To Build a Broch

From Construction to Conservation

"There is a house built out of stone
Wooden floors, walls and window sills
Tables and chairs worn by all of the dust
This is a place where I don't feel alone
This is a place where I feel at home"

***To Build a Home,* The Cinematic Orchestra (2007)**

Acknowledgements

To Build a Broch was written by Alan Braby, Andy Heald (AOC Archaeology), Matt Ritchie (Forestry and Land Scotland) and Tanja Romankiewicz (University of Edinburgh). It was produced by Matt Ritchie and designed by Ian Kirkwood, who also created our broch blueprint. Short articles were contributed by Graeme Cavers (AOC Archaeology), Gavin Douglas (Historic Environment Scotland), Simon Gilmour (Society of Antiquaries of Scotland), Kenneth McElroy (Caithness Broch Project), Sophia Mirashrafi (Historic Environment Scotland) and Rachel Pickering (Historic Environment Scotland). Our critical friends were Noel Fojut and Simon Gilmour. Our characters were created by Kim Biddulph and Alex Leonard; Kim also contributed to 'The Broch Builders' introduction. Linocut artwork by Liz Myhill and creative archaeological visualisations by Alan Braby, Rafael Maya-Torcelly and Lizzie Robertson. Our Pictish master stone mason was David McGovern and our Celtic creative embroiderer was Lily Hawker-Yates. Thanks to John Barber, John Borland, Fiona Braby, Murray Cook, Ian Cowe, Hamish Fenton, Lynn Fraser, Candy Hatherley, Meghan Kjartanson, Monika Maleszka-Ritchie, Ed Martin, Chris Nixon, Anna Ritchie, Stefan Sagrott, Bruce Taylor, John Town and all at Historic Assynt and the Caithness Broch Project.

In memory of Emma Metcalfe, the original Mesolithic mapmaker.

Published by Forestry and Land Scotland

March 2022

ISBN: 978-1-9160160-5-7

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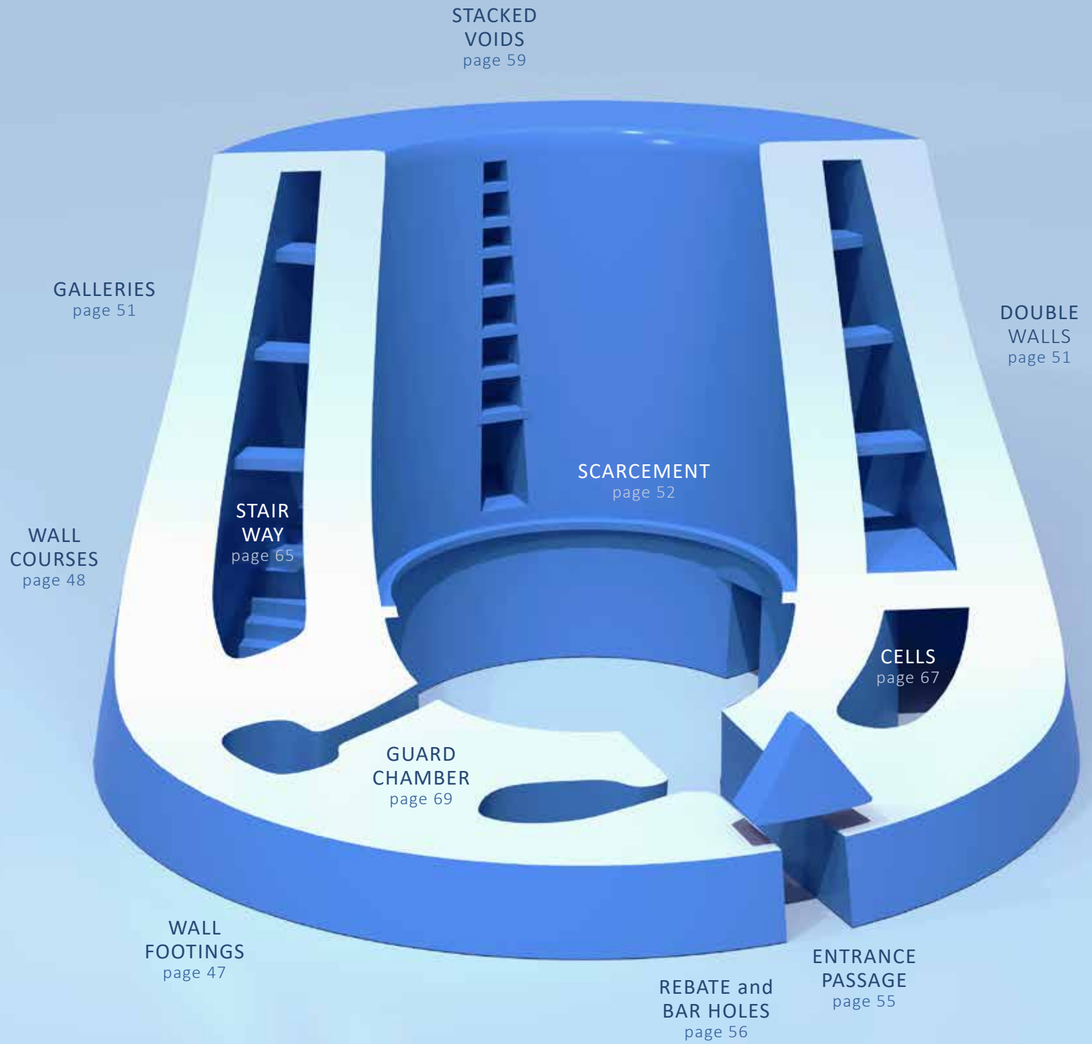
Alan Braby, Andy Heald, Matt Ritchie and Tanja Romankiewicz



