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Archaeology Research Grant Report

Recipient name:	Dr Kerri Cleary
Discipline and subject area:	Archaeology Research Grant
Year awarded:	2022
Title of project:	What's Cooking? Organic Residue Analysis of a Middle Bronze Age pottery assemblage from Corrstown in Northern Ireland

Summary of findings:

Forty potsherds recovered during excavations in the early 2000s at Corrstown, Co. Derry/Londonderry, were subjected to Organic Residue Analysis (ORA) at the School of Chemistry, University of Bristol (Dunne & Evershed 2023). Corrstown has the largest assemblage of pottery as yet recovered from a Bronze Age settlement site in Ireland. The limited evidence for associated environmental remains, however, meant that any insight into the diet and subsistence strategies of the occupants was constrained. The selected pottery sherds represented those with and without visual residues, from different pot forms and from various locations of recovery across the site. Of the selected vessels, 32 (80%) yielded interpretable lipid profiles, the majority (72%) of which saw sustained use in processing secondary ruminant (cattle, sheep, goat) products, such as milk, butter and cheese. The remainder were mainly used to process ruminant carcass products, albeit likely with some minor mixing of non-ruminant (pig) products in some vessels. Despite the location of the site, on the north Irish coast and close to the River Bann, no marine or freshwater biomarkers were detected. Further interpretation of the results and associated dissemination is ongoing, with a series of outputs, including conference presentations and a StoryMap, scheduled for 2023. Reference: Dunne, J. and Evershed, R.P. (2023) Organic residue analysis of Middle Bronze Age pottery from Corrstown, Ireland: Report. Unpublished report prepared by the Organic Geochemistry Unit, School of Chemistry, University of Bristol.

Sample COR23 - Vessel 397 (5453:36) - 19.7g

8 cm

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Please outline the objectives of the project.

The objective was to use ORA to examine a subsample of the pottery assemblage recovered from a Bronze Age settlement site excavated at Corrstown between 2001 and 2003. This represents the largest collection of Middle Bronze Age pottery (449 vessels) as yet found on a single site in Ireland. Corrstown, located in County Derry/ Londonderry, on the north Irish coast and close to the River Bann, consisted of 74 structures and endures as one of the most important Bronze Age occupation sites as yet excavated in Ireland or Britain. Although the results of the excavation were published in 2012, it was with a caveat that it was 'not intended as a definitive statement about the site. Instead, it is hoped that this volume represents a beginning of the study of Corrstown' (Ginn & Rathbone 2012, 11). It is within this context that the project aimed to generate new knowledge from the excavation archive. Despite the complexity of the settlement, there was a notable paucity of environmental remains. This included an almost complete lack of faunal material and poor preservation of plant macrofossils, likely due to high acidity levels in the soil and the impact of arable farming across the site (ibid., 9–10). The recovery of environmental remains was also impacted by issues with some soil samples and their processing (ibid., 12). All of this resulted in very limited insight into the diet and subsistence strategies of the inhabitants. To help address this, it was proposed to use ORA to determine whether absorbed lipids (i.e. fats, oils, waxes and resins) were preserved in a subsample of the potsherds. Analysis of the pottery in 2008 by Dr Eoin Grogan and Helen Roche noted carbonised residues on most of the 449 vessels, demonstrating the prolonged use of these pots. Such residues were visibly present on the exterior surface of 129 vessels (29%), the interior surface of 69 vessels (15%) and both surfaces of 190 vessels (42%) (Grogan & Roche 2008). These observations suggested that ORA could provide useful clues as to what had been cooked and processed in these vessels.

In early 2023, the analysis was conducted by Dr Julie Dunne and Prof. Richard P. Evershed at the Organic Geochemistry Unit (OGU), School of Chemistry, University of Bristol (Dunne & Evershed 2023). Sample selection and analysis were all completed in line with best practices and under the guidance of expert advice (see Section 9). This project, which represents the largest assemblage of potsherds/vessels analysed from a single Irish Bronze Age site, is an important addition to previous organic residue analysis undertaken on Bronze Age pottery in Ireland.
References:
Ginn, V. & Rathbone, S. (eds) (2012). Corrstown: a coastal community. Excavations of a Bronze Age village in Northern Ireland. Oxford: Oxbow.
Grogan, E. & Roche, H. (2008). The prehistoric pottery assemblage from Corrstown, Portrush, Co. Derry (AE/02/100). Unpublished report prepared for Archaeological Consultancy Services Ltd.

