Making finds matter: using charismatic objects, people power and digital technologies to build a better future for archaeological finds in Scotland

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Making finds matter: using charismatic objects, people power and digital technologies to build a better future for archaeological finds in Scotland

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ABSTRACT

From enigmatic carved stone balls to the patched breeches of an 18th-century bog body, many archaeological finds from Scotland are, without doubt, fabulous. Through these objects and the practices they embody, we can imagine alternative ways of living and thinking, wonder at past people's ingenuity and skill, and revisit significant moments in our own lives. Archaeological finds are also often fragile, scattered across diverse locations, and often difficult to access or find out about following their initial discovery. Only very few archaeological objects make it into museum displays where they can be widely enjoyed. In economically and socially challenging times, even these items can be hard to reach. Linking into wider moves to improve access to heritage collections in Scotland and across the UK, the Boundary Objects Project celebrated captivating archaeological objects from Scotland and the diverse sets of people involved in their discovery. Contemporary digital technologies and the goodwill, skills and energy of a wide set of archaeological professionals, students and enthusiasts were harnessed in order to improve access to information to scattered digital records relating to archaeological objects and sites, to raise the prominence of these items in existing community-led heritage initiatives, and to engage diverse audiences in actively enjoying them. This paper summarises work on the Boundary Objects Project – a collaboration between the universities of Reading and Manchester in partnership with Historic Environment Scotland (HES) and National Museums Scotland (NMS) – in the context of wider multi-stranded moves to build a better future for archaeological finds in and well beyond Scotland.

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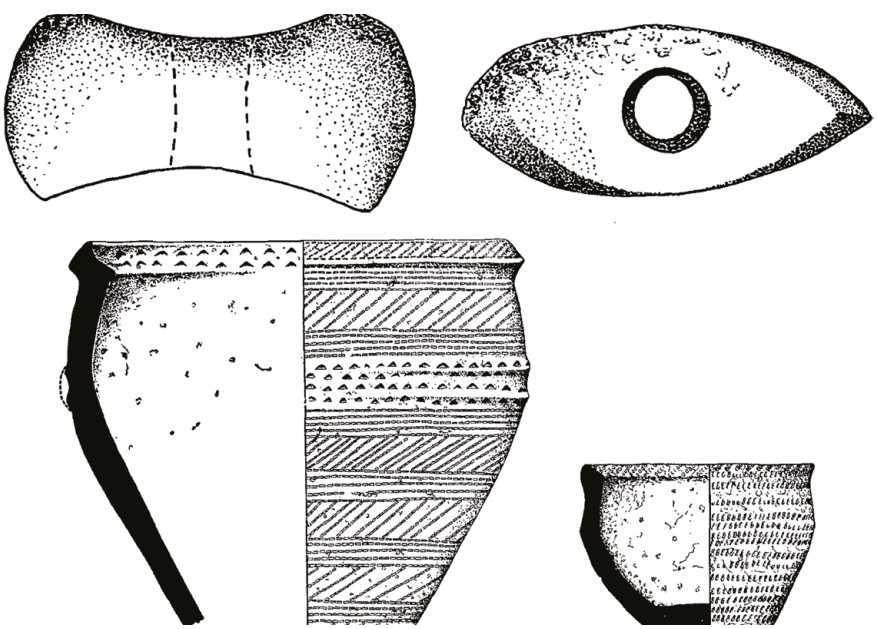
INTRODUCTION

On 4 March 1954, quarry workers at the Springbank Sand and Gravel Company in Doune, Perthshire, disturbed a small stone cist, embedded in a specially cut pit (Hamilton 1959). The cist contained the remains of a child of six to seven years. A miniature stone axe hammer and a small Food Vessel pot were placed at the child's head. Fragments from a larger Food Vessel were found in the broken cist edge and in quarry scree. The pots, while intensely decorated, were of a coarse fabric. The granitic miniature stone axe hammer – less than 7cm in length – was heavily worn on one face (Illus 1). Archaeological discoveries like these – currently on display in the National Museum of Scotland (NMS) – fuel diverse and exciting academic research, inspire wider public imaginations of the past, and prompt us to reflect on contemporary issues and experiences, in this case the tragedy of a child's death. For this reason, they should be accessible to as many people as possible via various formats and engagement channels – from direct handling in museums through to digital device-accessed virtual renditions.

Over the last 20 years, modes of engaging with and interpreting archaeological finds have transformed substantially. Metal detecting and developer-funded excavations have produced a wealth of new objects, both outstanding and ordinary. The array of scientific methods available for investigating these objects is increasingly sophisticated and accessible to a wide set of researchers, as are the ideas that have been developed for exploring the stories behind archaeological objects (see Cooper et al 2021 for a summary of recent interpretative trends). Of vital importance for the context of this paper, most information about archaeological finds is now 'born digital' – images, analytical reports and other information about archaeological objects are typically created in digital formats from the outset. Significant effort has also been invested in digitising multimedia (paper, microfiche, photographic prints, etc) finds information from earlier decades (see for example the Highland Finds initiative). Not only is it easier to synthesise and interrogate



Illus 1 Miniature stone axe hammer and Food Vessel urns buried with a child in a cist at Doune, Perthshire (Hamilton 1959: fig 8)

information about archaeological finds nowadays, the potential also exists to make this digital information available to multiple audiences.

Unfortunately, these positive changes have taken place in the context of a sustained period of economic austerity. A recent report by the Museums Association recorded that funding for local authority-run museums fell by 27% in real terms across the UK (23% in Scotland) between 2010 and 2020 (Rex & Campbell 2021, 2022). Concerns about the future survival of many museums, together with extended museum closures relating to the Covid-19 pandemic, have emphasised the urgent need to improve access to archaeological finds. In this setting, a series of action-oriented initiatives in Scotland and across the UK have sought to promote the huge social value of all heritage collections, to improve the flow of information about archaeological objects from their initial discovery to their arrival in museum stores, to explore methods for (re)connecting separate silos of finds information, and to make fresh opportunities for non-specialist audiences to engage with these objects (Cowie & McKeague 2010; Mann 2020; Towards a National Collection (TaNC)).

This paper outlines key findings from one such initiative – the Boundary Objects Project – that used prehistoric grave goods like those described at the start of this paper, and their proven ability to bring together a community of researchers and wider audiences, as a starting point for making a targeted and impactful contribution to future finds research and engagement in Scotland and beyond. Our use of the term 'boundary objects' is an adaptation of the sociological term referring to items that connect diverse sets of people and information (Star & Griesemer 1989; Bowker & Star 1999; Star 2010).

BOUNDARY OBJECTS PROJECT IN CONTEXT

The Boundary Objects Project was an AHRC Follow-on Funding for Impact and Engagement project which ran for 12 months from April 2021, following a 12-month delay for the initial peak of the Covid-19 pandemic. This detail is important, because the pandemic accentuated existing complexities concerning access to archaeological objects and underlined the urgent need to create digital and direct openings for engaging with archaeological finds. The project was a collaboration between the universities of Reading and Manchester, HES and NMS. It 'followed-on' directly on from the Prehistoric Grave Goods Project, which featured Orkney and the Outer Hebrides as one of six case study areas. The Prehistoric Grave Goods Project synthesised systematically, for the first time, evidence about prehistoric grave goods across Britain (Cooper et al 2020, 2021). Grave goods from Orkney and the Outer Hebrides, while numerically diminutive in the original project dataset – comprising just over 4% of the *c* 6,000 grave goods from our six case study areas – played a vital part in our research. The Boundary Objects Project capitalised on practical and interpretative findings from the Prehistoric Grave Goods Project, and keyed into existing finds-related agendas in Scotland.

