

Life Histories of Lindisfarne:
Isotopic Narratives from Holy Island

Life Histories of Lindisfarne: Isotopic Narratives from Holy Island

Project Design (2024)

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This document has been prepared as a project design for...

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Executive Summary:

This document has been prepared to support a programme of scientific analysis of human remains recovered during DigVentures' ongoing crowdfunded community-based excavations at Lindisfarne. The first stage of analysis is planned to take place in 2026 at the earliest, following the conclusion of DigVentures' on-site fieldwork. The proposed analysis programme will be undertaken by Durham University's Archaeological Isotope and Peptide Research Laboratory (AIPRL) and will primarily involve multi-isotope analysis and trace element analysis to reconstruct diet, mobility, and level of exposure to pollution of a selective sub-sample of the site's burial population. The following MoRPHE compliant document discloses the approach to the planned work, outlining the project's background and scope, key archaeological research questions, proposed methodology, stages, tasks and outputs, team roles and responsibilities, and resources.

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Part I. Description of the Project

Summary Description

This document presents the proposed outline for the Life Histories of Lindisfarne (LHL) project: a large-scale isotope analysis project planned to be undertaken by AIPRL at Durham University, to expand the information recovered from the human remains excavated at Lindisfarne as part of DigVentures' current fieldwork programme. The specialist scientific analysis programme, expected to begin around 2026, will involve a multi-isotope study (carbon, nitrogen, strontium, oxygen, and lead) and trace element analysis; the results of which will be interpreted and collated with previous findings from DigVentures' own analyses as part of the preceding Holy Island Archaeology (HIA) Project (Wilkins and Petts 2016; Wilkins *et al.* 2016; Casswell *et al.* 2018; 2020a; 2020b; 2021; Jackson *et al.* 2021; 2022; 2023a; 2023b). This project design defines how AIPRL will undertake the analysis and integrated data compilation in partnership with DigVentures to achieve numerous diverse aims, with the overarching aspiration being to reveal new knowledge about the individuals buried in Lindisfarne's early medieval cemetery through the use of scientific analyses, as part of a community-focused approach that prioritises public involvement, educational engagement, and promotion of the benefits of applying scientific techniques within multidisciplinary archaeological projects.

1. Project Background

1.1 Introduction

1.1.1 The LHL project derives from DigVentures' acknowledgement that due to the likely connection between Lindisfarne's excavated cemetery and the island's lost 7th century monastery, which became a power hub for Christianity in the Kingdom of Northumbria and beyond during the early medieval period (Magnusson 1984), the individuals exhumed as part of the HIA project are nationally important and should thus be afforded further analysis beyond osteological assessment to harness their full research potential (Caswell *et al.* 2020; Caffell in Jackson *et al.* 2022; 2023). As one of the main specialist techniques suggested in the HIA project documentation for future analysis of the burial population (Caswell *et al.* 2020; Caffell in Jackson *et al.* 2022;

2023), the application of isotope analysis to the recovered remains has been deemed a necessary next step for developing a holistic understanding of life and death on the Holy Island, and thus forms the basis of the proposed LHL project. This MoRPHE-compliant project design (Historic England 2008; 2015) presents an outline for AIPRL's delivery of the project in association with DigVentures, and details how the planned multi-isotope and trace element study and subsequent data analysis will be undertaken to deliver an integrated community-focused multidisciplinary study of the cemetery's inhabitants. Part I of the document provides a description of the project, defining its research context, aims and objectives, and business case, as well as summarising the methodology and outlining the principal tasks, their outcomes and the framework to support the project's successful delivery. Part II covers the project's resources and programming, identifying the project team structure, providing detailed methods statements and specifics regarding the proposed stages, products, and tasks. The associated risk log and budget are also provided within this section.

1.2 Research Context

1.2.1 *The Island*

Lindisfarne (also known as Holy Island) is located off Northumberland's north-east coast (Figure 1) and is a tidal island rich in history and archaeological potential. The Holy Island has been a site of major public interest throughout the centuries with its 16th century castle, ruins of the 12th century priory, and reputation as the provenance of the Lindisfarne Gospels, but is perhaps best known for its infamous status as one of the first places in England to be raided by the Vikings (Story 2024). This attack in AD793 targeted the Christian monastery, founded in AD635 by St Aidan at the request of Northumbria's King Oswald (Magnusson 1984), and very little evidence of this early monastic site besides early medieval sculpture has been recovered before DigVentures' HIA project began in 2016 (Petts 2013; Wilkins and Petts 2016). Surprisingly, despite the island's notorious and at times bloody history, archaeological excavation has been limited, especially in comparison to other significant early Christian sites associated with monasteries such as Iona, Whithorn and more locally at Jarrow and Monkwearmouth (Wilkins and Petts

2016). Where investigation has occurred, this has involved: a series of small excavations around the village and priory by Brian Hope-Taylor revealing later medieval finds and features (Petts 2013; Wilkins and Petts 2016); survey work and excavation carried out in the 1980s and 90s by Leicester University which uncovered the early medieval rural settlement of Green Shiel on the island's north side (O'Sullivan and Young 1995); and most recently an extensive magnetometry survey undertaken in 2012 by Archaeological Services Durham University, detecting a potential infirmary cloister associated with the priory and nearby anomalies of unknown date (Petts 2013).

