

# Human Osteoarchaeology in the UK 2001–2007: A Bibliometric Perspective

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**ABSTRACT** Bibliometric analysis of osteoarchaeology publications covering the period 2001–2007 in leading journals was carried out. The aims were two-fold: firstly, to characterise research in this field in the UK and make comparisons with selected other countries, and secondly, to shed light on the use of skeletal collections. It was found that, since a previous survey of this type, covering the period 1991–1995, isotopic and DNA studies have increased. In the UK, work on biodistance studies is minor compared with other countries, and the proportion of palaeopathology work is high. In palaeopathology, substantial effort continues to be devoted to case studies, particularly in the UK where the frequency of problem-orientated work directed at understanding earlier populations has not increased since the early 1990s. Although it is argued that the case study still has a place in osteoarchaeology, the balance of work needs to shift further in favour of population studies, particularly in the UK. Skeletal collections are vital for primary osteoarchaeological work, and there was little evidence for any great use of skeletal databases such as the Standard Osteological Database. Skeletal collections from the UK were the most used for the research papers analysed, demonstrating the importance of UK-held collections for research that leads to high profile publication in the international scientific literature. These observations are pertinent since legal, ethical and practical issues in the treatment of human remains, particularly those connected with retention of skeletal collections, are now coming under closer scrutiny in the UK. Copyright © 2008 John Wiley & Sons, Ltd.

*Key words:* palaeopathology; biodistance; museum; human remains; reburial

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## Introduction

Bibliometric analysis, the quantification of publications, is an established tool for evaluating research trends in scientific disciplines (King, 1987). In anthropology it has been used to assess aspects such as author productivity (e.g. Pacheco *et al.*, 2002), the visibility of different disciplinary areas of research (e.g. Lovejoy *et al.*, 1982; Buikstra *et al.*, 1990; Mays, 1997; Stojanowski & Buikstra, 2005), the balance between descriptive and analytical papers (e.g. Armelagos & van

Gerven, 2003; Stojanowski & Buikstra, 2005), and the character of research output from different countries (e.g. Mays, 1997). The current work uses bibliometric analysis to examine research in human osteology. The aims are as follows: to assess the character of osteoarchaeological research; to determine whether this has altered since a previous survey of publications from the period 1991–1995 (Mays, 1997); to compare the UK with certain other countries; and to assess the use of skeletal collections in the UK and elsewhere by authors of research papers. Several factors have prompted the current study.

Given the changes in osteoarchaeology that have occurred since a previous survey of published articles covering the period 1991–1995, such as the

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rise of biomolecular techniques and controversy over the desirability of some types of osteoarchaeological publication (such as the palaeopathology case study: Mays, 1997; Armelagos & van Gerven, 2003; Stojanowski & Buikstra, 2005; Roberts, 2006), it seems timely to investigate the ways in which osteoarchaeological publications have changed during that time. The previous study covering the period 1991–1995 indicated differences between the UK and some other countries in the balance of research, which appeared to reflect differing academic traditions. In the light of developments in osteoarchaeology since then, it is of interest to determine whether such differences persist.

In some parts of the world (e.g. North America), ethical aspects of archaeological human remains, particularly the issue of reburial of excavated material, have been subject to often quite polarised debate for more than 30 years (reviews in Ubelaker & Grant, 1989; Jones & Harries, 1998; Larsen & Walker, 2005; Walker, 2008). Although, by comparison, the debate in Britain has been less developed, this is now changing. Ethical issues, particularly those associated with reburial versus retention of skeletal collections, have assumed a higher profile, if not in the public arena then at least within the archaeological and anthropological professions (Mays & Smith, under review). Several factors are responsible. In 2000, the UK and Australian Governments made a joint declaration to increase efforts to repatriate Australian aboriginal human remains held in UK museums to indigenous Australian communities. As a consequence of this accord, changes were made in UK law in 2004 that gave some large national museums (e.g. the Natural History Museum, London) powers, which they previously lacked, to deaccession material. A code of practice for dealing with claims for repatriation of overseas human remains housed in UK museums was drawn up in 2005 at the behest of the UK government (Swain, 2005). Since these well-publicised events, successful claims have been made for repatriation of important overseas human remains from institutions including the Natural History Museum, Liverpool Museum, Glasgow Museum, Aberdeen Museum and University College London (e.g., see <http://www.nhm.ac.uk/about-us/news/2007/>

[http://www.nhm.ac.uk/about-us/news/2007/may/news\\_11682.html](http://www.nhm.ac.uk/about-us/news/2007/may/news_11682.html) for details of a recent claim for Tasmanian Aboriginal remains dealt with by the Natural History Museum). Given the current political climate, it seems inevitable that claims for repatriation of overseas material held in UK museums will continue to increase.