Please describe the methodology used in conducting the research.

The methodology can be divided into that applied to selecting the potsherds and that used to analyse the residues.

Sample selection: To ensure a statistically reliable amount of data, a minimum sample size of 30 sherds was recommended. Accordingly, in anticipation of any failing or unsuitable samples, 42 sherds from 42 different vessels were selected. These were chosen based on three questions/criteria:
1. Are there detectable differences between potsherds with visual residues and those with no visible residues? The following sherds were selected:
o Carbonised residue on pot exterior (n=9).
o Carbonised residue on pot interior (n=8.
o Carbonised residue on pot exterior and interior (n=17).
o Fire-blacked pot exterior (n=1).
o Fire-blacked pot interior (n=1).
o Fire-blacked pot exterior and interior (n=1).
o No visible residue or blackening (n=5).

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2. Are there detectable differences between the forms of the various vessels and their functions?
Sherds from various vessel forms were selected, including diversity in size; barrel-shaped vessels and straight-sided vessels; those with flat rims and rounded rims; and those with inward expanded rims/lips and those with outward expanded rims/lips.

3. Are there differences between the locations of recovery (structure types and context types)?
The following were selected:
Structure types (as defined by Ginn & Rathbone 2012):
Structure type 1A 1B 1C 1D 1E 1F 2 Other
No. of vessels 15 6 6 4 3 4 2 2

Context types:
o Foundation gullies (n=9).
o Cobbled surfaces, including in structure entranceways (n=7).
o Post-holes and pits in structure entranceways (n=7).
o Pits within structures (n=5).
o Collapsed stone wall/footing of structures (n=4).
o Pits external to structures (n=2).
o Post-holes within structures (n=2).
o Post-holes external to structures (n=1).
o External ditch (n=1).
o Other contexts (n=4).

Residue analysis: The lipid analysis and interpretations were performed in line with best practice (e.g. Historic England 2017a; 2017b) and using established protocols described in detail in existing publications (e.g. Correa-Ascencio & Evershed 2014). Overall, it uses the techniques of gas chromatography (GC), gas chromatography-mass spectrometry (GC-MS) and gas chromatography-combustion-isotope ratio mass spectrometry (GC-C-IRMS) to identify, at a molecular level, specific archaeological biomarkers that allow the detection of a range of commodities. These include terrestrial animal fats (ruminant adipose and dairy) as proxies for carcass processing and secondary product exploitation, marine animal fats, plant waxes and beeswax.
Of the 42 sherds selected, 40 were subject to ORA, with the associated 'burnt-on' or surface residue of one of these 40 sherds also analysed. Notably, this 'burnt-on' residue did not yield an interpretable lipid profile, nor did the potsherd from which it was extracted, suggesting the vessel may have been used only once or on very few occasions.
References:
Correa-Ascencio, M. & Evershed, R. P. (2014). 'High throughput screening of organic residues in archaeological potsherds using direct acidified methanol extraction'. Analytical Methods 6(5): 1330–40.
Historic England (2017a). Organic Residue Analysis and Archaeology: Guidance for Good Practice. Historic England.
Historic England (2017b). Organic Residue Analysis and Archaeology: Supporting Information. Historic England.

Please outline the findings of your research and/or milestones achieved.

Forty sherds were analysed from the Corrstown assemblage, with the 'burnt-on' residue adhered to one sherd also processed. The selected sherds yielded an excellent recovery rate of 80%, with 32 vessels yielding interpretable lipid profiles (Dunne & Evershed 2023). The mean lipid concentration from these sherds was 4.4 mg g-1, with the highest lipid concentration of 22.0 mg g-1 from a rim sherd (Vessel 81 from Structure 5/Type 1C). A further thirteen potsherds contained high concentrations of lipids (ranging between 2.0 mg g-1 and 20.0 mg g-1), likely indicating that these vessels were subjected to sustained use in the processing of high lipid-yielding commodities.
When the $\delta^{13}C$ values of the C16:0 and C18:0 fatty acids from the lipid profiles were plotted onto a scatter plot along with reference animal fat ellipses, five observations emerged.

