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Making the Dead Visible: Problems and solutions for "big" picture approaches to the past, and dealing with large "mortuary" datasets

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Please find corrected remaining references which appear within the text and were previously missing from the Bibliography (picked up by Reviewer 2).

1. Bradley & Schulting 2013 and Wysocki et al. 2013 have been added to the reference list.

2. Reviewer 2 listed Baker 2012 and Rogers 2013 as being cited in the text, but missing from the reference list. We have, however, not cited these references within the text.

3. The reference to Parker Pearson et al. in prep has now been removed.

Making the Dead Visible: Problems and solutions for "big" picture approaches to the past, and dealing with large "mortuary" datasets

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Abstract

There can be few 'bigger' questions than the nature and development of human experience and self-awareness, and few better ways to study it than through the changing treatment of the dead over time. Funded by the John Templeton Foundation the 'Invisible Dead' project (Durham University) is exploring diachronic changes in mortuary practices across two regions; Britain and the Levant. In doing so, it uses archaeology as a way to approach fundamental questions about the human condition. This paper explores the principal difficulties faced during the construction of a database for this project and their wider relevance for the development of robust and successful methods for the study of large "mortuary" datasets in the future. It discusses the issues and biases identified within the mortuary record and how the project has sought to mitigate some of these. By adopting a flexible and ultimately expandable approach to data entry and analysis, value can be added to legacy datasets and "grey" literature, allowing us to make comparisons between regions which are both geographically and chronologically distinct.

Keywords

Mortuary Archaeology; Death and Disposal; Database Management; Bioarchaeology; Britain; Levant

Introduction

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Formal disposal of the dead is widely practised today and this is often assumed to have been the case in the past. For some periods, however, so few burials are encountered that it appears to have been the exception rather than the rule. Universal formalised burial may not have been a widespread expectation among communities of the prehistoric and early historic periods, and its adoption in more recent centuries may have fundamental implications for changing attitudes to death and the body, and perhaps to issues of individual identity. Funded by the John Templeton Foundation, the 'Invisible Dead' project (Durham University) is exploring these issues by examining diachronic changes in mortuary practices from the Neolithic until the end of the Roman Period (c. 4,500/4000 BC-AD 400)[1] across two regions (Britain and the Levant[2]).

The project is using archaeological evidence to explore how mortality impacts upon human understanding and what prehistoric and early historic burials can tell us about ourselves. At a more specific level we are seeking to examine a number of 'big-picture' questions:

- What can the disposal of the dead (and its frequent invisibility in the past, perhaps indicating an absence of formal behaviour) tell us about human self-awareness in diachronic perspective?
- What light do past practices throw upon contemporary Western attitudes to death and the current preoccupation with commemoration of the dead and its materialization?
- Do varying burial practices reveal fundamental changes in human belief and cognition?
- What does burial (or its absence) tell us about the human sense of alterity ("otherness") and of afterlife beliefs?

The importance of laying this archaeological foundation for an ongoing interdisciplinary approach to the major questions of human self-reflection, occasioned by death and the challenge of the corpse, can hardly be exaggerated. Death is, after all, a part of life. This paper examines the challenges faced when dealing with large "mortuary" datasets and some of the solutions proposed by the 'Invisible Dead' Project, which may help us to answer major questions concerning belief, mortality and the human past in the future.

Research Background

The decades spanning the transition from the twentieth to the twenty-first century have witnessed a dramatic growth in what have, generically, been called death studies. From anthropology and

[1] The Neolithic begins much later in Britain than the Levant (i.e. c. 4000 BC rather than c.10, 000 BC in the latter). Data analysis for both areas start at c. 4500/4000 BC. Thus the periods covered by the project start in the Neolithic (c. 4000 BC) for Britain and the Late Chalcolithic (c. 4500 BC) for the Levant.

[2] The area (Levant) covered by the project includes Israel, Palestinian Territories, Jordan, Lebanon and Syria westwards from the Euphrates Valley

sociology, through classics, literature, art, music, philosophy, theology and ethics, to politics, biology and medicine, issues of death and dying have assumed a heightened profile [e.g. http://www.bath.ac.uk/cdas/; https://www.dur.ac.uk/cdals/; for further examples see Davies and Park (2012) and the interdisciplinary journal *Mortality*, published by the Association for the Study of Death and Society (http://www.deathandsociety.org/)]. Yet, the potential of the *archaeological* record of human burial, viewed in a diachronic perspective, to provide evidence of long-term trends and changes in belief, has not hitherto been systematically addressed. Awareness of death and formalized treatment of the corpse are deeply rooted in human antiquity (Davies 2002): chimpanzees have been recorded as mourning their dead and engaging in grooming and similar activities before abandoning the corpse (Pettitt 2011, 22-35). The earliest known formalized human burials, from the Skhul cave in Israel, date to between 130,000 and 100,000 BP (*ibid*. 59). These do not, however, mark the beginning of an unbroken normative practice of human burial, but belong rather within the context of a diversity of burial treatments, including defleshing and funerary caching (the disposal of bodies in specified natural locations), that have continued down to recent times. Moreover, the term "dead" as opposed to "living" carries with it specific connotations and meanings; at what point an individual can be classified as "dead" is culturally and contextually specific (e.g. Bloch 1988; Croucher 2012: 9-11; Hertz 1960: 28; Kastenbaum 2003; Parry 1982: 79). Having said this, the symbolic power of the human corpse means that disposal and treatment of the dead can provide unique insight into changing concepts of self, identity and the afterlife.

This diversity of human mortuary treatments can also be illustrated through the evidence of ethnography. Sources such as the *Human Relations Area Files* reveal that the majority of recent societies (unlike, perhaps, those of the distant past) dispose of their dead through a formalized practice of cremation or inhumation [and see Bryant and Peck, 2009 and Davies and Mates 2005, for further discussion and examples]. This is supported by individual ethnographies. Among nomadic hunter-gatherers, for example, a common tradition is to bury or cover the corpse and then move away from the death zone to a new campsite (e.g. Woodburn 1982). This avoidance of the dead is analogous to modern practices in which burials are placed in defined locations within or beyond the boundaries of settlements e.g. parish church cemeteries in England. Looking back across the human past with an archaeological perspective we would perhaps, therefore, expect to find numerous cemeteries or smaller burial plots around the edges of prehistoric farmsteads and settlements. This is very far from the case and two features of the early funerary record – the invisibility of the majority of the dead, and variable and symbolic manipulations of human bodies and body parts – demand detailed and concurrent attention. It is already widely recognized that in western Eurasia, the documented record of human burial from the beginnings of farming to the Roman period can represent only a fraction of those who must once have lived, despite, in the case of the Levant, a corpus of textual evidence that

seems to stress the importance of a "proper" burial (e.g. Davies 1999: 55, 64-5; Lundström 2013: 169). Furthermore, for lengthy periods of the prehistoric past and into historical periods, human remains are encountered in unusual contexts that are not typically funerary in character. Researchers are increasingly recognising the complexity of bodily treatments, both pre and post-mortem, and their links to personhood, identity, and the relationship between the dead and the living (e.g. Robb and Harris 2013). Different treatments of the dead also potentially betoken different beliefs about mortality and immortality, and the convergence on individual inhumation in western Eurasia in the early centuries AD may have been partly shaped by the rise of personal religions such Christianity (e.g. Rebillard 2009: 82-3). By the same token, previous practices, involving diverse treatments of often only a fraction of the dead [e.g. skull removal and post-mortem manipulation during the Pre-Pottery Neolithic of the Near East (Croucher 2012: 40-2), or the integration of human remains into Iron Age domestic contexts in Atlantic Scotland (Armit and Ginn 2007: 129)], indicate alternative understandings of the significance and persistence of personal identity, and differences in the structure of beliefs in which these are encapsulated.

Despite very different paths of development, by the 4th century AD, burial in Britain and the Levant included a significant number of examples sharing a range of features that were to become characteristic of Christian (and in due course Islamic) burials in the early Medieval period (e.g. Ibrahim and Gordon 1987; Petersen 2012; Petts 1998). Specifically, these features included the individual inhumation of intact burials, placed in an extended position in pits, at selected locations, and with minimal grave goods. One might assume that complexity of the disposal of the dead correlates with the complexity of the society concerned, but this is not necessarily the case. Both Christian and Islamic doctrines traditionally recommend fairly simple disposal (e.g. Petersen 2012; Green 1977), far simpler than during earlier periods in the regions. But has the widespread adoption of these two religions created a disproportionate emphasis on such practices, shaping current notions of 'normal' practice, or can their adoption be seen as part of a wider pattern, a more general shift towards simple, individual inhumations? A long-term and geographically broad perspective is essential if major trends are to be identified that transcend the confines of an individual site, locality, phase or period. Developing beliefs about the person and the afterlife may be expected to have gone hand in hand with social, economic and cultural change, and to have found expression in funerary behaviour. The emergence of distinct categories of "person" in the burial record (as indicated by grave furnishings or body treatment) marks changing attitudes to death and the person, as does the eventual trend towards more generalized burial and the rise of the cemetery (e.g. Saxe 1970). A full awareness of contemporary shifts from burial to cremation in increasing numbers of developed societies in the later twentieth century, as well as of the emergence of ecological-natural burial in Britain as the twenty-first century begins, adds its own insight to our interpretation of these cultural

dynamics of change (Davies and Rumble 2012). Showing how these traditions evolved through time may help us to better appreciate how far key elements of modern behaviour and belief can be traced back into the past, and at what point evidence for different aspects of identity first become visible in the archaeological record.

