

Ref.	Central NGR	Types	Periods	Description of features
AP A	SK0597 0662	DITCH	UNCERTAIN	A ditch of uncertain date is visible as a soilmark and cropmark on air photographs. It is aligned south-west to north-east between the A5 Watling Street and the railway line. It appears to underlie the extant field boundaries, which are probably of post medieval date. (1-2) 1 SHER HSL UK 6362 5992 09-JUN-1963 2 NMR RAF/CPE/UK2555 4099 27-MAR-1948
AP B	SK0602 0662	UNCERTAIN	POST MEDIEVAL	A disturbance of unknown cause but probable post medieval date is visible as cropmarks and earth-works on historic air photographs. It was located in the corner of a post medieval field unit, adjacent to Hanney Hay Road and covered approximately 0.16 hectares. (1-2) There are no visible surface indications of this disturbance on more recent air photographs. (3) 1 RAF/540/813 5056 2 NMR RAF/CPE/UK2555 4099 27-MAR-1948 3 Google Earth 10-AUG-2007
AP C	SK0622 0658	FIELD BOUNDARY	POST MEDIEVAL	A Y-shaped arrangement of post medieval field boundaries is visible on historic and recent air photo-graphs. The field boundaries survived as hedgerows until 1959 but had been levelled their remains were producing cropmarks by 1963. (1-2) 1 NMR RAF/CPE/UK2555 4099 27-MAR-1948 2 SHER HSL UK 6362 5992 09-JUN-1963
AP D	SK0632 0670	FIELD BOUNDARY	POST MEDIEVAL	Two parallel field boundaries of probable post medieval date are visible on air photographs. The eastern boundary was still extant in 1948. Both were visible as soilmarks on 1971 air photographs. The northern extent of these boundaries was probably truncated by the railway line. (1-2) 1 NMR RAF/CPE/UK2555 4099 27-MAR-1948 2 NMR MAL/71014 117 09-MAR-1971

Ref.	Central NGR	Types	Periods	Description of features
AP E	SK0653 0675	PLOUGH HEAD-LAND FIELD BOUNDARY	MEDIEVAL/POST MEDIEVAL	A possible levelled plough headland or field boundary of possible medieval or post medieval date is visible as a broad, pale toned soilmark on air photographs. (1) This feature may be a continuation of a similar linear recorded in **AP G**. 1 NMR RAF/CPE/UK2555 4099 27-MAR-1948
AP F	SK0636 0655	WATER CHAN-NEL FIELD BOUNDARY PA-LAEOCHANNEL	POST MEDIE-VAL UNCER-TAIN	A water channel and field boundary of probable post medieval date together with sections of sinuous palaeochannel are visible as earthworks on historic air photographs. The field boundary appears to have defined a parcel of land on the south-west side of Crane Brook. The water channel appears to intercut the palaeochannel and it may have been intended to straighten the course of the brook at this point. (1) These features appear to have been levelled on more recent air photographs. (2) The field boundary and water channel are depicted on the Ordnance Survey map of 1834. This map also indicates that a building stood on the north-east bank of the water channel and that the brook was split with a northern diversion cutting across the meandering water channel.(3) The 1884 Ordnance Survey map does not depict the field boundary, water channel or the building and at that time the brook ran in a single channel following the northern diversion. (4) Yate's map of 1775 appears to show the small field on the south-east side of the brook, other land this side of the brook is depicted as waste.(5) 1 NMR RAF/540/813 5056 16-JUL-1952 2 Google Earth 10-AUG-2007 3 1834 Ordnance Survey map 4 1884 Ordnance Survey map 5 Yate's map of 1775
AP G	SK0698 0671	PLOUGH HEAD-LAND FIELD BOUNDARY	MEDIEVAL/POST MEDIEVAL	A possible levelled plough headland or field boundary and a ditched field boundary are visible as soilmarks on historic air photographs. The putative plough headland may be a continuation of features recorded in **AP E**. (1) 1 NMR MAL/71013 124 09-MAR-1971

Ref.	Central NGR	Types	Periods	Description of features
AP H	SK0694 0660	DITCH	UNCERTAIN	A ditch of uncertain date is visible as a cropmark on historic air photographs. It appears to be slightly irregular and curving in form. (1) 1 NMR RAF/540/813 5058 16-JUL-1952
AP I	SK0568 0623	SAND PIT	POST MEDIEVAL	The remains of a post medieval sand pit are visible on historic air photographs (1). This extraction pit, which covered approximately 2.5 hectares, dates back to at least 1884. (2). The pit was relandscaped in the mid-20th century and now contains housing. (3) 1 NMR RAF/CPE/UK2555 4099 27-MAR-1948 2 1884 Ordnance Survey map 3 SHER HSL UK 6362 5992 09-JUN-1963
AP J	SK9308 3867	BANK	UNCERTAIN	Pale toned soilmarks are visible on historic air photographs. These tentative features are aligned near east to west and may be levelled banks. (1) 1 NMR MAL/71013 097 09-MAR-1971
AP K	SK0626 0612	CANAL, LOCK, CANAL BASIN CANAL POUND,	POST MEDIEVAL	A section of the Wyrley and Essington canal system is visible on air photographs. Construction of this canal began in late 18th century. The canal, locks, basin and pounds were still extant in 1948 but were gradually infilled and relandscaped on later air photographs. (1-2) 1 NMR RAF/CPE/UK2555 4099 27-MAR-1948 2 NMR MAL/71134 25 08-SEP-1971
AP L	SK0615 0591	QUARRY	20TH CENTURY	A long narrow quarry of likely 20th century date is visible on historic air photographs. The quarry activity appears to have been active in 1948 but is now overgrown. It covers approximately 0.3 hectares. (1) 1 NMR RAF/CPE/UK2555 4099 27-MAR-1948
AP M	SK0619 0644	UNCERTAIN	UNCERTAIN	A small bright mark is visible on 1971 air photographs. It contrasts distinctly with the surrounding soil but it is not certain that this mark was of archaeological origin and it may have been of superficial cause. It appears that the site of this soilmark was truncated by a cutting for Hanney Hay Road when it was widened between 1993 and 2003. (1) 1 NMR MAL/71013 096 09-MAR-1971