One prompt for the Boundary Objects Project was our recognition that information about grave goods and other archaeological finds is often very difficult to access and to navigate for academic researchers, for other heritage professionals, and for the wider public alike. Information about archaeological finds has been gathered by a gamut of researchers, heritage professionals and members of the public over the course of more than two hundred years. This information can be contradictory in its makeup and out of date across different data sources – a museum accession number recorded 50 years ago in a database of archaeological sites (for instance, in the National Record of the Historic Environment (NRHE), accessed via Canmore) is unlikely to have been updated to match museum accession numbers that have been revised to meet the requirements of a contemporary museum database (for instance the NMS online collection); similarly, object identifications and typologies can change over time and thus become outdated until updated everywhere. The teams who excavate archaeological sites are often different to those who analyse the excavated material, and to those who revisit and

re-analyse objects once they have been deposited in a museum store. Discovery site names drift and morph as excavated finds make their way from fieldwork unit finds rooms to individual finds specialists to museum stores to digital datasets. As a result, objects easily become divorced from information about them – for example, vibrant hand-drawn illustrations, excavation notes, the results of scientific analysis, letters, and contemporary newspaper reports of antiquarian discoveries, often rewardingly rich in detail and with telling commentary (Illus 2). The divergent routines by which information about archaeological sites and information about objects are processed and stored, and by which further analyses of archaeological sites and objects are published, again separately, further contribute to a current situation in which rich, diverse, complementary and sometimes also contradictory information about archaeological objects is scattered across assorted data silos. To take just one example, rare Beaker sherds recorded as being from the Fraga cist burial at Brecks, Scatness, Mainland, Orkney in the Hunterian Museum online collection, are

Illus 2 Disjointed information from the Early Bronze Age cist burial at Tappoch of Roseisle, Moray (Canmore ID 16160): Sophia Dunbar's watercolour illustrations of (a) the cist, which was accompanied by handwritten excavation notes (not shown) (image © HES) and (b) the jet necklace from this excavation (image © NMS)

recorded in the Canmore online collection as being from Brecks, Shetland, and as being located in the NMS collection. Considerable time and effort are therefore required in order to reconcile varying accounts, to stitch information together, and to tell compelling new stories about the past.

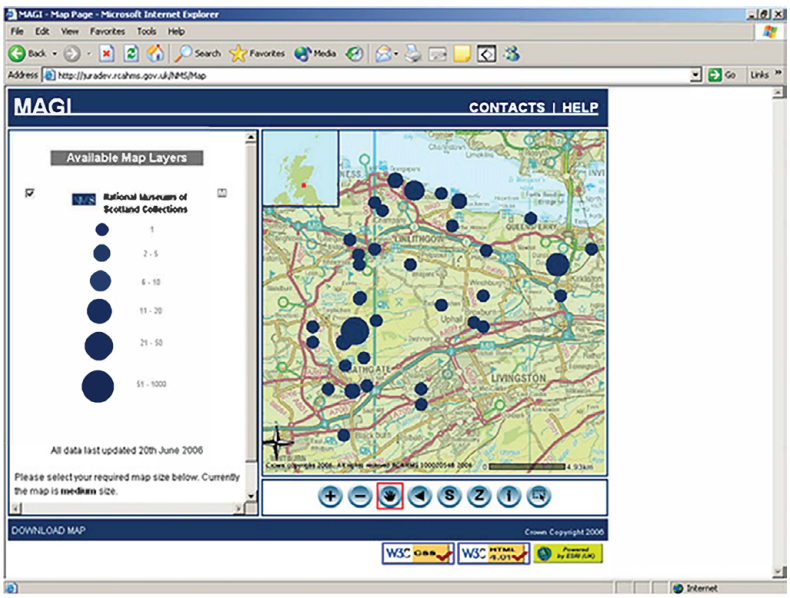
The Prehistoric Grave Goods Project research team navigated these intricacies at first hand in compiling evidence from across Britain. Within Scotland, finds work undertaken by Archaeology for Communities in the Highlands (ARCH), initially for the Highland Regional ScARF project (HighARF, running 2018–21) and augmented by the Highland Finds project (2020), gathered key information about the current makeup of museum collections and records across the Highland region and beyond. This survey revealed that few Highland museums have online collections; many smaller museums have no digital catalogues at all. Additionally, finds information is often absent in site-focused records like Canmore and Historic Environment Records (HERs). Access to finds information is compounded further by the limited documentation provided with finds assemblages at the point of deposition in museums and by delays in the process of accessioning and cataloguing new finds assemblages following their deposition in museums (Mann 2020). Where online information about archaeological objects is available, it is often scant and lacks engaging and analytically helpful images.

Another trigger for the Boundary Objects Project was our realisation that, despite the huge popularity of archaeological objects in general and of prehistoric grave goods in particular, non-specialists rarely get to work directly with this material. The recent World of Stonehenge exhibition at the British Museum, many of the objects from which were prehistoric grave goods, attracted an international audience of 192,000 visitors: there is little doubt that, given the right setting, the public appetite for viewing archaeological objects is substantial. The situation regarding access for non-specialists to archaeological finds collections and datasets is more complicated. On the one hand, workshops held at the outset of the Boundary Objects Project with museum professionals, heritage data curators and volunteer coordinators across Scotland established that, irrespective of the particular restrictions associated with the Covid-19 pandemic, opportunities for members of the public to become actively involved in archaeological finds research and to directly handle archaeological material are scarce. For instance, most of NMS's volunteers, numbering around 500, help with administrative and clerical tasks and events or operate as guides; only a handful work regularly with the archaeological collections. On the other hand, many regional museums in Scotland are entirely run by community groups who lack financial support, and, sometimes, direct archaeological experience, making it difficult for them to undertake routine cataloguing or to make the most interpretatively of important finds in their collections. Unusually, ARCH's HighARF and Highland Finds projects (see above) were community driven and did involve significant volunteer input. These two projects underlined the wide enthusiasm among non-specialists for working on targeted projects with archaeological collections, and the significant gains that can be made in doing so: 1,341 finds records were created, a further 2,678 were updated, and around 6,000 Highland HER records were furnished with finds information over a three-year period. Regionally and internationally significant archaeological objects, for example at Dunrobin Castle Museum and Inverness Museum and Art Gallery, were catalogued digitally and linked to Treasure Trove information for the first time.

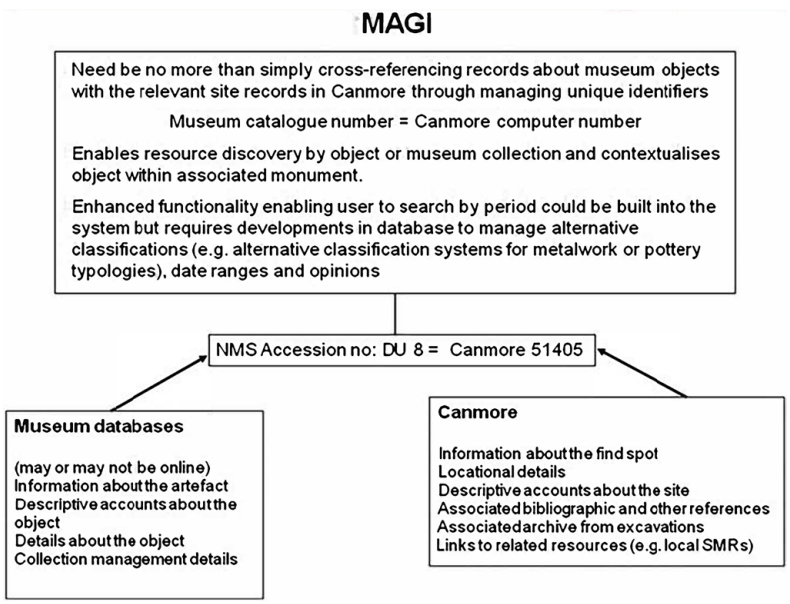
Essential to our decision to focus Boundary Objects Project work in Scotland was a pilot study undertaken between 2006 and 2007 by NMS and the Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS) – the Museum Artefact Geographical Interface project (MAGI) (Cowie & McKeague 2010), together with the enthusiasm and support of current colleagues in these organisations, in regional HERs, and in community groups across the Highlands. With minimal resources, MAGI created an online geographical interface for aligning NMS object records with their equivalent

Canmore site records in recognition that 'artefacts in museum collections derive from *places in the Scottish landscape*; that the removal of an artefact from the ground involves *loss of connection with that geography*; and that the power of information technology offers possibilities for the *virtual reconnection of objects and place*' (Cowie & McKeague 2010: 91, original emphasis). Ultimately, 122 NMS objects were linked securely to 65 RCAHMS sites in West Lothian, furnishing these objects with vital locational and other contextual details for the first time (Illus 3).