Turning to remains of UK origin, some followers of Neo-Pagan religions are currently approaching UK museums requesting reburial of prehistoric British human remains (discussion in Mays & Smith, under review). In addition, recent and continuing re-evaluation of burial laws in England (Ministry of Justice, 2007) means that the legal basis for retention of skeletal material excavated from archaeological sites under Ministry of Justice permission is at present unclear, although discussions are continuing to try to resolve this (<http://www.archaeologists.net/modules/icontent/inPages/docs/Burial%20law%20and%20archaeology%20statement.doc>). In the light of the above developments, evaluation of the use made of UK archaeological collections for research is timely.

Publications in refereed journals were chosen as the basis of the current study for several reasons. Journal articles are the accepted means by which the scientific community reports its results, and they form the main basis for textbooks and other synthetic work. Periodicals represent the most prestigious avenue for publication of primary research. They generally have a wider circulation and longer lasting availability than monographs or edited volumes. External peer-review helps ensure the highest standards. Most journal articles in osteoarchaeology give details of the collections used in the work, and it was this that was the source of the data for the part of the present work focusing on use of collections. This methodology permitted evaluation of use of collections that resulted in high-profile publications with quality control by peer review.

## Methods

To ensure comparability with previous work (Mays, 1997), the selection of scientific journals, and the methodologies for classifying publications therein, are identical with those used in that study. Briefly, publications from authors

based in the UK are compared with those of authors based in the US, Germany and Japan. These countries were selected because they are major centres of osteological research and have differing academic traditions. Seven journals from the countries of interest were selected for analysis. They comprise two periodicals published in the UK (*International Journal of Osteoarchaeology* and *Journal of Archaeological Science*), one from the US (*American Journal of Physical Anthropology*), one from Japan (*Anthropological Science*) and three from Germany (*Homo: Journal of Comparative Human Biology*; *Zeitschrift für Morphologie und Anthropologie*; *Anthropologischer Anzeiger* (incorporates *Zeitschrift für Morphologie und Anthropologie* from 2003)). Publications in these journals from the period 2001–2007 were analysed. This period was chosen in order to give a view ten years on from the earlier study (Mays, 1997). Works concerned with tracing human evolution were excluded.

Articles were ascribed to countries on the basis of the academic affiliation of the author. In multi-author papers, the academic address of the first author was used. Each article was classified into theme and subtheme (Table 1). In addition, each article was classified, according to the primary nature of the contribution, into one of the following categories:

- (1) Case study. An article whose prime aim is the study of remains on an individual-by-individual basis. Most often seen in palaeopathology, case studies are often devoted to only one skeleton but, equally, several skeletons may be described.
- (2) Population study. A study of patterning in osteological data in one or more skeletal collections, the aim of which is to shed light on one or more earlier populations.
- (3) Methodological study. Innovations in osteological methodology.
- (4) Review/comment. Reviews of existing publications; anything from wide-ranging literature reviews to comments on single papers.

For papers based on primary data, rather than reviews or comments on existing work, the source of the data was classified as: archaeological skeletal material, modern skeletal material (distinguished from archaeological material by

Table 1. Classification of published articles into theme and subtheme

Theme	Subtheme
Bone chemistry	DNA Bulk or trace elements Isotopic
Palaeodemography	Age Sex Age and sex
Normal skeletal variation	Metric Non-metric Metric and non-metric
Palaeopathology	Growth Infection Arthropathy Neoplasm Trauma Metabolic disease Non-specific stress Dental disease Congenital disease General

*Note:* Articles which do not fall into any of the above themes or subthemes were classified as 'other'.

having never been buried, and/or dating from the 20<sup>th</sup> or 21<sup>st</sup> centuries), or data from one or more existing skeletal databases (e.g. the W.W. Howells Craniometric Database, <http://konig.la.utk.edu/howells.htm>). When skeletal remains were used, the location(s) of the holding institution(s) were recorded. In cases where remains were held in the UK, the following aspects were noted: whether remains were of UK or overseas origin, the specific holding institution(s), and the countries where the remains originated (for overseas remains) or the archaeological site(s) where they were excavated (for UK remains).