Ref.	Central NGR	Types	Periods	Description of features
AP N	SK0623 0645	curvilinear crop-mark (non-NMR Thesaurus term)	UNCERTAIN	Several different air photographs show curvilinear cropmarks at this location, which is immediately north- east of the area the hoard was recovered from. Although the form of these marks vary: a broad amorphous halo of faster ripening crop (see 1 and Fig. 3), a narrow ring of darker crop (see 2), or two partial circuits of lighter-toned crop (see 3), the consistency of their position suggests they are caused by the same underlying feature(s). Geophysical survey identified an anomaly that corresponds with the western side of the cropmarks (4). The geophysical anomaly was targeted by trial trenching and concluded to be an infilled ice-wedge (5). 1 NMR MAL/71013 96 09-MAR-1971 2 SHER HSL UK 6362 5992 09-JUN-1963 3 SRO Geonex/92121 (RUN 38) 48 20-JUL-1992 4 Burrows and Jones 2010. figs. 5 & 6 5 Burrows and Jones 2010. para 6.3.2
AP O	SK0631 0641	FIELD BOUNDARY	POST MEDIEVAL	A post medieval field boundary is visible on air photographs. The field boundary was extant on historic air photographs but had been removed by 1971, after which time it appeared as a soilmark or crop-mark. (1-2) 1 NMR RAF/540/813 5056 16-JUL-1952 2 NMR MAL/71013 97 09-MAR-1971
AP P	SK0643 0648	BANK	UNCERTAIN	A narrow line of parched crop is visible on a single set of air photographs. This feature ran parallel to and just to the south of the course of the Roman road. It is unlikely to be of archaeological origin and could have been caused by some superficial influence on the crop. The area of this feature was significantly truncated when the A5 was widened (sometime between 1971 and 1981). (1) 1 NMR RAF/540/813 5056 16-JUL-1952
AP Q	SK0654 0648	UNCERTAIN	UNCERTAIN	Cropmarks resembling a pair of rectilinear enclosures are visible on a single set of air photographs. It is unlikely that these features are of archaeological origin. (1) 1 NMR OS/68277 24 12-AUG-1968

Ref.	Central NGR	Types	Periods	Description of features
AP R	SK0704 0643	SAND PIT	20TH CENTURY	A sand pit is visible on air photographs. This extraction pit appears to be active in 1952. It was still active in 2007 and at that time covered approximately 2 hectares. (1-2) 1 NMR RAF/540/813 5058 16-JUL-1952 2 Google Earth 10-AUG-2007

Appendix 4 Structure and content of digital map dataset

The digital map data generated by this survey is arranged in a series of layers as follows

Layer name	Description
APBANK*	Archaeological bank outline
APBANKFILL	Archaeological bank hatch
APDITCH*	Archaeological ditch outline
APDITCHFILL	Archaeological ditch hatch
APEXTENT OF FEATURE*	Extent of vague or diffuse archaeological features
APNATURAL	Natural feature
APNATURALFILL	Natural feature hatch
APREF	Catalogue reference id.

Features in the layers marked with an asterix (*) above are also tagged with the following information

CATREF	Catalogue reference letter
TYPE	NMR Monument Type Thesaurus term
PERIOD	Period
LAYER	See above
APSOURCE1	NMR/SRO/SHER reference number of the source air photograph
APEVIDENCE1	Evidence (earthwork, soilmark, parchmark, cropmark) for feature on APSOURCE1
APSOURCE2	NMR/SRO/SHER reference number of the source air photograph
APEVIDENCE2	Evidence (earthwork, soilmark, parchmark, cropmark) for feature on APSOURCE2

This information can be accessed in AUTODESK products via the Property Pane.

References and resources cited

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Jones, R J A and Evans, R 1975. 'Soil and crop marks in the recognition of archaeological site by air photography' in Wilson, D (ed) *Aerial Reconnaissance for Archaeology*. CBA Research Report 12. 1-11

Christopher M. Welch, C M (ND). Early Post-medieval Staffordshire West Midlands Regional Research Framework for Archaeology, Seminar 6 via *www.iaa.bham.ac.uk/research/projects/wmrrfa/seminar6/Chris_ Welch.doc*

Digital resources

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'Townships: Hammerwich', *A History of the County of Stafford: Volume 14: Lichfield* (1990), pp. 258-273.

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'Ogbourn - Oldham', *A Topographical Dictionary of England* (1848), pp. 472-476. URL: http://www.british- history. ac.uk/report.aspx?compid=51192&strquery=ogley hay Date accessed: 23 May 2011.

Geology of Britain viewer (URL http://maps.bgs.ac.uk/geologyviewer_google/googleviewer.html) for geological information. Accessed 23/05/2011

Old-Maps (URL http://www.old-maps.co.uk) for the Ordnance Survey map of 1884. Accessed 19/04/2011 Soils-

capes Viewer (URL http://www.landis.org.uk/soilscapes/) for soils information. Accessed 23/05/2011
Staffordshire Past Track (URL http://www.staffspasttrack.org.uk/) for Yate's 1775 map. Accessed 23/05/2011

Vision of Britain (URL http://visionofbritain.org.uk/maps/index.jsp) for the Ordnance Survey Map of 1834. Accessed 26/05/2011 conservation event / decoration / object investigations etc.