1.2.2 *The Holy Island Archaeology Project*

DigVentures' HIA project in partnership with Durham University developed from the results of this previous fieldwork, and the results of the magnetometry survey in particular. The location of the identified geophysical anomalies in combination with gathered documentary evidence and the majority of the early medieval sculpture (including burial monument fragments) being found in and around the later medieval priory ruins, led to the inference that this area held the greatest potential to be the site of the original early medieval monastery including a potential monastic cemetery, and as such became the focal site for physical investigation (Petts 2015; Wilkins and Petts 2016). Through the implementation of a multidisciplinary approach involving remote sensing, non-invasive survey, multiple trench excavations, palaeoenvironmental sampling, and compilation of results for publication and wide-reaching dissemination, it was hoped that the community-based fieldwork programme would provide insight into different aspects of early medieval life on Lindisfarne by helping to define the extent and character of the site's archaeological remains, refine the site's stratigraphy and chronology, and understand the overall archaeological and palaeoenvironmental conditions of the site (Wilkins and Petts 2016; Caswell *et al.* 2018). Now entering into its ninth year of fieldwork scheduled for September 2024, the project has thrived, benefitting significantly from the dedicated community it has developed through an integrated programme of public outreach, with both digital and in-person volunteer opportunities provided as part of crowd-funding initiatives (DigVentures 2024c). The works

have discovered vast swathes of archaeological evidence mainly spanning the 8th-10th centuries, and some exceptional finds have made international headlines (Addley 2020; Current Archaeology 2022; DigVentures 2024c). The site narrative has gradually developed over the fieldwork seasons, although there are many questions still remaining, particularly concerning the extent, chronology, and prescribed use of the extensive Christian burial ground found to extend across multiple excavated trenches from at least the boundaries of the priory ruins up to the ancient shoreline (Jackson *et al.* 2022). Although a small number of individuals discovered nearby on Lindisfarne Heugh were sampled *in-situ* for isotope analysis, the human remains exhumed from this cemetery are believed to be the first to be fully excavated on the island, and as such provide a unique opportunity to investigate early medieval life and death within a monastic context (Caffell in Jackson *et al.* 2022; 2023a).

1.3 Previous Work

1.3.1 *Summary of excavated human remains*

The human remains excavated during DigVentures' fieldwork programme represent the overall dataset from which an appropriate representative sub-sample will be selected for the proposed scientific analysis programme. A brief quantitative summary of the remains recovered from each fieldwork season is presented in Table 1, and further details including preservation condition, completeness and basic osteoprofiles for all individuals are available in the respective HIA project reports (Wilkins *et al.* 2016; Caswell *et al.* 2018; 2020; 2021; Jackson *et al.* 2022; 2023a). Information in the table is derived from the latest interim assessment report reflecting on the 2022 fieldwork season (Caffell in Jackson *et al.* 2023a), and consequently does not represent the full scale of the available burial dataset. Data from the forthcoming 2023 report and subsequent documentation will be collated once available. The full *in-situ* recordings for all excavated burials are also available online on DigVentures' "Digital Dig Team" recording system, and will be consulted during sample selection as part of Stage 1 (DigVentures 2024d). Large quantities of disturbed disarticulated human remains (approximately 16,000 as of 2022) from individuals of all ages have also been found across the excavated trenches (Caffell in Jackson *et al.* 2023a). However, although they are useful

to facilitate interpretations of demographic and palaeopathological patterns, and minimum number of individuals interred in the cemetery, disarticulated remains have less research potential for further analysis than articulated remains found in secure burial contexts, and as such do not fall within the scope of the current LHL project (Historic England 2018; Caffell in Jackson *et al.* 2023a).

Table 1: Summary of Exhumed remains

Fieldwork Season	Description of Excavated Human Remains
2016	• Only disarticulated human remains recovered from burial disturbance and clearance contexts. • Three bone samples were sent for radiocarbon dating. • The generated dates suggested the cemetery was in use between the late 8th to late 10th century AD.
2017	• Two fully articulated adult inhumation graves recovered from Trench 2 (East). • Traditional Christian burials – extended supine position within east-west aligned graves with heads at west end and hands overlying pelvis.
2018 and 2019	• Two fully articulated adult inhumations recovered from Trench 2 (West). • Eight individuals recovered from Trench 2 (East) – 7 adults, 1 child, and a foetal, peri- or neo-natal skeleton. • All burials oriented east-west. • Not all burials fully articulated or complete.
2020	• Eight graves excavated in Trench 2 (West) – 6 adults, 1 child, 1 neonate • All skeletons articulated and mostly complete.

2021	• Fourteen burials excavated during this season (including a chest burial adjacent to a potential focal burial). • 5 skeletons from Trench 2 (East) – 4 adults and one older adolescent/young adult (chest burial) • 9 from Trench 2 (West) – 8 adults and one young juvenile. • All skeletons articulated but not all complete.
2022	• Fourteen skeletons excavated • 1 from Trench 1 - adult • 6 from Trench 2 (East) – 2 adults, 4 non-adults • 7 from Trench 2 (West) – all adults • All skeletons articulated but not all complete.

1.3.2 Osteological Assessment

As of 2022, the total number of articulated skeletons recovered is 46 (Caffell in Jackson *et al.* 2023a). Osteological specialists at Durham University have conducted basic osteological assessment of these remains as part of the post-excavation programme of the HIA, with the results discussed as previously mentioned in the interim reports. More detailed osteological analysis has been recommended by Dr Caffell (in Jackson *et al.* 2023a), which will fall within the scope of the HIA and could reveal important information such as:

- Burial population demography from sex and age estimations
- Age and/or sex-based funerary practices
- Stature estimations from metrical analysis
- Trends in health and lifestyle from palaeopathological analysis
- Dental health, hygiene, and diet within the population from dentition analysis

Once completed, the interpretations from this full analysis will be combined with the results of the proposed isotope and trace element analyses, as part of LHL's multidisciplinary approach to developing a holistic understanding of the interred individuals and the burial population in general.

1.4 Analysis Proposals

The principal driver of the proposed project is the clear and substantial research potential of the exhumed remains, and the need to ensure their full, comprehensive analysis and understanding due to their national importance. As such, the LHL project will encompass a multi-isotope study (carbon, nitrogen, strontium, oxygen, and lead) and trace element analysis of a suitable sample of the articulated skeletons, with results being integrated with DigVentures' analyses to form a holistic and multidisciplinary understanding of the life histories of individuals buried at Lindisfarne.