Selecting the sample regions and currently available data

The nature of the project's aims and objectives made it appropriate to select sample regions with separate and contrasting developmental trajectories and research traditions, to provide a range of characteristics offering a good balance between points of difference and aspects that were more readily comparable (see Table 1).

Insert Table 1 here

In neither region is data currently available that would allow researchers to readily quantify the evidence for the number of individuals deposited in archaeological contexts for the whole period under study, or the number of sites at which human remains, whether deriving from a formal burial or not, have been found. The databases presently available for Britain cover only fragments of this remit [e.g. sites at which formal burials are present in the south of England (Bristow 2001); Neolithic human remains present without numbers recorded (King 2004); site locations without full burial information (Pastscape, English Heritage online database)]. For the Levant the situation is equally variable with databases or literature reviews and doctoral theses focusing on individual sites, specific periods and/or regions (e.g. Aubet 2003; Cooper 2007; Gonen 1992). One of the most significant outcomes of the 'Invisible Dead' Project will be the production of a database of funerary/burial data, unparalleled for Britain or the Levant. Given the variable nature of the known and documented archaeological record in the two study regions, this is no easy task. To borrow a phrase more often associated with the analysis of large commercial and service organizations, archaeology as a discipline might well be described as being *data* rich and *information* poor (e.g. Forte 1994, *our emphasis*). The sheer volume of burial data available, and questions of how to extract and ultimately analyse these data in a way which produces valuable information, is what lies at the heart of this project. As Atici et al. (2012) have suggested, it is pivotal that we, as archaeologists, develop strategies for best use of "legacy data" which are transparent and ultimately transferable. By necessity, the approaches to this problem for Britain and the Levant have had to be different (Table 2 and see Figure 1a, b and Figure 2 a, b), largely owing to the different histories of scholarly research and the nature of the evidence in the two regions. At present, for Britain, it is estimated that the

number of recordable individuals involved may be somewhere in the region of 100,000, whilst the number of mortuary sites may be around 10,000. The number of sites in the Levant is significantly less, but a similar minimum number of individuals is expected. At present this minimum number of individuals (MNI) does not include an estimation of the number of "formalised" burials that can be inferred, but have not survived (e.g. in areas of acidic soils). It is also not possible to account fully for individuals that may survive in the archaeological record but have not yet been discovered, or those missing individuals that are "invisible" by virtue of never having received formalised burial. By examining patterns over the *longue durée* in relation to demographic and climatic reconstructions, population estimates and long-term survey results, however, it is possible to identify phases when the dead, or at least large sectors of the population, do seem to be invisible and consider why this might be the case.

Insert Table 2 here

Insert Figure 1a, b here

Insert Figure 2a, b here

Britain

Information regarding the burial record of Britain is characterised by a legacy of antiquarian reports, modern "grey literature", research excavations and national and county databases. One of the main challenges faced by the project is how to extract valuable information from such a wealth of data that is scattered across a huge variety of different sources, at different levels of detail and accessibility. The distribution of evidence across England, Wales and Scotland is not even. Planning guidance [specifically Planning Policy Guidance 16 (1990) and Planning Policy Statement 5 (2010) which have provided a policy framework for archaeology in the context of wider planning and development issues] has generated a wealth of new archaeological data (Chamberlain 2012; Last 2012). As a result, however, excavations have been centred on regions of large-scale development (i.e. the south and east of England). Britain also suffers from a legacy of unpublished or only partially published research excavations. This issue is partly being addressed through funding schemes that require projects to disseminate and publicise their findings in a timely manner and deposit any digital products/data with the Archaeology Data Service (ADS), hosted by the University of York and funded by the Arts and Humanities Research Council (AHRC). In contrast, there is currently no policy in place to enforce the dissemination of the so-called "grey literature" generated by commercial archaeological units which has, to some extent, been seen as inaccessible. As recent research by Bradley (2006; 2007) has demonstrated, our understanding and reconstruction of past human

behaviour within Britain has been heavily influenced by the different administrative and professional practices of both university academics and commercial archaeological units across the country. Thus, data for "big picture" projects can be very challenging to access. For example, Roberts and Cox (2003) found that a significant proportion of their bioarchaeological data came from grey literature (40% of the health data based on 35,000 skeletons from over 300 sites), sources that they generally accessed through personal contacts.

Levant

The Levant shares many of the problems outlined above for the British dataset – in particular an uneven distribution of evidence across the region, and numerous unpublished research excavations. Vast national databases of sites exist [e.g. http://www.megajordan.org/; http://www.antiquities.org.il/survey/newmap.asp; see Figure 3 for coverage] but these include only very basic information on burials/tombs/cemeteries and do not cover the entire region of interest to. In addition, there exists a different type of sampling bias in the available data, with skeletal information mainly deriving from large cemetery or tell (mounded settlement) sites, the majority of which are located within the western half of the study region. The traditional focus upon excavating large tells and Graeco-Roman urban settlements and standing architecture has been modified over the past twenty years and research projects now include more regional surveys and non-tell excavations (e.g. Braemer et al. 2004; Castel 2007; Chesson et al. 2005; Philip et al. 2005; Ur and Hammer 2009). There is still a legacy, however, of projects, the main aim of which was to discover the roots of agriculture, urbanism, or to chart the history of past empires. The preoccupation of much of Near Eastern archaeology with architecture and material culture has also meant that the actual human remains found within "burial" contexts have, until recently, received relatively little attention (Perry 2012: 457). Any analysis of burial forms and mortuary populations within the Levant will have to consider seriously whether any of the patterns identified are realistic archaeological distributions, or merely artefacts of excavation and survey histories. Across the Levant there are no general equivalents to UK policy frameworks, and, with the exception of the state of Israel, rescue archaeology or developer-funded projects are relatively rare. It is interesting to note that, unlike the "grey literature" of Britain, archaeological work carried out in Israel as part of developer-funded projects is published by the Israel Antiquities Authority in a publically accessible journal, *Atiqot*. Salvage excavations elsewhere in the Levant often remained unpublished, or are only published in preliminary form, often due to political circumstances beyond the control of the archaeologists involved (e.g. de Jong 2010: 601-2). Local religious and cultural policies also impact upon the reliability and accessibility of material. For example, many orthodox groups, particularly in Israel, continue to push for the immediate reburial of human remains; in many cases this precludes bioarchaeological studies (e.g. van den Brink 2008). The diverse socio-political and academic

implications of these issues are too extensive and complex to be discussed in detail here. Indeed, one of the challenges for the future development of this project will be to devise methods for the full integration of unpublished salvage excavations and to liaise more closely with archaeologists and anthropologists based in the region.

Insert Figure 3 here

Bringing value to legacy mortuary datasets

Over the past decade increasing emphasis has been placed upon the integration, publication and re-interpretation of legacy datasets (e.g. Allison 2008; Atici et al. 2012; Kintigh 2006; Lawrence et al. 2011; Witcher 2008). The re-analysis of mortuary datasets brings with it a series of both distinctive and familiar challenges. One of the main tasks is to design a sampling strategy and methodology that minimise the biases inherent within the distribution of mortuary data. References to the presence of skeletal material can range from a detailed report compiled by a bioarchaeologist to the mere mention of the existence of "human bones" or a "burial". Moreover, many of the terms utilised by excavators and bioarchaeologists are not consistent across all sources. For example, when describing the body position of an inhumed articulated skeleton many sources use terms such as "contracted", "flexed" and "crouched" to convey a variety of different meanings. There has been some acknowledgement of this issue by archaeologists (e.g. Sprague 2005) and, whilst some authors define their use of certain terms, that does not necessarily resolve the difficult of comparing sources across centuries of publication and excavation.

Contemporary bioarchaeologists routinely outline the methods they used in their skeletal analysis and the meanings of the terms they are employing. These methods will not necessarily be consistent over time and space, as they have been subject to progressive development and modification. Additionally, they will reflect the particular training, resources, facilities and research trajectories extant in any one region of the world. A factor which will clearly affect the validity and reliability of mortuary data, in both Britain and Levant, is the level of training received by individuals undertaking skeletal analysis both on-site and as part of large research projects [e.g. see Roberts 2012 for further discussion particularly with reference to palaeopathology]. For example, the study by Gobalet (2001), involving the blind analysis of archaeological fish bone assemblages by researchers with different levels of experience and training, demonstrates the impact that such factors can have upon results and interpretation. Similar experiments have been carried out on data collected from human skeletal populations, for example, in relation to age at death estimations (Kimmerle et al. 2008), and the recording of pathological lesions. The latter can be illustrated by the study of Miller et al. (1996), which assessed the analytical abilities of conference delegates. They found an overall accuracy of

28.6% for diagnosis of a specific disease as opposed to a more general diagnosis of a disease "category" with a 42.9% accuracy (e.g. leprosy versus "infectious disease"). One factor affecting diagnostic accuracy was the knowledge and experience of the observer. Bridges (1993) also found great variability in frequencies of observed osteoarthritic lesions when comparing different techniques of data presentation and analysis, concluding that there was at that time no overall consensus about methods to be used, a situation that remains in palaeopathology. Waldron and Rogers (1991), however, in their analysis of 38 conference delegates (11 self-assessed as beginners) who participated in a study of inter-observer variation in recording osteoarthritis in 10 bones, found that there was little difference between beginners and experts. Nevertheless, although all the bones met the published criteria for osteoarthritis, the experts agreed with that diagnosis in only three bones, and the beginners in only one! These examples have obvious implications for the final datasets produced, and for "big picture" projects where large amounts of data are being synthesized. It should be noted that the use of standardised recording methods for skeletal analysis is a relatively recent development [e.g. Buikstra and Ubelaker 1994), and has been further developed by Brickley and McKinley 2004 for British skeletal material, and the Global History of Health project: see the Data Collection Codebook at http://global.sbs.ohio-state.edu/european_module.htm]. Nevertheless, these "standards" have still not been adopted by all bioarchaeologists.

