Institution: University of Bradford

Unit of assessment: 17 – Geography, Environmental Studies and Archaeology

a. Overview

Archaeology at Bradford has a long-established reputation as a key centre for research. Bringing together staff from Humanities and Science backgrounds, we have created a powerful and distinctive interdisciplinary research identity blending cultural archaeology with cutting edge science. Our research ethos is to advance socio-cultural interpretation in concert with fundamental archaeological science. Field and laboratory-based projects have a global reach, encompassing Mediterranean and South-East Europe, Western Asia, the North Atlantic, Africa, Japan, and South America.

Our two principal research areas have been substantially reformulated since RAE 2008, when we defined 'Biological and Social Identity' and 'Social Dynamics' as our major themes. Subsequent staff changes and new research opportunities have led to structural changes and we now define two new research themes with considerable interplay of ideas and perspectives between them:

1) Social and Biological Identities
2) Archaeological Sciences

These changes have given new focus and vibrancy to our research. Several staff participate in both, reflecting the highly connected, interdisciplinary nature of archaeological research at Bradford. Regular group meetings define emergent directions, help to share best practice, and enable the integration of Early Career researchers, PDRAs, and PhD students.

b. Research strategy

We believe that the human past can only be adequately addressed within a robust trans-disciplinary framework. We aim to advance understanding of the human past by (i) developing new analytical approaches to archaeological research questions, (ii) integrating perspectives from the humanities and sciences, (iii) capitalising on the diversity of expertise within our staff group. Our research strategy in RAE 2008 is reviewed in the relevant sections below. Staff changes have meant the discontinuation of certain areas, notably research on human origins, which lapsed with Lee-Thorp's departure to a chair at Oxford.

Social and Biological Identities: (Armit (co-ordinator), Batt, Becker, Buckberry, Croucher, Dockrill, Gaffney, Gibson and Wilson) Our distinctive approach in this area combines cultural archaeology with biological anthropology in the study of the social and biological identities of past people and societies. Working at a range of scales, from the individual to the societal, we address issues such as social inequality, conflict and violence, landscape inhabitation, diet, health and migration. Our work maintains a focus on the human body and its centrality to social relations, particularly in prehistory. Methodologies range from osteological analysis to theoretical studies of personhood, applied through a series of long-term field-based projects extending geographically from the N Atlantic to Mediterranean and SE Europe, SW Asia, and Easter Island, and chronologically from the Mesolithic to Norse periods. These draw on the full range of scientific expertise at Bradford and represent real integration of humanities and science-based perspectives.

Evaluation of strategy and achievements since RAE 2008: Our research strategy in 2008 mapped key areas where work has subsequently focussed. Interpretive studies linking cultural and osteological evidence around the theme of the body and social identity in prehistory have resulted in major books on *Headhunting and the Body in Iron Age Europe* (Armit[1]) and *Death and Dying in the Neolithic Near East* (Croucher[1]). The interdisciplinary nature of our approach is demonstrated by publications in journals covering a range of disciplinary areas, including studies of personhood in *Feminist Theory* by Croucher and violence in the *British Journal of Criminology* (Armit[3]). Our focus on individual osteobiographies identified in RAE 2008 is exemplified by the interdisciplinary analyses of the Bronze Age Gristhorpe Man (Batt[2]) and Andean mummies (Wilson[1]), demonstrating the centrality of the body in social relations. Underpinning our approach is fundamental osteological work on age, sex and health status, combining with funerary archaeology to situate human biological identity in its social and cultural contexts (Buckberry[1,2]).

Key thematic areas were identified in RAE 2008 around the 'human ecology of the N

Atlantic' and the 'dynamics of social control in the complex societies of Iron Age Europe'. The former has been led by continuing work on the Iron Age and Viking Age societies of the N Isles, including publication of long-running excavations at Old Scatness in Shetland (Dockrill[1]), and analyses of societal responses to marginal environments in the N Atlantic (Dockrill[2]). Research into social complexity in Iron Age Europe includes methodologically innovative analyses of proto-urban centres in France (Gaffney[3]) and the UK (Gaffney[2]). The significance of enclosure to the construction of prehistoric communal identity across Neolithic Europe has been explored in a number of studies (e.g. Gibson[1]), including a specific focus on monumentality in the British Neolithic (Gibson[3]). Croucher has conducted a series of theoretically-engaged studies including recent fieldwork on Easter Island (Croucher[2]), and archaeological perspectives on the treatment of the dead (Croucher[3]).