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• Two of the lipid residues plot directly within the ruminant (cattle, sheep or goat) adipose ellipse, with a further two sherds plotting just outside, suggesting these four vessels were solely used to process ruminant carcass products.
• Seventeen sherds plot within or just outside the ruminant dairy ellipse, suggesting these were either mainly or solely used to process secondary products, such as milk, butter and cheese.
• Four sherds plot between the ruminant and non-ruminant (pig) ellipses, suggesting these vessels were used to process mixtures of ruminant and non-ruminant carcass products, whether contemporaneously or during the lifetime use of the pot.
• One sherd plots between the ruminant dairy and non-ruminant ellipses, suggesting some minor mixing of these products.
• Six sherds plot outside the dairy ellipse or between the ruminant adipose and dairy ellipses, similarly suggesting some minor mixing of these products. These results are in good agreement with a large-scale study of 450 Carinated Bowl pottery vessels (lipid recovery rate of c. 90%), from a range of Irish Neolithic sites (causewayed enclosures and houses), where 89% of sherds yielded evidence for dairy processing (Smyth & Evershed 2015).

Therefore, analysis of the Corrstown pottery assemblage may suggest continuity in practice from the Neolithic, where the processing of secondary products, such as milk, butter and cheese, remained fundamental to how ceramic vessels were utilised. Additional analysis of the ORA results is in progress, including investigating if any other patterns can be determined, such as between vessel forms and functions and between structure and context types and vessel use.
Reference:
Smyth, J. & Evershed, R.P. (2015). 'Milking the megafauna: using organic residue analysis to understand early farming practice'. Environmental Archaeology 21, 214–29.

Please provide details of the dissemination of the outcomes from this project.

The organic residue analysis was completed in February 2023, accordingly, there has been no dissemination of the results as of yet (28 February 2023). See below for planned dissemination in 2023:
Public presentation(s): The project results will be presented by Dr Kerri Cleary at the annual conference of the Institute of Archaeologists of Ireland to be held in Dublin on 24–25 March 2023. In addition, it is hoped that aspects of the project will contribute to presentations at two additional conferences this year: the European Association of Archaeologists Annual Meeting, to be held at Queen's University Belfast on 30 August–2 September, and the Bronze Age Forum, to be held at the University of Leicester on 11–12 November. Furthermore, contributing to the RIA biannual 'Revealing the past' conference would also be welcomed.
ArcGIS StoryMap and video: This medium will be used to document all stages in the project through video and photography, including interviewing key people, and presenting the story of the project and the value of ORA to a wider audience. Video footage and interviews at Bristol University are scheduled for 13 March, this will be followed by additional interviews in Ireland in April/May. It is anticipated that the StoryMap and embedded video will be completed by late Summer 2023, when it will be accessible via the Archaeological Consultancy Services Unit (ACSU) website, which will also host a page detailing the project.
Publication: In tandem with preparing a presentation of the results for the IAI conference, a short article will be prepared for a popular publication, to highlight the value of returning to older excavated material to gain new insights. Following discussions with the project partners, a more in-depth journal article may also be prepared in 2023.

How did the award enhance your professional development?

This award has facilitated a collaboration between the applicant, who holds a PhD in Irish Bronze Age settlements and patterns of deposition in associated material culture, the ORA expert Dr Julie Dunne and her team at the University of Bristol, and the prehistoric pottery specialists Dr Eoin Grogan and Helen Roche. By doing so, it has allowed an interdisciplinary study of the Corrstown pottery assemblage and added value to material recovered from

an older excavation. The project has also offered the applicant the opportunity to develop skills in alternative ways of disseminating archaeology to the wider public, including completing video interviews, editing video content and designing a project StoryMap.

What plans (if any) do you have to further your proposal/project?

As analysis of the ORA results is still in progress, it is unclear yet if additional investigations will be proposed, such as further examining patterns related to vessel forms and food processing functions. The latter could, for example, include experimental archaeology to examine the possible roles of in-turned and out-turned rims. Alternatively, further analysis of other artefacts recovered during the excavations at Corrstown may also provide additional insights into this important settlement site. There is, for example, a large collection of worked stone that is consistent with other later Bronze Age domestic lithic assemblages, with Dr Maria O'Hare reporting that rough scrapers account for one-third of the secondary assemblage, followed by a significant quantity of roughly flaked pieces and a very small percentage of neat subcircular scraper types. The application of use-wear/microanalysis could, for example, prove fruitful in assessing more fully these artefacts and what role they may have played in this society.