In considering more detailed aspects of skeletal analysis, it is widely acknowledged that it is very difficult (some would say impossible) to sex non-adult individuals (Scheuer and Black 2000). While some reports will offer estimations of the sex of non-adult skeletons (e.g. Molleson et al. 1998), these cannot be treated with the same degree of accuracy as estimations for adult individuals. It may be argued, however, that it is important for both consistency and future analysis to retain these interpretations, albeit with a way of marking out their uncertainty. We may, for example, want to explore on what criteria individuals have been sexed and aged (e.g. osteoarchaeological assessments or grave goods), or alternatively, examine levels of uncertainty in relation to age and sex categorisations for certain periods, regions or sites. Without retaining the original classifications it would be difficult, or at least time consuming to do this. In terms of adult ageing methods, many currently in use were only developed in the 1980s [e.g. focused on the pelvic auricular surface and sternal ends of the rib: Lovejoy et al 1985, İşcan et al. 1984, 1985], whilst repeated testing for accuracy on a variety of skeletal "populations" has led to increased or decreased certainty in some of the methods being utilised [e.g. cranial suture closure (Hershkovitz et al. 1997) and auricular surface ageing (Falys et al. 2006)]. An added complication is the fact that descriptions of age, especially those in skeletal reports predating the mid-20th century, may be vague and inaccurate. For example, an individual may be described as "younger" without any additional details or clarification as to whether this categorisation is referring to a child, adolescent or adult. Many bioarchaeologists, rather than risk

being over-precise with data that can be questionable, now advocate general adult age categories, such as young, middle aged and older adult [e.g. see O'Connell 2004, and Molleson and Cox 1993 for an example of the age of adult skeletons being over- and under- estimated, when comparing historical documents for age against skeletal estimations].

Re-evaluation of skeletal assemblages can also generate new and often different data and conclusions. Buikstra and Gordon (1981) found that re-study of skeletons curated by museums changed conclusions about the population, and created new data. In some cases this was facilitated by new techniques and/or generated by new questions, and produced results that would previously have been unattainable due to inadequate methodologies/technologies. Furthermore, when dealing with aspects of bioarchaeology, such as disease, it is clear that both macro- and micro-scale approaches can be of benefit. On the one hand, the "case" studies that dominate the literature, especially in Britain (e.g. see Mays, 1997, 2010, 2012), can be criticised as being limited in the information they provide about the overall health of populations. Population-based studies usually provide more representative pictures of the once-living population, purely because they represent analyses of multiple individuals. When brought together in a "big picture" project, however, both approaches are extremely useful in showing the impact of geographical locations and time periods on the data presented. These two examples aptly illustrate the benefits of a multi-scalar approach to archaeology and the skeletal record, but also emphasise the need for continued curation of skeletal collections for future research. Bearing all of these issues in mind this paper seeks to explore what is "best practice", or at least one example of "best practice", for setting up a database which can transform legacy, and in some cases highly biased and partial data, into valuable *information*.

The Invisible Dead Database

Considerable progress has been made in recent decades in terms of long-term data storage, archiving and open access initiatives (e.g. http://www.dans.knaw.nl/en; http://archaeologydataservice.ac.uk/; http://www.tdar.org/). Many of these services require databases to be stripped down to a bare minimum, preferring the use of relatively simple file formats which, whilst retaining the original data, break apart any multiple relations and specific function and analysis tools which the database/datasets may have used. New projects are beginning to address these issues (e.g. http://ochre.uchicago.edu/page/ochre); but there is a still a major gap in communication and knowledge between research scholars and technology specialists. Archaeology as a discipline has yet to explore fully both the practicalities of technological innovations in software design and cyberinfrastructure, and their research potential (e.g. Kintigh 2006; Llobera 2011: 216-7). Many of the current databases and gazetteers of mortuary evidence are based around "memo" fields [e.g. Bristow 2001; Historic Environment Records (HER) for Britain -

http://www.heritagegateway.org.uk/Gateway/CHR/]. Whilst such an approach allows for a fairly exhaustive *description* of the burial evidence, it limits the potential for statistical analyses and standardisation, especially when the data have been entered by more than one individual and drawn from a potentially unlimited number of sources. Having the flexibility to make changes and add detail to the database as it grows is also important. It is not always obvious until several months into a data rich project where the significant issues may lie, and for many database models the early imposition of a rigid structure may mean that issues can only be explored via the substantial re-working of data fields and by making fundamental changes to the structural set up of the database (e.g. Banning 2000: 62).

The relational database template (Microsoft Access) adopted for the 'Invisible Dead' Project is based upon the Fragile Crescent Project database (see Lawrence et al. 2012 for additional details concerning the database design and structure). Rather than using tightly defined static fields, data entry is structured around a series of flexible numerical and text based fields. Every piece of data concerning the context, nature and interpretation surrounding the human skeletal remains is treated as a separate "observation". Thus, an individual "burial" or even fragment of human bone can, theoretically, have an ***infinite*** number of observations, categorising, describing and quantifying it. Each observation requires the minimum of 1) an overall ID which uniquely identifies the grave/skeletal deposit/monument concerned and allows information regarding these details to be linked and queried alongside one another; 2) a data type which categorises the type of evidence being recorded by the observation; 3) a data source which identifies the original source or bibliographic reference for the observation being recorded, and finally; 4) a geographical location, separately stored in GIS layers, and to which information can be linked. Additional numerical and text-based fields can be used to add detail to each observation (see Tables 3 and 4). Categorised entries for these fields are drawn from a standardized glossary or list of "observation" types (see Table 4 for examples), whilst a single memo field allows for descriptive information to be added, as deemed necessary. The key to the functionality of the database is a series of user-defined IDs (Parent and Sub IDs) which allow information to be summarised at different levels (e.g. site level, grave/burial/tomb level, phase level, individual level). To put this into context, Table 5 illustrates how such levels operate. Retrieval of corresponding data is made possible through the use of these unique IDs. Simple access queries retrieving information on, for example, the sex and age at death of individuals, their body positioning and the associated items of material culture can be generated, joined and further analysed in Access, Excel (using pivot tables) or ArcGIS (see below for further discussion). This allows multiple lines of enquiry to be carried out simultaneously, so that, for example, a list of all recorded young adult males lying on their left side associated with personal grave goods and buried in Yorkshire during the Iron

Age can be retrieved. In addition, the Access database uses a "front end form" whereby users can search, by site, for all entries relating to shaft tombs, or all adult males.

Insert Table 3 here

Insert Table 4 here

Insert Table 5 here

Before upload to the Access database, initial data entry is carried out using a macro-enabled Microsoft Excel spreadsheet. This allows users to check for and correct any mistakes in data entry (e.g. misspellings, incorrect use of categories). It also generates the necessary connections between multiple ID levels. Upon upload into the database, a series of "data-generating" queries are performed which assign unique numerical fields to each ID and ensure that the connections between the tables within the relational database are operating correctly.

This approach has a number of advantages:

1. Multiple interpretations, certainties and reliabilities of evidence can be recorded, e.g. a tomb could be recorded both as a possible shaft tomb and a possible grave/pit (burial)
2. Categories of evidence can be modified without the need to alter the design or fields within the database.
3. The standardized glossary/observation types can be expanded to suit requirements without having to change the design or fields within the database.

The approach outlined above allows flexibility in terms of the design of "observations". Data types can cover categories of evidence that relate to specific regions or time periods, as well as those which can be used more generally to describe and interpret features across the entire study region and beyond. For example, an archaeological site feature with associated burials might be entered for Britain with the data type "Henge", although this will clearly not be suitable for the Near East. Equally, for the Levant the data type "Tell" may be entered in relation to a series of burials associated with a settlement mound; this, conversely, will not be suitable for Britain. Whilst "observations" which suit particular places and time periods are being used, and many more may be added at a later date, an attempt has been made to standardize the terms as far as possible. This is of particular relevance for the Levant where the political and linguistic history of the region has influenced not only the languages (e.g. Arabic, English, French, German, and Hebrew) used in archaeological reporting, but also recording conventions, research agendas and the terminologies used in publication.

More generally applicable terms defined within the project glossary allow analysis of data from different sources and geographical regions. For example, when dealing with body position, **Flexed/Semi-Flexed (Unclassified)** and **Tightly Flexed (Unclassified)** can be used for the majority of situations, in which the body is not **Extended**, with **Sitting/Seated** being used to indicate a body which is in the upright seated position. Similarly, the use of age categories e.g. **Young Adult**; **Young Adult/Middle Adult**, whilst not necessarily giving a high level of analytical precision (something which is not possible when ageing older adults), allows comparability. Again, as with much of the information being entered into the database, further details can be provided where they are available; for example, if a child is listed as c. 8 years old, or a young adult given the age range 19 to 22 years, these data are entered into the numerical data fields and can be used to refine queries on age at death. Further details might also be available from a closer inspection of some of the data sources or through re-evaluation of older skeletal collections (e.g. Wysocki et al. 2013), and the flexibility of the database allows for this to be taken into account.