Prehistoric identities have also been approached through studies of depositional practices (Becker[2]). As proposed in RAE 2008, we have broadened our links with government and industry, e.g. with the completion of large-scale projects dealing with 'legacy' data, most notably the *Broxmouth Project*, which used unpublished excavation archives as a platform for reinterpretation of Iron Age social relations in Scotland and analysis of the role of place and memory in the past (Armit[2]). Becker and Armit's analysis of more than 2000 Late Bronze and Iron Age ^{14}C dates from Ireland, obtained through commercial and development-funded archaeology, has similarly used legacy data as a platform for understanding demographic patterns in later prehistory (Becker[1]).

Key objectives and new/developing activities 2013-2018: Plans are in place and funding secured for initiatives that build on existing strengths and develop new lines of enquiry into our core questions around the nature and development of past social and biological identities. Research on Iron Age identities will develop through Armit's ENTRANS project (*Encounters and Transformations in Iron Age Europe*), a Bradford-led consortium with the Universities of Zagreb and Ljubljana, with €1M funding from HERA (2013-2016). Armit will also publish '*Iron Age Lives in Britain and Ireland: 800 BC-AD 400*' (Routledge), presenting a new vision of the Iron Age in the British Isles, and will lead 'legacy projects' on the internationally important Iron Age landscapes at Wetwang/Garton Slack, E Yorkshire, and the Late Bronze/ Iron Age ritual occupation at the Sculptor's Cave, Moray (scoping projects funded by English Heritage and Historic Scotland respectively). Armit and Gaffney's work on early urbanism in the Mediterranean will develop in partnership with French colleagues at the archaic Greek colony of Megara Hyblaea, Sicily (initial funding obtained through CNRS). Armit is also working in partnership with the Yorkshire Dales National Park Authority, through AHRC-funded CDAs, on a research programme focused on the later prehistoric landscapes of the Dales, in liaison with Gibson's British Academy-funded work on the Neolithic monuments of the area, carried out in partnership with the University of Vienna. Work on the N Atlantic will develop through Dockrill's *Gateway to the Atlantic* project, Batt's British Academy-funded chronological analysis of the Viking diaspora, and collaborations with colleagues in Durham and NERC Isotope Geosciences Laboratory on diet, health and mobility in the Danelaw (Buckberry).

Croucher is developing a project to explore archaeological perspectives on death in relation to interdisciplinary work on the end of life experience, with colleagues from the Schools of Life Sciences and Health at Bradford. Buckberry is currently leading osteoarchaeological research on elite burials from Stirling Castle and plans to develop a major interdisciplinary initiative around this project. Wilson will develop a new project, *Making the Metropolis*, examining diet, health and mobility in urban populations of the 18th and 19th centuries, through a funding proposal for the Wellcome Trust. Buckberry and Wilson will address aspects of these same research questions through work on Villiers St Crypt in Sunderland.

Archaeological Sciences: (Heron (co-ordinator), Batt, Beaumont, Gaffney, Koon, Stern and Wilson) Bradford continues to make a highly original and significant contribution to developments in fundamental archaeological sciences. In turn, this research stimulates new applications and enables new perspectives on the past. Research is integrated with Social and Biological Identities particularly in underpinning applications of prospection and dating in fieldwork programmes and in interdisciplinary investigations into human remains.

Evaluation of strategy and achievements since RAE 2008: Our strategy in 2008 emphasised the development of new analytical approaches to archaeological questions and their integration with the humanities. We have, as identified in 2008, undertaken pioneering

new investigations into *life-histories through incremental, high resolution isotope analyses to generate further insights into diet, social identity, and mobility* (Beaumont[1]). These applications are supported by fundamental research testing the efficacy of high-resolution intra-dentine carbon and nitrogen isotope profiles (Beaumont[1]) and oxygen isotopes in collagen (Koon[4]).