(a)



(b)



ILLUS 3 (a) Map interface showing NMS finds located via Canmore site records on the MAGI project; (b) schematic representation of the MAGI project idea (after Cowie & McKeague 2010: figs 2 and 7). (© HES)

Unfortunately, MAGI project researchers were unable to secure further funding to archive the project results or to maintain the online interface, which is no longer accessible. Information from MAGI, held initially in a .csv file by the NMS, has, however, been revived and embedded as permalinks – URLs intended to remain unchanged for many years into the future – in existing online NMS records as part of the Boundary Objects Project.

Wider parallel initiatives, both specific to Scotland and spanning the UK, give vital context to work on the Boundary Objects Project and emphasise the significant current impetus to address social and practical concerns surrounding access to archaeological finds and heritage collections more broadly. The largest of these initiatives, Towards a National Collection (TaNC), involves £18.9 million UKRI (UK Research and Innovation) funding, spans a five-year period (2020–25) and the whole of the UK, and targets heritage collections located in a range of settings. TaNC aims to exploit the opportunities offered by new digital technologies – machine learning, persistent identifiers, visualisation software, and so on – in order to build, in future, a world-leading unified national heritage collection which will transform the questions we ask of heritage collections, and also expand and diversify access to these collections.

Before the Museum, At the Museum, and Access to Knowledge/Expertise/Skills are ongoing interlinked projects that tie into Scotland's Archaeology Strategy and are led by Association of Local Government Archaeological Officers (ALGAO) Scotland in partnership with NMS and the Scottish Archaeology in Museums Working Group (Mann 2020). One key aim of Before the Museum was to forge stronger bridges between the outcomes of developer-funded fieldwork in Scotland – finds and archives – and the museums that often, ultimately, host these collections, by better understanding of disjunctions in this relationship, and by devising methods to address these (guidelines, new funding streams, and so on). Structural and procedural changes like this take time, multiple stages of negotiation and successive funding inputs. Projects like Before the Museum therefore play an essential role in tackling fundamental issues in finds management in Scotland that cannot be reached within the timescale of relatively fleeting, but arguably also more agile, research projects. Other important community projects like the NMS's National Lottery Heritage-funded Scotland 365 project (2016–23) are seeking to transform museum collection engagement for specific audiences, in this case 16–25-year-olds.

Within this landscape, the Boundary Objects Project made a brief – but, we hope, bold and enduring – intervention, key elements of which are outlined below. Augmenting work undertaken on the MAGI project we piloted an accessible online digital platform – the Finds Hub – for linking archaeological finds records from online museum collections in Scotland with online monument records in Canmore and in regional HERs. Chiming with wider social aspirations of the TaNC project and the practical positivity of the Highland Finds and HighARF projects, we created a set of digital and hands-on opportunities for volunteers in Scotland to make an active contribution to finds research at a broad level, and to undertake their own archaeological object-inspired research. Featured among these are (a) the Ancient Death Café, an online monthly gathering which inspired finds-related research across a wide set of participants, and (b) our finds-related input into existing community-driven heritage initiatives.

FINDS HUB

CONCEPT, CREATION AND ESSENTIAL FEATURES

The Finds Hub was designed and built by Crispin Flower and colleagues at Exegesis, in consultation with the Boundary Objects Project team, partner organisations and project workshop participants, using a suite of open source technologies including .NET Core, cloudscribe, OpenLayers and MapServer. It is hosted, managed and maintained by Exegesis. The basic idea was to create an online platform for gathering, in one place, disparate digital records from separate

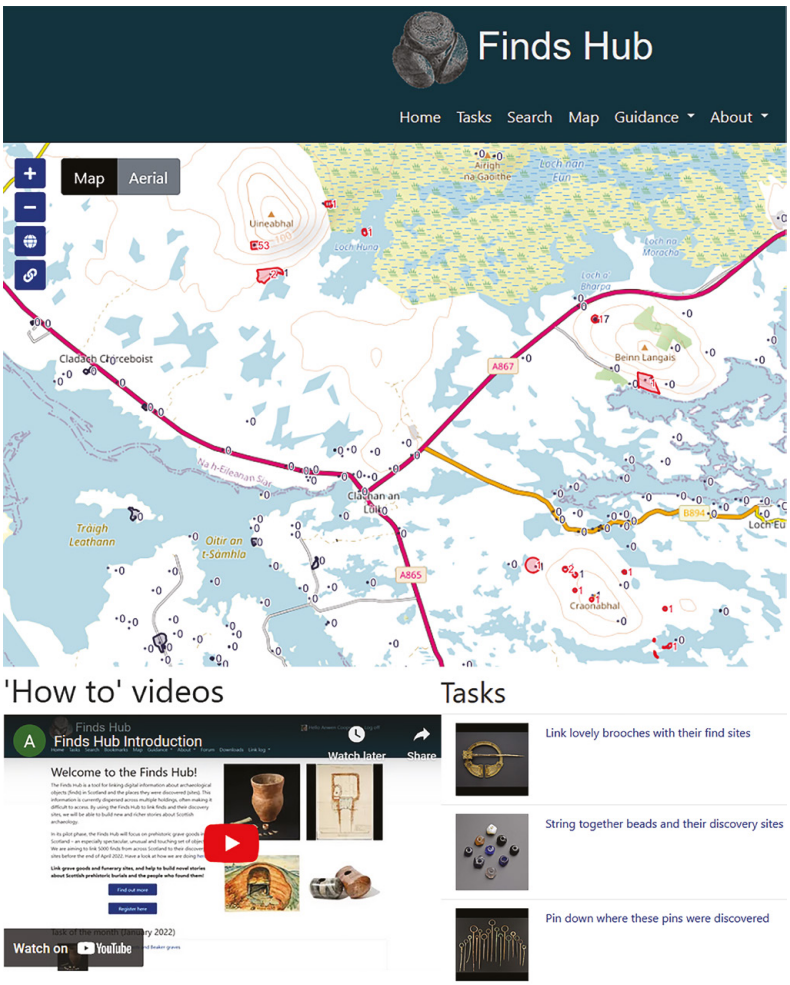
collections relating to archaeological sites (monument records), investigations (event records) and finds (object records). A wide set of participants – volunteers, researchers, heritage professionals, and so on – could then identify and actively make links between these disassociated but related records.

For its initial rendition, a static set of records from contributing organisations was imported into the Finds Hub database. Users then identified and made links between equivalent digital records from separate collections and, where relevant, commented on the character of these links or on why it was not possible to make a link. Agreement was made with contributing organisations that these links would be periodically downloaded from the Finds Hub and then uploaded into their respective datasets. The ultimate aim was that scattered information about archaeological objects – records about their excavation, about context of discovery and about the objects themselves – would first be assembled, scrutinised and understood better in relation to one another *in* the Finds Hub and, second, once the links were embedded within constituent datasets, would be more easily navigated between, *across* datasets. As a result, it was hoped that the process of investigating archaeological finds would, in future, be streamlined and much more gratifying. New and richer stories about archaeological objects and the people and processes by which they were discovered could then emerge.

Key features of the Finds Hub are outlined briefly below and illustrated in Illus 4. Readers are encouraged to explore the Finds Hub itself for further details. Given the Boundary Objects Project's initial hope for the Finds Hub to operate as a tool for heritage professionals, researchers and the general public alike, an attractive interface and simple mechanisms for linking digital records are central to its design. The Home page features engaging examples of archaeological objects and archival material from Scotland and a monthly Task, designed to direct users to work on certain sets of objects, sets of sites, or geographical areas. A series of How To videos explains the operation of the Finds Hub to new users; further user support is provided via Frequently Asked Questions and a Forum. Records are searchable in a free text box or, for site-based records with locational details, via an interactive map. Searches can be refined using a series of filters. Related sets of event, site and finds records can also be grouped in one place in a Bookmark tab, making it easier to link separate records from excavated assemblages – for example, three flint arrowheads, a Beaker pot and an amber bead from a single burial cist – in one go.