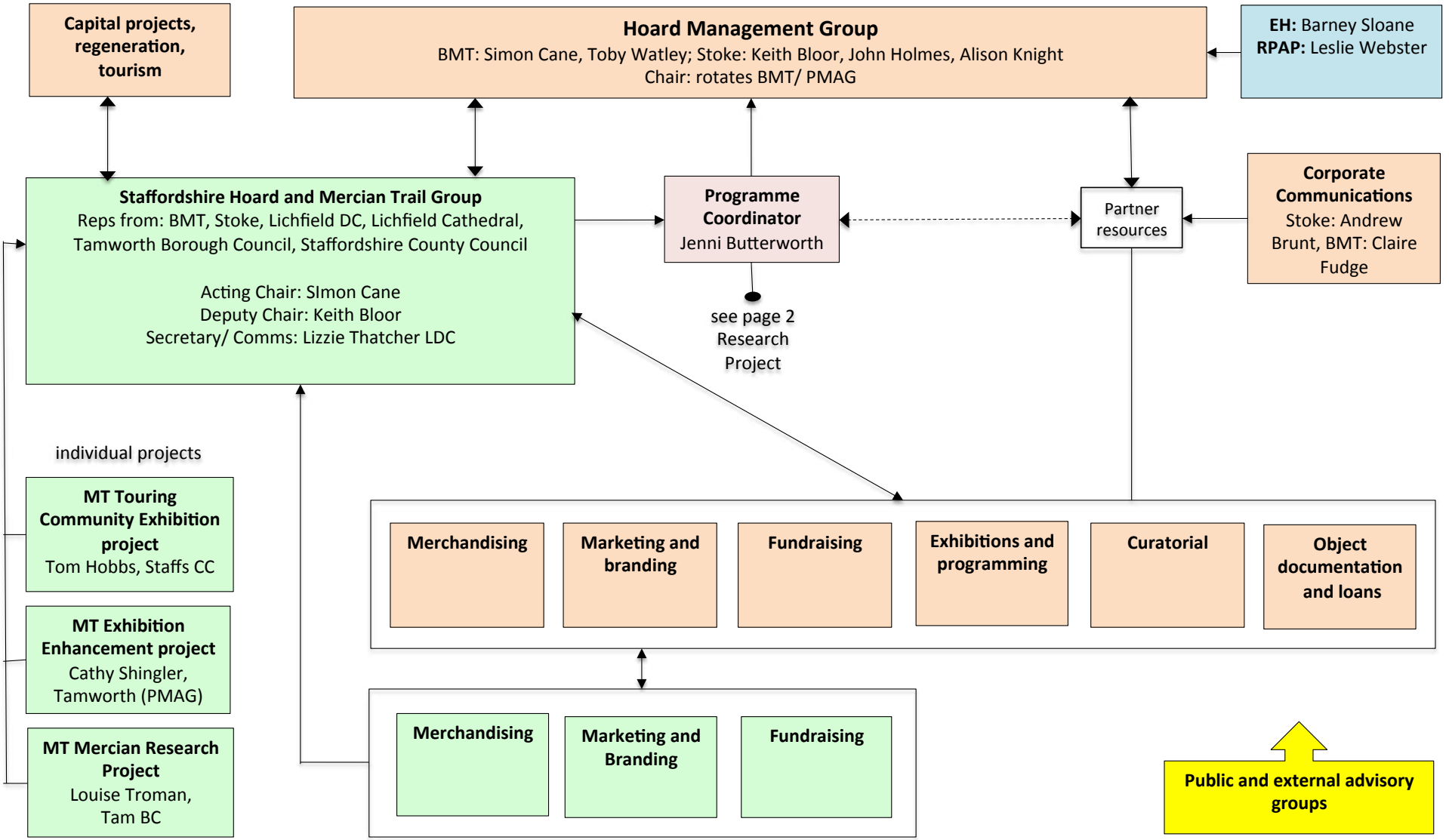
Appendix 4: The Staffordshire Hoard Programme

Programme Co-ordinator and Organisational chart

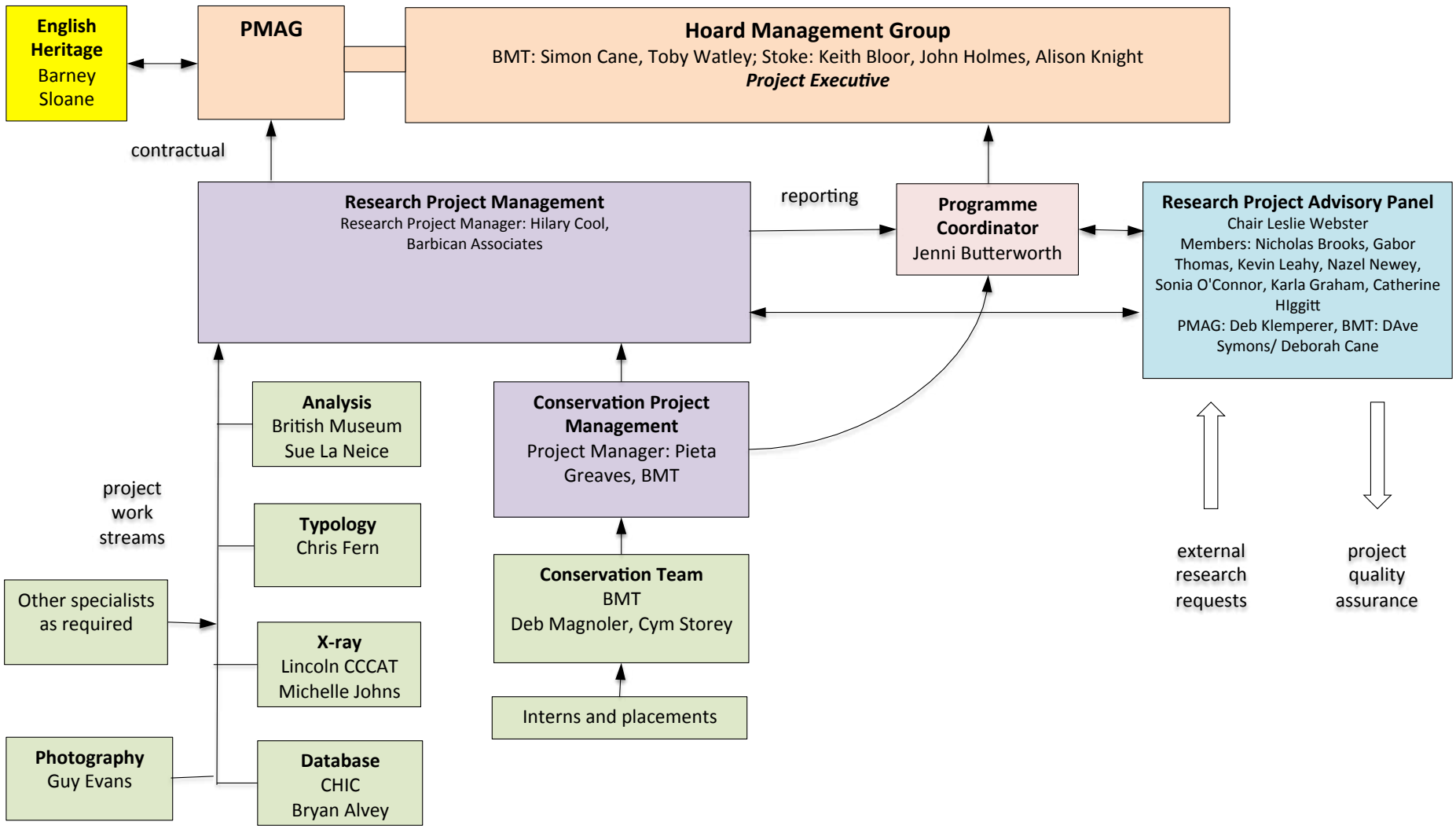
The Research Project sits within a wider Hoard programme and the Programme Co-ordinator is the link between the Project and the Programme. The role facilitates the research project by supporting and servicing the HMG (Project Executive) in informed decision-making. The Programme Coordinator takes an overview of programme activities and coordinates the reporting of those activities to deliver prioritized assessments accompanied by relevant recommendations and advice to the HMG. A schedule is maintained to assist in monitoring the work streams within the programme. It records targets, progress and key events for each work stream (in Gantt chart form), providing an assessment of active and proposed project activities in relation to each other. This enables the HMG to prioritise those streams which require action and assists in strategic decisions. This schedule may be extended to object movement level in future, but it does not currently include this information.