Research into taphonomic processes and its close interplay with forensic science was identified in our 2008 plans. This includes experimental research exploring relationships between body treatment and cadaver decomposition (Wilson[4]). Our expertise in microscopic integrity, isotopic characteristics and DNA preservation in hair, led to collaboration in research of global signficance with the sequencing of the first ancient human genome (Wilson[2]). The huge potential for biomolecular recovery from keratinous tissues has been identified (Wilson[3]. The preservation of ancient DNA in thermally-damaged archaeological bone shows that moderate heating of bone in the past increases the yield of DNA (Koon[2]). Visualisation of damage to collagen fibrils using TEM has been used to distinguish cooked bone from bone of butchered animals, providing new insights into animal processing (Koon[1]). Koon's research into hydroxylation mechanisms of collagen, applied to the detection of scurvy, has contributed to fundamental studies of collagen:mineral interactions (Koon[3]).

Our 2008 return emphasised *key transitions, such as the transition to agriculture*, and we have generated new data from residues in pottery vessels (Heron[2]). This approach has also been applied to Jōmon pottery dating to 15,000 BP from the late glacial period, the oldest pottery so far investigated (Heron[1]). These data sets rely on the comprehensive evaluation of single-compound isotope signatures obtained on ancient and modern fats and oils (Heron[4], Stern[4]). The efficacy of molecular markers for archaeological interpretation has been examined in the context of detecting ancient wine residues (Stern[1]), resins used in mortuary rites (Stern[2]), and marine mammal oil processing (Stern[3]) and use (Heron[3]).

Commitment to geophysics research was emphasised in our 2008 strategy. The archaeological interpretation of magnetic data from the fundamental concepts, field measurement and survey to interpretation and visualisation has been combined in a single volume (Gaffney[1]). Our expertise in dating is applied systematically in major Bradford-led fieldwork programmes and has provided a platform for new approaches. We are active in the ongoing comprehensive validation of rehydroxylation dating of ceramics (Batt[3]) whilst continuing to extend and to refine archaeomagnetic dating (Batt[1]).

Key objectives and new/developing activities 2013-2018: All of the following initiatives involve national and/or international collaboration and have either received funding or have bids under development. Wilson has led two JISC-funded awards, *From Cemetery to Clinic* (£150K, 2010-11) and *Digitised Diseases* (£750K, 2011-13), which use visualization techniques such as 3D laser scanning and CT scans to create a web-accessible archive of digital 3D models of pathological type-specimens. This foundation has resulted in new research developments including an AHRC/EPSRC Science and Heritage award (*Visualising Animal Hard Tissues*; 2013-14). We have recently been awarded £1.6 million by the AHRC to lead on a new project, *Fragmented Heritage* (Wilson), which will facilitate a considerable expansion of research capacity using visualisation approaches to artefacts, sites and landscapes. Beaumont is expanding her pioneering studies of intra-dentine isotope profiles with the aim of pinpointing short-duration events such as dietary change or nutritional deprivation in the juvenile years of life. Stern is embarking on new investigations (British Academy-funded) into organic poisons in prehistory using stone tools as a potential vehicle for their presence and use. Gaffney will develop his work on the buried landscapes around Stonehenge and will pursue innovative approaches to archaeological prospection through his role in the EPSRC-funded DART (*Detection of Archaeological Residues using remote sensing Techniques*) Partnership. Batt will develop archaeological chronologies through the ERC-funded *Persia and its neighbours* Project, the British Academy-funded *Telling the Time in Neolithic Orkney* and fundamental geomagnetic studies (NERC-bid pending). Heron, in collaboration with Habu (Berkeley), is testing the sensitivity of pottery vessel function to the growth and decline of one of the largest Jōmon sites in Japan (Sannai Maruyama). Koon's proof-of-concept research into collagen markers of scurvy will be tested on early European settlers in North America (EU Career Integration Award bid submitted).

c. People

Staffing strategy and staff development: The shape of the unit has changed

significantly since 2008 with the departure of several senior colleagues, including several to professorial positions elsewhere (Lee-Thorp at Oxford, Taylor at Vienna, Schutkowski at Bournemouth), and subsequent investment in a new generation of researchers. These changes necessitated the re-shaping of our research profile, with a consequent recruitment focus on key strengths and disinvestment in areas (e.g. human origins) where critical mass was felt to be lacking.