It is worth stating at the outset that linking equivalent records from separate site, event and object-focused data repositories is not straightforward. As already noted, the names of discovery sites can vary between equivalent records; objects have, on occasion, been initially assigned to the wrong discovery site (for instance the wrong cairn within a group of cairns). For this reason, Finds Hub users can attach a confidence level to the links they make and can also comment on these links (or on the absence of relevant links between an object and its discovery site, see 'Ongoing and future developments' below). Establishing whether or not this kind of work was suitable for a non-specialist audience was, necessarily, a key question for the pilot phase.

The Finds Hub has received three batches of funding so far: an initial grant from the AHRC-funded pilot work (the design, construction and initial operation of the Finds Hub) from April 2021 to March 2022, the results from which are the main focus of this article. Further funding from the universities of Manchester and Reading (April 2022 to March 2023) and Historic Environment Scotland (April 2023 to March 2025) was secured following the success of the initial pilot, and in order to maintain momentum and to ensure that maximum impact was achieved from the initial project. Updates from work subsequent to March 2022 are discussed briefly at the end of 'Ongoing and future developments' below. For the Finds Hub's pilot phase from December 2021 to March 2022, progress, in terms of links made between Finds Hub records, was visualised in a static Finds Hub Figures! tab. A restricted-access Downloads tab allowed contributing organisations to check on progress with links relating to their own datasets. At the end of



ILLUS 4 Key Finds Hub features: search map, How To videos and Tasks. (© OpenStreetMap; HES; NMS)

the current phase of funding in April 2025, Finds Hub links and comments about these links will also be archived and made accessible for all via the Archaeology Data Service website (https://doi.org/10.5284/1110590).

IMMEDIATE RESULTS AND WIDER (UNEXPECTED) OUTCOMES

In total, 176,190 digital monument, event and object records were imported into the Finds Hub for its initial three-month use period. Expanding the Prehistoric Grave Goods Project's Orkney and Outer Hebrides case study area, and considering (a) the Boundary Object Project's timespan and Finds Hub budget (one year from April 2021 and under £15,000); (b) ARCH's previous success with archaeological finds work in the Highlands (see above); and (c) the total number of links made between objects and discovery sites on the MAGI project (122), the pilot focused on a subset of digital archaeological records from northern Scotland (the Highland Region and Aberdeenshire, Orkney, Shetland and the Outer Hebrides). Relevant digital records were collated from national institutions (HES and NMS), from other willing museums with searchable online collections, and from Historic Environment

Table 1
Summary of records imported to the Finds Hub in December 2021

Data source	*No. of records*	*Record type*
NMS	42,270	Object
Canmore	72,942	Monument and Event
University of Aberdeen Museums (UAM)	14,683	Object
Highland HER	33,607/3,108	Monument/Event
Aberdeenshire HER	1,515	Monument and Event
Historic Environment Portal (HES)	8,065	Scheduled Monument
Total	**176,190**	

Records (HERs) that maintain datasets that vary significantly from records available in Canmore (Table 1).

During the pilot phase, 93 people registered for the Finds Hub, of whom 23 actively made links between records. Personal data was not gathered on registered users beyond name, email address and IP address. However, discussions via the Finds Hub forum and informally indicate that registered users included student and community group archaeologists, heritage professionals from across Britain, and people entirely new to archaeology (eg digital volunteering specialists). In this period, just under 98,000 links in total – an impressive figure, and almost 20 times the number of links that the Boundary Objects Project originally set out to achieve – were made between Finds Hub records in two main ways. During the initial import of records, just under 30,000 'inverse links' were created, where a record from one dataset (for example, a Highland HER monument record) already included a link to a record in another dataset (for example, an NMS object record) but where the inverse link (from the object record to the monument record) had not previously been made. The remaining *c* 68,000 links were made manually by Finds Hub users – collaborators in partner and data-contributing organisations, Boundary Objects Project researchers, and non-specialist volunteers. Bearing in mind that some object records were linked to both Canmore records and regional HER records (and hence are counted twice in this figure), 37,603 object records in museum collections were furnished for the first time with locational and other contextual details via the Finds Hub in this pilot phase. Most of these manual links (just under 55,000 or 82%) were made by one heritage professional – Hugo Anderson-Whymark (NMS); 2,272 links (3%) in total were made by non-specialist volunteers. Alongside the Finds Hub links, 606 comments were made about linked and unlinked records. Many of these comments were attached to records which *could not* be linked in the Finds Hub; the significance of these unlinked records is explored below ('The value of unconnected records: a positive negative').

The makeup of links returned to contributing organisations after the Finds Hub's pilot phase is summarised in Table 2. The process of integrating these links into existing online records was tested and refined by Canmore and National Museums Scotland early in 2023. Where current commitments allow, other contributing organisations have pledged to test the integration process (Highland and Aberdeenshire HERs, the Hunterian Museum) before December 2024. Full integration of links made thus far in the Finds Hub into contributing online collections will be undertaken at the end of the current funding period (April 2025).

The clearest practical gain from this exercise is that where Finds Hub links are integrated into existing online collections, the resulting records are significantly richer and more informative. It is much easier to navigate between nuggets of related information – images, scientific details,

TABLE 2
Summary of links exported from the Finds Hub in April 2022 and subsequently imported into contributing datasets.

Data contributor	*Finds Hub links returned*	*Record type contributed*	*Record type/data repository linked to*
NMS	17,820	Object	Monument and Event records in Canmore and in Highland and Aberdeenshire HERs; Monument records in the Historic Environment Portal
Canmore	62,458	Monument and Event	Object records in NMS and UAM; Monument records in the Historic Environment Portal and Highland and Aberdeenshire HERs
University of Aberdeen Museums (UAM)	8,381	Object	Monument and Event records in Canmore; Monument records in the Historic Environment Portal, and Highland and Aberdeenshire HERs
Highland HER	1,559/159	Monument/ Event	Object records in NMS and UAM
Aberdeenshire HER	2,209	Monument and Event	Object records in NMS and UAM; Monument and Event records in Canmore
Historic Environment Portal	5,365	Monument	Monument and Event records in Canmore
Total	**97,951**		

excavation descriptions, and so on – that currently reside in separate collections – in HERs, on Canmore and in museum collections. This improvement not only makes online collections more accessible and attractive to a wide set of potential users, it also streamlines the investigative process, making the important jobs of researching archaeological objects and their discovery sites, and of sharing the resulting stories with diverse audiences, swifter, more fulfilling and more productive. It is worth highlighting that three of the twelve research pieces undertaken as part of the Boundary Objects Project's Ancient Death Café initiative (see 'Ancient Death Café' below) were prompted by unexpected discoveries made in the course of linking records in the Finds Hub, which allowed users to make (or not make) connections between objects and their discovery sites, and thus to uncover previously untold archaeological stories.

Beyond these direct gains, it is worth highlighting two wider, indirect and perhaps less expected gains relating to the existence and use of the Finds Hub. The first of these relates to the fact that once online heritage collections become part the Finds Hub and are made more accessible, they are exposed to greater scrutiny by heritage professionals and by the wider public. Through directly engaging with online records, and in the process making links between objects and their discovery sites, Finds Hub users gain a strong sense of the relative richness and accuracy of these records. This is important, because most archaeological records (for objects, sites and events) were not originally intended for public consumption; in many cases, as the curators of these collections are well aware, the content of these records is ripe for enhancement. With this in mind, during the lifetime of the Boundary Objects Project, NMS created (either new, 'born digital' images, or by digitising existing photos) and uploaded 5,500 images of objects in their online collection – doubling the previously available number of NMS online archaeology collection images. Additionally, 31 scans of archival material were made available on Canmore and 14 records were updated using information from heritage professionals and volunteers involved in the Boundary Objects Project. As a direct result of Finds Hub activity and research undertaken for Canmore 'longreads' (see 'Ancient Death Café' below), Canmore was also qualitatively

improved. One new site was added while investigating longreads, many more potential new sites were flagged up for further investigation via Finds Hub linking (see 'The value of unconnected records: a positive negative' below), locational information was improved for existing Canmore entries, and many new images were uploaded via MyCanmore. Alongside these digital record enhancements, the process of linking records in the Finds Hub pinpointed lumps and bumps in the connectivity of records from different collections, some of which it was possible to remedy straightforwardly. As a direct outcome of Boundary Objects Project work, key object types found mainly in Scotland but also elsewhere in Britain, and that were previously missing from the standardised Forum on Information Standards in Heritage (FISH) vocabularies widely used across the UK heritage sector (including Shetland knife and discoidal knife), have been recommended for adding to the Archaeological Objects Thesauri for Scotland and, where relevant, for England. Conversations are also underway between Canmore and NMS about harmonising the terminologies each organisation uses to describe key archaeological object types. Additionally, it has been possible to discuss, and in some cases resolve, the mechanisms for grouping whole assemblages of individually accessioned objects in museum collections under one link which can be embedded in online site records. As a result, individually accessioned NMS object records, like the 9,283 excavated finds from the Neolithic settlement at Skara Brae, can now be accessed via a single hyperlink within the Canmore record. Although some museums already group finds assemblages using 'collection level identifiers', these identifiers are not currently accessible for online searches.

