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## Introduction and aims

Evidence for movement of people from Scandinavia in the Viking period is found on archaeological sites across the North Atlantic, including the Northern and Western Isles and mainland Scotland. Traditional chronologies indicate an east to west migration through the 9<sup>th</sup> and into the 10<sup>th</sup> centuries. However, new scientific dating evidence from archaeological excavations suggests a more complex pattern of interaction over an extended period of time.

In recent years there has been a significant increase in the number of scientific dates from the region, the range of methods has extended beyond radiocarbon to include tephra, archaeomagnetism and luminescence, and there have been major advances in statistical and scientific understanding of the methods. All of these developments allow a more nuanced interpretation of the timing, duration and nature of westwards expansion.

This poster presents the initial stages of a project to collate, critically evaluate and reinterpret scientific dating evidence in a regional synthesis across the North Atlantic, with a view to understanding this crucial period in both Scotland and the wider context.

## Starting point

### Data Collation

Interpreting evidence for migration and settlement requires a robust chronological framework, and so the initial aim is to collate scientific dates from all relevant archaeological contexts. Studies so far have focussed on individual sites or regions; this research brings together the dating evidence across the entire North Atlantic for the first time. Initial literature survey has identified over 190 sites with evidence of Scandinavian contact excavated in the region since 1950. Of these, over 90 have produced 700 chronometric dates, drawn from published literature, site reports, student theses and laboratory reports.

All relevant dates, with associated scientific and archaeological information, are collated into an Access relational database. The selection of data involves extensive discussions with archaeologists working in the region and the database will become a resource for other researchers.

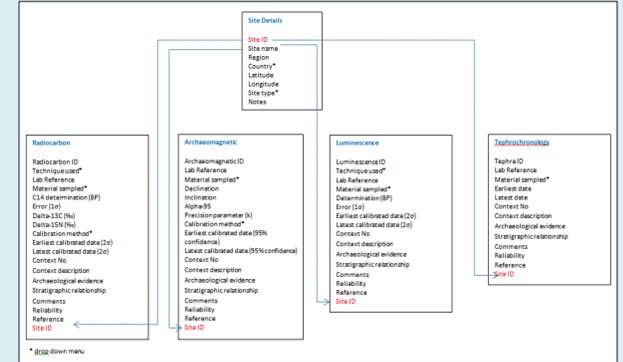


Fig. 1. Database structure, including details of the scientific dates and their archaeological context.

## The next stage

## Data Evaluation

The next stage is to evaluate the quality of these data using current understanding of the archaeological record and the scientific basis of the methods. Quality assessment of the dates considers the material dated, precision and accuracy of laboratory measurements and likelihood of contamination. To evaluate the data it is also essential to understand the relationship between dates and archaeological context, prioritising close and unequivocal associations.

- Radiocarbon dating is the primary method employed, but there have been significant advances in measurement and calibration over the period it has been in use. The suitability of material dated is evaluated, radiocarbon determinations are recalibrated with the most recent datasets (Reimer *et al.*, 2009) and appropriate corrections made for marine carbon contributions (e.g. Ascough *et al.*, 2011).
- Tephrochronology is well-established in some regions (e.g. Dugmore *et al.*, 2000) and checks are made to ascertain that the tephra layer identified has not been reworked and can be clearly linked to a dated eruption.
- Archaeomagnetic dating has mainly been used in Orkney and Shetland for dating the last use of fired structures (e.g. Outram & Batt, 2010). The reliability of material as a magnetic recorder is quantified and, where necessary, magnetic directions are recalibrated (Zananiri *et al.*, 2007; Pavón-Carrasco *et al.*, 2011).
- Optically stimulated luminescence is not used widely but has significant potential for dating sediments (e.g. Rhodes *et al.*, 2003).

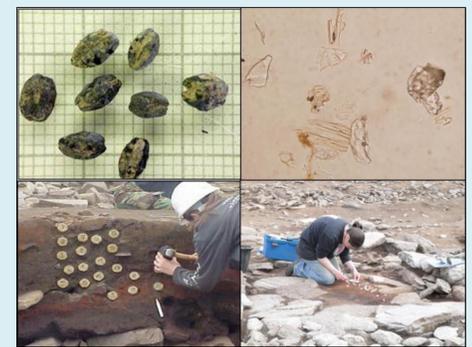


Fig. 2. Main scientific dating methods used in the region. Clockwise from top left: radiocarbon, tephra, archaeomagnetism, luminescence.