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◄ **There is no 'standard' broch, no 'broch blueprint' – brochs were a diverse collection of distinctive *structural components*, present in different ways within individual sites, although each reflecting the same *architectural tradition*.**

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Introduction

"A wave in the sound – one of those seventh waves that comes in higher and colder and more rampant than the six ordered predictable waves on either side of it – crashed against the round ancient ruin on the shore, and carried away another stone"

George Mackay Brown, *Beside the Ocean of Time*, 2014, 68.

Brochs are a truly unique aspect of Scotland's rich prehistoric tapestry. These distinctive circular drystone towers display quite startling structural complexity, rising high from their foundations by employing a series of weight-saving and load-bearing galleries, stairways and passages within their double-skinned walls. Over five hundred are recorded, all built in local stone and held in place by shape and gravity. They are concentrated in the north and west Highlands and islands, with some unusual lowland outliers. They were built in the Iron Age, around 400 BC, and are part of a wider *architectural tradition* of building large domestic roundhouses in both stone and timber that developed over many centuries.

Brochs are part of an Iron Age settlement pattern of *defended homesteads* found all along the Atlantic coast of Scotland. Although they protected their occupants, they also demonstrated land ownership and tenure. They were usually built in places with good agricultural land, with relatively productive soils and sheltered conditions. The people who built them were productive and self-sufficient farmers, growing barley and rearing cattle and sheep. Most brochs were set within pockets of cultivated land and wider areas of unenclosed pasture, often with unrestricted access to the sea or to a large river. But some brochs, particularly in Shetland and in the Western Isles, were built in very different locations, and can be found perched on tiny islands or high on barren, windswept cliffs.

◄ **The broch of Caisteal Grugaig stands on a slope overlooking Loch Alsh. It was recently the subject of *digital documentation* by laser scanning, before archaeologists and stone masons undertook a programme of *conservation management*.**

Brochs were built and occupied, altered and repaired, fell into disuse and were sometimes reoccupied. They stood for centuries or collapsed into ruination, to be later robbed for building stone. The ruins that we see today range from great stone mounds to a few low courses of walling; from *unconsolidated ruins* showing only tantalising glimpses of their *structural components*, to *consolidated structures*, partially rebuilt in places and held together by introduced mortar and steel bars.

For decades, archaeologists have discussed their architecture, creating structural typologies and arguing about nomenclature, categorising and re-categorising the various features. But there is no 'standard' broch, no broch blueprint – brochs were a diverse collection of distinctive *structural components*, present in different ways within individual sites. *"Even among the best-preserved broch towers,"* observes archaeologist and broch investigator Ian Armit, *"no two are exactly alike in size, design or layout"* (2003, 57).

The poet Kathleen Jamie visited the broch of **Mousa** on Shetland, in the middle of a northern midsummer night. *"When we reach it"*, she wrote, *"the broch seems very tall in the half-light, stolid and resolute. Its walls are beautifully made, stone on stone. Local stone, no mortar: this building is an expression of the island itself. 'I was made here of this place', it says, but that's all it admits to"* (2017, 50). Brochs are undisputed icons of Scotland's prehistory, the celebrated cover stars of our ancient past. But have archaeologists created an accessible icon, where the lives of the broch builders matter as much in the story as the now silent brochs that they built?