Some caveats should be borne in mind regarding the methodologies used here. The approach provides only a partial overview of osteoarchaeology as there are myriad other publishing venues for articles in this field besides the journals analysed. Secondly, the picture obtained is one that is distorted by the editorial policies of the journals studied. Nevertheless, the work should provide some insight into osteoarchaeological practice. Papers published in academic journals cannot be considered independent entities for the purposes of statistical analysis. This means that the levels of statistical significance

of patterning in the data will not be as great as suggested by standard inferential statistical tests. Nevertheless, statistical tests are undertaken as a general aid to identifying the more important patterning in the data.

## Results

A total of 735 articles published from 2001–2007 were analysed (Table 2). Articles were published by authors located in 45 different countries. Not surprisingly, given the journals selected, the countries contributing most articles were the US, UK, Germany and Japan (a total of 422 papers). Of the remaining 41, only four countries (Canada, France, Italy, Spain) contributed more than 20 articles. In the review of 1991–1995 publications (Mays, 1997), only articles by authors from the UK, US, Japan and Germany were studied ( $n = 325$  articles). To ensure comparability with that work it is, unless specifically stated, the subset of 422 articles published 2001–2007 from the UK, US, Japan and Germany that form the basis of the analysis below.

### *Assessment of the character of osteoarchaeological research*

Chi-square tests indicate no evidence for changes in themes of published articles over the period 2001–2007. However, comparison with previous data (Mays, 1997) indicates some shift of emphasis since 1991–1995, with an increase in articles on bone chemistry (Table 3). This trend is

Table 3. Articles from authors based in the UK, US, Japan and Germany split by theme and compared with previous data

Theme	Period	
	1991–1995	2001–2007
Bone chemistry	43 (14%)	91 (23%)
Demography	48 (15%)	41 (10%)
Normal skeletal variation	96 (30%)	116 (29%)
Palaeopathology	128 (41%)	151 (38%)
Total	315	399

1991–1995 data from Mays (1997). Data exclude articles with themes classified as 'other'.

Chi-square = 11.9,  $p < 0.001$ .

particularly marked in the UK and Germany (Figures 1 & 2). Among bone chemistry studies, both DNA and isotopic work have increased, but there has been a fall in publications on trace and bulk element composition of bone (Table 4). The proportion of bone chemistry articles devoted to ancient DNA is particularly high in Germany (about half) and the UK (about a third). In the UK, although the balance appears to have shifted in favour of articles on bone chemistry, overall, as in 1991–1995, palaeopathology articles are greatest in frequency. In 1991–1995, palaeopathology articles also dominated in the US, but they have now been surpassed by articles on normal skeletal variation. For Germany, articles on normal variation are now the least rather than the greatest category, whilst the highest proportion of contributions is on bone chemistry. The overall pattern for Japan is the least changed since 1991–1995.

Table 2. Numbers of articles published 2001–2007 in the journals included in the study, split by country of author

Journal	Country of author					Total
	UK	US	Japan	Germany	Other	
<i>International Journal of Osteoarchaeology</i>	52	38	3	13	99	205
<i>Journal of Archaeological Science</i>	37	17	4	3	37	98
<i>American Journal of Physical Anthropology</i>	49	116	7	12	121	305
<i>Anthropological Science</i>	0	4	30	0	5	39
<i>Anthropologischer Anzeiger</i>	0	1	0	16	11	28
<i>Homo</i>	1	8	2	6	39	56
<i>Zeitschrift für morphologie und Anthropologie</i>	0	1	1	1	1	4
Total	139	185	47	51	313	735