2. Research Aims and Objectives

2.1 Aims

As the Life Histories of Lindisfarne project is directly linked to DigVentures' Holy Island Archaeology Project and will compliment findings from the current fieldwork programme, it was deemed appropriate and necessary to ensure the aims and objectives of both projects are linked. Therefore, to acknowledge the significance of the LHL as the first large-scale use of isotope analysis on the excavated population, three unique aims (Aims 1, 2 and 3) and associated research questions were developed to focus on the ambitions of the proposed scientific analysis programme. Aims 4 and 5 were adapted from DigVentures' project designs (Wilkins and Petts 2016; Casswell *et al.* 2018) and assigned unique isotope-focused research questions. This was done to create a direct connection with the goals of the preceding work, and to emphasise LHL's desire to be integrated with the existing project and continue to develop the produced narratives and degree of public engagement.

2.2 Aim 1 – To use specialist scientific analyses to uncover new data and evidence that can contribute towards the reconstruction of the life histories of individuals buried within Lindisfarne’s early medieval cemetery.

2.2.1 Achieving this aim will involve the selection of a representative sub-sample of individuals from the osteologically-assessed burial population for isotope and trace element analyses, based on preservation criteria and skeletal element availability. This will generate the data needed to form interpretations of individuals’ diet, mobility, and pollution exposure, and will allow inter-burial comparisons.

- Q1. What can carbon and nitrogen isotope analysis of excavated remains reveal about the dietary behaviour of individuals buried in Lindisfarne’s cemetery?
- Q2. What can strontium, oxygen, and lead isotope analysis of excavated remains reveal about the residential origins and lifetime mobility of individuals buried in Lindisfarne’s cemetery?
- Q3. What can trace element analysis reveal about the level of pollution individuals buried in Lindisfarne’s cemetery were exposed to during life?
- Q4. Can the effective combination of isotopic data and results of other planned post-excavation analysis techniques improve our understanding of the burial population of Lindisfarne’s cemetery?
- Q5. How can specialist scientific analysis of a representative sub-sample of Lindisfarne’s excavated remains facilitate interpretations of both individual life histories and trends within the burial population?

2.3 Aim 2 – To investigate the extent to which the use of scientific techniques such as isotope analysis can aid interpretations of the people living on/coming to Lindisfarne over time, and how this may be reflected in the use of the cemetery.

2.3.1 Using the strontium, oxygen, and lead data produced for Aim 1, this aim will be fulfilled by expanding upon interpretations of mobility and contextualising them with other relevant evidence from DigVentures’ fieldwork records and planned analyses. A multidisciplinary understanding of any observed

chronological variation in buried individuals' residential origins will be created, and potential related changes in cemetery use will be extrapolated from this.

- Q6. Can evidence of mobility and lifetime movement interpreted from strontium, oxygen, and lead isotope analysis be used in combination with stratigraphic records and scientific dating to identify change in the residential origins of individuals being buried in Lindisfarne's cemetery (and by extension coming to the island) over time?
- Q7. Can evidence of mobility and lifetime movement interpreted from strontium, oxygen, and lead isotope analysis be used in combination with stratigraphic records, scientific dating, and osteological assessment to identify change in the use of Lindisfarne's cemetery over time?

2.4 Aim 3 – To contribute new knowledge and develop a more holistic understanding of the lives and deaths of people living across the Kingdom of Northumbria during the early medieval period through the use of isotope analysis.

2.4.1 Accomplishing this aim will entail establishing the results and interpretations from the isotope analysis within the study's wider research context. Broad and refined academic research themes will be explored by combining the isotope analysis results with findings from a review of relevant literature, as well as with contemporaneous and geographically-related comparative data from isotope studies focusing on other early medieval sites within the Kingdom of Northumbria.

- Q8. How can the current understanding of the early medieval population of Northumbria be enhanced by integrating the results of the proposed isotope analysis of Lindisfarne's burial population with previous work?
- Q9. Can the combination of isotope analysis results from other early medieval Northumbrian sites with those from Lindisfarne identify any patterns or anomalies in mobility, diet, or level of exposure to pollution?

2.5 Aim 4 – “Making recommendations, analysis and publication” (Wilkins and Petts 2016)

2.5.1 All data generated from Aims 1-3 will be compiled and collated with DigVentures’ data to achieve this aim. The research potential of the whole dataset and resulting interpretations will be examined as part of an integrated assessment, and recommendations will be made for further analysis, publication, and dissemination.

- Q10. In light of the evidence recovered from isotope analysis and previous work, can a link be articulated between the multi-phased use of the site and its different areas? (Caswell *et al.* 2018)
- Q11. Can results from the specialist scientific analysis programme be integrated with previous work undertaken by DigVentures to refine interpretations of various aspects of the overall site narrative, such as subsistence practices, industrial activity, and health and disease?
- Q12. Can the results of the specialist scientific analysis programme be integrated with DigVentures’ plans for publication and dissemination of the site’s data?
- Q13. In light of the evidence recovered from isotope analysis, can recommendations be made for further analysis to combat remaining research and knowledge gaps?

2.6 Aim 5 – “Creating opportunities for people and communities” (Casswell *et al.* 2018)

2.6.1 As this aim was designed by DigVentures (Casswell *et al.* 2018) to ensure the prioritisation of public involvement throughout the entire project, it is therefore significant to the LHL to continue this community-based approach to archaeological investigation. During the specialist scientific analysis programme, AIPRL and Durham University will work with DigVentures to keep all interested public parties up-to-date with the work via the Lindisfarne project website (DigVentures 2024b) and offer participation opportunities linked to data analysis and interpretation. All project products will be publicly available and circulated widely. An education programme will also be developed for

different age groups to promote careers in archaeological science and awareness of the overall project.