Our current team comprises a dynamic blend of senior staff, providing research leadership, and high-calibre Early Career staff working in a highly collaborative environment. Recent appointments of Beaumont, Croucher and Koon, as Research Investment Lecturers, strengthen and refocus research in stable light isotope research and biological anthropology, providing succession planning in these areas. The appointment of Becker as an AHRC Post-Doctoral Research Fellow has strengthened our research in cultural archaeology. New lecturers and PDs have reduced teaching and administrative duties and prepare a research development plan, supported by experienced mentors. New staff are inducted into the University's ethics policy which commits to maintaining high ethical standards in research. Research involving human participants, tissues or databases of personal information requires advance approval by the Research Ethics Committee. Ethical practice in authorship procedures is monitored by our Research and Knowledge Transfer Group which advises on best practice and is responsible for dispute resolution. All staff commit to the University's *Equality and Diversity Strategy 2011-14* (which also underpins practice in recruitment and selection), complete a *Diversity in the Workplace* e-Learning module and have access to an ongoing programme of staff training courses. Two staff (Beaumont, Croucher) have been invited to participate in GENOVATE, a £3.2 million FP7 project led by Bradford to promote equality and diversity among academic researchers in the EU. The ratio of male to female staff is currently 9:6. We subscribe to the principles of the 'Concordat to Support the Career Development of Researchers'.

Sabbatical leave is available to all academic staff, as part of their career development, through an institution-wide scheme, and is initiated by the staff-member in consultation with their line manager. Internally-funded sabbatical leave has been awarded recently to both part- and full-time staff, for example, to Batt (2012) and Wilson (2013) to enable sustained periods of time to complete specific research outputs and grant applications. Batt was subsequently awarded a British Academy Mid-Career Fellowship (2012-13) to evaluate and reinterpret scientific and archaeological dating evidence for the Viking expansion westwards across the N Atlantic region. She was also awarded an AHRC–funded KT Fellowship with English Heritage, *Magnetic Moments in the Past* (2009-10). These have enabled focussed periods of research on both of Batt's key research areas. Gaffney was also awarded a KT Fellowship by the National Roads Authority of Ireland (2010-13). Since RAE 2008, Wilson and Gaffney have been promoted to Senior Lecturer and Buckberry to Lecturer.

Post-Doctoral Researchers: Over the review period, eleven (8 female and 3 male) externally-funded post-doctoral researchers, including holders of prestigious research council fellowships, have contributed significantly to our research through publications and research collaboration. Dr Katharina Becker was PDRA on Armit's British Academy-funded *Mobility, Climate and Culture: Re-modelling the Irish Iron Age* (2010-11), was subsequently awarded an AHRC Early Career Fellowship (2012-13) for her project *The Irish Iron Age: Beyond Celts and Romans* and is now a University-funded Post-Doctoral Fellow. Dr Adrian Evans worked on the Leverhulme-funded *Hunter-Gatherer Mobility and subsistence strategies in the Upper Palaeolithic of Peninsular Italy* (2009-12), was subsequently awarded an AHRC Early Career Fellowship (2012-13) to develop new 3D microscope techniques for the study of stone tool usage and is now Project Manager on the AHRC-funded *Fragmented Heritage* Project (2013-17). Dr Sonia O'Connor (2010-13) obtained an AHRC/EPSRC Science and Heritage Programme Fellowship on *Cultural Objects Worked in Skeletal Hard Tissues*, and is now PDRA on an AHRC/EPSRC Science and Heritage award (*Visualising Animal Hard Tissues*; 2013-14).

