

Ballyhanna Research Project 2009 update



Deirdre McCarthy

Deirdre McCarthy, NRA Assistant Archaeologist with the North-west Team, introduces a series of brief articles that provide a timely update on the progress of the Ballyhanna Research Project.

The first issue of *Seanda*, back in 2006, introduced the Ballyhanna Research Project, an exciting research initiative funded by the NRA that is studying the human remains excavated by Irish Archaeological

Consultancy Ltd (IAC Ltd) from a medieval graveyard at Ballyhanna, Co. Donegal. The project had just been established as a partnership between the NRA, the Institute of Technology, Sligo (ITS), Queen's University, Belfast (QUB) and Donegal County Council. A series of articles (*Seanda*, Issue 1 [2006], pp. 60–5) gave the background to the graveyard, its amazing discovery along the route of the N15 Bundoran–Ballyshannon Bypass in 2003 and the excellent preservation of the 1,000+ burials. The Ballyhanna Research Project, which brings

together archaeological and various analytical sciences under one investigative umbrella, was created to explore the research possibilities of this well-preserved skeletal assemblage and to maximise the amount of information that this important site could tell us about medieval Ireland. Over the last three years the various elements of the project have been progressing full steam ahead, so a brief update on how things have advanced and what is still to come seems timely.

The QUB component of the project involves the osteological and palaeopathological analysis (the study of bones and ancient diseases) of the human skeletal remains recovered during the excavation of the graveyard. Catriona McKenzie, under the supervision of Dr Eileen Murphy and Dr Colm Donnelly, is undertaking doctoral research on the adult skeletons from the site. This major analysis is now complete and data has been compiled on each person's age-at-death, sex and stature, and any evidence for past diseases or injuries. Dr Murphy has been studying the skeletons of the children who were buried at Ballyhanna and along with Róisín McCarthy's analysis of the disarticulated remains, a huge amount of osteoarchaeological data has



Human remains during excavations at the Ballyhanna graveyard. (Photo: IAC Ltd)



been catalogued on the burials. The Ballyhanna skeletal assemblage catalogue contains the details of 869 adults, 427 juveniles and the disarticulated remains. Catriona McKenzie is now undertaking the necessary analysis of the osteological results. It is this process that will provide us with much more information about lifestyles in a medieval Irish town, as well as burial practices.

Two additional doctoral research projects are based in ITS. Tasneem Bashir, under the supervision of Dr Ted McGowan, is generating quantitative multi-element data to aid in the reconstruction of the palaeodiet and environmental conditions of the cemetery population and to gain insights on diseases that may have affected them. This is being achieved through analysis of concentrations of trace elements (substances, such as iron, that cannot be resolved by chemical means into simpler substances) in a representative sample of male, female and child bones from Ballyhanna. Sheila Tierney, under the supervision of Dr Jeremy Bird, is attempting to extract and amplify ancient DNA (aDNA) from the archaeological human remains. Results are now emerging in both areas of research and Sheila Tierney and Tasneem Bashir presented well-received papers outlining their research to date at the World Archaeological Congress held in University College Dublin in July 2008.

Phillip McDonald and Naomi Carver of the Centre for Archaeological Fieldwork, QUB, are undertaking a reconstruction of the Ballyhanna burial sequence. Their work involves the analysis of position of skeletal remains in the graveyard and study of the stratigraphical relationship between the skeletons using site plans. It is hoped that this analysis, combined with radiocarbon dating, will show how the cemetery evolved over time. Their work could ultimately set a standard for excavating and interpreting graveyards in the future. The analysis is complete and work is now ongoing on the report aided by a comprehensive radiocarbon dating programme at QUB, which produced its first results in June 2009. These initial dates indicate the site had been in use, but not continuously, from the eighth to the 16th century AD.

This unique and comprehensive project has attracted both local and international attention, from Italy to the USA. Collaborations and discussions on the project and other possible research avenues with universities in the USA and Britain are ongoing, with the oversight, approval and much appreciated support of the National Museum of Ireland, building on the research established by the Ballyhanna Research Project.