- Q14. How can the prioritisation of high levels of public involvement within the fieldwork project be maintained during the proposed specialist scientific analysis programme?
- Q15. How can DigVentures' established community of volunteers and followers be included within the specialist scientific analysis programme?
- Q16. How can the local community's involvement be maintained during the proposed specialist scientific analysis programme?
- Q17. How can this proposed programme of scientific analysis be used as an educational tool to engage students from primary years through to university?

3. Business Case

3.1 Research Design Justification

The specialist scientific analysis programme developed to achieve the project's aims and objectives exploits the laboratory facilities available at AIPRL and staff's expertise. AIPRL is best placed to carry out the programme as the closest isotope analysis laboratory to the site, and has extensive experience working with community-based projects with high public interest. As the project requires detailed knowledge of previous work on Lindisfarne, the partnership with DigVentures and integration with the HIA project will ensure this, and bring with it the mechanisms and developed audience for efficient crowdfunding. The timing of the project's initiation at fieldwork closure also guarantees the full burial dataset is available, whilst still allowing sufficient time for analysis before the reburial deadline. It is acknowledged that additional analyses such as sulphur isotope analysis and incremental dentine analysis are also available, and would likely yield valuable results. However, as the first scientific study of these remains, the proposed analysis programme will permit significant quantities of data to be obtained for interpretation, whilst limiting the required crowdfunding costs and maintaining the dataset's future research potential.

3.2 Research Priorities

The LHL project is designed in line with research agendas presented in the North-East Regional Research Framework (NERRF) (Petts and Gerrard 2006; Research Frameworks Network 2019) and the Northumberland Extensive Urban Survey (NEUS) covering Holy Island (Finlayson and Hardie 2010). The potential to contribute to specific regional and local research priorities forms part of the justification for this project.

3.2.1 NERRF

Table 2 outlines the key research priorities relevant to the LHL project, and details how the research design will contribute towards these.

Table 2: NERRF research priorities applicable to the LHL project.

NERRF Research Priorities	Relevant Aims and Research Question Objectives	Description of Contribution
EMii. Settlement EM7: Is it possible to understand the location and nature of early medieval settlement?	Aims 1, 2, 3, and 4 RQs 2, 4, 5, 6, 7, 8, 10, 11, 12 and 13	Investigation of the burial population's mobility patterns using strontium, oxygen, and lead isotope analysis will improve an understanding of the cemetery's use, administration, and purpose within the island's early medieval settlement, and any visible change over time.
EMiv. The Early Medieval Coast EM8: How was the coast exploited in the early medieval period?	Aims 1, 2, 3, and 4 RQs 1, 2, 4, 5, 6, 8, 9, 11, 12, and 13	Investigation of the burial population's dietary behaviour patterns using carbon and nitrogen isotope analysis may reveal evidence of coastal resource exploitation (e.g. consumption of marine food resources) and its significance to the subsistence of the island's inhabitants. Investigation of the burial population's mobility patterns using strontium, oxygen, and lead isotope analysis has the potential to inform interpretations regarding the extent of migration to the island during the early medieval period, for economic, religious, or other reasons.
EMv. Trade and Economy EM10: How did the economy of early medieval	Aims 1, 2, 3, and 4	Investigation of the burial population's mobility patterns using strontium, oxygen, and lead isotope analysis

north-east England function?	RQs 1, 2, 3, 4, 5, 6, 8, 11, 12, and 13	may aid interpretations of Lindisfarne's economic activity and trade networks through identification of individuals' residential origins. Investigation of the burial population's dietary behaviour patterns using carbon and nitrogen isotope analysis has the potential to reveal evidence of the consumption of imported foods not locally available to Lindisfarne. Investigation of the burial population's exposure to pollution using trace element analysis could allow interpretations to be made about individuals' involvement in mining industry and trade activity.
EMvi. Christianity EM1. How can we better understand the key cultural cores of early medieval Northumbria? EM9: How did Christianity arrive and develop in early medieval north-east England?	Aims 1, 2, 3, and 4 RQs 1-12	Investigation of the burial population's mobility patterns using strontium, oxygen, and lead isotope analysis could uncover further evidence for connections and contact between Lindisfarne and the church on the Continent. Mobility studies will also reveal the potential extent of migration to this major religious power centre of early Christianity. Investigation of the burial population's mobility patterns using isotope analysis may identify individuals with residential origins consistent with other major Christian monastic sites. Investigation of the burial population's dietary behaviour patterns using carbon and nitrogen isotope analysis may reveal evidence for consumption of specific or unexpected resources, potentially influenced by religious teachings or status. Dietary study of focal/exceptional burials may also help to identify individuals connected to the original monastery and its religious order. Investigation of the burial population's exposure to pollution using trace element analysis may allow inferences to be made about connections between the early

		medieval monastery and trade on the island.
EMvii. Death and Burial EM3: How can we improve our understanding of burial and funerary traditions?	Aims 1, 2, 3, and 4 RQs 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 13.	Investigation of the burial population's mobility patterns using strontium, oxygen, and lead isotope analysis may produce evidence of individuals' movement to the island before death or after death for burial. Investigation of the burial population's dietary behaviour patterns using carbon and nitrogen isotope analysis has the potential to aid interpretations of social stratification in burial through identification of consumption of lavish or poor diets. The results of isotope and trace element analyses have the potential to be added to a regional synthesis of early medieval burials across Northumbria to enable comparisons with existing and future work.
EMviii. The Impact of the Vikings EM4: How can we better understand the impact of the Vikings across the north-east of England in the 9th-11th centuries AD?	Aims 1, 2, 3, and 4 RQs 1, 2, 4, 5, 6, 8, 9, 11, 12, and 13.	Investigation of the burial population's mobility patterns using strontium, oxygen, and lead isotope analysis could uncover evidence of individuals with residential origins in Scandinavia to aid interpretations of Viking presence and/or settlement on the island. Mobility studies may also reveal a change in the residential origins of the individuals buried on Lindisfarne before, during, and after the Viking raids. Investigation of the burial population's dietary behaviour patterns using carbon and nitrogen isotope analysis may reveal individuals consuming unusual dietary resources that could be linked to resources available and commonly exploited in Scandinavia.