Research students: Archaeology has a substantial and dynamic PGR community (55 graduated over the review period) including a significant number of students holding prestigious research council awards (17 AHRC, 3 NERC and 2 EPSRC graduated during the review period; a further 14 AHRC, 1 NERC and 1 HERA award are held by current PGR) and

international government funding (Greek, Egyptian, Libyan, Malaysian, Nigerian, Saudi). The number of competitive awards ensures a high quality of candidates creating a strong research ethos. Since 2002 the School of Life Sciences has funded PGR studentships by internal competition: the first students, including one in Archaeology, enrolled in 2012. All PGR students have a support committee, with a Principal and 1-2 Associate Supervisors; regular contact includes formal monthly meetings and annual progress monitoring. The University Graduate School provides a programme of research and transferable skills training (including employability skills). Formal MPhil-PhD transfer occurs after *c*.12 months. PGR students receive an annual subvention of £1000 towards research expenses, to cover the costs of laboratory work, field research and conference attendance. Early Career Researchers progress to principal supervisor status through initial involvement as Associate Supervisors.

Research students are fully integrated into academic life within Archaeology, participating in and organising seminars, workshops and conferences (e.g. the annual Iron Age Research Student Seminar, held in Bradford in 2010 and 2013). They can access University support to present at national and international conferences, and are encouraged to publish in peer-reviewed journals. The University's *Statement of Principles Relating to the IPR of Student Research* ensures inclusion of students as authors wherever their research contributes to a paper. Our active PGR research culture includes regular coffee-meetings, a journal club, 'geo-lunches' where PGR students trial ideas, and a 'code club' where PGRs and others create open source research materials. PGR students benefit from free access to CPD modules taught within the Analytical Centre, dealing with specialist analytical skills, and CPD short courses on Palaeopathology and Dental Anthropology. The quality of PGR student work is shown by the award of ten prizes at major international and national conferences over the review period, including the best podium presentations at the British Association for Biological Anthropology and Osteoarchaeology Conference in 2009 and 2013 and the European Meeting of the Palaeopathology Association in 2010, and the best student presentation at the European Association of Archaeologists Annual Conference in 2009. Two PGR students have been awarded highly competitive scholarships from the British Federation of Women Graduates.

d. Income, infrastructure and facilities

Organisation: Research activity is overseen by the Director of Research in Archaeology (DR), who chairs an internal Research and Knowledge Transfer Group (RKTG), which includes PGR and PD representatives. The DR meets annually with individual staff to review research performance and identify targets. The DR, along with two other Archaeology staff, sits on the School of Life Sciences Research Committee, chaired by the Associate Dean for Research. Heron represents Archaeology on the University Research and Knowledge Transfer Committee and the institutional REF Steering Group. The Research Support Unit provides assistance for grant applications and contract negotiations.

Income: During the review period, Archaeology has a research spend total of over £5.1 million from a range of sources including UK and European research councils, charities, government agencies and commercial companies. Recent successes include €1M from HERA for the *ENTRANS* Project (2013-2016, Armit, Gaffney, Koon) and £1.9M from AHRC for *Fragmented Heritage* (2013-2018, Wilson). These and other awards will generate outputs across a range of our research areas. We have also received JISC funding totalling £900K for two major projects: *From Cemetery to Clinic* and *Digitised Diseases* (2010-2011 and 2011-2013, Wilson, Gaffney, Buckberry). As well as standard funding routes, we actively procure income via research contracts from diverse sources including a range of commercial companies as well as local and regional government organisations. Funding strategies are developed through research theme meetings, the RKTG, and individual mentoring meetings. Recent HEIF investment of £180K (2013, Wilson, Gaffney) will develop new funding streams (research and commercial) around our visualisation capability.

Infrastructure and resources: Archaeology is located within a dedicated building, housing a range of outstanding analytical facilities. These include the Biological Anthropology Research Centre which holds the largest collection of human skeletal remains in any archaeology department in the UK, including specimens from the Neolithic to the 19th century, and contains dedicated environmentally-controlled storage facilities, three osteology laboratories, histology and microscopy laboratories, and a newly refurbished radiography suite with both traditional and digital radiography equipment. We have one of the best-equipped