The database is also designed to work with and incorporate different chronological terms and levels of chronological detail. Using the estimated start and end dates for each defined chronological period it is possible to investigate time slices. Database queries recalling sites that may have been in use between 2500 BC and 1500 BC would return those dated to any period falling in between, or partly between, these two dates, for example the British Late Neolithic/Early Bronze Age (3000-1500 BC), Early Bronze Age (2500-1500 BC) and Overton Assemblage Phase (2000-1700 BC), and for the Near East, Early Bronze Age IV (2500-2000 BC), Middle Bronze Age (2000-1600 BC) and Late Bronze Age I (1600-1400 BC); see Lawrence et al. (2012) for further details of this methodology].

Using the form interface it is possible to filter and recall entries on a site by site basis. The majority of queries, however, are carried out using the query design function in Microsoft Access. Theoretically, any variables (e.g. age, sex, site feature form, etc.) can be selected and then analysed alongside one another through a series of joins (in Access), pivot tables (in Excel) and/or join and relate functions (in ArcGIS). There are some limitations to this approach. Where data are entered at the same level, query and analysis are very simple. For example, from the given Unique ID it is possible to link infinite variables together (e.g. see Table 6). Data stored at different levels, however, requires further processing and summarising (often using a series of pivot tables and standard Excel functions, for example IF statements). In some cases the project has reduced the levels of processing involved by creating summary units quickly to recall the principal forms of information required by the project (e.g. Minimum Number of Individuals or Minimum Number of Burial Features). Such queries can

then be directly joined across to Excel or ArcGIS for further analysis. In many cases the complexities involved in extracting and querying the database are a direct result of the complexities of the data. This is especially the case for the Levantine material, where detailed entries have been compiled on material culture types and their association with buried individuals. The key overall benefit of this approach is our ability to analyse material at different scales of analysis, from a single grave context up to the level of the entire project area.

Insert Table 6 here

Ultimately this database is intended to be a stepping stone towards future analysis, and is hence designed with flexibility and expandability in mind. The issues arising from the continuing curation and maintenance of such a database will be the subject of a future paper. As the project moves forward it is clear that adjustments will be made, both in terms of the expansion of data entry and in data structure. However, the database enables changes to be made without having to re-design the entire data framework. To date, the project has compiled over 100,000 observations for the two regions, bringing together information on over 60,000 individuals and more than 4,000 sites. Thus, already at the current stage it offers huge potential for analysis and interpretation. Whilst, as indicated in Table 2, different levels of detail are present within the database, these can be distinguished via associated entries indicating whether sites and/or graves are merely summarised (e.g. site name, period, number of burial features and minimum number of individuals), or alternatively recorded in full detail.

Bias, source reliability and interpreting the mortuary record

The majority of archaeological terms, especially those relating to burial practices, are laden with culturally derived meanings. There are also inherent biases in the sources, with specific terms being used for specific periods. To some extent, these biases will unavoidably be incorporated in the 'Invisible Dead' database; data can only be recorded which are available and we may also bring our own preconceptions to their categorisation. For example, a secondary database source describing *"Disarticulated human skeletal material, including pelvis and fragment of a femur, with a flint axe in a pit marked with a wooden post"* (King 2004, ID 174) could be interpreted in a number of different ways. Moreover, the same data can be described in very different ways by different sources; Pastscape describes this particular feature as a pit 23 ft. (7 m) wide, originally interpreted by the excavator in 1893 as a "pit dwelling", although the subsequent review suggests that a "refuse/storage pit" is more likely. How then do we record this example? Is the pit a deliberate burial feature or a discard pit and is the wooden post a grave marker, or is the post part of a separate feature? Rather than being forced to choose one option, the 'Invisible Dead' Project database allows multiple data types to be entered

(i.e. 1. Grave/Pit (Burial); 2. Pit (Storage/Rubbish)/Silo), each with associated certainties (see below) and comments.

The same issues apply to overall site level interpretations. Is it straightforward to assume that a site or monument was designed as a burial place, or are there other attributes which make it a catalyst for actions such as human deposition? We can classify Stonehenge as "Britain's largest cemetery of the 3rd millennium BC" (Parker Pearson et al. 2009: 23), or as a "henge" monument (despite not fully complying with the basic definition of such a monument), but it is probably both of these and many other things besides. Once again, the flexibility of the database allows multiple interpretations and categorisations to be incorporated in the analysis. In this case both "henge" and "cemetery" can be added.

The relationship between items of material culture, burial contexts and human skeletal material is another area for debate and bias. For example, when a few isolated and potentially fragmentary human bones are being considered, such as a femur or pelvis found within a mixed deposit of cultural remains, it is difficult to determine whether items such as an axe were specifically associated with the human remains, or whether it is the human remains that were associated with the axe. Conversely, if this were a single articulated individual it would be easy to assume, without any further evidence, that a direct relationship existed between the axe and individual, although this may never have been the case. Determining the relationships and associations between objects and human remains is never a simple exercise and will ultimately come down to an informed, yet subjective, assessment by the investigator.

The same argument can be made when assessing the relationships between human and animal remains. In both Britain and the Levant the relationship between human and animal remains in burial contexts reveals a range of activities and symbolic meanings (e.g. Thomas and McFadyen 2011; Weber 2012). For example, 3rd millennium BC installations recorded at the site of Umm el-Marra in Northern Syria contained skeletal remains of equids, some of which may have been deliberately killed. These remains were found alongside human infants, other non-equid animal remains and pottery vessels (Schwartz et al. 2012: 163-5). Given the highly prized nature of these equids within 3rd millennium BC society (ibid: 164), it is difficult to determine whether the additional animal remains and pottery vessels, and even possibly the human infant remains, should or could be associated with the equid remains as objects or items demonstrating prestige and status. These installations were found within a larger mortuary complex, also containing rich tombs. The investigators of this site interpret these features as tools for elite legitimization, the equids intended to

accompany the adult individuals buried in the tombs into the afterlife (ibid.). The role of human infants and the additional animals in this scenario is unclear, as is the nature of the relationships between the different animals, human remains and items such as pottery vessels within the installations themselves. Due to these issues, in this case, both the animal and human remains were recorded simply as skeletal remains without any assumptions about their value or role as objects or items of associated material culture. This allows changing theories about the past, and specific sites, to be used in later interpretations of the data.

Within the literature there is also often an underlying preconception that the inhumation of an individual articulated skeleton is a deliberate, careful and respectful deposit. Conversely, the Late Chalcolithic "mass graves" at Tell Majnuna, in North-East Syria have been interpreted as resulting from conflict in the local area, and the mass of disarticulated remains as the disrespectful dumping of enemy dead following warfare (McMahon et al. 2011: 215). This example emphasises the distinctions made by many researchers in relation to burial vs. disposal and disarticulation vs. articulation. It also highlights an assumption, that *'…retention of the individual body as a discrete entity…'* (ibid.) is the norm throughout history. By way of contrast, there are numerous examples from the Neolithic and later periods in the Levant where the intermixing of bones of multiple individuals, and in some cases particular body parts, can be seen as part of a deliberate burial practice Examples such as Pre-Pottery Neolithic B (PPNB) Tell Aswad, Syria (Stordeur et al. 2006: 56); see also Croucher (2012: 212-225) for further Neolithic examples. and Early Bronze Age II-III Bab edh Dhra, Jordan, where individuals are interpreted as having been subsumed into a corporate unit (e.g. Chesson 1999), demonstrate that these preconceptions do not hold true across all of time and space. A similar example from Britain is offered by the Bronze Age "mummies" from Cladh Hallan in the Western Isles of Scotland, where detailed osteological analysis demonstrated that the so-called "individuals" were actually composed of skeletal parts from different people (Parker Pearson et al. 2005).

Clearly, these assumptions and biases need to be exposed and their impact upon the existing literature explored. It is acknowledged, however, that no matter how carefully data entries are made, there will always be some degree of interpretation, and thus bias. Despite this, the use of standardized terms within a project utilising and comparing data from such a wide variety of resources, time periods and regions is vital if any cross comparison or analysis is to take place. The task then is to develop a series of standardised terms that are defined so as to promote transparency but that also seek, as far as possible, to describe and characterise any uncertainties indicated by the original investigator or sensed by the individual who is recording the data in the database.

Certainty, accuracy and precision in the mortuary record

It is very rare that a source of archaeological data will be incontrovertibly accurate and contain every single detail researchers would desire. Even when dealing with primary sources from recent research excavations there will usually be at least some issues of interpretation or limits to the information provided, especially in developer-funded archaeology where time and resources for report preparation may be limited. When working with sources that go back to the 19th century, or with secondary summaries, these issues are amplified. The 'Invisible Dead' database will tend to compound these problems; given the time constraints it is impossible to investigate fully each and every item of data entered. Having said this, the database is designed to allow issues of uncertainty to be recorded and acknowledged.