3.2.2 NEUS: Holy Island

Table 3 outlines the key research priorities relevant to the LHL project, and details how the research design will contribute towards these.

Table 3: NEUS research priorities applicable to the LHL project

NEUS: Holy Island Research Priorities	Relevant Aims and Research Question Objectives	Description of Contribution
Where was the monastic community located and what was its extent and character?	Aims 1, 2, 3, and 4 RQs 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 13.	Investigation of the burial population's dietary behaviour patterns using carbon and nitrogen isotope analysis may reveal evidence for consumption of specific or unexpected resources, potentially influenced by religious teachings or status. Dietary study of focal/exceptional burials may also help to identify individuals connected to the original monastery and its religious order. Investigation of the burial population's mobility patterns using isotope analysis may identify individuals with residential origins consistent with other major Christian monastic sites.
Where was the secular settlement and what was its extent and character?	Aims 1, 2, 3, and 4 RQs 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 13.	Investigation of the burial population's mobility patterns using strontium, oxygen, and lead isotope is likely to identify individuals consistent with a residential origin local to Lindisfarne, that may have been part of the secular community.
How did the establishment of an early Christian foundation affect the existing population and what relationship did they have?	Aims 1, 2, 3, and 4 RQs 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, and 13.	Investigation of the burial population's mobility patterns using strontium, oxygen, and lead isotope analysis will reveal the potential extent of migration to this major religious power centre of early Christianity. Investigation of the burial population's dietary behaviour patterns using carbon and nitrogen isotope analysis may reveal evidence for consumption of specific or unexpected resources, potentially influenced by religious teachings or status. Dietary study of focal/exceptional burials may also help to identify

		individuals connected to the original monastery and its religious order. Investigation of the burial population's exposure to pollution using trace element analysis may allow inferences to be made about connections between the early medieval monastery and trade on the island.
How much of an impact did Viking raids have on the secular community? Did the Vikings settle on the island?	Aims 1, 2, 3, and 4 RQs 1, 2, 4, 5, 6, 8, 9, 11, 12, and 13.	Investigation of the burial population's mobility patterns using strontium, oxygen, and lead isotope analysis could uncover evidence of individuals with residential origins in Scandinavia to aid interpretations of Viking presence and/or settlement on the island. Mobility studies may also reveal a change in the residential origins of the individuals buried on Lindisfarne before, during, and after the Viking raids. Investigation of the burial population's dietary behaviour patterns using carbon and nitrogen isotope analysis may reveal individuals consuming unusual dietary resources that could be linked to resources available and commonly exploited in Scandinavia.

4. Project Scope

4.1.1 The project's scope as outlined above focuses on isotope and trace element analyses of individuals recovered during the HIA project. Although it will incorporate results of osteological assessment, palaeopathological analysis, and scientific dating, it will not undertake any of these analyses itself where information is not provided in DigVentures' work.

5. Interfaces and Communication

5.1 Interfaces

5.1.1 The projects, stakeholders, and initiatives the project interfaces with are outlined in Table 4.

Table 4: Interfaces of the LHL project

Interfaces	Link to LHL Project
DigVentures' Holy Island Archaeology Project	As the foundational work underlying this project's creation, the integration of the HIA project and its results is crucial for successful delivery of the LHL project. Crowdfunding for this project will also be undertaken through DigVentures' established initiatives and developed public audience.
Academic Advisory Board	This board was established at the commencement of the HIA project (Wilkins and Petts 2016), and consists of early ecclesiastical and monastic archaeology specialist researchers. The board will be retained for the LHL project and consulted to ensure AIPRL's interpretations are justified and appropriately situated within their wider research context.
Ministry of Justice	Any conditions of the Licence permitted by the MoJ to the HIA project for burial exhumation must be adhered to during the LHL project, including storage requirements and reburial deadlines.

Local Stakeholders – Community Archaeology	Local community archaeology societies and groups such as the Border Archaeological Society have shown considerable interest in the preceding HIA project. These groups should continue to be informed about project updates and opportunities created for giving talks and presentations to local communities.
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5.2 Communications

5.2.1 Communication needs are outlined in Table 5.

Table 5: Communication needs of the LHL project.

Communication Needs	Format	Assigned Responsibility
Formal Project Team meetings	At least one formal meeting with whole Project Team scheduled during each project Stage. These will likely be conducted online via Teams or Zoom. Appropriate documentation will be forwarded ahead of meetings.	All
Informal progress meetings between: PM and Expert Team PM and Projective Executive Project Executive and Project Board	Informal progress meetings may occur online, in-person, or via email communication.	PM and Project Executive
Laboratory work scheduling	Informal communication between and within Expert Team and PM to organise sample preparation and maintain chain of operations. Likely to occur via email and laboratory booking on Teams.	PM and Expert Team
Public Outreach	Communication with the public about the project and its progress will be carried out via DigVentures' Lindisfarne project website.	Project Manager
Stakeholder Liaison	Communication of project progress with relevant stakeholders will be undertaken as required via organised meetings online or in-person.	Project Executive and Project Board

5.3 Dissemination Strategy

5.3.1 Effective time-conscious dissemination to stakeholders is essential throughout the project and will be conducted through numerous channels to share results with diverse audiences. Proposed dissemination outputs for this project include, but are not limited to:

- Wide public circulation of specialist report of results from scientific analysis programme.
- Inclusion of results within HIA project's final publication of the site's investigation.
- Dedicated LHL project webpage within DigVentures' established Lindisfarne project website (DigVentures 2024b).
- Results presentation to local community groups (e.g. Border Archaeological Society).
- Publication of results within a relevant local or national journal.
- Deposition of project documentation with the Archaeology Data Service (ADS) and local Historic Environment Record (HER).
- Submission of isotope data to open-access database (e.g. IsoArch)
- Educational resources for multiple age ranges (primary, secondary, further education, higher education).