The organisational chart on the next two pages shows the scope of the Programme and the relationships between the different parts.

Staffordshire Hoard Organisational Chart/ OVERALL STRUCTURE



Staffordshire Hoard Organisational Chart/ RESEARCH PROJECT



Appendix 5: Protocols relating to Handling and Security

1. Requests for Loan for research of the Staffordshire Hoard.

1.1 Both ("the Borrower") and Birmingham Museum and Art Gallery "BMAG" and Potteries Museum and Art Gallery (PMAG), Stoke (the Joint Owners) agree to abide by these Conditions of Loan unless any modification is agreed between them in writing.

1.2 Loan item(s) will be subject to satisfactory condition assessment of the loan item(s) and approval of the Facilities Report. A pro-forma Facilities Report will be provided by the BMAG for prospective borrowers on behalf of the HMG.

1.3 The Joint Owners reserve the right to recall any loan item at any time provided that it will not do so except in the event of some compelling and unforeseen circumstance.

2. Expenses

2.1 The Joint Owners will be responsible for transporting the loan item(s) to the research laboratory and to provide couriers as necessary where such research has been initiated by the joint owners. Externally initiated research projects will bear the cost of transport and couriers. Where necessary the courier(s) will oversee all unpacking and all repacking.

3. Insurance

3.1 The Borrower will insure the loan item(s) on an all risks "nail to nail" basis in transit, in store, and whilst undergoing research at the valuations supplied by the Joint Owners in these Conditions. For research initiated by the Joint Owners, the Borrower will insure the items while on their premises. Such indemnity or commercial insurance shall include provision for

(i) In the case of loss or destruction of the loan item, payment of the agreed valuation.

(ii) In the case of damage to the loan item, a sum not exceeding the agreed valuation, representing the cost of reasonable repair and an amount equal to any reduction in the market value of the loan item after such repairs have been carried out.

3.2 A copy of the insurance policy must be forwarded to the BMAG and PMAG Loans Registrars in advance of the date of collection of the loan item(s).

3.3: Immunity from seizure should be applied for if applicable for international loans.

4. Transport and Packing

4.1 Our preferred UK packing and transport agents are OES, Constantine or Momart. In some instances transport may be undertaken by the BMAG vehicle, an Iveco Ford 7.5 t Truck. Loan item(s) travelling by road must be carried in a suitably equipped vehicle and accompanied by no fewer than two people at all times (these may be staff supplied by the Joint Owners). The vehicle must not be left unattended and overnight stops should be avoided - all transport should be direct delivery/collection between venues.

Where necessary, Travelling Case construction will be undertaken by either Kent Services or Ramplas Ltd of Dudley West Midlands on a hire basis. The Joint Owners will arrange for the cases to be ordered and for the works to be packed on site. All costs will be passed to the Borrower (please see additional information for costing), except where the research has been initiated by the Joint Owners. All other packing and shipping arrangements must be negotiated with the Registrars at least two months before the artefacts are required and be approved by the representatives of the Joint Owners responsible for Collection Care and Conservation.

4.2 Packing cases must travel in the position shown on the case and wherever possible aligned with the length of the case in the direction of travel.

4.3 Throughout the period of loan packing cases should be stored indoors under the same conditions as those agreed as acceptable for the loan item(s) during the research project. If this is not possible, at least twenty-four hours must be allowed for the packing materials to re-acclimatise to the specified RH and temperature levels before the items are repacked.

4.4 All packing materials will be retained for repacking and loan item(s) will be packed in the same manner as that originally employed.

4.5 The Borrower will return the loan item(s) on the date agreed in the research programme. The Borrower will notify the BMAG and PMAG Loans Registrars immediately in the event of any delay actual or anticipated.

5. Security

1.1 Security measures appropriate to the safe keeping of the loan item(s) will be in place at all times during the period of loan. Such provisions will include:

(i) The whole of the building must have an automatic fire detection system fitted by a NACOSS (National Approval Council for Security Systems) approved alarm company which is serviced annually and maintained in good working condition.

(ii) The intruder and fire detection systems must comply with European Union Standard 3 Regulations, and must be connected by monitored signalling to a commercial alarm-receiving centre

5.2 Security measures in regard of research and storage must be agreed with the Acquiring Partners representatives.

- Please see Hoard Conservation Security Protocol document attached.

6. Environmental Conditions

The Borrower will maintain a stable climate for the loan item(s) as follows:

6.1 Some Hoard artefacts may be light sensitive so appropriate lux levels should be agreed as part of the agreed research programme.

6.2 Relative humidity and temperature must be in the range 45-60% RH 20ºC ± 2ºC.

6.3 Borrowers will be required to present satisfactory evidence / records of the environmental performance of the proposed work areas prior to agreement of the loan.

6.4 UV levels will not exceed 75 microwatts/lumen.

6.5 It is at the discretion of the courier how long to wait before unpacking the loans to allow the loan item(s) to acclimatise. This may involve a wait of 24hours.

6.6 It is expected that air-conditioning systems and environmental control equipment will run twenty-four hours a day, seven days a week.

6.7: The courier will check RH and Temperature levels prior to departure.

7. Care of the Loan item(s)

- Please see Hoard Conservation Analysis Handling Policy document attached.

8. Photography and Reproduction

8.1 The loan item(s) must not be individually photographed, digitally captured filmed, televised or reproduced without prior consent of the Joint Owners although there is no objection to general views of ongoing work being taken for press and publicity purposes. All permitted photographs of the loan item(s) must be credited "Birmingham Museums & Art Gallery and The Potteries Museum and Art Gallery, Stoke-on-Trent".

9. Governing Law

This Agreement is governed and interpreted according to the law of England and Wales and each party submits to the exclusive jurisdiction of the English and Welsh courts for the resolution of any dispute.

Signed by…….

On behalf of ("the borrower")…..