For both Britain and the Levant, the MNI represented within each burial context is of major importance for data analysis and interpretation of long-term trends. One of the key issues in using this is the fact that the MNI figure is obviously a ***minimum***. There will also be clear differences in the accuracy and precision of the MNI calculated depending upon the method used to determine it. In studies of contexts with disarticulated collective human remains [e.g. Hazleton North, Cotswolds (Saville 1990); Isbister, Orkney (Lawrence 2006) and Jericho, West Bank (Kenyon 1960)], MNI is based on duplicated bones, whereas counts of single inhumations in graves are much more likely to reflect the number of people actually buried [e.g. Cirencester (Wells 1982); Poundbury (Farwell and Molleson 1993) in Britain, and Queen Alia Airport Cemetery in Jordan (Ibrahim and Gordon 1987)]. Where there is evidence to suggest that the same individual or collections of skeletal material may have been moved from one location to another [e.g. Shiqmim, Negev; where skeletal remains were possibly moved from a primary burial locale within the settlement to an extramural cemetery (Rowan and Ilan 2012: 101)], there is clearly the risk of a gross over-estimation or under-estimation of the total burial population. Additional issues arise from reports that, for a variety of reasons, may not even include an estimate of MNI. In many cases, in both Britain and the Levant, reports merely record the presence of human remains and often make no reference even to the nature of those remains (e.g. disarticulated, articulated, cremated, etc.). Whilst such data cannot be entered into the database with the same level of detail or certainty as those where the human remains which have been subject to an osteological study, it is still vital that they are included.

With this in mind, the 'Invisible Dead' project has adapted procedures, originally designed for the Fragile Crescent Project (Lawrence et al. 2012: 354-355), to quantify the levels of uncertainty involved in the analysis and entry of data. Using this approach, a barrow recorded with no more detailed description than the fact that it contained 'Inhumations' and was 'rifled before' (Kinnes 1992:

29, entry SU73, summarizing primary 19th century sources) can be entered into the database, albeit with "**Negligible"** or "**Possible**" certainties and limited information. In this case, entries would reflect that 1) the site is a barrow and 2) it contains/contained inhumations. The number of inhumations would be recorded as an unquantifiable "**Multiple (Unknown)"**, with an estimated MNI of 2. This approach can also be used in relation to age/sex assessments. If an antiquarian excavation, or an excavation where no specialist skeletal assessments have taken place, describes a skeleton as that of an 'elderly' individual, it can be entered as **Older Adult**, with a **Probable** or **Possible** certainty level attached to it. This assessment of certainty largely depends on the reliability of the source (and references to methods used), as well as the subjective analysis of the researcher or individual recording the data. In certain cases, a standard protocol for the levels of certainty can be developed. For example, when the sex of children has been listed in the original report this data has always been included with "negligible" certainty. In other cases, an assessment of certainty has been agreed after discussion by project members. For example, discussion of the dating criteria used for a number of Levantine sites has led to data being entered with "possible" period certainties. In some cases inconsistencies in the data have also made it necessary to use broader chronological phases (e.g. EB I, as opposed to EB IA and B). Expert knowledge has been pivotal for allowing poorly excavated deposits to be entered with lower certainty values. Further detailed analysis of the osteoarchaeological methods used for sex and age estimation of individuals is an area for future work, although in many cases the original reports lack these details. It is undeniable that some subjectivity will always be present and certainty assessments between researchers will vary. This approach does at least, however, offer a way of quantifying and evaluating the variable accuracy and precision encountered by a project collating such varied sources. This approach may only allow us to separate out data where there is uncertainty, as opposed to data that there is no reason to question. It is hoped, however, that with future refinement of the osteoarchaeological component and reassessment of material culture assemblages and chronologies, the levels of certainty in database entries will be further explored and improved.

Research Questions: attainability and future potential

Given the biases, uncertainties and difficulties faced by such an ambitious project, is it really possible to interpret the changing treatment of the dead over time and thus the development of human experience and self-awareness? In adopting the methodology outlined above, the 'Invisible Dead' project is already beginning to demonstrate that not only do the human remains which are visible within the archaeological record result from highly specific selection processes at death, but that there are periods when sections (even large parts) of society in certain geographical areas were disposed of in ways that appear invisible to archaeology. This is not a new observation – previous studies, often restricted to particular regions or time periods have reflected this (e.g. Bristow 2001; Brück 1995).

The database constructed by this project represents only the start of this study, but it is intended to provide a much wider overview of the situation, making full use of both earlier and more recent records. Through this rich source of *information*, it will be possible to quantify and explore some of the patterns which seem to be shaping the burial record at different points in time and in different regions of the two study areas.

Within the Levant an obvious focus for further research is the uneven distribution of burial data from the 4th-early 3rd millennia BC. Within the northern Levant there is an almost total absence of mortuary evidence dating to the 4th millennium BC. This is in direct contrast to the contemporary south and indeed to the entire region during the later 3rd millennium BC. Burial practices in the Southern Levant during the 4th-early 3rd millennia BC range from extramural cemeteries with shaft or chamber tombs containing interments of upwards of 300 individuals within a single tomb [e.g. Tomb K2, Jericho (Kenyon 1965), and see Figure 3] to the inhumation of the dead within stone-built monuments, such as dolmens and cairns [e.g. Tall al Umayri (Dubis and Dabrowski 2002), and see Figure 3]. Alongside these, intramural burial practices persist, with certain groups or individuals within society being interred within settlement contexts [e.g. Tel Te'o (Eisenberg et al. 1999), and see Figure 3]. What is particularly remarkable about the evidence from this region during this period is the extent of manipulation of human remains, with evidence for deliberate disarticulation (e.g. Jericho), body part removal (e.g. Bab edh Dhra) and potentially deliberate burning of burial monuments (e.g. Bab edh Dhra). For the northern Levant, the paucity of burial evidence during the 4th millennium BC during this period is intriguing. This makes the recently identified presence of c. 29,000 stone burial cairns within 120 sq. km of volcanic terrain west of modern Homs, in Syria, particularly striking (Bradbury and Philip 2011). Even if used over several millennia they could have accommodated a significant proportion of the local population. Their identification within what was, until relatively recently, a well-preserved prehistoric landscape raises interesting questions about taphonomy, and the quantification of tombs and burial data in other areas of both the northern and southern Levant. Furthermore, the discovery (already referred to) of mass disarticulated "burials" dating to the 4th millennium BC at Tell Majnuna, several hundred metres away from the large contemporary settlement of Tell Brak [McMahon et al. 2011, and see Figure 3] may indicate that, at least, in the northern Levant, the dead during this period were being disposed of in ways that have not yet come to the attention of archaeologists.

For Britain the burial record for the Late Bronze Age through to the Early Iron Age (approximately 1000 BC through to 500 BC) is significantly sparser than that either following or preceding it. Formal burial monuments (particularly round barrows) disappear and human remains are disposed of in ways

that are associated with other ritual practices or refuse disposal activities, either as cremations or body parts (Brück 1995; Darvill 2010: 221-223, 287; Hill 1995; Parker Pearson 2005: 113-114; Whimster 1981). Examples include the disarticulated and fragmentary remains found on settlements [e.g. Brean Down, Somerset (Brück 1995)] or 'wet' contexts [e.g. the Cambridgeshire Fens (Evans 2013); Watermead Country Park, Leicestershire (Ripper and Beamish 2012)]. A recent study has shown that many of the human skulls recovered from the River Thames belong to this period, and may represent a deliberate practice of river burial (Bradley and Schulting 2013). Before this, in the later 3rd millennium and the first half of the 2nd millennium BC, burial monuments in the form of round barrows (burial mounds) are easily recognisable in the landscape and would have been all the more so prior to heavy ploughing (Ashbee 1960; Grinsell 1953). In some areas (e.g. the Stonehenge region, in southern England, or the Yorkshire Wolds) they are ubiquitous (Woodward 2000). The great majority were "excavated" by antiquarians. Some of the latter recorded their findings, whilst other interventions are only known because their successors (both antiquarian and contemporary) noted that the monuments had been "opened" before (e.g. Hoare 1812; Greenwell 1877; Mortimer 1905).

It is important to understand whether the significant change in the burial record from early to late 2nd millennium BC is entirely due to the abandonment of more formal burial practices, and how far inherent biases in excavation, recording and dating, or land use, contribute to the picture. Where monuments are visible and conspicuous, they have generally been recorded and often excavated. Less obvious categories of burial may never be found. A barrow that features in the literature may be recorded as preserved, or as having been ploughed out or destroyed by gravel quarrying. There are many such records of destroyed burial monuments that can often still be identified through the use of aerial photography or satellite images. English Heritage, for example, has a National Mapping Programme which involves identifying archaeological monuments using data from non-intrusive survey methods. Aerial photography taken as part of this programme from over a 173 sq. km. region of Hampshire, England recorded over 100 Bronze Age barrows, of which 64 were newly identified monuments (Trevarthen 2010). In the region of Burton Fleming, East Yorkshire, the numbers of Middle Iron Age 'square' barrows probably run into the thousands. The majority of these have all but disappeared (i.e. are no longer upstanding), but their presence was noted from the early 1960s due to the use of aerial photography (Stead 1976). It is possible to infer burials from many of these barrow identifications, since most or all of them were funerary monuments with graves, but without the benefit of excavated skeletal remains no details can be confirmed. Thus burials can be inferred from funerary monuments, but non-monumental, albeit still formalized, burials that have been ploughed out will provide no information. Many barrows also contain or are associated with "secondary" deposits which are subsequent to the initial interment, but dating is often problematic. It is clear that prehistoric mounds received subsequent burials into the Anglo-Saxon period (5th century to 11th

century AD) [e.g. Winterbourne Stoke 41, Wiltshire (Pastscape, monument no. 870384), see Semple 2013 for a discussion of the perception and use of prehistoric monuments during the Anglo Saxon period] and perhaps occasionally beyond. Radiocarbon dating, however, usually targets the "primary", initial burials, and less visible deposits, possibly later in date may remain undated. When dating is carried out on all of the human remains associated with a monument, surprising findings can sometimes emerge. There are, for instance, examples of rare Late Bronze Age burials associated with Early Bronze Age barrows. These have only been identified through extensive dating programmes, for example, the two radiocarbon dated Late Bronze Age burials inserted into an Early Bronze Age barrow at the Barrow Hills monument complex in Oxfordshire, England (Barclay and Halpin 1999: 53).