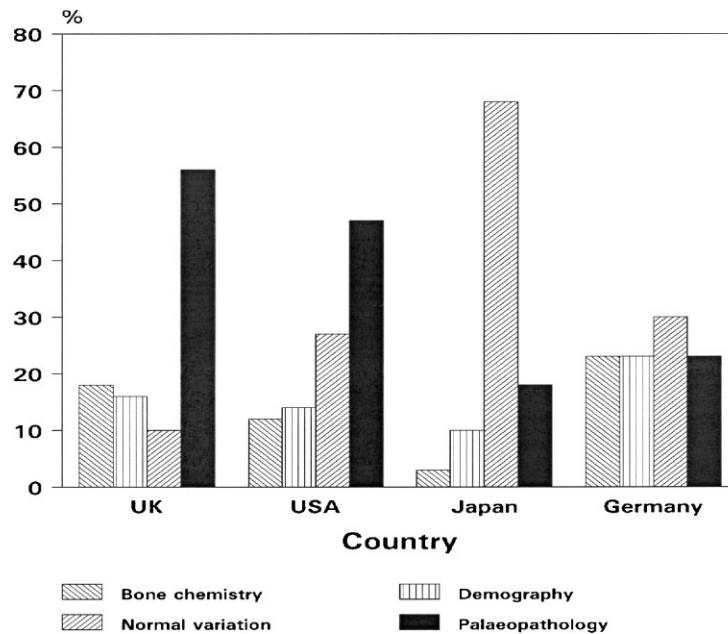


Figure 1. Percentage of articles on human osteoarchaeology published from 1991–1995 by theme for each country. Data from Mays (1997).

In both Japan and the US, the greatest number of articles are on normal skeletal variation, and in each case the majority of these are population studies (83% of Japanese and 63% of US). Among

Japanese authors, the majority of population studies (14/19 = 74%) focus on biological distance (i.e. they examine variation in skeletal morphology in attempts to define patterns

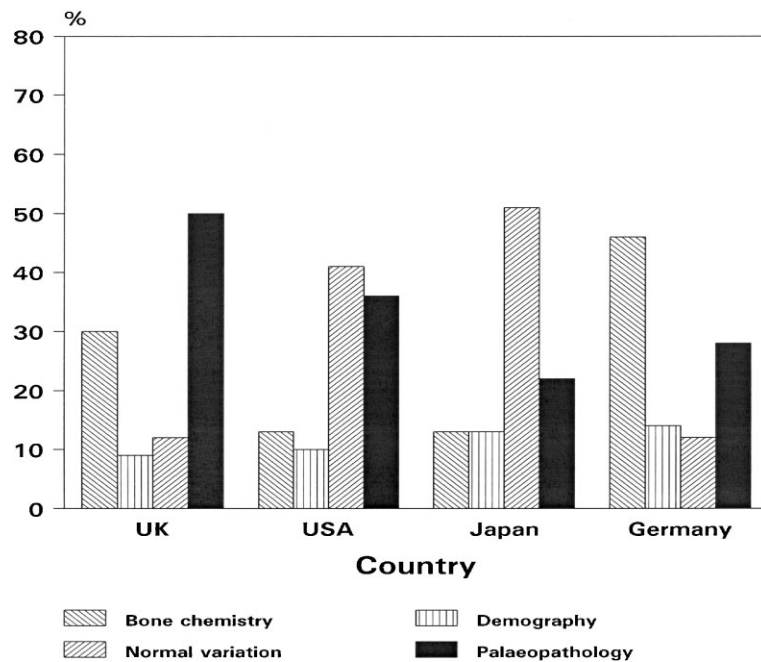


Figure 2. Percentage of articles on human osteoarchaeology published from 2001–2007 by theme for each country.

Table 4. Bone chemistry studies by subtheme

Subtheme	Period	
	1991–1995	2001–2007
DNA	9 (27%)	32 (37%)
Bulk/trace element	17 (52%)	5 (6%)
Isotope	7 (21%)	49 (57%)
Total	33	86

1991–1995 data from Mays (1997). 2001–2007 data exclude articles with subthemes classified as 'other'.

thought to reflect genetic relationships (Buikstra *et al.*, 1990)). In the US, 20/45 = 44% take this perspective, and the remainder either use skeletal morphological variation to investigate activity patterns or other extraneous variables, or else take an exploratory approach in which both genetic and non-genetic factors are considered in interpreting the results.

Given the debate, particularly in the last ten years, surrounding the value of case studies in palaeopathology, it is of interest to examine whether the frequency of this type of palaeo-

pathology publication has changed in recent years. In the data-set for the period 1991–1995, 55/128 = 43% of palaeopathology publications were case studies (Mays, 1997). For the 2001–2007 data-set the corresponding figure for Japan, Germany, UK and US combined is 56/151 = 37% (the figure for all countries combined is 113/295 = 38%). Although this appears to represent a slight fall in the proportion of palaeopathology papers which are case studies, the difference between the two periods fails to reach statistical significance (chi-square = 1.01,  $p = 0.3$ ). However, analysis of the 2001–2007 data by year of publication indicates a significant pattern, with a lower proportion of case studies toward the end of this period (Table 5).