archaeologically-dedicated stable light isotope laboratories in the UK, as well as specialised laboratories for molecular sample preparation and analysis. We are a leading centre for multi-isotope analysis of archaeological materials including bone, teeth, hair, shell and pottery 'foodcrusts' through the analysis of the stable isotopes of hydrogen, carbon, nitrogen, oxygen and sulphur. The facility, comprising three isotope mass spectrometers and peripherals, is managed by Heron with Gledhill as dedicated research technician. It supports numerous research collaborations with UK HEIs and overseas organizations. Although employed as a technician, Gledhill's expertise is such that he has been co-author on a *Nature* paper as well as many other research publications. Research since 2008 using isotope data from this facility has been published in *Nature*, *PNAS*, *Antiquity* and *Rapid Communications in Mass Spectrometry*. Novel and innovative approaches include incremental analysis of dentine and enamel, sequential analysis of hair, and 'foodcrusts' preserved on the earliest pottery in northern Europe and East Asia. Funding to support this facility is from diverse sources but includes research contracts across the archaeological and environmental sciences.

Separate laboratories are dedicated to archaeological geophysics, lithic microwear analysis, soils/biological processing, and environmental archaeology. Our Archaeomagnetic Dating Laboratory has been upgraded to additionally serve new research on Rehydroxylation Dating. A dedicated Forensic Taphonomy Laboratory with entomology facilities was completed in 2010, complementing existing facilities in our Conservation Laboratory and enabling whole animal taphonomic research to be built into staff and PGR projects. Forensic archaeology is also supported by our dedicated Crime Scene House and Taphonomic Field Station at Oxenhope. A series of project work-rooms and archive facilities support specific research teams, including the Iron Age Research Laboratory, Iron Age Project Room and the North Atlantic Research Laboratory, each accommodating PDRAs, PGR students and other technical and research staff. PGR students have supervised access to all facilities including field equipment, technical support, computer lab and analytical facilities: specialist analytical training is provided as required. PGR students are allocated shared office space as well as having access to laboratories, work-rooms and other facilities associated with their research group. Technical support is provided by a team of technicians (5.3 FTE).

Archaeology is a leading partner in the campus-wide Centre for Chemical and Structural Analysis, home to a full suite of instrumentation (~£2M), including scanning and transmission electron microscopy (SEM/TEM), gas chromatography/liquid chromatography-mass spectrometry (GC-MS, LC-MS/MS), X-ray diffraction and vibrational spectroscopy. Three staff (Heron, Stern and Wilson) are closely involved in the centre either as instrument managers or members of the advisory panel. A new GC-MS was approved for internal university funding in 2008 as a result of a successful business case prepared by Heron and Stern. Stern is the Instrument Manager of this facility. Since 2008, one AHRC-funded PDRA (Steele) and five PhD students have used the facility to generate primary research data. All research outputs in the review period from Heron and Stern include molecular information generated by this investment. The facilities are directly related to the techniques necessary to underpin our research areas and the Centre is a major vehicle for interdisciplinary work supporting archaeological research published in *Nature* and *PNAS*, as well as commercially-funded applications. The facilities are supported by dedicated technical staff and service contracts. Bespoke training extends to PhD students and PDRAs.

AHRC, JISC and HEIF-funded research projects have brought significant capital investment to our imaging capability. Our new in-house Visualisation Suite encompasses a wide range of archaeological imaging and analysis capability, including remote aerial imaging, landscape and building scanning, a high end photo-studio for large and macro work (including stacking), laser, white-light, RTI and photogrammetry for 3d recording of objects, radiography, and 3d microscopy (confocal and FVM). We have made a significant investment in geophysical equipment including a Multi-Sensor Platform, GPS-tracked magnetometer cart, GPS-enabled Magnetic Susceptibility meter, RM85 Resistance meter, CMD Mini-explorer and Flash Res64 ERT: the last three items are the first to be held in a UK institution.