Signed by ……

On behalf of HMG (Hoard Management Group)

11. Object details

Staffordshire Hoard: Valuations of artefacts to be researched

Object	Insurance value (£)

Loans Registrar Details:

Varshali Patel
Loans Registrar
Birmingham Museums and Art Gallery
Tel/Fax: 00 44 (0)121 303 3986
E-mail. Varshali_patel@birmingham.gov.uk

Samantha Richardson
Collections Registrar
The Potteries Museum & Art Gallery
t 01782 232323 f 01782 232500
e sam.richardson@stoke.gov.uk

Appendix 6 : The Final Publication

The final publication will be edited by Chris Fern, Chris Scull and Leslie Webster. Chris Fern, with the Project Manager, will take responsibility for ensuring that the texts of section 3 below form a coherent whole. Chris Scull and Leslie Webster will be the academic editors responsible for introductions, conclusion and assessing the different stories about the Hoard that have emerged during the research (see section **15.3**).

The final publication will be an integrated letterpress and digital publication with the bulk of the information freely available via the Hoard website and the Archaeological Data Service where it will be curated for the long term. It is anticipated that during the life of the project there will be interim releases of data. The outline below presents the topics that we will address.

The letterpress volume will be published by the Owners. Both Museums have marketing departments and shops, and can provide the infrastructure for this. The production of a popular publication is beyond the scope of this project but, as noted in **15.14iv**, it will be generating a considerable amount of copy that the Owners will be able to draw on to produce popular publications.

1 Introduction

1.1 Academic editors introduction

1.2 Acknowledgements to all the Stakeholders

2 The Beginning: Discovery, Recovery and fund raising; approaches to its study

2.1 Academic editors introduction

2.2 A brief scene setting of both 7th century more generally and what was known about the West Midlands at the period before July 2009.

2.3 The site - to include physical description of site (topography, geology, farming regime), chronological description (i.e. what do we know had happened in this area in the past from previous work).

2.4 The detectorist stage

2.5 The PAS phase and initial contacts with the establishment

2.6 The first excavation and survey phase

2.7 The Inquest and Treasure Phase.

2.8 Fund-raising and the intense local interest and the feeling of local ownership

2.9 The follow-up excavation and survey work

2.10 Post-ownership phase. A consideration of the demands placed on the owners by all the interest. A consideration of all the stakeholders and the Mercian Trail. An explanation of the exhibition programme and the need for exhibition standard conservation.

2.11 How the Research project was developed and what the underlying philosophy was.

2.12 Methodological approaches. The methodologies used / developed during the Research project will be detailed. These will include:

- Conservation protocols
- Database structure
- Cataloguing protocols
- Materials analysis methodologies
- Statistical analysis methodologies

3 The Hoard itself and its direct research outcomes

3.1 Academic editors introduction

3.2 Summary of the composition of the hoard including approaches taken to quantify it. Explanation in both letterpress and digital version of how to use the digital catalogue and database.

3.3 Consideration of the materials used and what we know of where they came from.

3.4 Consideration of the old typologies used and a full explanation of new typologies developed.

3.5 Description of the items by object type with associated commentary on *comparanda* etc, degree of wear and damage etc..

3.6 Survey of the craft practices exhibited by the pieces, how they were put together, how they were decorated etc..

3.7 Survey of the art styles used, motifs observed and how these fit into or disrupt currently accepted models of the development of interlace etc..

3.8 Consideration of the epigraphy.

3.9 Consideration of how the gold fineness data fits into or disrupts current model of how seventh century people valued gold.

3.10 Consideration of when the Hoard was most likely to have been deposited and the date range implied by its contents, and how this might help us to understand the motivation for its deposit, thus neatly taking us to the next major part of the publication.

4 The Hoard in it wider background

4.1 Academic editors introduction

4.2 A consideration of normal patterns of seventh century material culture use in both domestic and sepulchral contexts and how the Hoard stands in relationship to these. Does this help us understand the Hoard?

4.3 A survey of hoarding and deposition patterns in Britain and the Continent. How does the Hoard fit into these? Do they provide useful ways of understanding why it was deposited?

4.4 A consideration of what the Hoard might tell us about lordship and the elite at the time

4.5 A survey of the seventh century mindset, how Christianity was used by the elite and how this might

explain the context of the overtly Christian items within what otherwise is snapshot of a very militaristic, male society.

4.6 The Hoard in its modern context. What its reception tells us about changing attitudes to Treasure finds and what implications it has for the future.

5 Conclusions

5.1 What have we learnt that is new and where has the Hoard confirmed old beliefs? Do we know what the motivation for its deposition was?

5.2 What are the future avenues of research?

Appendix 7 Product Descriptions

Product Number: 1
Product Title: Project Management – general.
Purpose of Product: To oversee smooth running of project & report to stakeholders including EH.
Composition: Emails, telephone calls, phase to face meetings. Acting as secretary to RAP and producing minutes. Administering external research requests. Maintaining budget controls. Organising seminars and team meetings. Drafting two monthly reports for HMG / EH.
Derived from: This project design.
Allocated to: Hilary Cool.
Format and Presentation: Word documents for written reports.
Quality Criteria and Methods: Maintaining timetable outlined in section 16.
Person/Group responsible for Quality Assurance: Hilary Cool.
Person/Group responsible for Approval: Project Executive.
Planned Completion date: 31 : 5 : 14

Product Number: 2
Product Title: Project Management - Newsletter and Website.
Purpose of Product: Communication within team and with outside world..
Composition: Information collected from the different strands of the team and circulate it in the form of an email Newsletter once a month. To identify aspects of the developing work that will form useful additions to the website, draft copy and check it with team. Copy edit it and upload to web site.
Derived from: This project design and ongoing work during the life of the project.
Allocated to: Stephanie Rátkai and Val Kinsler with the aid of Hilary Cool.
Format and Presentation: Word, .pdf and HTML files
Quality Criteria and Methods: Feedback from team as to what aspects are useful; double check that there is sufficient information to produce reports noted in Product 1.
Person/Group responsible for Quality Assurance: Hilary Cool (project manager)
Person/Group responsible for Approval: Hilary Cool (project manager)
Planned Completion date: 31 : 3 : 14.

Product Number: 3
Product Title: Project Management: Up-dated project Design
Purpose of Product: To review the work of the first stage and re-focus as appropriate, and prepare a costed programme of work to be submitted to EH.
Composition: Information collected from work during the first year with assessment of potential.
Derived from: Products 4-23.
Allocated to: Hilary Cool.
Format and Presentation: Word and . pdf files.
Quality Criteria and Methods: Normal Assessment criteria.
Person/Group responsible for Quality Assurance: RAP / EH.
Person/Group responsible for Approval: RAP / EH.
Planned Completion date: 31 : 5 : 14.

Product Number: 4
Product Title: Database & web development
Purpose of Product: To provide the web-based database to store and analyse the data collected during the project.
Composition: Database as fully scoped in Appendix 2.
Derived from: Appendix 2 of this document.