THE VALUE OF UNCONNECTED RECORDS: A POSITIVE NEGATIVE

A key aim of the Boundary Objects Project was to improve connectivity between the NRHE, regional HERs and museum datasets. However, as the project progressed it became apparent that many objects in museums' datasets did not have corresponding NRHE/HER records that they could be linked to. These objects include well-provenanced finds, for example a plant textile found in a probably Bronze Age cist at Firth's Park, Stromness in 1911 (*X.EQ* 593; Illus 7), and a wide variety of surface finds, from flint flakes to bronze axeheads. While the first example is one that we would clearly expect to appear on the NRHE/HER that for some reason evaded recording, many of the other objects had poor provenances, often located only to parish or county, and may have been intentionally excluded from the NRHE/HERs at some point in the past. The range of sites and objects recorded in NRHE/HERs is, however, much broader today than in the 20th century and most of these items would be recorded if reported as new finds. 'Absent' records therefore present an opportunity to investigate decisions made in the past that shaped the NRHE/HERs and to identify historic finds that warrant consideration as new records. Moreover, examination of patterns of connectivity from the Finds Hub has the potential to quantify the degree of enhancement we might anticipate if records from museums across Scotland were all connected to Canmore/HERs.

In order to assess the quantity and character of artefacts lacking corresponding NRHE (and thus potentially also HER) records, the Finds Hub was used to connect all possible prehistoric–early historic artefact records supplied by NMS in selected counties to Canmore records until no further links could be made. The counties selected were Orkney, Caithness, Sutherland and Ross and Cromarty (excluding Outer Hebridean islands), using pre-1975 boundaries to separate the latter three, which now form part of Highland. The Finds Hub contained a total of 21,733 unique NMS accession records for artefacts from these regions.

In total 20,803 NMS accession numbers from the chosen counties were linked to site records in Canmore, representing 95.7% of accessioned objects; 930 accession numbers (4.3%) could not be linked despite considerable effort.

However, sites with large artefact assemblages (eg Skara Brae with 9,283 artefacts) considerably distort overall proportions of unlinked

finds, and it is notable that if the data is considered from the perspective of unique findspots a different picture emerges. In the study area, artefacts were linked to 493 Canmore sites, while the 930 unlinked artefacts derived from 121 unique localities. This indicates that 19.6% of findspots of artefacts in NMS are not on Canmore, highlighting a considerable gap in coverage there (and potentially also in HERs).

Examination of the unlinked NMS records provides some insights into the reasons these records are not on Canmore. Due to limitations of space only key factors will be explored briefly here. One of the key sources of NMS objects used to populate Canmore was records of donations to the Museum, published annually in the *Proceedings of the Society of Antiquaries of Scotland* from 1851 until the 1980s. However, occasionally objects were not published in the *Proceedings*, usually at request of the donor, and large donations or bequests were frequently acknowledged but not fully listed.

In other cases donations were published in the *Proceedings*, but the records appear to have been considered too imprecise to warrant a Canmore/HER entry; for example, David Murray's 1923 donation of lithics 'from Stemster Hill and Knockdee, parish of Bower, and from Hill of Swordale, parish of Halkirk, Caithness' (Society of Antiquaries of Scotland 1923–4) were accessioned by NMS as being from 'Caithness'. However, a stone axehead from the same donor attributed to the village of 'Melvich, Sutherland' also lacks a Canmore record, demonstrating that in the mid-20th century artefacts with imprecise locations, whether parish, village or island, were not routinely recorded.

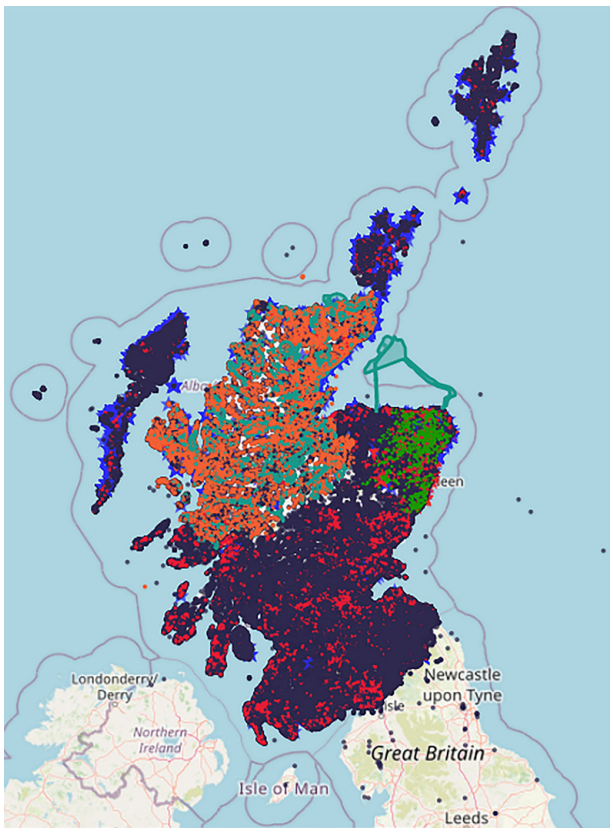
Poorly provenanced artefacts, with parish- or county-level locations only, represent the majority of the unlinked artefacts (737 of 855). While many are common artefacts (such as flint scrapers and spindle whorls) of limited archaeological significance without close provenance, some others are of regional significance even if they are only located to county. For example, the unlinked artefacts provenanced to 'Orkney' include a bronze flat axe, a bronze flanged axe and a steatite mould for a bronze flanged axe; important objects in a region where Bronze Age metalwork is exceptionally scarce. Several steatite and pottery vessels donated to NMS by George Petrie, but provenanced only to 'Orkney', also lack Canmore records. However, these will have been discovered on his excavations; here the Finds Hub also serves to highlight museum objects that require additional research.

The examples highlighted indicate that while some artefacts may effectively have been hidden in museums due to the absence of publication, other published donations were intentionally excluded from the National Record. Poorly located objects and certain common artefacts were deliberately omitted. The presence of exceptionally few unlinked artefacts accessioned after 1980 indicates that this was largely a mid-20th-century practice. Today, the findspots of all artefacts reported to the NRHE/HER would be recorded as standard.

Overall, the main point to take from this exercise is that alongside operating as a productive tool for making 'positive' links between archaeological find and site-based digital records, 'negative' results should also be seen as 'positives'. These 'positive negatives' aid the identification of artefacts and associated data that deserve further investigation, since they can lead to the creation of new site-based records which can inform future research. They also help us to characterise past recording practices and thus to understand biases and 'character' in our data (Cooper & Green 2016).