The results of the project will be published upon its completion in 2010. It is a unique project in Irish archaeology and one that is delivering exciting results. Its success is a reflection not only of the high level of preservation of the skeletons but more so of the commitment and vision of the researchers that the project has been able to attract. The forthcoming Ballyhanna Research Project monograph will draw together all the various areas of research to create a comprehensive overview of the graveyard and the life and times and struggles of those buried there.

As part of national Science Week 2009, ITS will host an evening of lectures entitled *The Science of a Cemetery—The Ballyhanna Research Project* at 7.30pm on Monday 9 November in Lecture Hall A0004 at the Institute of Technology, Sligo, Ballinode, Sligo.



Late 12th-/early 13th-century arrowhead, which was found associated with one of the Ballyhanna skeletons. (Photo: Richie Bromley)

The Adults of Ballyhanna

The analysis of the adult skeletons has been undertaken over the last couple of years by Catriona McKenzie (QUB) and Róisín McCarthy (ITS). A total of 869 adult skeletons have been examined and detailed information has been recorded on sex, age-at-death, height and any evidence of pathological changes or trauma-related injuries present on the skeletal remains.

There was widespread evidence for trauma, ranging from the relatively minor, such as standard bone fractures, to trauma that was likely to have been fatal, such as sword wounds to the head. One particular case is very interesting because it provides evidence of medical surgery in the medieval period. A young female had a large trepanation on the top of her skull—a hole where a circular section of skull had been surgically removed. It is not possible to be sure why the surgery was undertaken, but extensive healing around the edges of the lesion indicates that the woman lived for some time after the surgery was performed.

Evidence of disease in the Ballyhanna population is also extensive: dental disease, infections, developmental defects, joint diseases, circulatory disorders, diseases caused by dietary deficiency and evidence also of cancer. The identification and examination of these diseases and pathologies in the Ballyhanna population is providing us with valuable information concerning diet, health and lifestyle in a Gaelic medieval population.

Catriona McKenzie, Osteoarchaeologist, QUB.

Analysis of the 427 child skeletons has been completed at QUB by Dr Eileen Murphy, with the assistance of Clare McGranaghan. Children of all ages were present, from premature babies to older teenagers. The palaeopathological findings for the children largely mirror that for the adult population. There was much evidence for non-specific infection and one 8.5–10.5-year-old child displayed lesions (body tissue abnormalities caused by damage owing to disease or trauma) due to tuberculosis. The disease had caused massive destruction of the bones of the spine and signs of the infection were widespread throughout the skeleton. General signs of poor health and diet during childhood were also apparent through the presence of lesions characteristic of iron deficiency anaemia and possibly even scurvy, which is due to Vitamin C deficiency and is commonly associated with medieval mariners. A number of minor developmental defects that would have been of little or no consequence to the affected children were also recorded. However, one 12–14-year-old adolescent displayed evidence of a major hip deformity (slipped femoral epiphysis), which would undoubtedly have caused some problems with walking and eventually, had the individual survived to adulthood, secondary arthritis. Evidence of unhealed injuries made from bladed weapons were visible in the remains of two older teenage boys and these injuries had without doubt been instrumental in their deaths. The synthesis of the results is ongoing and will undoubtedly contribute to a greater understanding of the health, diet and everyday lives of children in medieval Ireland.

Eileen Murphy, Senior Lecturer in Osteoarchaeology, QUB.



Catriona McKenzie (right) and Róisín McCarthy conducting osteoarchaeological analysis at the Institute of Technology, Sligo. (Photo: Studio Lab)

Photos: Jonathan Hession)



Cribrra orbitalia, due to iron deficiency anaemia, in the eye sockets of Skeleton 225, a 7–10-year-old child.



View of the upper ends of the normal right and left femur (thigh bone) with slipped femoral capital epiphysis of Skeleton 355, a 12–14-year-old adolescent.



Sword cut on the left scapula (shoulder blade) of Skeleton 1C, a 14–18-year-old boy.