Allocated to: Bryan Alvey.
Format and Presentation: Web-based database as described in section 15.4 of this document.
Quality Criteria and Methods: See 15.4 also discussions with relevant team members.
Person/Group responsible for Quality Assurance: Bryan Alvey.
Person/Group responsible for Approval: Hilary Cool (project manager).
Planned Completion date: 31 : 5 : 13.

Product Number: 5
Product Title: Database Training.
Purpose of Product: To train team members to use the database.
Composition: A hands-on training session lead by Bryan Alvey.
Derived from: Product 6.
Allocated to: Bryan Alvey and core team.
Format and Presentation: Question and answer session, database documentation.
Quality Criteria and Methods: The team learns how to use the database.
Person/Group responsible for Quality Assurance: Bryan Alvey / Hilary Cool.
Person/Group responsible for Approval: Hilary Cool (project manager).
Planned Completion date: 30 : 6 : 13.

Product Number: 6
Product Title: Database Support.
Purpose of Product: To support the team, provide additional training to high end core team members, develop additional report facilities as the research progresses.
Composition: Training, new report facilities on the database.
Derived from: Product 4 and 5.
Allocated to: Bryan Alvey.
Format and Presentation: To prepare costing for new report facilities etc needed in 2nd stage.
Quality Criteria and Methods: The team can acquire the information in the database in a format they can analyse.
Person/Group responsible for Quality Assurance: Bryan Alvey / Hilary Cool.
Person/Group responsible for Approval: Hilary Cool (project manager).
Planned Completion date: 31 : 3 : 14.

Product Number: 7
Product Title: Aerial Photographs.
Purpose of Product: To complete the Air Photograph Assessment at Cambridge .
Composition: Up-dated assessment.
Derived from: Appendix 3 here
Allocated to: Alison Deegan.
Format and Presentation: Word files and and .jpeg / .tiff files.
Quality Criteria and Methods: Normal Assessment standards.
Person/Group responsible for Quality Assurance: Hilary Cool.
Person/Group responsible for Approval: Hilary Cool (project manager)
Planned Completion date: 31 : 3 : 13.

Product Number: 8
Product Title: X-radiograph planning meetings.
Purpose of Product: To establish joint standards between Lincoln and BM and select the most appropriate grouping for transport to Lincoln.
Composition: Face to face meetings with notes taken.
Derived from: This document.
Allocated to: BMAG Conservators / BM strand leaders / Lincoln X-radiography Team.

Format and Presentation: A Word document itemising the protocols
Quality Criteria and Methods: Fulfilling the detailed methodology set out in **15.6**..
Person/Group responsible for Quality Assurance: Hilary Cool.
Person/Group responsible for Approval: Hilary Cool (project manager).
Planned Completion date: 31:3:12.

Product Number: 9
Product Title: X-radiography at Lincoln.
Purpose of Product: To produce a full X-radiographic record.
Composition: All the items excluding the impressed foils (see methodology 15.7)
Derived from: Product 11.
Allocated to: Lincoln X-radiographic team and Bradford University.
Format and Presentation: 2 sets of X-radiographic plates as hard copy and digitised versions for web site.
Quality Criteria and Methods: See **15.6.**
Person/Group responsible for Quality Assurance: Rob White / Michelle Brown
Person/Group responsible for Approval: Hilary Cool (project manager)
Planned Completion date: 31 : 12 : 13.

Product Number: 10
Product Title: Impressed foils. First Stage.
Purpose of Product: To assess the potential of the pressed foils for joining and grouping.
Composition: X-radiography, Materials analysis, joining of fragments. Investigative conservation as appropriate.
Derived from: Ongoing BM / BMAJ work
Allocated to: BM foil conservator (to be appointed).
Format and Presentation: Grouped foils with brief report in Word for Project manager.
Quality Criteria and Methods: see **15.7ii.**
Person/Group responsible for Quality Assurance: Marilyn Hockey / Fleur Shearman.
Person/Group responsible for Approval: Hilary Cool (project manager).
Planned Completion date: 31:3:13.

Product Number: 11
Product Title: Material analysis First stage pilots.
Purpose of Product: To establish the most useful avenues of material analysis.
Composition: Metal analyses brief report in Word for Project manager to allow focussing of direction for second stage.
Derived from: Ongoing BM /BMAG work and this document.
Allocated to: BM metal specialist (to be appointed).
Format and Presentation: Analytical results and Word report.
Quality Criteria and Methods: see **15.8iii.**
Person/Group responsible for Quality Assurance: Duncan Hook, Susan la Niece.
Person/Group responsible for Approval: Hilary Cool (project manager).
Planned Completion date: 31:3: 2013.

Product Number: 12
Product Title: Impressed foils. Second Stage.
Purpose of Product: To build on first stage work prioritising where appropriate.
Composition: X-radiography, Materials analysis, joining of fragments. Investigative conservation as appropriate.
Derived from: Product 10.
Allocated to: BM foil conservator (to be appointed).
Format and Presentation: Grouped foils with final report in Word for final publication.
Quality Criteria and Methods: see **15.7ii**.

Person/Group responsible for Quality Assurance: Marilyn Hockey / Fleur Shearman.
Person/Group responsible for Approval: Hilary Cool (project manager).
Planned Completion date: 31:10:13.

Product Number: 13
Product Title: Material analysis Second Stage.
Purpose of Product: To build on the first stage results and focus resources on the most useful avenues.
Composition: Metal analyses, especially of gold for the gold value strand. with final report in Word for final publication.
Derived from: Product 12.
Allocated to: BM metal specialist (to be appointed).
Format and Presentation: Analytical results and Word report.
Quality Criteria and Methods: see **15.8iv.**
Person/Group responsible for Quality Assurance: Duncan Hook, Susan la Niece.
Person/Group responsible for Approval: Hilary Cool (project manager).
Planned Completion date: 31:10: 2013.

Product Number: 14
Product Title: Technology, construction and inlays
Purpose of Product: To explore working practices, identify materials etc.
Composition: Materials analysis, investigative and exhibition standard conservation as appropriate. Case studies for final publication.
Derived from: Ongoing work BM /BMAG work.
Allocated to: full BM team and BMAG conservators
Format and Presentation: Conserved items, case studies in Word documents with appropriate illustrations for final publication
Quality Criteria and Methods: See **15.8v.**
Person/Group responsible for Quality Assurance: Susan La Niece
Person/Group responsible for Approval: Hilary Cool (project manager)
Planned Completion date: 31:11:13.