ONGOING AND FUTURE DEVELOPMENTS

After further funding was secured for maintaining and developing the Finds Hub in December 2022, a further 338,713 digital records were added (Illus 5). These include records from Canmore and NMS for the whole of Scotland, as well as object records from the Hunterian Museum, University of Glasgow. Indeed, the Hunterian Museum asked specifically to contribute records to the Finds Hub, having heard about its success from colleagues elsewhere in Scotland. Around 88,500 additional Finds Hub links have since been made (as of July 2023)



Illus 5 Visualisation showing the overall volume of all site-based and located object records gathered in the Finds Hub in November 2022. (© OpenStreetMap; Exegesis)

– this means that over half of the NMS online collection of 150,000 archaeological object records are now linked to their respective discovery sites. In response to feedback from Finds Hub users (specialist and non-specialist), the data linking process has been improved for this development phase. Object records that have been linked to a site-based record with locational details are now visualised on the Finds Hub map, making it much easier to see the collective outcome of the linking process. A simple league table gives a clear sense of Finds Hub progress and, potentially, sparks users' competitive instincts. If a Finds Hub user has already attempted but failed to link an object or site record and has a left an explanatory comment, this is now clearly signposted with a comment symbol. The obvious next step in terms of improving the effectiveness and sustainability of the Finds Hub would be to use Application Programming Interfaces (APIs). These would effectively automate the harmonisation of records across the Finds Hub and its constituent datasets, removing the need for periodic manual uploads and downloads, and allowing fragile cross-references between collections to be stored and managed for all within the Finds Hub (rather than multiple times by separate data contributors).

Lastly, it is worth highlighting that the Finds Hub is eminently adaptable and scalable. The Finds Hub could easily be employed to make similar improvements to information flow across heritage collections in other regions of Britain – Wales, or specific counties and county museums in England. Other types of heritage data collections could fruitfully be built into the Finds Hub

– information from metal detecting, from antique dealers, and so on. The Finds Hub template could also be adapted for use across other research collections – palaeontological specimens could be linked to their sites of provenance, zoological specimens could be connected to the surveys and expeditions that obtained them, and meaningful associations could be made between artworks, their owners and locations through time, and the artists who produced them.

REACHING OUT BEYOND THE FINDS HUB

The Finds Hub was central to the Boundary Objects Project. Beyond this, the project team and collaborators were keen to test the potential interpretative benefits of Finds Hub linking, to consider ways of enhancing non-specialist access to museum collections in Scotland that are not readily available online, and to reach out to audiences who were interested in other ways of engaging with and interpreting finds in Scotland. These important Finds Hub counterparts are summarised below.

ANCIENT DEATH CAFÉ

As the Boundary Objects Project advanced, and the ongoing impact of Covid-19 measures took their toll on both the museum sector and volunteer community, it became evident that the 'face to face' recruitment, training and realisation of its 'citizen science' objectives needed a different mode of delivery. Here, we drew upon the experience of our project team, specifically methods from the Continuing Bonds Creative Dissemination Project (CBCD), and its use of the international concept of the 'Death Café'. These ground-upwards, ad hoc gatherings have been pioneered in the UK as part of Dying Matters week, to normalise 'talk of the dead'. In the CBCD project (led by Karina Croucher, University of Bradford), the 'Archaeology Death Café' was used to facilitate in-person creative workshops, during which archaeological artefacts and ethnographic visual resources were used as talking points or spurs for inspiration. In the course of these sessions, discussion moved between the past and the present, in a mutually enriching and moving manner.

In the Boundary Objects Project we took this model and adapted it for an online forum, using Microsoft Teams to organise monthly online evening workshops, enabling participation by those in full-time work or study, or with care responsibilities. We dubbed these 'Ancient Death Cafés' and their role was threefold:

(1) To enhance recruitment for the 'citizen science' element of the Boundary Objects 'Finds Hub'
(2) To host short research-focused lectures and skills training sessions, delivered by a cross-section of people working with Scottish finds data
(3) To share, support and develop projects for the Canmore longreads, 1,500-word research stories hosted on the Canmore in Context webpages

The Ancient Death Cafés spanned 12 months from September 2021, facilitated by Anwen Cooper and Melanie Giles, gathering together 10–15 participants on each occasion (25 people participated in total). Each session began with a general welcome, before a structured activity; these included training on the Finds Hub, sharing of the longread format guidance and advice, introductions to Canmore, HER and NMS records, and short research lectures on different aspects of mortuary archaeology.

Finally, we devoted space to ongoing discussion of personal research projects which we hoped to (and in most cases ultimately did) develop as Canmore longreads (Table 3). Some of these case studies were right at the start of the research journey, such as Grace Woolmer-White's desire to create a story out of the re-set stones from a series of cists in Drumnadrochit (Illus 6). Time was used to share the archaeological evidence and shape the story. Others were at the end of the research process. The summary of the Golspie burial mound by Matt Knight and Adrián Maldonado revealed a fascinating story of an old burial attracting a later, reverential and potent

TABLE 3
Longreads researched and produced via the Ancient Death Café and showcased on Canmore in Context

Author(s)	*Affiliation(s)*	*Title*
Anwen Cooper	University of Reading	A tale of two Dunbars: Lady Sophia Dunbar
Anwen Cooper	University of Reading	A tale of two Dunbars: Louisa Duff-Dunbar
Cecily Spall	FAS Heritage	Six heads are better than one? A curious medieval burial from St Colman's Church, Portmahomack, Tarbatness
Grace Woolmer-White	Perth and Kinross Heritage Trust	Hidden in plain sight: the Bronze Age burial stones near Drumnadrochit
Hugo Anderson-Whymark	NMS	A forgotten cist from Firth's Park, Stromness, Orkney
Jen Valentine	Historic Assynt	An Iron Age burial cairn at Loch Borralie, Durness
Lynne Mahoney	Historylinks	Memorialising the ancient past: a letter to the Bronze Age
Mel Giles	University of Manchester	A bog body from Barrock
Susan Kruse	ARCH	Investigating an antiquarian find: a Bronze Age cemetery at Dalmore, Easter Ross
Alison Sheridan	NMS	Mrs and Mr Culduthel: two remarkable individuals from Inverness
Matt Knight; Adrián Maldonado	NMS	Visiting the ancient dead: Pictish reuse of a Bronze Age grave at Golspie, Highland

ILLUS 6 Canmore longread research starting points: inventive uses of Bronze Age capstones in the wall of a housing development at Drumnadrochit, Highland. (Image: Grace Woolmer-White)

offering. The 'six heads' found in a composite grave at Portmahomack provided an intriguing medieval story of ancestral connections, told by Cecily Spall. Others set the scene for new scientific analysis which the project facilitated in partnership with other teams (such as the Iron Age burials from Loch Borralie, researched by Jen Valentine, currently being analysed as part of the COMMIOS project). Others closed the circle, allowing the findspot of a discovery to be finally identified (such as Hugo Anderson-Whymark's cist from Firth's Park, Kirkwall) (Illus 7). Finally, the longreads built on initiatives in wider Scottish archaeology, epitomised by Anwen Cooper's 'Tale of Two Dunbars', championing the role of early female archaeologists, building on the Society of Antiquaries of Scotland's Forgotten Stories project.

These longreads were authored by a cross-section of archaeologists and by postgraduate students and a museum curator with diverse working backgrounds. They provided a strategic platform for accessible, inviting and informative, story-led open access research, enabled by the skilled editing and illustrative talents of Maya Hoole and Leanne McCafferty (HES). They thus embodied the long-term aims of the Boundary Objects Project, using the results of the linking of research data from multiple sources to create compelling new tales of the ancient dead. By using the unique, open access platform of Canmore to host narratives full of 'hotlinked'

Illus 7 Early Bronze Age textile fragments from a previously unlocated cist at Firth's Park, Stromness, Orkney. (Image: NMS)

connections to source material, as well as related sites, finds and archives, the pivotal role of HES in the project became clear; creating a novel format of citizen-led research publication which we hope will be followed by others.

However, the crafting of these stories was not without issues. The impact of the pandemic inevitably delayed research into these topics. Some authors were over-ambitious with content or veered towards the tone of a more formal research article (the authors of this article included!) and had to be 'reined in' to adhere to the word limits and vision for these narratives. Illustrative ambitions were frustrated by a lack of personal site or archive visits, while the desire to use images from institutions that were not project partners, or those without Creative Commons Licences, was often thwarted by the understandably strict copyright guidance for hosting images on Canmore.