5.4 Archive Strategy

Produced project documentation, the final report, and associated data files will be deposited with the ADS and local HER for open-access dissemination and long-term digital storage, as appropriate. The isotope data will also be submitted for archival within an open-access database such as IsoArch (2024). All remains will be returned to DigVentures' immediately after sampling.

6. Project Review

6.1 Stages and Review Points

6.1.1 The Project Executive and Project Manager will continuously review project progress, with formal reviews performed at the end of each Stage as outlined in Table 6.

Table 6: Project review programme for the LHL project.

Stage	Description	Review Point	Completion Date
Start-up	Development and examination of Project Proposal	R1: Project Proposal approved and preliminary Project Team assembled	Completed – January 2024
Initiation	Project Design and Risk Log finalised, and project scope defined	R2: MoRPHE-compliant Project Design signed off and resources committed	Completed – April 2024
Stage 1	Review of HIA project results following project closure and sample selection for scientific analysis	R3: Final sample selection approved	2026
Stage 2	Scientific analysis programme (dietary reconstruction, geographical origin assessment, trace element analysis) and preliminary analysis of raw data	R4: Review research potential of assembled dataset from preliminary analysis	early 2027
Stage 3	Interim Assessment Report and Updated Project Design	R6: Critical review of data and preliminary interpretations. Recommendations made for further work or project closure	mid-2027
Stage 4	Data analysis, interpretation, and contextualisation	R5: Review of interpretations and findings, and preparation for dissemination product creation	late 2027
Stage 5	Specialist report production, publication of report and dissemination outputs, and preparation of project archive	R7: Sign-off of final report and dissemination products. Project archive deposited.	early 2028
Closure			mid-2028

7. Health and Safety

- 7.1.1 All sample preparation conducted by AIPRL will conform to established Durham University risk assessments and health and safety guidance.

Part II. Resources and Programming

8. Methods Statement

8.1 Links with Aims and Objectives

- 8.1.1 The proposed methods are directly linked to the LHL project aims and objectives as described in Table 7.

Table 7: Links between the methodology and research questions

Research Question Objectives	Sample Selection	Geographical Origins Assessment	Dietary Reconstruction	Trace Element Analysis	Data Analysis, Interpretation and Contextualisation
Q.1			✓		✓
Q.2		✓			✓
Q.3				✓	✓
Q.4	✓	✓	✓	✓	✓
Q.5	✓	✓	✓	✓	✓
Q.6		✓			✓
Q.7		✓			✓
Q.8	✓	✓	✓	✓	✓
Q.9	✓	✓	✓	✓	✓
Q.10	✓	✓	✓	✓	✓
Q.11	✓	✓	✓	✓	✓
Q.12	✓	✓	✓	✓	✓
Q.13		✓	✓	✓	✓
Q.14		✓	✓	✓	✓
Q.15		✓	✓	✓	✓
Q.16		✓	✓	✓	✓
Q.17		✓	✓	✓	✓

8.2 Sample Selection

- 8.2.1 From the complete burial dataset of articulated remains, a suitable representative sub-sample of individuals will be selected for specialist scientific analysis based on preservation criteria and skeletal element availability. Osteological assessments in the HIA project documentation (Wilkins *et al.* 2016; Caswell *et al.* 2018; 2020; 2021; Jackson *et al.* 2022;

2023a) will be used alongside DDT records and any future osteological analysis to collate the information required to refine the sample size. Specific skeletal elements must be available from each individual to ensure the full range of planned analyses can be undertaken. To assess geographical origins and mobility between childhood and later life, enamel samples are needed from one early forming permanent tooth (preferably a canine) and a late forming permanent molar (ideally a second or third molar) for strontium and oxygen isotope analysis. Trace element and lead isotope analyses will be performed using enamel samples from the same early forming teeth. Reconstructing diet across an individual's life using carbon and nitrogen analysis requires bulk samples from the rib, femur, and dentine (the same teeth should be sampled again). Some flexibility will be permitted for these criteria, especially for non-adult remains where full permanent dentition may not be present and elements' development periods cover the same timeframe. Preservation condition of selected bone and teeth samples must also be sufficiently good to permit extraction of well-preserved collagen that meets quality parameters (DeNiro 1985; van Klinken 1999).

8.3 Geographical Origins Assessment

8.3.1 *Strontium Isotope Analysis*

Enamel samples will be prepared for strontium isotope analysis in AIPRL's laboratory at Durham University, and analysed within the Arthur Holmes Isotope Geology Laboratory (Earth Sciences, Durham University). Standard column chemistry methodologies (Font *et al.* 2008) will be used. The bioavailable strontium range for Lindisfarne will be estimated using reference materials (Evans *et al.* 2018) or additional analysis of plant and/or faunal remains recovered from the site, and will be used to identify individuals consistent with a local residential origin.

8.3.2 *Oxygen Isotope Analysis*

Powdered enamel samples will be prepared in AIPRL's laboratory, and will be sent to Iso Analytical for oxygen isotope analysis. The resulting data will be converted for comparison with modern drinking water values (Chenery *et al.*

2012; Fricke *et al.* 1995) to enable identification of individuals consistent with a local residential origin.

8.3.3 *Lead Isotope Analysis*

Enamel samples will be prepared for lead isotope analysis in AIPRL's laboratory and analysed by an external company. Indications of 'cultural focusing' (Montgomery *et al.* 2005) within the data and comparison with reference data for native ore sources across Britain will aid interpretations of geographical origins and mobility.