Product Number: 15
Product Title: Cataloguing, typology First stage.
Purpose of Product: To conduct an assessment of the whole Hoard other than the impressed foils.
Composition: Basic catalogue entries and assessment of typology.
Derived from: This document.
Allocated to: Chris Fern , photographer
Format and Presentation: Web database catalogue entries, digital photographs.
Quality Criteria and Methods: Normal cataloguing protocols, see **15.9ii-iii**.
Person/Group responsible for Quality Assurance: Hilary Cool.
Person/Group responsible for Approval: Hilary Cool (project manager)
Planned Completion date:31 : 3 : 13.

Product Number: 16
Product Title: Cloisonné pilot project
Purpose of Product: To assess the best way to record the garnets and foils.
Composition: Draft cell-shape and foil typology, brief report and sampling methodology.
Derived from: This document and images already taken by BMAG conservators and taken as part of Product 15.
Allocated to: Hilary Cool , Mike Baxter.
Format and Presentation: Digital Photographs Word documents, records in database.
Quality Criteria and Methods: See **15.9iv**.

Person/Group responsible for Quality Assurance: Hilary Cool / Chris Fern.
Person/Group responsible for Approval: Hilary Cool (project manager).
Planned Completion date: 31:9:13.

Product Number: 17
Product Title: Investigative conservation.
Purpose of Product: To aid the typological team in cataloguing..
Composition: Cleaned and documented items.
Derived from: Product 15.
Allocated to: BMAG conservation team.
Format and Presentation: Up-dated records in database.
Quality Criteria and Methods: See **15.7**.
Person/Group responsible for Quality Assurance: Deborah Cane.
Person/Group responsible for Approval: Hilary Cool (project manager)
Planned Completion date: 12:12::13.

Product Number: 18
Product Title: PMAG admin support
Purpose of Product: To conduct necessary conditions checks, act as liaison and start archiving associated documentation..
Composition: Updated condition checks. Admin assistance to team and museum.
Derived from: Ongoing work at PMAG and this document.
Allocated to: Sam Richardson.
Format and Presentation: Up-dated object documentation in PMAG system.
Quality Criteria and Methods: see **15.14i.**
Person/Group responsible for Quality Assurance: Hilary Cool.
Person/Group responsible for Approval: Hilary Cool (project manager).
Planned Completion date: 30:5:14.

Product Number: 19
Product Title: Art Style Study.
Purpose of Product: To provide input into 2nd Stage project design
Composition: Assessment of objects. .
Derived from: Product 15, 16.,
Allocated to: George Speake in association with Chris Fern
Format and Presentation: Word documents, / email to project manager and input into third team meeting.
Quality Criteria and Methods: As for Speake 1980.
Person/Group responsible for Quality Assurance: George Speake / Chris Fern.
Person/Group responsible for Approval: Hilary Cool (project manager).
Planned Completion date: 31:3:14.

Product Number: 20
Product Title: Gold Value study.
Purpose of Product: To conduct preparatory work for second stage work which will evaluate current theories of how gold was valued in the 7th century in light of the hoard data.
Composition: Meetings with teams producing gold composition data.
Derived from: Product 12, 13, 17 and past publications (Hines 2011 etc).
Allocated to: John Hines.
Format and Presentation: Word documents, / email to project manager and input into third team meeting.

Quality Criteria and Methods: Normal Academic, see **15.11iii**.
Person/Group responsible for Quality Assurance: John Hines.
Person/Group responsible for Approval: Hilary Cool (project manager).
Planned Completion date: 31:3:14.

Product Number: 21
Product Title: First Team meeting.
Purpose of Product: To introduce different team members to each other and discuss progress.
Composition: A one day meeting.
Derived from: This document and work to date.
Allocated to: Core Team. Editors
Format and Presentation: Brief presentations of what everyone is doing, introduction from Project Manager.
Quality Criteria and Methods: People get to know each other and discuss project.
Person/Group responsible for Quality Assurance: Hilary Cool.
Person/Group responsible for Approval: Hilary Cool (project manager).
Planned Completion date: 31:10:13.

Product Number: 22
Product Title: Second team meeting.
Purpose of Product: To assess progress after first year; start to decide priorities for second stage.
Composition: One day meeting.
Derived from: Work to date
Allocated to: Core Team. Editors, Invited contributors.
Format and Presentation: Brief presentations by team members. Discussion of 1st year review.
Quality Criteria and Methods: Revised (if necessary) plan for rest of first stage.
Person/Group responsible for Quality Assurance: Hilary Cool..
Person/Group responsible for Approval: Hilary Cool (project manager).
Planned Completion date: 30:5:13.

Product Number: 23
Product Title: Third team meeting.
Purpose of Product: To assess progress, consider draft project design and decide on priorities for second stage.
Composition: One day meeting.
Derived from: Work to date.
Allocated to: Core Team. Editors, Invited contributors.
Format and Presentation: Brief presentations by team members. Discussion draft up-dated project design.
Quality Criteria and Methods: Production of useful second stage within known budget.
Person/Group responsible for Quality Assurance: Hilary Cool.
Person/Group responsible for Approval: Hilary Cool (project manager).
Planned Completion date: 30:5:14.

Product Number: 24
Product Title: Grouping Exercise planning
Purpose of Product: To provide coherent groupings for the laying out of the pieces to aid the grouping of the pieces into confirmed object groupings.
Composition: Ordering of material into suitable table top groups containing pieces that it is suspected come from the same items.
Derived from: 15
Allocated to: Chris Fern
Format and Presentation: Word documents and, lists and sketch plans.
Quality Criteria and Methods: Production of groups that enable rapid laying out and which facilitate the

making of joins.
Person/Group responsible for Quality Assurance: Hilary Cool.
Person/Group responsible for Approval: Hilary Cool (project manager).
Planned Completion date: 31:1:2014

Product Number: 25
Product Title: Grouping Exercise
Purpose of Product: To confirm suspected joins etc and group the pieces into item groups – both joining and pieces from the same suite of fittings.
Composition: Two week intensive laying out of all objects and organising fragments into items.
Derived from: 24
Allocated to: Chris Fern, Assistant. Museum personnel.
Format and Presentation: Up-dated database entries, digital photographs.
Quality Criteria and Methods: Production of definitive list of what the Hoard consists of.
Person/Group responsible for Quality Assurance: Chris Fern.
Person/Group responsible for Approval: Hilary Cool (project manager).
Planned Completion date: 28:2:2014.