Whilst a change in burial practice undoubtedly occurs between the Early Bronze Age period of round barrows and the Late Bronze Age and Early Iron Age, bringing together some of the data discussed here (e.g. radiocarbon dates and records of monuments from non-intrusive surveys) will help to clarify our understanding of the distribution and relative "invisibility" of the dead for these different periods. Future phases of data entry will add value in this respect and highlight where radiocarbon dating programmes, for example, can best be targeted in order to elucidate and explore some of these patterns and apparent gaps in evidence.

Future Research Avenues

It is clear that this project represents only the beginning of a research mission addressing much larger questions and areas of potential investigation and collaboration. The aim is to produce a database that, while not comprehensive, is robust and representative, and that will help to identify specific periods, regions or issues that should be priorities for further research. The incredible wealth of data that is available for Britain is the product of intensive archaeological excavation over many years. Completion of the comprehensive database will require several more years. The methods and structures already established by this project, however, indicate the real potential for future expansion as well as providing initial results that point the way towards productive research outcomes.

For the Levantine data, analysis is currently limited by the relative paucity of excavated, well-studied and published skeletal data; Bab edh Dhra (Ortner and Frohlich 2008) and Tell Majnuna (Sołtysiak and McMahon 2010) are good but scarce examples of well published and studied skeletal collections. The potential here lies partly with new avenues of scientific investigation, such as stable isotope analysis (Katzenberg 2008), which hitherto has been relatively little used within Near Eastern

archaeology [but see Gregoricka and Sheridan (2013), Perry (2008, 2009, 2011), Sandias (2011) and Sheridan et al. (2014) for examples of where this has been undertaken]. New research can also add value to old data [e.g. a recent re-assessment of the skeletal analysis from Jericho has been undertaken as part of a PhD Thesis by Rula Shafiq (2010)]. Whilst there are issues with the preservation of bones and teeth for isotopic sampling from the Levant due to the climate (e.g. Holmes et al 2005; Von Endt and Ortner 1984) these techniques could reveal important information regarding aspects of diet in relation to age, sex, gender and burial customs. When combined with other evidence, such an approach might allow aspects of identity within the mortuary record to be more fully explored. Stable isotope evidence for the movement of populations (and remains of the deceased) across the landscapes of the Levant throughout antiquity would enable the homogeneity vs. heterogeneity of burial populations over time and space to be assessed. The project might also be expanded geographically and chronologically to cover the Levant, Mesopotamia and Arabia up into the Islamic period, examining processes of Islamization, syncretism between the Islamic and Christian world, and change and continuity in long term burial practices and associated beliefs. Another rich vein of information could be mined through comparison between the data from the burial record and the rich textual evidence relating to the dead, a record that for the Near East goes back to the 3rd millennium BC.

The importance of this project lies not only with its research questions, but also with its ability to deal with large, uneven and fragmentary datasets, the likes of which have often been traditionally rejected as "too difficult to handle". The database/GIS model presented here is explicitly designed to make datasets of this kind accessible to analysis. The adoption of an inherently flexible and expandable framework also means that the database can be built upon and further analysed into the future. This paper has demonstrated the value of legacy datasets, as well as approaches that combine both macro- and micro-scale analyses. The mortuary record is highly complex; its study is essential, however, if we are to address fundamental questions about the human condition. The method presented here enables *data* to be transformed into valuable *information*, and provides a powerful means of addressing some of the ambitious and complex questions being posed by the 'Invisible Dead' project.

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Figure 2. Sampling and data collection strategies for (a) Britain and (b) the Levant. The Figures give examples of the different types of sources used for data collections and the stages involved in collation.

Figure 3. Sites from the Levant mentioned in the text. Hatching indicates the countries where national online databases are available/not available. Sites are plotted against a 90m SRTM backdrop.