Types of palaeopathology publication by country are shown in Table 6. Palaeopathology publications in the US and UK differ (chi-square = 6.53,  $p = 0.04$ ), with more population studies in the US and more case studies and methodological work in the UK. The most popular palaeopathology subthemes for authors from Japan, Germany, UK and US combined

Table 5. Case studies and other palaeopathology publications by year

	Year of publication							Total
	2001	2002	2003	2004	2005	2006	2007	
UK, US, Japan, Germany only								
Case study	5	13	12	2	7	11	6	56
Other	9	12	7	7	17	19	24	95
All countries								
Case study	12	21	22	11	18	17	12	113
Other	22	20	17	16	26	37	44	182

Kolmogorov-Smirnov test:  $p = 0.033$  (UK/US/Japan/Germany),  $p = 0.014$  (all countries).

Table 6. Types of palaeopathology publications split by country

	Country of author				
	UK	US	Japan	Germany	Other
Case study	25 (39%)	17 (27%)	5 (50%)	9 (64%)	57 (40%)
Methodological study	19 (30%)	11 (16%)	0	1 (7%)	25 (17%)
Population study	18 (28%)	30 (48%)	5 (50%)	3 (21%)	60 (42%)
Review/comment	2 (3%)	5 (8%)	0	1 (7%)	2 (1%)
Total	64	63	10	14	144

Table 7. Use of archaeological collections of human skeletal remains held in different countries, split by location of researcher

Location of researcher	Location of collection			
	UK	US	Japan	Germany
Same country as location of collection	96 (71%)	86 (85%)	34 (77%)	32 (88%)
Different country to location of collection	40 (29%)	15 (15%)	10 (23%)	9 (22%)
Total	136	101	44	41

were trauma (making up 29% of articles) and metabolic disease (15%); for all palaeopathology papers, trauma (25%) and infectious disease (14%) were most frequent.

### Assessment of use of skeletal collections

Of the 735 articles analysed, 44 did not present primary skeletal data but were solely concerned with describing technical or methodological innovations, or were reviews of, or comments on, existing literature. The remainder were based on skeletal data. Five used data from existing skeletal databases (principally the W.W. Howells Craniometric Database), and 686 utilised examination of skeletal material. Five hundred and eighty-six used archaeological material only, 70 used modern material only, and 30 used both archaeological and modern remains. Of the total of 616 articles using archaeological material, information on the location of the collection was available in 597. Of these, 527 articles made use of collections held in one country, while 70 used material located in more than one country. Most frequently used were collections held in the UK (136 papers), followed by the US (101), Japan (44) and Germany (41). As might be expected, collections in a particular country tended to be used most often by workers from that same country (Table 7), but UK collections showed a greater proportion of use by researchers from overseas than did collections in other countries (chi-square = 5.44,  $p = 0.02$ ).

Of articles that made use of archaeological collections held in the UK, 135 gave information on the origin of the collection (Table 8). Among UK-based researchers, 87% used only UK-excavated collections, with 13% making use of

Table 8. Use of archaeological collections of human skeletal remains of domestic and overseas origin held in UK institutions by researchers based in the UK and those based in other countries

Location of researcher	Origin of collection(s) in UK institution(s)		
	UK	UK and overseas	Overseas
UK	84	1	11
Overseas	16	4	19

overseas material held in the UK. Of researchers visiting the UK from overseas, the split was more even, with similar numbers using material of UK and non-UK origin. The specific UK institutions whose collections were most often used were, for material of UK origin, the Natural History Museum, London (used in 27 articles) and English Heritage, Portsmouth (used in 28 articles), with Christ Church Spitalfields, London (968 burials), used in 20 articles, and Wharram Percy (687 burials) used in 22 articles, being the most frequently used individual collections. Of the 23 UK archaeological collections used for the preparation of more than one research paper, 21 (91%) consisted of more than 100 burials, 18 (78%) more than 200 and 9 (39%) of more than 500 burials. This is despite the fact that large assemblages in the UK are in a minority – about 13% of excavations at archaeological burial sites have yielded more than 100 skeletons; the figures for more than 200 and more than 500 are approximately 7% and 2% respectively (Mays, n.d.). For material of overseas origin, the great majority of studies used collections from either the Natural History Museum, London (used in 23 studies) or the

Duckworth Collection at the University of Cambridge (20 studies). The most commonly used collections of overseas origin were excavated from Egypt or the Sudan (14 studies).