Multi-element Analysis of the Ballyhanna Bones

The search for trace elements in skeletal material that may tell us about diets and social and environmental conditions is an exciting one, and the correlation of various trace elements with diet grants us information on medieval life that is otherwise very difficult to gather. The search for the trace elements is a complicated one and is predominantly affected by alterations to the bone that may occur over the time it is buried in the ground, at least several hundred years in the case of the Ballyhanna burials. Diagenesis refers to this alteration of archaeological bone due to the impact of the burial environment. This alteration may involve the substitution of original chemical entities within bone with those from soil. Significant bone diagenesis renders impossible any insights from bone chemistry regarding diet and health of the population. Happily, current indications, based on a measurement of calcium (Ca) to phosphorous (P) ratios, are that diagenesis of the Ballyhanna bones is quite low—low enough to deem them acceptable for the research project's aim of investigating diet and disease.

Elemental data for bone and teeth that are demonstrated to correlate with diet include: strontium (Sr), calcium (Ca), copper (Cu), barium (Ba), magnesium (Mg), manganese (Mn), iron (Fe) and zinc (Zn). Some trace elements, such as lead, cadmium and mercury, can indicate either environmental conditions or working environments. The ratio of barium to strontium obtained for the Ballyhanna bones sampled to date appears to indicate that the diet consumed was predominantly marine, based on a comparison with results obtained from another coastal site where the diet was known to be marine.

Cross-referencing of the multi-element analysis results with details of age, sex and various pathologies gleaned from various burials will add overall value and significance to the results. Coupled with the establishment of an overall chronology for the site being fixed with the radiocarbon-dating programme and stratigraphical reconstruction by QUB, these results are providing us with new insights into the life of a medieval Irish population.

Tasneem Bashir, Analytical Chemist, and Ted McGowan, Lecturer, ITS.



Coring of femur (thigh bone) from the Ballyhanna assemblage as part of multi-elemental analysis. (Photo: Deirdre McCarthy)

Biomolecular Analysis of Ancient DNA from Ballyhanna

To date DNA has been recovered from seven out of 16 disarticulated adult human bones from Ballyhanna. Recovery of ancient DNA (aDNA) is very much reliant on the degree of degradation of the DNA within each bone and varies widely between bones within an archaeological site. By following set 'criteria of authenticity', extracted DNA sequences can either be validated as ancient or ruled out as contemporary contaminants. These criteria provide a framework from which biomolecular archaeologists can critically authenticate their results. Adhering to these authenticity criteria, we have used a dedicated aDNA laboratory with admittance restricted to persons wearing the correct protective clothing and engaged solely in aDNA extraction work. Scrupulous care was taken to remove surface contamination from the bones by removing the external bone layer where modern human DNA would most likely be, and these precautions have proved successful.

We also analysed DNA from animal remains recovered from Ballyhanna, to see if human contaminant DNA was present, thus giving an indication of the scale of contamination by modern human DNA. Human DNA was recovered from the external surface of the animal bones, but none was found in the internal layer from where bone powder is routinely taken for DNA extraction during sampling of the human bones. This indicates that the DNA that was recovered from the sampled remains was more than likely aDNA.

This work is ongoing and it is hoped that further analysis will help authenticate our results as true aDNA sequences. Further research on skeletons exhibiting lesions consistent with tuberculosis has just begun. Ancient DNA will be used to confirm that the lesions are evidence of tuberculosis and to distinguish between infections caused by *Mycobacterium tuberculosis* or *Mycobacterium bovis*, the bacteria that most commonly causes tuberculosis.

Sheila Tierney, Biomolecular Scientist, and Jeremy Bird, Head of School of Science, ITS.

Sheila Tierney at work in sterile conditions in the dedicated aDNA lab at the Institute of Technology, Sligo. (Photo: Sheila Tierney)



Tasneem Bashir at work in the lab at the Institute of Technology, Sligo. (Photo: Deirdre McCarthy)



Removal of inner layer of bone using a sterile scalpel for subsequent extraction of ancient DNA. (Photo: Deirdre McCarthy)

Human remains during excavations at Ballyhanna. (Photo: IAC Ltd)