Nonetheless, this aspect of the project felt particularly rewarding. Distance in space contracted over broadband: from Oxford to Sheffield, Bradford to Edinburgh, and Aberdeenshire to Orkney. We may not have been 'together' but actually there was something very special about hearing (from afar) the batter of wind from the Outer Hebrides during the winter or seeing (from down south) the long evenings of light in Scotland, during the summer, over the sharing of screens. The medium actually enabled quick, improvised screen-sharing of discoveries, articles or images. We shared skills, as well as resources, and benefited from talking together across a range of professions and institutions (for example, the group included a retired GP, a working Chief Inspector of Police and an early career researcher). Would we have achieved this number of longreads from such a diverse range of writers without the Ancient Death Café? We think, without doubt, not. Yet it has to be admitted that the stable group who came month after month primarily consisted of women (often Duncan Garrow was the only male face on screen), although the published longreads include a better gender balance of authors. It would be interesting to know if this reflects a wider, gendered take-up of this kind of informal, supportive, virtual network to facilitate academic research in our discipline. If so, this might have wider, long-term methodological implications for the humanities. The Ancient Death Café also required engagement 'out of working hours', perhaps excluding some members who might otherwise have built the commitment into their working day.

In sum, the method of delivering this aspect of the project might have been born out of necessity and the historical moment in which the Boundary Objects Project took place, but it arguably pioneered new methods for virtual workshop-led research which resulted in more diverse citizen-science participation across all aspects of the project than we originally envisaged.

'FINDING' WIDER COMMUNITY-LED INITIATIVES

The Boundary Objects Project, as envisaged in the original funding application, sought to celebrate archaeological finds and the stories told about them not only through the Canmore longreads just described, but also through a travelling exhibition. The Covid-19 pandemic, however, prevented us from producing such an exhibition within the lifetime of the project. Instead, we initiated a number of collaborations with wider projects that were already in existence and happening within our case study regions in order to facilitate and enhance the presence of prehistoric grave goods (and other finds) more firmly within ongoing work across Scotland.

Altogether, we developed four different partnerships, working closely with colleagues in the Outer Hebrides, Orkney and Highland regions, as set out below. In many ways, this new strand of work actually enabled us to achieve the original project goal of *celebrating the connective and interpretative powers of grave goods across Scotland* even more effectively than the travelling exhibition would have done. This work has also ultimately enabled our project to have a lifetime well beyond its own 12-month limit.

Our first collaboration was with Archaeology for Communities in the Highlands (ARCH). Susan Kruse, Learning and Development Manager at ARCH, was a key participant in our Ancient Death Cafés, and led this initiative from

the start. Our focus in this case was Dunrobin Castle Museum, which 'displays the heads of numerous animals shot by the family on safari, ethnographic items collected from around the world (particularly Africa), and *an important collection of archaeological relics*' (Dunrobin Castle, our emphasis). The museum has what would probably be described by most people as an 'old-fashioned' aesthetic, with finds arranged, often in somewhat random order, within upright wooden and glass cases (Illus 8). In collaboration with Dunrobin Castle's Managing Director, Scott Morrison, ARCH volunteers sought to improve the visitor experience at the museum – both in terms of navigating what can be an overwhelming physical space and in terms of accessing information about the finds – in two ways: through the provision of *case information sheets* and through the creation of *museum trails*, both of which are accessed via laminated A4 sheets provided within the museum. The former were facilitated by the Boundary Objects Project through funding for professional case photos, and include QR codes used to link through to further information (for example on the HighARF webpages) about key finds types within each case. The trails, written by volunteers, are thematic and lead visitors around the museum via key relevant objects, investigating, for example, 'finds from around the castle', 'stone axes' or 'curiosities' within the collection. These new initiatives were launched at a public celebration event in August 2022 (Illus 9).

Our second collaboration was with the award-winning Uist Virtual Archaeology Project (UVAP), led by Emily Gal and Rebecca Rennell at University of the Highlands and Islands (UHI) Outer Hebrides in partnership with Comhairle nan Eilean Siar. This innovative digital project, funded by the ERDF Natural and Cultural Heritage Fund and administered by NatureScot, the National Lottery Heritage Fund, Comhairle nan Eilean Siar, Stòras Uibhist and UHI Outer Hebrides, has created an app – Uist Unearthed – which contains augmented-reality reconstructions of five archaeological sites. The project has sought to make Uist's archaeological sites and landscapes more accessible and better understood and to enhance existing tourism infrastructure, specifically along the Hebridean Way (UVAP). Hugo Anderson-Whymark and Fraser Hunter (NMS) visited Uist and worked with the

Illus 8 Displays at Dunrobin Castle Museum, Highland. (Image: Michael Sharpe)

Illus 9 ARCH volunteers, Historylinks Young Curators Club and volunteers at the launch of the Dunrobin Castle Museum Trail. (Image: Alasdair Cameron)

UVAP team and local volunteers to create digital 3D models of key artefacts relating to sites along Phase 1 (and an anticipated Phase 2) of the trail and the Uist Unearthed multimedia exhibition; professional-standard photographs were also taken of key objects held at NMS. The UVAP team intend that, if funding for Phase 2 is secured, a key theme for the extended trail will be objects and sites that have produced spectacular grave good finds.

Our third collaboration was with Historylinks Museum, Dornoch, led by museum curator Lynne Mahoney, another participant in our Ancient Death Café meetings. In this case, we commissioned replicas of two key grave good objects – a tripartite Food Vessel urn and a remarkable woollen cover – recovered from an important local burial at Spinningdale (Arabaolaza et al 2013), finds from which are housed at Inverness Museum and Art Gallery, although the burial site is closer to Historylinks Museum. The hope is that in future these replicas will enable a new multimedia reconstruction of the burial assemblage, revitalising a key prehistoric element of the museum and, it is hoped, placing grave goods firmly at the centre of interpretation there for years to come.

Our final collaboration was with the Tombs of the Isles project (Lee 2021), based at the Orkney Research Centre for Archaeology (ORCA), UHI Archaeology Institute, and led by Dan Lee. This initiative, funded by the North Isles Landscape Partnership scheme seeks, through a programme of research, walks, archaeological fieldwork and schools activities, to investigate some of the most iconic tombs in the North Isles of Orkney, as well as bringing lesser known sites into the spotlight. The Boundary Objects Project work in this case facilitated new research (undertaken by Hugo Anderson-Whymark and Luke Dale at NMS) into key grave goods from Neolithic tombs in Orkney, leading to the creation of eight 'tomb in a box' object-handling collections (Illus 10). These boxes are now located at each of the North Isles heritage centres, providing local people and visitors alike with the opportunity to engage at first hand with 'Neolithic' objects, placing grave goods firmly at the centre of this exciting initiative to enable new kinds of understanding of Orkney's famous tombs.

Illus 10 Orkney 'tomb in a box' object-handling collections. (Image: NMS)

The disruption to our planned travelling exhibition programme caused by Covid-19 forced us to be innovative and creative in ensuring that Scottish grave goods (and archaeological finds in general) were foregrounded and celebrated. It was immensely rewarding to have been part of the various and varied collaborations described above. We strongly feel that the new direction forced upon us turned out to be hugely beneficial, leading a wider set of people to benefit from the Boundary Objects Project and providing a longer lasting legacy for it within our target case study areas and beyond.

DISCUSSION

Overall, we hope the quantity of work completed through, and substantial wider progress made as a result of, the Boundary Objects Project across a range of different areas has become clear. Following on from the project's final workshop (attended by 60 heritage professionals and volunteers), our follow-up survey asked attendees to reflect on the contribution the project had been able to make in terms of delivering Scotland's Archaeology Strategy (2016–2025). The key elements highlighted as especially successful by those who responded – notably across all five areas of the Strategy – are listed in Table 4.