## Discussion

Perhaps the most striking change in the overall character of osteological research since the period 1991–1995 is the rise in the proportion of articles devoted to aspects of bone chemistry. This rise is due to an increase in articles on ancient DNA and on stable isotopes, whereas publications on trace or bulk elemental composition of bone decreased quite markedly. The rise in isotopic work and the decline in elemental analyses are probably related. For dietary studies, the former has replaced the latter as the technique of choice as the problems in interpreting element levels in buried bone in dietary terms, chiefly due to the pervasiveness of diagenetic changes, became generally appreciated (Burton, 2008). In addition, since the early 1990s, carbon and nitrogen stable isotopic work has broadened beyond the investigation of C4 or marine contributions to diet, to include more studies which investigate aspects such as trophic level (e.g. Hedges & Reynard, 2007), age at weaning (e.g. Richards *et al.*, 2002) and attempts to quantify dietary components using mathematical modelling (e.g. Kellner & Schoeninger, 2007). The study of residential mobility using isotopic composition of tooth enamel was beginning in the early 1990s (e.g. Price *et al.*, 1994) and has since become a major focus (e.g. Budd *et al.*, 2004; Bentley, 2006). The rise in DNA articles is also as expected given that the field was still in its infancy in the early 1990s (Donoghue, 2008; Stone, 2008).

The rise in bone chemistry studies is particularly evident in Germany and the UK. In Germany this may reflect the strong links that biological anthropology has traditionally enjoyed with the natural sciences (as evidenced, for example, by early work there on trace elements in buried bone: Grupe & Herrmann, 1988), coupled with a strong positivist tradition in the humanities in Germany (Härke, 1995). In the UK, work on ancient biomolecules was stimulated by a five-

year (1993–98) initiative by the Natural Environment Research Council, a major UK science funding body, resulting in £1.9 million for work in this area. For human remains, this particularly boosted work on ancient DNA (<http://ads.ahds.ac.uk/catalogue/collections/blurbs/278.cfm>).

In Japan, studies of normal morphological variation form the largest category. Most comprise craniometric studies aimed at evaluating biological affinities and population history. Cultural history has long been the predominant theme in Japanese archaeology (Tsude, 1995), and the balance of osteological work seems to reflect this. Studies of normal skeletal variation also form the largest category in the US. The balance between studies emphasising activity patterns and other environmental influences on bone morphology, and those focusing on biological affinities was more even but, although less than in Japan, a substantial proportion of research on normal skeletal variation in the US remains devoted to investigations of biological affinity. This is despite recent critiques from some US commentators which characterise such work as driven by outmoded views of culture change being due to ancient migrations and admixture of populations (Armelagos & van Gerven, 2003). Critiques of this nature are grounded, to a great extent, in the so-called New Archaeology, which arose in the 1960s and 1970s in North America. In this paradigm, there was a move away from particularistic approaches to understanding the past in which culture change was ascribed to specific historical events (such as migration of peoples), toward an emphasis on the study of social process, particularly the ways in which cultural systems enable communities to adapt to their environments. Clearly in some minds, the study of population history, whether using measures of biological distance or other means, is tainted by associations with earlier, simplistic views of culture change. However, it is incontestable that population movements can be powerful engines of social and cultural change, and it has been emphasised (Anthony, 1990, 1997) that analysis of migrations can be accommodated within a processual framework by treating them as patterned, dynamic human behaviour rather than as unique events. The study of migrations and population history are import-



ant areas of enquiry in other disciplines (Anthony, 1997) and ought not to be neglected in osteoarchaeology.

The continued importance of biodistance studies in literature from the US is in contrast to the situation in the UK. Only five UK-authored articles were population studies of normal skeletal morphology, and of these only one was a study of biological affinities. In Britain, the rejection of traditional biodistance studies since the 1960s has been stronger than in North America (Mays, 2000). This clearly continues, despite the rise in Britain of post-processual models in theoretical archaeology in the 1980s and 1990s which placed an emphasis on constructing historically-specific accounts of past societies in which events as well as processes assume importance (Champion, 1992), and the rise in interest in ethnicity (e.g. Jones, 1997), of which biological relationships are an important component. That biodistance studies in the UK continue to languish, despite the now rather less hostile theoretical environment, may reflect that osteology has tended to remain rather isolated from developments in social and historical theory in British archaeology (Sofaer, 2006: 31–4).