Figure 1a
Click here to download Figure: Figure1a.jpg

Figure 1b
Click here to download Figure: Figure1b.jpg

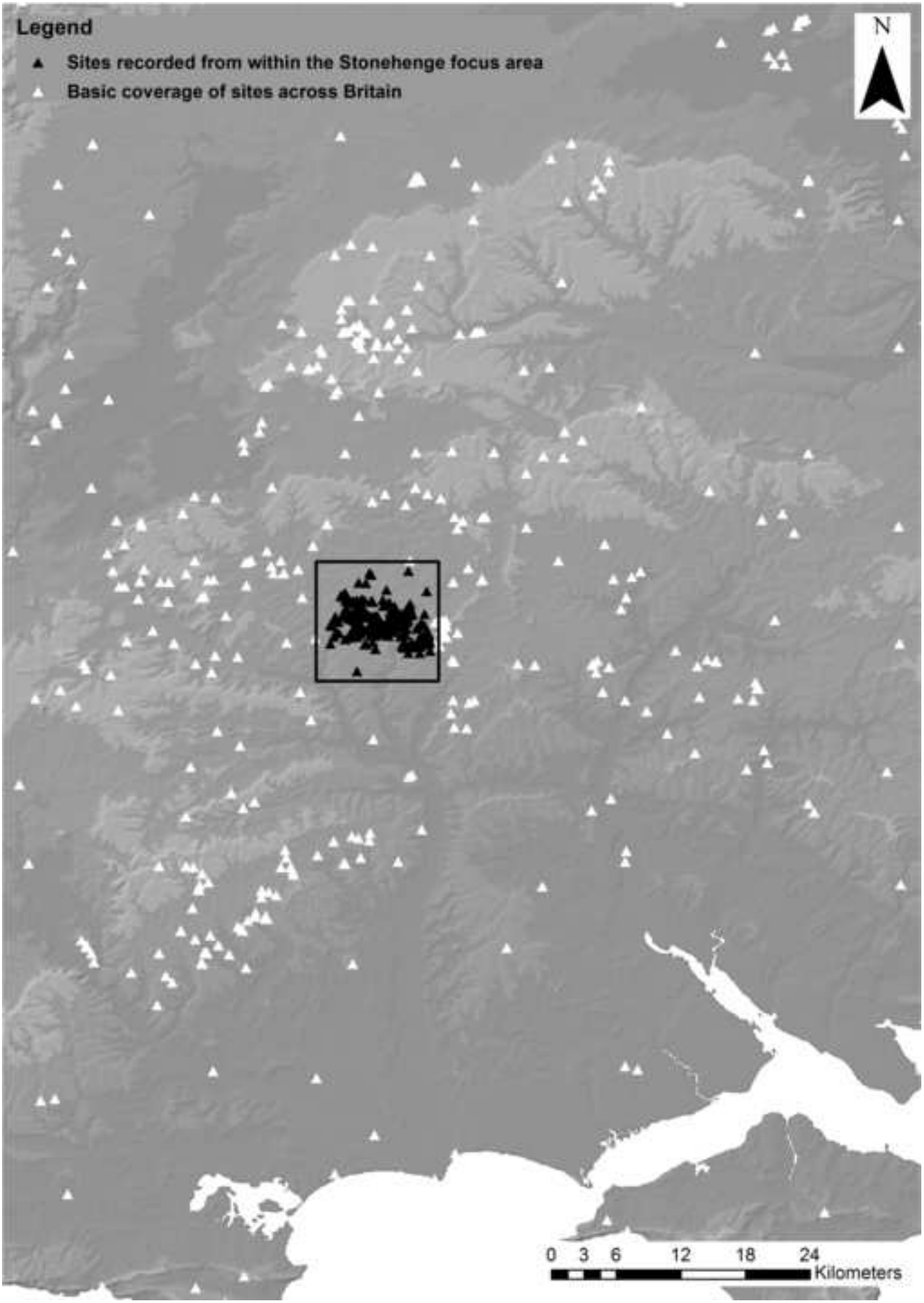

Figure 2a
Click here to download Figure: Figure2a.jpg

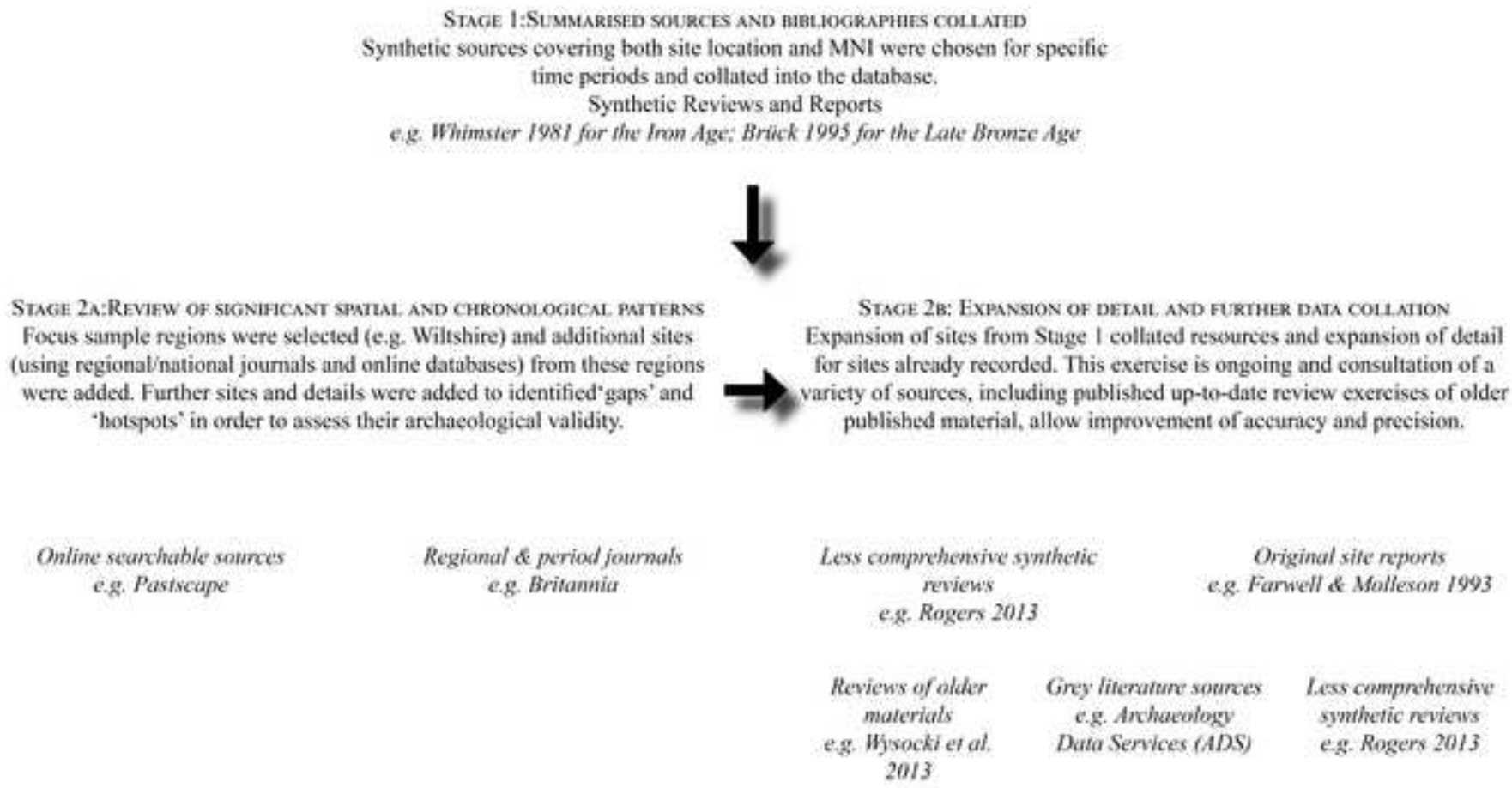

Figure 2b
Click here to download Figure: Figure2b.jpg

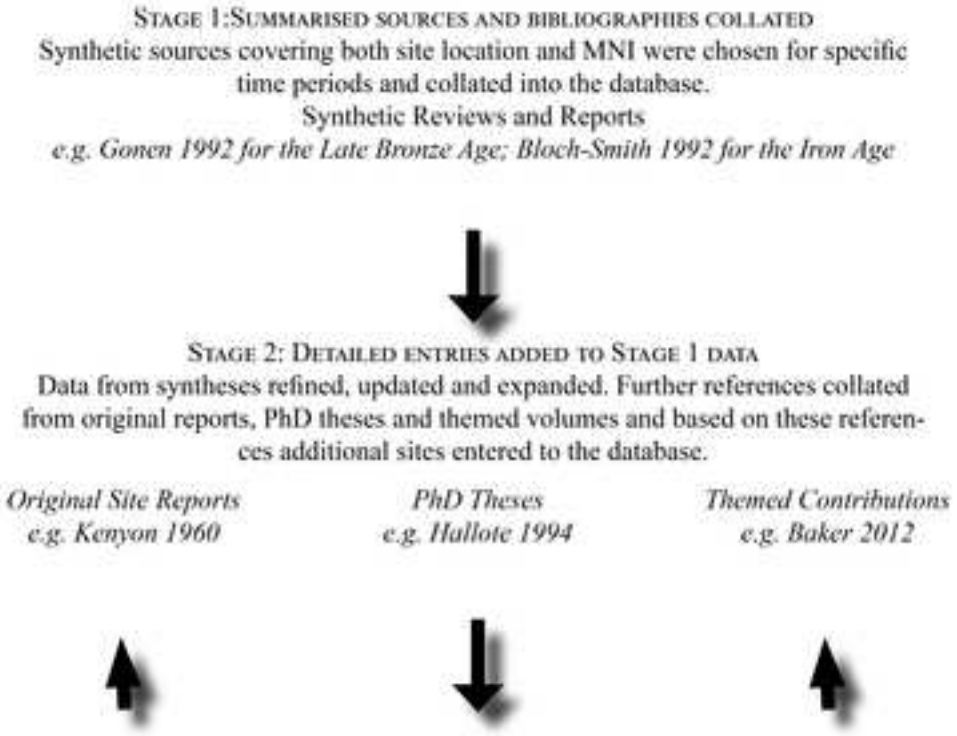

Figure 3
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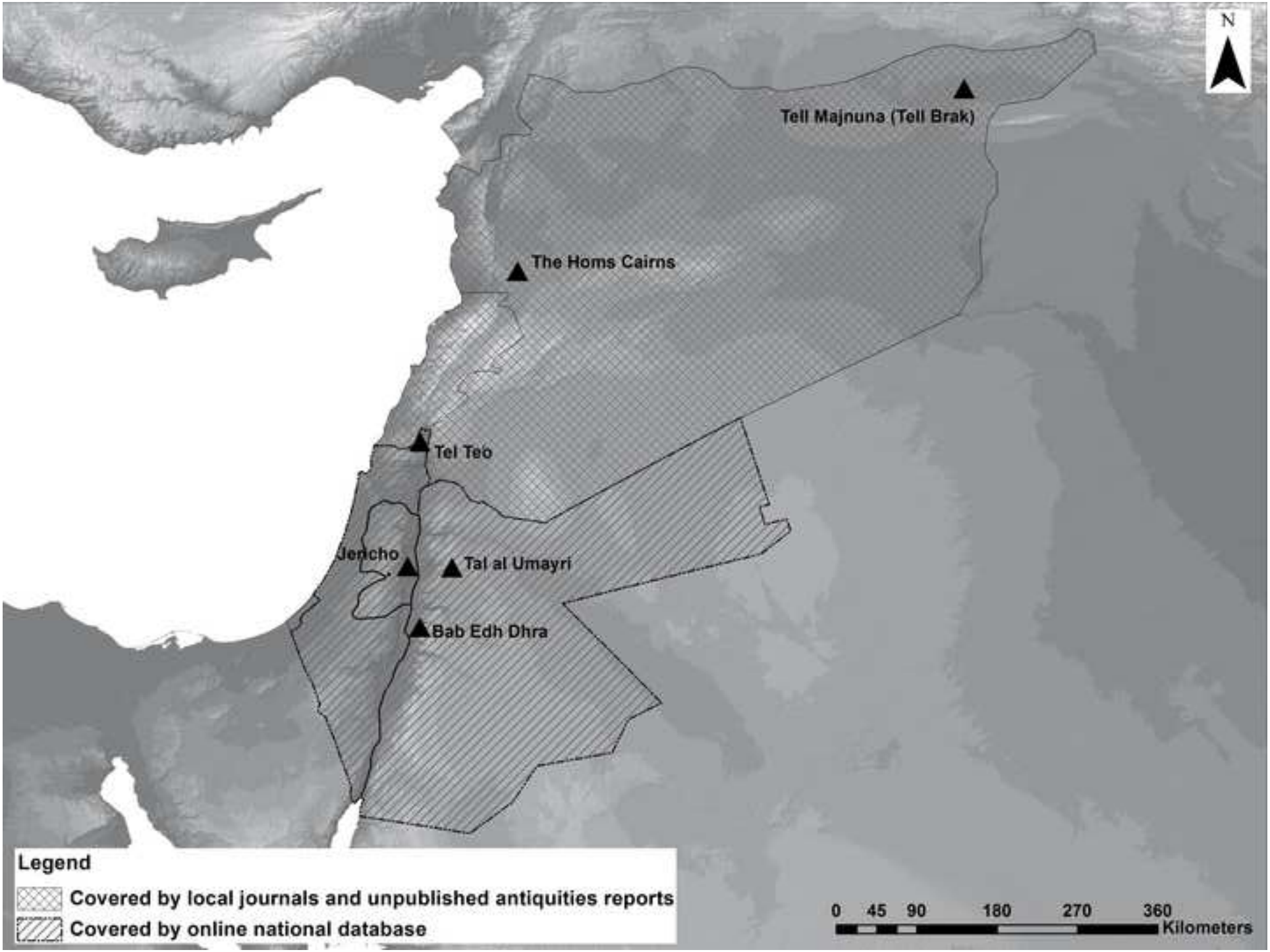

Table 1
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Table 1. Mortuary Data from the Two Study areas (Britain and Levant): points of similarity and contrast