This booklet imagines the building of a broch, describing the process with an illustrated narrative populated by a cast of relatable characters. It assumes that brochs were *defended homesteads*, secure and domestic, constructed by experienced builders, commissioned by well-to-do *productive households*, likely in relatively stable times of plenty, when they had the agricultural surplus and resources to devote to building elaborate high-status *display architecture*. However, although perhaps the most likely scenario, it must be remembered that this is only one possibility. Some researchers prefer to see brochs as defensive fortifications first and foremost, while a very few even think they might be for some ritual purpose, with domestic occupation only beginning once that original purpose had ended.

Caisteal Grugaig © Matt Ritchie ►

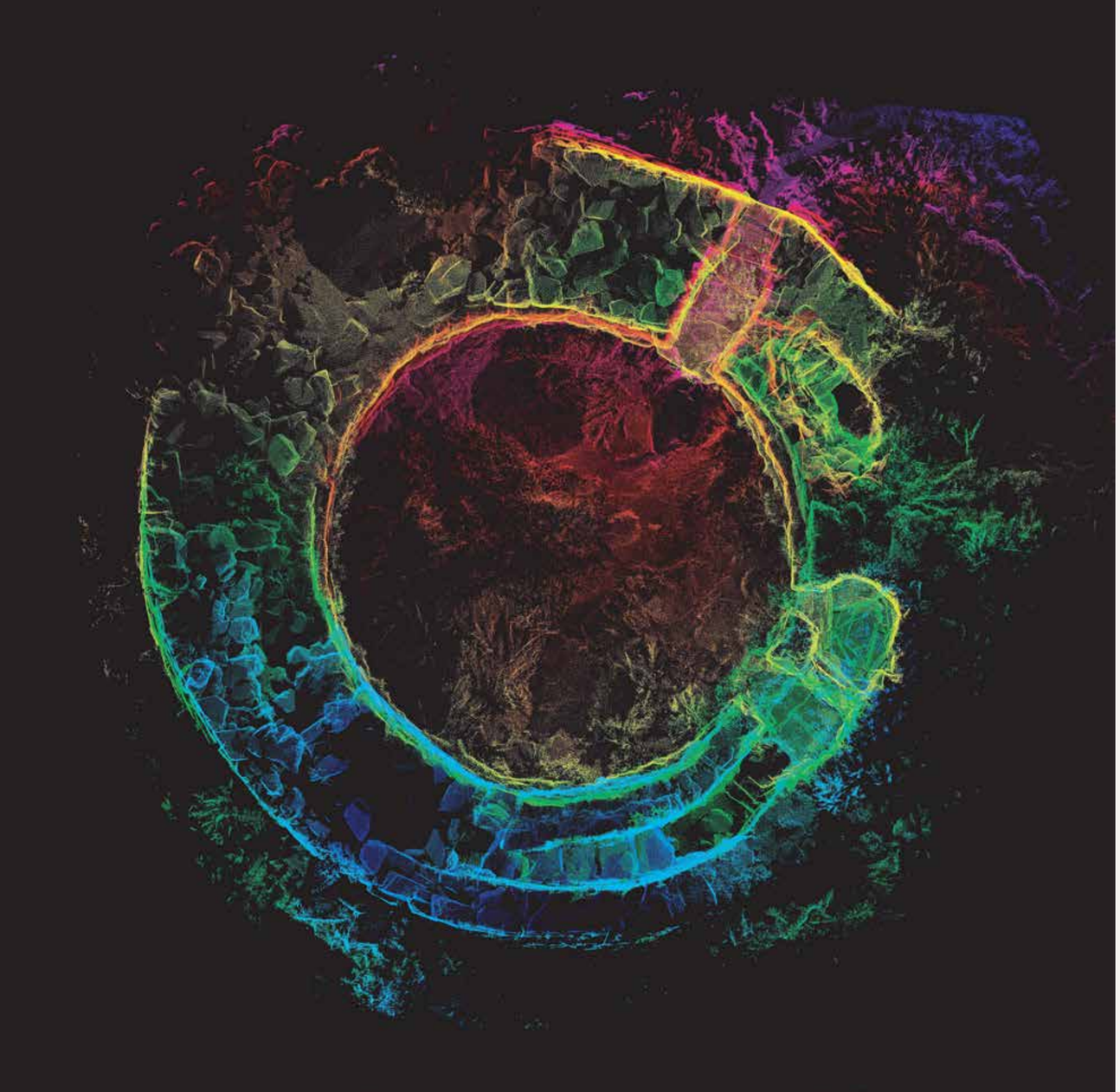
This booklet is not a definitive study of brochs. It does not attempt to write the history of broch studies, or contain a gazetteer of the best sites to visit – readers are encouraged to find their own. It does not explore the fascinating wider context of the Iron Age in Scotland, of Celts and Romans, natives and invaders, admirably dealt with by others elsewhere.