During the 1960s–1980s in the UK, many osteologists (or their teachers) came from medical backgrounds. In the 1980s, the first UK postgraduate programmes were set up to teach osteology within an explicitly archaeological framework, and this type of course proliferated during the 1990s so that such training became quite widely available (Roberts, 2006). It seems reasonable to expect such a change might have resulted in a reduced emphasis on the study of ancient disease as opposed to other areas of osteoarchaeological enquiry, and that a greater proportion of palaeopathology work should now be population studies rather than case studies or methodological works. The current study provides little evidence of such changes since the early 1990s. In the UK, articles on palaeopathology predominate just as they did in 1991–1995, and the proportion of population studies in palaeopathology is similar (28% in 2001–2007, 27% in 1991–1995). Compared with palaeopathology in the US, in the UK there are more methodological and case studies and fewer population studies. The divide between published

palaeopathology output in the US and in the UK remains as strong as in 1991–1995. This may reflect a continued medical influence in UK palaeopathology, with a consequent emphasis on careful description of lesions and diagnostic congruence with clinical sources, whereas in the US the anthropological tradition demands a population-based approach with statistical analysis of patterning directed at hypothesis testing (Robb, 2000).

There is no very strong evidence that the proportion of case studies has changed since 1991–1995, not just in the UK but in palaeopathology publications as a whole. In part, this may reflect pragmatic factors. In the UK, many osteoarchaeologists work not in a university environment but in a commercial one in which they are employed on contract to produce osteological reports on skeletal series which have been excavated in advance of development (Mays, 1997). Similar divides exist between 'academic' and 'contract' osteoarchaeology in other countries (Grauer, 2008). In a commercial environment, osteoarchaeologists are not usually in a position to apply for academic funding for research proposals, nor would their contracts normally permit them the time to work on such projects. However, 'interesting' specimens, encountered during preparation of osteological reports, can fairly readily be written up for publication as case studies in the scientific literature. Osteological reports often languish unpublished for considerable periods of time, and even when they are published they often have limited circulation. Publication of case studies in academic periodicals is thus a means of ensuring that important specimens are made known to the wider scientific community, and of allowing contract osteoarchaeologists to raise their publication profiles. In the current data-set, among UK-based authors 44% of palaeopathology case studies came from workers employed in contract osteology, 24% from those in museums or heritage bodies, and 32% from those in universities. For other types of palaeopathology publications the figures were 3%, 36% and 61% respectively.

Commentators have often characterised the history of palaeopathological enquiry as progress from a descriptive case-study approach toward

population-based research (e.g. Armelagos, 1997; Mays & Pinhasi, 2008; Grauer, 2008). There seems to be a feeling, at least among some observers, that more progress needs to be made in this direction, particularly in the UK (e.g. Roberts & Manchester, 1995: 196; Mays, 1997; Roberts, 2006). Others appear to go further and question whether the case study should have any continuing role in the discipline (Armelagos & van Gerven, 2003). In response, it has been pointed out (Stodder *et al.*, 2006) that case studies are important as they provide the basis for synthetic work, for example works dealing with particular diseases (e.g. Roberts & Buikstra, 2003), particular geographical areas (e.g. Roberts & Cox, 2003) or broader reviews (e.g. Larsen, 1997). However, one would clearly not wish the literature flooded with case studies on the basis that somebody somewhere might find them useful for some future synthesis. Further justification is surely needed. For a case study publication to be worthwhile, the specimen needs to have some wider significance. This would be so if, for example, it represents a case of a particular disease in a period or region from which it had not hitherto been well-described (e.g. Suzuki & Inoue, 2007), if it is from a context which sheds new light on historical debates over the origins of a particular condition (e.g. the Columbian hypothesis in the history of syphilis and treponemal disease: Erdal, 2006), or if the case has particular cultural significance (e.g. Formicola & Buzhilova, 2004; Porr & Alt, 2006). Case studies also have a value if they aid future workers in palaeopathological diagnosis. This may be the case if they illustrate aspects not well-covered in standard palaeopathology text books (e.g. renal osteodystrophy: Mays & Turner-Walker, 2008). Provided that one or more of the above conditions are satisfied and, in addition, description and illustration of lesions is thorough, histological study and medical imaging are used if appropriate, the distribution of lesions in surviving skeletal elements is illustrated, and differential diagnosis is rigorous and takes account of the latest relevant medical literature, the case study still has a valid place in palaeopathology.