Britain	Levant
Points of Similarity	
Well documented in part	Well documented in part
Varied environments, topography and preservation across study area	Varied environments, topography and preservation across study area
Some databases available e.g. Pastscape, ADS	Some databases available e.g. MegaJordan
Data covers a range of periods	Data covers a range of periods
Points of Contrast	
Representative of trends in Prehistoric western Europe	Representative of the complex urbanized societies of the ancient near east
Incremental change over time (prior to Roman period)	Points of major political and economic restructuring can be identified (e.g. appearance of urban centres, impact of external colonial powers)
Prehistoric for most of the period under study	Written records available from the 3rd millennium BC
Christianity introduced through imperial structures	Christianity emerges from local religious traditions
Significant commercial archaeology component within data	Data dominated by traditional research projects in Syria, Palestine and Jordan. Commercial/salvage archaeology component in Israel and Lebanon.
Sources almost entirely in English language	Sources in multiple languages e.g. Arabic, English, French, German, Hebrew etc.,
Broad conformity in reporting formats	Marked inter-country divergence of reporting and dissemination formats e.g. local journals (Syria, Lebanon, Palestine); online databases (Jordan and Israel)
Long term history and tradition of osteoarchaeological research (e.g. Roberts and Cox 2003)	Poorly developed tradition of osteoarchaeological research, with direct opposition from religious authorities in some areas. Historical focus on grave goods and burial context (see Perry 2012 for further discussion)

Table 2
Click here to download Table: Table2.docx

Table 2. Sampling and recording methodologies for Britain and the Levant

Britain	Levant
Provide coverage for sites across the *whole* study region of England, Wales and Scotland but with minimum detail in order to achieve broadest possible geographical and chronological scope (e.g., restricting information to site locations & MNI (minimum number of individuals)	Provide coverage for sites across the *whole* study region that appear to represent mortuary contexts, but where no skeletal data have been recorded. Data entered with minimal detail in order to achieve broadest possible geographical and chronological scope (e.g., restricting information to site locations and basic burial context information).
Provide detailed coverage for small focus areas, chosen to cover different: 1). geographical regions (e.g., Scotland, England & Wales); 2). geologies (e.g., chalk which preserves bone well; acidic Scottish and Welsh soils which do not); 3). excavation histories (e.g., urban areas where developer-funded excavation is currently required; rural areas where development is minimal); 4). archaeological population densities (e.g., Wiltshire, where later prehistoric activity is represented by a high density of sites; central Wales, where the evidence is more rare). These patterns may again be reflecting the level of development and thus excavation histories of the two regions, rather than any true archaeological patterns.	Provide detailed coverage for *every* site across the study region where data regarding human skeletal material is available/has been recorded, whether or not the site is interpreted as a cemetery, formal burial site or a rubbish deposit. Entered data include; site locations, MNI; counts and details about the burial context (e.g. 12 Rock Cut Tombs); information regarding the dating of the burial context (e.g. Roman); counts and details about the material culture from the burial context (e.g. association of unknown material culture: Pottery vessel (diagnostic, complete); lamp)

Table 3
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Table 3. The main database fields used in the 'Invisible Dead' Project Database

Major ID	This ID enables the database to relate a single skeleton to its associated grave and cemetery e.g. articulated skeleton *JTFNE_2_1_1* is from grave *JTFNE_2_1_0*, which can be found within cemetery *JTFNE_2_0_0*. JTFNE and JTFB are used as unique dataset codes for the Levant and Britain.
Category	This enables the identification of the category of information being recorded. For example, is it information about the site, a particular object or something related to how the site has been studied/excavated e.g. Site Feature, Object Data, Literature Reference
Data Type	This allows us to categorise the type of information being dealt with e.g. Rock Cut Tomb; Human Bones: Articulated Skeleton; Directly associated material culture: Pottery Vessel (Diagnostic, Complete).
Detail Data Type	This allows further specification of the type of data type e.g. Sealed, Plaster; Single Individual; Bowl.
Data Source	Bibliographic Reference e.g. Kenyon 1960 This links information stored in the database to its original source.
Period Code	A code for each defined period block is entered, which then links through to the master list of periods and timeblocks e.g. NE_EBA1= Early Bronze Age I in the Levant (3500-3000 BC)
Overall Certainty	Using four categories (Negligible, Possible, Probable, Definite), this field defines how certain the project members are about the information entered e.g. a possible Minimum Number of Individuals (MNI)
Period Certainty	Using four categories (Negligible, Possible, Probable, Definite), this field defines how certain the project members are about the date of a particular context entered e.g. probably Roman.
Numerical Data 1, 2 and 3	Numerical fields 1, 2 and 3 enable quantification of information e.g. MNI, age ranges, radiocarbon dates.
Text Data A, B and C	Text data A, B and C provide indications for quantities when absolute numbers are not quoted e.g. a report lists 'numerous' individuals.
Data Comments	This field defines what type of information is being entered into the Numerical Data/Text Data field e.g. Numerical data: 1=Minimum Number of Individuals; Text data: A=Quantification of Individuals

Table 4
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Data Type	***Detail Data Type***	**Glossary Definition**
Burial Container: Ossuary/Box (Unclassified)	*e.g. House Shaped, Ceramic; Anthropoid, Stone*	Receptacle; (ceramic or stone) purposely designed to contain human remains the state of which (fragmentary/complete) is unknown.
Burial Floor (Below)		Covered or sealed by a floor deposit.
Human Bones: Age	*Young Adult*	18 years to 24 years
Human Bones: Articulated Body Parts	*Single Individual*	This is to record the presence of articulated body parts where the whole skeleton is not present. There has been no re-arrangement of remains and the remains can be related to a single individual.
Grave Circle	*e.g. Mudbrick*	Circle of stones either set slightly into or constructed upon the ground surface inside which skeletal material or cremated remains are scattered or deposited.
Grave Marker	*e.g. Stone*	Feature being used to mark the location of human remains.
Grave/Pit (Burial)	*e.g. Lined, Stone*	A feature deliberately dug/cut into the earth and/or stone and used solely to contain human remains. This record should NOT be used when it is assumed that the pit or feature was originally had another purpose e.g. storage.

Table 4. Examples from the standardized glossary or list of "observation" types used by the 'Invisible Dead' Project Database

Table 5
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Parent ID=JTFNE_X_0_0 (Site Level)

Category	Data Type	Detail Data Type	Period Code	Numerical Data 1	Data Comments
Literature Reference	Summary Period		LROM		
Site Feature	Cemetery	Cremation		1	Numerical data 1=Minimum Number of Site Features

Sub ID=JTFNE_X_1_0 (Sub Level 1 e.g. grave)

Category	Data Type	Detail Data Type	Period Code	Numerical Data 1	Data Comments
Literature Reference	Summary Period		LROM		
Site Feature	Grave/Pit (Burial)			1	Numerical data 1=Minimum Number of Site Features

Sub ID=JTFNE_X_1_1 (Sub Level 2 e.g. burial container)

Category	Data Type	Detail Data Type	Period Code	Numerical Data 1	Data Comments
Literature Reference	Summary Period		LROM		
Object Data	Burial Container: Jar/Urn (Complete)	Cooking Pot		1	Numerical data 1=Minimum Number of Objects
Object Data	Minimum Number of Individuals			2	Numerical data 1=Minimum Number of Individuals
Object Data	Human Bones: Cremated Remains	Multiple Individuals		2	Numerical data 1=Minimum Number of Individuals

Sub ID=JTFNE_X_1_1A (Sub Level 3 e.g. individual)

Category	Data Type	Detail Data Type	Period Code	Numerical Data 1	Data Comments
Literature Reference	Summary Period		LROM		
Object Data	Human Bones: Age	Adult		1	Numerical data 1=Minimum Number of Individuals
Object Data	Human Bones: Sex	Female		1	Numerical data 1=Minimum Number of Individuals

Table 6
Click here to download Table: Table6.docx

Major ID	DT	DDT	N 1	N2	N3	Data Comments	OC	Start BC	End BC
JTFNE_1_2_12A	Age	Child	1			N1=MNI		1800	1600
JTFNE_1_2_12A	Articulated Body Parts	Single Individual	1			N1=MNI		1800	1600
JTFNE_1_2_12B	Age	Infant	1			N1=MNI		1800	1600
JTFNE_1_2_12B	Articulated Body Parts	Single Individual	1			N1=MNI		1800	1600
JTFNE_1_2_12C	Age	Adult	1			N1=MNI		1800	1600
JTFNE_1_2_12C	Articulated Skeleton	Single Individual	1			N1=MNI		1800	1600
JTFNE_1_2_12C	Body Orientation	N-S	1			N1=MNI	Possible	1800	1600
JTFNE_1_2_12C	Body Position	Extended (Unclassified)	1			N1=MNI	Possible	1800	1600
JTFNE_1_2_12C	Head Orientation	N	1			N1=MNI	Possible	1800	1600
JTFNE_1_2_12C	Sex	Female	1			N1=MNI	Possible	1800	1600
JTFNE_1_2_10A	Age	Child	1	8	9	N1=MNI; N2=Start in years; N3=End in years		1800	1600
JTFNE_1_2_10A	Articulated Skeleton	Unclassified	1			N1=MNI		1800	1600
JTFNE_1_2_10A	Body Orientation	NW-SE	1			N1=MNI	Possible	1800	1600
JTFNE_1_2_10A	Body Position	Extended (Unclassified)	1			N1=MNI	Possible	1800	1600
JTFNE_1_2_10A	Head Orientation	NW	1			N1=MNI	Possible	1800	1600
JTFNE_1_2_10B	Age	Child/Adolescent	2			N1=MNI		1800	1600
JTFNE_1_2_10B	Articulated Body Parts	Multiple Individuals	2			N1=MNI		1800	1600

Table 6. Example data entries and queries from the 'Invisible Dead' Project Database (DT=Data Type; DDT=Detail Data Type; N1-3=Numerical data 1-3; OC=Overall Certainty). In this example, data were filtered using the data type, "Human Bones" and by period (1800-1600 BC). This query can be further refined and added to in Access, but also through the use of excel pivot tables.