Library and IT: Research is supported by the University Library, subject to major refurbishment in 2012; this provides staff and PGR students with excellent access to a broad range of electronic and paper resources, and holds significant archaeological collections (e.g. the Raistrick archive relating to the prehistory of the Yorkshire Dales, which supports two

AHRC CDA students; the Calvin Wells archive, and the Jacquetta Hawkes archive). Our dedicated subject librarian has herself published peer-reviewed papers in archaeological journals. IT support is provided centrally within the University and in conjunction with our imaging and visualisation capabilities.

e. Collaboration and contribution to the discipline or research base

Collaborative research is fundamental to our work, whether involving interdisciplinary teams from across the University or international partnerships. Increasingly we have developed internal partnerships that engage the interdisciplinary potential within the institution, e.g. in our new AHRC-funded (£1.9M) *Fragmented Heritage* programme, which includes the Centre for Visual Computing. We have strong links with a wide range of other UK HEIs, including funded projects during the review period conducted in collaboration with the universities of Aberdeen, Birmingham, Durham, Edinburgh, Exeter, Glasgow, Leeds, Manchester, Nottingham, Oxford, Royal Holloway, Sheffield, Stirling, UHI, Winchester, and York. We have recently received funding as an AHRC Centre for Doctoral Training (2014-2019), as part of a heritage consortium across seven HEIs in the north of England. Collaborations with non-HEIs, including government agencies, commercial organisations, and the voluntary sector, both in the UK and elsewhere, have long been central to our research strategy: these are detailed in REF 3a.

We also work extensively with overseas HEIs. Recent examples include Armit's *ENTRANS* collaboration with the Universities of Zagreb and Ljubljana, and his work at Megara Hyblaea with colleagues from CNRS and the Université de Provence. The new *Fragmented Heritage* Project includes collaboration with UC Berkeley and Tarragona (Spain). Heron's AHRC-funded research (2008-2011), with project partners in Schleswig and Kiel, has continued with new research projects in Germany, Latvia and Lithuania as well as a nomination (outcome pending), from German researchers, to the Humboldt Foundation for a Fellowship for him to work for a period in Germany. Institutional support is available to staff for the development of such overseas networks, for example through attendance at the Society of American Archaeology Annual Conference and specific overseas study visits.

Dockrill is a member of NABO (North Atlantic Biocultural Organisation) which held its conference on *Archaeological Futures: A Research Agenda for the North Atlantic*, at Bradford in 2008, and GHEA (the Global Human Ecodynamics Alliance), and is Associate Professor at CUNY (City University of New York); other staff act as adjunct supervisors to PGR students at the Universities of Copenhagen (Buckberry), Florida (Heron), Bergen (Heron), Trondheim (Gaffney), and Texas A&M (Stern).

AHRC Collaborative Doctoral Awards are central to our PGR recruitment strategy and have been held with a range of partners (Historic Scotland (3), Museum of London, National Trust, Sutton Hoo Society, Yorkshire Dales National Park Authority (2), Dales Landscape Research Trust (2), Geoscan Research, Norwich Castle Museum (2), and Orkney Museum). A collaborative PGR award has also been funded by the National Roads Authority of Ireland.

We host an annual programme of 22 research seminars largely comprising external speakers. This helps foster international research collaborations, e.g. Dr Hrvoje Potrebica, University of Zagreb, is now a partner on Armit's *ENTRANS* Project. Staff additionally host numerous national and international symposia and workshops in Bradford, with high-profile international examples over the review period including the NABO (North Atlantic Biocultural Organisation) conference on '*Archaeological futures: a research agenda for the North Atlantic'* (2008), the international symposium '*From foraging to farming in northern Europe: the impact of scientific approaches'* (2011), and the Prehistoric Society's Europa Conference *'The rise of Bronze Age society: new results from science and archaeology'* (2013).

Staff also make broader contributions to the discipline, e.g. through journal editorship (Gaffney as editor of *Archaeological Prospection*, Batt as Managing Editor of *Archaeometry*), holding offices in learned societies (Gibson as Vice-President of the Prehistoric Society (2009-present) and Council Member of the Royal Archaeological Institute (2010-present), Gaffney as Chair of the International Society for Archaeological Prospection (ISAP, 2009-present), participation in research council activities (Armit as Chair of AHRC Peer Review Panel (Fellowships, Culture and Heritage) 2011 and member of four other AHRC Peer Review Panels). Heron is Chair of the Subject Committee for Archaeology (SCFA, 2013-present).