Turning to the sources of skeletal data, less than 1% of studies used as their data source

existing osteological databases, rather than skeletal collections. The general lack of use of existing databases for primary research, despite the availability of many substantial ones (e.g. the Standard Osteological Database (<http://www.cast.uark.edu/cast/sod>), the W.W. Howells Craniometric Database (<http://konig.la.utk.edu/howells.htm>), and the Database for Prehistorical and Historical Anthropology (Schwidetzky & Jäger, 1991)) is perhaps not surprising. For studies involving destructive analysis, only the skeletal material itself will suffice. The rise in investigations involving chemical analyses, evident in the current study, demonstrates the growing importance of such work. For palaeopathology case studies, databases are unlikely to provide sufficient details of the right kind to permit useful publication. For problem-oriented methodological or population studies, researchers clearly need to gather data specifically relevant to the problems they are investigating. Research questions and methodologies develop rapidly, and authors bring a diversity of approaches to bear on remains. It is therefore unlikely that an existing database, however carefully it was constructed, will serendipitously contain the exact data required by any particular researcher. Osteological recording of remains, no matter how painstakingly carried out, cannot compensate in primary research for loss of a skeletal collection due to reburial. This serves to reinforce the point that retention of skeletal material is fundamental for the continuance of osteoarchaeological research.

As might be expected, there was a tendency among researchers to utilise skeletal material held in the country in which they were based. Due to the methodology, the current work is biased toward workers based in the UK, US, Japan and Germany. The use of collections held in these countries by authors of articles considered in the current work will therefore doubtless be exaggerated compared with the use made of them by the research community as a whole. Nevertheless, the finding that collections in the UK were used more often than those from any other country (despite the fact that UK authors were not the most numerous category) testifies to the importance of UK collections for research that leads to high-profile publications. The particular importance to researchers of large collections is shown

by the observation that the great majority of UK-held collections recovered from UK archaeological sites which were used for more than one research study consisted of more than 200 burials. The greater use made of larger collections has also been noted for collections held in other countries (Gordon & Buikstra, 1981).

Of studies using UK-held material, nearly 75% used solely material excavated from UK archaeological sites. However, more than half of overseas researchers who used UK-held collections studied material originating overseas. This illustrates the importance of holdings of overseas material in cementing the UK's position as an international centre for osteological research.

## Conclusions

Since a previous survey covering the period 1991–1995, the most striking change in the character of research in osteoarchaeology is the rise in articles focusing on ancient DNA and bone stable isotopes. Work on ancient DNA was in its infancy in the early 1990s, and since then the field has matured. In the 1990s, stable isotope analysis of diet was already an established technique in osteoarchaeology, but recently it has begun to address more nuanced questions about diet and has also expanded to address other aspects, such as residential mobility.

To a large extent, the differences in the balance of osteological work between the UK and the other countries studied identified for the 1991–1995 publications persist. The proportion of UK publications devoted to palaeopathology remains high, and works on normal morphological variation, particularly biodistance studies, are few.

In palaeopathology, the case study remains a common type of publication, particularly in the UK, and there are only weak signs of decline since the early 1990s. Although it may well be that the proportion of publications taking the form of case studies is rather high, particularly in the UK, it was argued that carefully prepared case studies that have a wider significance either for the history of disease, for palaeopathological diagnosis, or for other reasons, have a valid part to play in advancing the discipline.

The current study reinforces the necessity for retention of skeletal collections for the continuance of primary research in osteoarchaeology. Osteological recording of skeletal material can never compensate for the loss of a collection. Although recording of the material to current standards is an understandable response when faced with reburial, the lack of use made of databases such as the Standard Osteological Database, evidenced in the current study, makes one question whether that is an optimal strategy. Perhaps a better use of resources might be to fund problem-orientated work that uses threatened collections.

UK-held skeletal collections are vital for maintaining the position of the UK as a centre of international importance for the study of osteoarchaeology. The importance of UK-held skeletal collections as a basis for research published in leading journals is particularly pertinent at a time when the threat of repatriation hangs over many collections of overseas remains held in UK museums, and there is uncertainty even over material excavated from within the UK. This serves to remind us that, although most osteologists and archaeologists agree that in some circumstances it may be right to repatriate or rebury specific collections (e.g. SAA, 2004; BABAO, 2008), indiscriminate reburial of collections is unethical as it denies future generations the opportunity to learn from them. Most use tends to be made of large skeletal assemblages. Their importance is likely to increase given recent calls for further progress, particularly in palaeopathology, toward population-based, problem-orientated studies, which by their very nature require large collections.

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