Appendix 8: Risk Log

Risk Number: 1
Description: The Department of Conservation and Scientific Research at the British Museum will move premises late in 2013. We have a window of opportunity of having the two posts working there for 15 months and completing the timetabled work before this happens. If there are delays in Stoke-on-Trent commissioning the project with the BM, we will get less work done. There would be problems in redirecting the analysis to other laboratories because of the security protocols that surround the pieces. These are not a problem to a laboratory in a national museum, they are to one in a university.
Probability: Moderate
Impact: High
Countermeasures: EH and the Owners are urged to take note of this.
Estimated time/cost: There would be no extra monetary cost. If we had to wait for the Department to be able to do the work after the move, a delay of a year or more to the project. Moving the sort of machinery would be using is not straightforward and various tests would need to be completed before the laboratories were fully functioning again.
Owner: Hilary Cool
Outcome: The work was commissioned in time. Risk Log closed.
Date this entry last updated: 26th April, 2013.

Risk Number: 2
Description: Much of the work in this project is being done by external specialists managed via Barbican Research Associates. Until we are commissioned and a mutually agreed contract signed, the project cannot make much progress as we will not commission our specialists to do any work**.** Despite repeated requests over the past six months that discussions take place about the practicalities of the procurement, no meetings have taken place. We have been promised that progress will be made, but until we have seen the contracts we cannot commit ourselves to involvement in this project, especially in the light of all the problems that have existed over the past 15 months.
Probability: Moderate
Impact: High
Countermeasures: EH and the Owners are urged to take note of this. Barbican will manage the project on a care and maintenance basis for 6 weeks after EH signs the contract with Stoke-on-Trent. If at the end of that period there is no satisfactory outcome, the project manager will withdraw from the project until a mutually agreed contract is in place together with appropriate funds.
Estimated time/cost: Considerable delay. The cost is unquantifiable.
Owner: Hilary Cool
Outcome: The work was commissioned in time. Risk Log closed.
Date this entry last updated: 26th April, 2013.

Risk Number: 3
Description: The proposed methodology of using high resolution images and X-radiographs to aid the cataloguing may not prove successful, and Chris Fern may need to visit PMAG more frequently than planned. There may also be issues over the speed with which the images can be produced.
Probability: Moderate.
Impact: Moderate
Countermeasures: The progress of the methodology will be closely monitored and if necessary additional visits will be planned. The progress of the photography will be re-assessed after one month.
Estimated time/cost: It might be possible to re-allocate some of the £20,000 allowed for photography as part of this task to travel and subsistence. If the number of visits needed to be doubled this would cost an additional £3000.
Owner: Chris Fern**,** Hilary Cool

Outcome: The planned methodology did not work for various reasons including the fact that photographs could not be used in many cases for the first nine months of the project because so many of the items were dirty. This resulted in less uasable photographs than had been hoped. The problem was solved in part by transferring some money from one task to CF's travel budget (See Highlight Report 2 section). It was also aided by Lincoln providing space for CF to work on the items that were there for X-radiography, thus reducing the amount of time and money that had to be spent travelling. It also had the happy outcome that CF and the Lincoln team were able to liaise closely. The additional resources that came as a result of Variation for the conservation also included additional trips for CF to liaise with the conservators and this too allowed him to have more time to catalogue the items directly. It is now possible to close this Risk Log.
Date this entry last updated: 16th March, 2012

Risk Number: 4
Description: In November 2012 the field in which the Hoard was found was the subject of a systematic metal-detecting and field-walking surface survey following the ploughing of the field for the first time since the discovery of the original Hoard (Palmer 2013). During this work 86 additional items were recovered that were declared Treasure as well as three items of gilded copper alloy that were not despite being of the same date as the Hoard. At the time of writing this document it is not known whether the Owners will or will not be able to acquire both the Treasure and non-Treasure items. For this reason, though the hope is that they will be acquired and ultimately absorbed into the Research project alongside the original items, no allowance for work on the pieces has been costed in this document.

The material can be divided into fragments likely to belong to helmet foils, edging strips etc. (27 pieces) and other items of the type that Chris Fern has been preparing the catalogue of during Stage 1 (62 pieces). If the owners acquire the pieces this latter group will need to be cleaned and catalogued to the same level as the rest of the pieces by the proposed grouping exercise. The pieces have already been X-radiographed at Lincoln and so no further X-radiography will be required at this stage. Pieta Greaves has informed me that the conservators at BMAG will be able to complete the cleaning within this financial year and so that aspect of the work will not require additional resources. Additional resources would be needed to pay for the necessary work by Chris Fern. It would be proposed to defer photography of them until Stage 2. .
Probability: High
Impact: Moderate
Countermeasures: The possible / likely cost has been included as a Risk Log solely because at this point it is not possible to include it in the budget, though it can be anticipated that a Variation will be needed. We anticipate two three day trips will be needed, one to BMAG and one to PMAG as it is likely that the new items will be divided initially between the two venues so that the public can see them. both lasting two days
Estimated time/cost: No delay to the project. Additional cost of c. £2350.
Owner: Hilary Cool
Outcome The Owners acquired the items, the cost have been included in this revised Project Design. Risk Log closed.
Date this entry last updated: 4th June 2013.

Risk Number: 5
Description: During the first year of the project the conservation team had access to £50,000 of materials analysis support at the BM in case unusual materials needed identification (see **15.8v**). The income stream for this is now finished so if additional items that need specialist identification are recovered, other sources of funding will be needed. The likelihood of finding such an items is progressively declining as more items are cleaned. In some cases the identification of the material could wait until the second stage of the project. In other cases such as textile, a fragment of which was found earlier this year, it would be advisable to have such specialist input immediately in case of deterioration
Probability: Moderate
Impact: Moderate
Countermeasures: Commission specialist input from the BM if possible, or other specialists if the Depart-

ment is unavailable – see Risk Log 1.
Estimated time/cost: c. £2000 for five days of specialist advice.
Owner: Pieta Greaves
Date this entry last updated: 24th June, 2013.

Risk Number 6
Description: The Grouping exercise (Product 25- see 15.15) will require all of the pieces to be collected in one venue. Currently the owners have decided that the venue will be BMAG, but detailed planning has yet to start. It can be anticipated that the Hoard pieces will be scattered in four venues (Birmingham, Stoke, Tamworth and Lichfield). The transport costs have not been included in the budget because currently there are too many unknowns relating to the venue, precisely which pieces will be where, the availability of the BMAG van etc. It is likely that additional resources will be needed to pay for professional couriers for at least some of the trips.
Probability: High
Impact: High
Countermeasures: Retain couriers for transport from exhibition venues and back to the at the end.
Estimated time/cost: c. £5000.
Owner: Hilary Cool
Date this entry last updated: 4th June, 2013.