8.4 **Dietary Reconstruction**

8.4.1 *Carbon and nitrogen isotope analysis*

Bulk dentine, rib, and femur samples will be prepared in AIPRL's laboratory using standard collagen extraction methods (O'Connell and Hedges 1999), and will undergo carbon and nitrogen isotope analysis in the Stable Isotope Biogeochemistry Laboratory (Earth Sciences, Durham University). The resulting data will be used to interpret diet during the last c. 5 years before death from the rib (Cox and Sealy 1997; Fahy *et al.* 2017), during tooth development in childhood from the dentine (Beaumont and Montgomery 2015), and during adolescence from the femur (Hedges *et al.* 2007).

8.5 **Trace Element Analysis**

8.5.1 Enamel samples will be prepared in AIRPL's laboratory and will undergo trace element analysis in the Arthur Holmes Isotope Geology Laboratory. The produced data will potentially include lead, arsenic, and mercury concentrations which will be used to form interpretations of individuals' exposure to these non-essential pollutant minerals during their lifetime (Bowen 1988; Swaine 2000).

8.6 **Data Analysis, Interpretation and Contextualisation**

8.6.1 All data from the scientific analysis programme will be contextualised with appropriate identified comparative data during analysis, and integrated and synthesised with the results of the HIA project as well as other suitable contemporaneous and/or geographically-related studies within the project's

wider research context. Crowdfunding initiatives will support training of data analysis volunteers in appropriate research skills.

9. Project Team

9.1 Project Team Structure and Responsibilities

9.1.1 The LHL project team and role responsibilities are defined in Table 8.

Table 8: Team structure of the LHL project

Project Role	Name	Key Responsibilities	Personal Specification
Project Executive	Professor Janet Montgomery (Durham University)	Overall responsibility for project and final decision-making. Budget responsibility. Project assurance. Regular liaison with and delegation of day-to-day management to Project Manager to ensure project progression. Regular liaison with stakeholders and sponsors.	AIPRL academic lab lead Leading academic researcher specialising in isotope analysis Extensive experience in grant application and project executive duties
Project Manager	Dr Joanna Moore (Durham University)	Management of day-to-day project operation. Project planning. Creation of Risk Log and maintenance of Issue Log. Cost and scheduling monitoring. Prepare interim assessment report and Updated Project Design, and oversee creation of final report and dissemination products. Ensure project outputs comply with Project Design.	AIPRL research technician (lab management) Established success of AIPRL as commercial venture with large network of connections Job responsibilities include managing and undertaking laboratory work, data analysis, and report writing.

Expert Team	Dr Joanna Moore Dr Anwen Caffell (Durham University - osteology) Aimee Parker (Durham University – isotope analysis) Brett Ostrum (Durham University – isotope analysis)	Provide specialist knowledge and expertise to project's execution stages. Contribute to Project Design and Updated Project Design. Monitor Risks and raise Issues where appropriate. Undertake sample selection, isotope and trace element analyses, and subsequent data analysis and interpretation under direction of Project Manager. Contribute to interim and final reports and dissemination products.	Dr Moore's role as PM allows supervision of the Expert Team and contribution of expertise and specialist knowledge to it. Dr Caffell conducted osteological assessment of remains recovered during the HIA project so has specialist knowledge of this particular burial population to inform sample selection. Parker and Ostrum have long-term experience working in AIPRL's laboratory and are well placed to identify risks and arising issues within the scientific analysis programme.
Project Board	Lisa Westcott Wilkins (DigVentures) Dr David Petts (Durham University)	Project assurance with Project Executive. Monitor progression of progress against Project Design from perspective external to scientific analysis programme. Provide expertise and specialist knowledge of HIA project and overall site. Assist Project Manager and Expert Team with accessing burial population, contextualising results, and integration of project with DigVentures' preceding work.	Westcott Wilkins is the Project Executive of the HIA project with project assurance responsibilities, so has a thorough understanding of the logistics of the preceding HIA project and its aims and objectives. Dr Petts is an early medieval specialist researcher and is the academic archaeological site director for the HIA project with responsibilities of liaising with stakeholders and the project team.

10. Stages, Products and Tasks

10.1 Programme

10.1.1 It is expected that this project will involve 5 execution stages, which are outlined in Table 9 with their associated products and tasks in relation to the project aims and objectives.

Table 9: Stages, products, and tasks of the LHL project

Stage	Description	Linked Aims and Research Questions	Products	Task List
Stage 1	Review of HIA project results following project closure and sample selection for scientific analysis	Aim 1 (RQ 1-5)	1. Skeletal sub-sample	1. Collect skeletal remains from DigVentures (PM + Experts) 2. Consult HIA project documentation (PM + Experts) 3. Compile skeletal sub-sample (PM + Experts) 4. Project Team meeting to review selected sub-sample (all) 5. R3 sign-off (Project Executive and Project Board)
Stage 2	Scientific analysis programme (dietary reconstruction, geographical origin assessment, and trace element analysis) and preliminary analysis of raw data	Aims 1 and 2 (RQs 1-7)	2. Raw isotope dataset	6. Sample preparation for carbon, nitrogen, strontium, oxygen, and lead isotope analysis and trace element analysis (Expert Team) 7. Sample analysis at internal (Durham University) and external laboratories (Iso Analytical) 8. Brief review and analysis of raw data (PM and Expert Team) 9. Project Team meeting to discuss preliminary findings (all)