Fig. 3. An example of evaluation of scientific dates from the Faroes, showing the region of study, location of the relevant sites in the Faroes, archaeological excavations at Við Kirkjugarð, an example of the data obtained and a plot of the selected dates for the islands. Red denotes archaeomagnetic dates, blue denotes marine corrected radiocarbon dates.

## The final stage

## Synthesis

Once reliable scientific dates within an established archaeological framework have been identified, it is possible to use Bayesian statistical methods to interpret the data on a site-based, regional and international scale (Bronk Ramsey, 2009). Within a site, Bayesian analysis can be used to integrate scientific dates within a stratigraphic sequence, producing more precise dates from existing datasets and highlighting anomalies.

Critical analysis of dating evidence from all methods across the entire region allows research questions concerning the nature and timing of migration to be addressed:

- The speed of expansion and evidence of first settlement in different regions;
- Evidence for waves of expansion, potentially supporting complex diaspora models rather than East to West movement;
- Longevity of occupation and interaction between diaspora and indigenous populations.



### Interest beyond the academic

In addition to the academic focus of the project, there is strong commitment to public engagement, with a project website and blog providing a forum for discussion. A key aspect demonstrates the contribution that archaeological evidence can make to teaching migration and settlement within Primary schools, moving beyond the popular image of Viking raiders and using evidence from the past to promote discussion of migration in modern societies. The project is working with schools in Bradford, Orkney and Iceland, and with the Council for British Archaeology. Outputs include workshops at the Orkney International Science Festival, York Viking Festival and the Festival of British Archaeology.

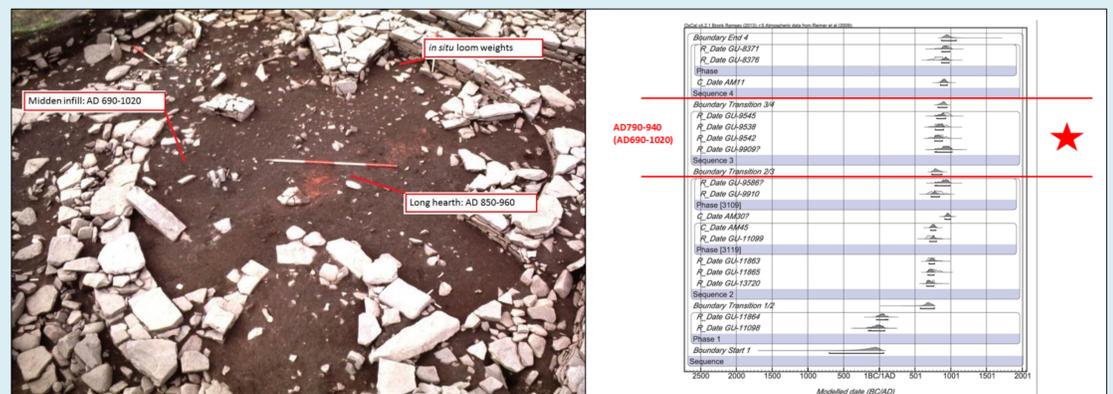


Fig. 4. An example of the use of Bayesian analysis to improve the precision of dating of the Norse period deposits at Old Scatness, Shetland. The deposits were characterised by a long hearth, loom weights and diagnostic artefacts within reused earlier structures. Radiocarbon and archaeomagnetic dates were constrained using their stratigraphic position to produce a more precise date for this period of occupation (Outram & Batt, 2010). Modelled date is given in brackets.

### Acknowledgements and References

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### Conclusion and on-going work

The research project is currently at the data collation and evaluation stage and outcomes will be reported in the academic literature and via the website. It is intended that the project will promote the scientifically informed use of a variety of dating methods on sites across the North Atlantic and a re-evaluation of existing data. A sound quantitative basis for addressing questions about migration and settlement will promote wider discussion of shared heritage across the North Atlantic, past and present.