The success of the Finds Hub in joining up previously scattered information about finds in museums and about sites/events in the NRHE/HERs is most clearly demonstrated in numerical terms. As a direct result of the project, more than 215,000 digital records have now been linked, improving the discoverability, visibility, accessibility and efficacy of the information their respective repositories hold. While the creation of these linkages is, of course, important in its own right, it is also vital because it will help people in future to make connections across the heritage sector, and thus to construct rewarding and effective archaeological narratives about grave goods and many other finds. The involvement of *people* from across the heritage sector and beyond in Scotland in creating, using and embedding the results of the Finds Hub is important. Accepting the growing promise of machine-led initiatives to improve connectivity between online heritage

TABLE 4
Key aspects of Scotland's Archaeology Strategy enhanced through the Boundary Objects Project

1. DELIVERING ARCHAEOLOGY	
1a. Through communication and innovative practice, to foster a culture of collaboration and ambition locally, nationally and internationally	✓
2. ENHANCING UNDERSTANDING	
2b. To make knowledge discoverable, accessible, referable and reusable now and for future generations	✓
3. CARING AND PROTECTING	
3d. To ensure the management of collections in museums and archives supports their accessibility for learning, research, creativity and participation	✓
4. ENCOURAGING GREATER ENGAGEMENT	
4c. To increase and improve the presentation and interpretation of archaeological information	✓
5. INNOVATION AND SKILLS	
5c. To improve collaborative links, knowledge transfer and creative synergies between universities, communities, museums, businesses, local authorities and the arts sector	✓

collections, machine-led work can only go so far: direct human involvement is required (Winters et al 2022: 10).

One area in which the Finds Hub was less successful overall was in engaging large numbers of users beyond the core project team and direct collaborators. Of the 121 users currently signed up to the Finds Hub, 25 have gone on to make links between records of finds and their discovery sites (21% as of July 2023); links made by non-specialist users made up 3% of links made during the Finds Hub's pilot phase from December 2021 to March 2023. While at one level these numbers might be viewed as disappointing, at another they are an important outcome of the pilot and are informative in shaping future Finds Hub developments. Although we would have liked to engage a wider set of Finds Hub users, raw user numbers are also a narrow measure of success. Archaeological crowd-sourcing projects typically involve low numbers of enthusiastic contributors (Bonacchi et al 2015: 284). In certain settings, low numbers can also be valuable. The small number of regular Ancient Death Café attendees lent this setting an intimate atmosphere, in which all participants felt able to contribute. Attracting significant numbers of non-specialist users to undertake the intricate work of linking disjointed heritage data could raise problems (in terms of creating erroneous links) as well as gains in terms of public engagement figures. Overall, we suggest, low non-specialist engagement figures should not overshadow the successes of the Finds Hub, in opening up and testing new research and digital volunteering avenues, developing a more joined up and accessible heritage information landscape, and giving the participants who *were* involved a rich and positive experience. Non-specialists who did persist with making Finds Hub links and who undertook research via the Ancient Death Café are unequivocal in their praise for these initiatives.

Having said this, it is important to reflect on why the Finds Hub has not attracted a wide non-specialist user audience thus far and on how this situation might be addressed in future. First, feedback from users in the pilot phase suggests that many non-specialists found the practicalities of linking disjointed (and sometimes contradictory) information about archaeological finds and their discovery sites too difficult, even after formal training and/or watching the How To videos. For this reason, non-specialist users tended either to make very few links and then stop, or to make several hundred links once they became familiar with and interested in the

linking process. Natural audiences for the Finds Hub may therefore be people with good existing knowledge (ie not those who are brand new to heritage) and people looking for a project to get their teeth into (not for a project to dip in and out of), for instance graduate students undertaking placements and internships. Second, although volunteer coordinators from partner organisations, community groups and wider volunteer bodies in Scotland were involved in initial project workshops, there was not scope for the Boundary Objects Project to employ a dedicated specialist volunteer coordinator. Employing someone in this role and developing a better advertising strategy are worth considering for future Finds Hub campaigns. As it was, in the three-month window in the lifetime of the Boundary Objects Project during which the Finds Hub was also operational, the project team did advertise the Finds Hub and wider engagement initiatives on social media, via our network of 60 workshop participants, and through additional talks and training workshops. Beyond this funded timespan, however, advertising by the project team was, necessarily, on an ad hoc basis. Susan Kruse regularly posted adverts for the Finds Hub and reports on wider Boundary Objects Project activities in ARCH's newsletter from January 2021 to September 2022. Communications teams at HES and NMS also advertised the Finds Hub via their social media platforms. Third, it is possible that higher levels of non-specialist engagement would have been achieved had we chosen a different target region for our pilot. While ARCH has been particularly successful in engaging people in finds work in the Highlands, digital volunteering (necessarily a focus for the Boundary Objects Project, which ran during the peak of Covid-19 restrictions) is an altogether different task to going 'behind the scenes' in museums (the previous focus for ARCH initiatives). Other volunteer groups in northern Scotland were candid in telling us that their core members preferred work that involved getting out and about. They were therefore unsure about how to reach out to volunteers potentially interested in digital engagement opportunities. A future focus on engaging urban audiences might be more productive.

Moving forward, the Finds Hub's existing results will be archived by the Archaeology Data Service (ADS) in perpetuity at the end of the current funding cycle (April 2025); links made will be embedded in the datasets of data contributors for the benefit of all who use these platforms. The Finds Hub has already proved itself to be a useful tool not only for linking records but also, for data contributors, for answering research questions and queries from the wider public. Wider Finds Hub benefits – for instance the potential increase in traffic to online digital collections created by a more joined up information landscape – are still unfolding. In this sense, the Finds Hub pilot's value and future legacy are secured. Beyond the Finds Hub's current funding cycle, there is little doubt in our minds that the Finds Hub itself *should* have a future. Much more could be achieved with minimal financial and practical input, especially as heritage collections increasingly become available online. HES is already looking towards mechanisms for creating more joined up heritage data in Scotland – the Finds Hub can certainly inform this and could also play a direct role in these developments. The Museum Data Service – a collaboration between Art UK, Collections Trust and the University of Leicester, launched in October 2023 – aims to build links between museum collections in the UK (including but also well beyond archaeological collections). The ADS's AriadneRI initiative focuses instead on linking geolocated (site-based) archaeological collections from across Europe. As far as we are aware, no current digital infrastructure initiatives beyond the Finds Hub focus specifically on linking museum collections that currently lack locational information with site-based online collections. Importantly, once Finds Hub links are embedded in geolocated online collections that contribute to AriadneRI (eg Canmore), the online collections of museums whose records are not otherwise geolocated and of organisations that do not currently contribute to AriadneRI (eg many regional HERs), do become accessible via AriadneRI's powerful portal. For example, as a direct outcome of Finds Hub linking, the AriadneRI record for the carved stone ball from New Keig, Aberdeenshire now connects

not only to the contributing Canmore record but also (via the Canmore record's External Links section) to the relevant NMS and Aberdeenshire HER records. One remit of the initial Boundary Objects Project workshops in April 2021 was to determine how to position the Finds Hub within the emerging information landscape at that time. Three years on from these workshops, it is the job of both Finds Hub enthusiasts (like the authors of this paper) and those seeking to develop complementary digital infrastructures (like those described above) to determine the Finds Hub's future role.

Lastly, the Boundary Objects Project was, we feel, especially successful in terms of cross-sector working. At its core, it involved universities, national heritage bodies and museums, regional HERs and museums, one-off funded (and unfunded) projects operating across Scotland, and numerous volunteers of many different kinds. Over the course of the project, these people provided data and benefited from data enhancements; discovered new sites and uncovered hidden museum finds; shared stories, working practices and long winter evenings online; created new narratives of the past and enhanced old ones; built 3D digital models; researched, made and enjoyed replica artefacts; opened up museums to new, better visitor experiences; and – most important of all – enhanced enjoyment of the past across the board. The project as a whole simply could not have worked without such wide-ranging collaboration and was especially effective because of it. The Boundary Objects Project lasted initially only for 12 months, but the legacy of what was achieved, in such a small length of time, is we hope secure for decades to come.

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DATA ACCESS STATEMENT

On completion of Phase 2 of the project (March 2025), all links made within the Finds Hub will be given back to data providers to be included within their online digital repositories. A snapshot of all data/links held within the Finds Hub at that point will also be deposited with the Archaeology Data Service: https://doi.org/10.5284/1110590.

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