				10. R4 sign-off (Project Executive and Project Board)
Stage 3	Interim Assessment Report based on preliminary findings and creation of Updated Project Design	Aims 1, 2, 3 and 4 (RQs 1-13)	3. Interim Assessment 4. Updated Project Design	11. Production of interim assessment report (PM and Expert Team) 12. Production of Updated Project Design (PM and Expert Team) 13. Review and approval of Updated Project Design (Projective Executive and Project Board) 14. Project Team meeting to review UPD and recommendations for further work (all) 15. R5 sign-off (Project Executive and Project Board)
Stage 4	Data analysis, interpretation, and contextualisation	Aims 1, 2, 3, 4 and 5 (RQs 1-17)	5. Data visualisation products (isoplots/graphs) 6. Comparative dataset	16. Specialist analysis of isotope and trace element data (PM and Expert Team) 17. Training of volunteers in research skills for data analysis (PM and Expert Team) 18. Compilation of interpretations with HIA project results and comparative data 19. Project Team meeting to review interpretations and integrated analysis (all) 20. R6 sign-off (Project Executive and Project Board)
Stage 5	Specialist report production, publication of report and dissemination outputs, and	Aims 1, 2, 3, 4 and 5 (RQs 1-17)	7. Final report 8. Dissemination outputs 9. Project Archive	21. Specialist report production (PM and Expert Team) 22. Creation of dissemination outputs (PM and Expert Team)

	preparation of project archive			23. Review of final report and produced dissemination outputs (Project Executive and Project Board) 24. Project Team meeting in advance of publication and archive deposition (all) 25. Creation and deposition of project archive (PM and Expert Team) 26. Project Team meeting to discuss project closure (all) 27. R7 sign-off (Project Executive and Project Board)
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11. Product Descriptions

11.1.1 The product descriptions are presented in Appendix 1.

12. Risk Log

12.1.1 The Risk Log is presented in Appendix 2.

13. Budget

13.1.1 The project's estimated budget is outlined in Table 10, and a quote template for AIPRL's analytical costs is available in Appendix 3. Finances are expected to be sourced through grant applications and crowdfunding.

Table 10: The proposed budget for the LHL project

Resource	Details	Individual Cost	Total	Notes
Staff costs	Project Executive salary @ 20% employed time for 2 years	£34,000	£95,600	Staff costs estimated using Durham University payscales
	Project Manager salary @ 20% employed time for 2 years	£14,000		
	Expert salary @ 25% employed time for 2 years	£12,000		
	Expert salary @ 25% employed time for 2 years	£12,000		
	Expert salary @ 25% employed time for 2 years	£12,000		
	Project Board salary @ 5% employed time for 2 years	£5,800		
	Project Board salary @ 5% employed time for 2 years	£5,800		
Analytical costs (sample preparation and analysis)	Combined strontium and lead isotope ratios measured in early forming tooth (46 samples)	£16,100	£42,320	Analytical costs estimated using current skeletal dataset (46 individuals) to cover possibility of large sub-sample AIPRL Quote Template available in Appendix 3 and is inclusive of external specialist analysis costs
	Strontium isotope analysis of later forming tooth (46 samples)	£11,500		
	Oxygen isotope analysis – 2 per individual (92 samples)	£5,520		
	Trace element analysis (46 samples)	£2,300		
	Bulk carbon and nitrogen isotope analysis – 3 per individual	£6,900		

	(dentine, rib and femur: 138 samples)			
Specialist Report	AIPRL specialist report produced by PM and Expert Team and quality assured by Project Executive	£2000	£2000	
Laboratory Consumables	Required consumables for large-scale isotope and trace element analyses (sample preparation)	£1,500	£1,500	
ADS Deposition	Deposition of Project Design, Final Report, Updated Product Design, and Interim Assessment Report pdf files. Deposition of analytical data spreadsheet	£30	£216 (inc. VAT)	Approximate quote obtained from ADS (2024a)
	Startup fee	£150		
			£141,636	

14. GANNT Chart

14.1.1 The preliminary timeline for the LHL project is presented in the GANNT chart below. Due to expected long lead times for sample analysis, the project is proposed to take around 2 years to complete.

Task ID	Task Name	Duration	Jan-Jun 26	Jul-Dec 26	Jan-Jun 27	Jul-Dec 27	Jan-Jun 28
	Stage 1: Sample Selection and HIA Result Review						
1	Collect skeletal remains	1 week					
2	Consult HIA project documentation	1 month					
3	Compile skeletal sub-sample	2 months					
4	Project Team meeting	1 day					
5	R3 sign-off	1 week					
	Stage 2: Scientific Analysis Programme						
6	Sample preparation	2 months					
7	Sample analysis	1 year					
8	Review of raw data	1 month					
9	Project Team meeting	1 day					
10	R4 sign-off	1 week					
	Stage 3: Project Review						
11	Interim Assessment Report creation	1 month					
12	Updated Project Design production	1 month					
13	Review and approval of interim report and UPD	1 month					
14	Project Team meeting	1 day					
15	R5 sign-off	1 week					
	Stage 4: Data Analysis, Interpretation and Contextualisation						
16	Specialist analysis of data	6 months					
17	Volunteer training in research skills	1 month					
18	Compile interpretations with HIA results and comparative data	2 months					
19	Project Team meeting	1 day					
20	R6 sign-off	1 week					
	Stage 5: Publication, Dissemination and Archive						
21	Specialist report production	2 months					
22	Dissemination output creation	2 months					
23	Final report and dissemination output review	1 week					
24	Project Team meeting	1 day					
25	Project archive creation and deposition	1 month					
26	Project Team meeting	1 day					
27	R7 sign-off	1 week					
	Completion						

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Figure 1: The location of the tidal island of Lindisfarne off Northumberland's north-east coast. The site of DigVentures' Holy Island Archaeology project excavations is indicated by the arrow, with a picture of an in-process exhumation of an articulated skeleton (Google Earth 2024)

16. Appendices

16.1.1 The appendices have been uploaded as supporting documentation.

Appendix 1: Product Descriptions

Appendix 2: Risk Log

Appendix 3: AIPRL Quote Template