Instead we will step back in time to describe the building of an imagined broch in stone and timber, and to ask what it meant to build a broch. Were they a distinctive *architectural tradition*, a statement of cultural and social identity? As *display architecture*, what was the message they were meant to convey? Were brochs built by the community, a shared enterprise similar to a North American barn raising? Were they guided by specialist broch builders, who had all the requisite *structural engineering* and masonry skills?

We present a picture of complex structural engineering and bold architectural design – of an amazing vernacular building tradition that was the height of fashion over two thousand years ago.

While considering these questions we will also focus on today's archaeological recording techniques and *conservation management*. We will combine fictional voices from the past with contemporary voices from across the heritage sector, and encourage the reader to look at brochs in a new light.

◄ **Caisteal Grugaig was the subject of several very attractive *measured drawings* made in 1871 and 1872 by the antiquarian Sir Henry Dryden. These carefully considered illustrations can be very favourably compared to the plans and elevations produced as a result of modern *digital documentation* by laser scan survey. They are all part of the long tradition of archaeological measured survey in Scotland, their shared illustrative methodology both functional and aesthetic.**



Reading the ruins

Using this booklet, learners will explore three interlinked themes running through broch studies: the archaeological narrative, the structural narrative and the conservation narrative. *Keywords* have been highlighted in italics throughout the text that define the main concepts involved (see glossary on page 76), and key sites have been highlighted in **bold**.

- The **archaeological narrative** considers questions of architectural design, and aims to get the reader thinking about how brochs were built, who built them, and why.
- The **structural narrative** encourages the reader to consider the buildings they see today in terms of their *structural engineering* and their various *structural components* (see page 17); and to think about the *destruction process* and the material missing from the picture – the stone that has been robbed and the timber and other materials that have been lost.
- Finally, the **conservation narrative** describes more recent and contemporary interventions such as structural consolidation, archaeological excavation, *conservation management* and *digital documentation*.

Recognising the various processes at work within the timespan between construction and collapse is an important step towards becoming a broch investigator, as is appreciating the differences between *unconsolidated ruins* and *consolidated structures*. Learning to spot these clues within the structure helps us to better understand the various narratives at play, and imagine the key *moments in time*.

This booklet aims to help teachers use the study of Scotland's brochs as a cross-disciplinary classroom topic as part of the **Curriculum for Excellence** (Third Level), blending history, geography, English and the creative arts.

To Build a Broch can be used as a stand-alone topic or included as an element in a wider investigation. Quotes from leading archaeologists and broch investigators help to make some of the key ideas more accessible, and a series of short personal features enable us to focus on important sites, describe personal experiences or explain archaeological methodology. The features link to the various careers represented, recognising the aims of the **Developing the Young Workforce** initiative and the *Historic Environment Skills Investment Plan*. They could also be used as short reading tasks in the classroom.

◄ **This plan of Caisteal Grugaig uses the point cloud created by laser scan survey and is coloured by height. The warm purples and reds depict the ground surface and lower wall courses, while the height of the walls is shown ascending from yellow through green to blue.**

Outdoor archaeological learning

To Build a Broch is the latest in a series of publications from Forestry and Land Scotland that take a creative and imaginative approach to outdoor archaeological learning. The booklets present some quite complex and sometimes unconventional ideas, and use archaeological discussion, creative indoor activities and practical outdoor learning to imagine ancient landscapes, explore today's historic environment and understand contemporary archaeological methodology.

> *"Archaeology is the study of the human past through its material remains. Through archaeological research and analysis of our places, artefacts and ecofacts, everyone can explore, better understand, value and care about the prehistory and history of Scotland's people, culture and landscape"*
>
> **Scotland's Archaeology Strategy, 2015.**

By engaging pupils in outdoor learning and conducting meaningful research within the classroom, archaeological learning can provide real and cohesive links across a range of curricular areas. Archaeology can help develop critical thinking skills, exploring the evidence that our shared past has left in our culture and environment. The methodology of archaeology requires the objective study of *material culture* alongside its subjective interpretation – and, because archaeology is the study of the past in the present, it can encourage reflection on our own attitudes, culture and society.

This elevation shows the triangular lintel above the entrance passage of Caisteal Grugaig using the 3D model resulting from laser scan survey. ►

The booklets are the result of many different contributions and collaborations from a range of professions, including foresters, ecologists, archaeologists, dendrochronologists, educators, artists and photographers, all working together to present a fresh take on the interpretation of our ancient past and contemporary archaeological science. The booklets are aimed at teachers, youth group leaders, archaeological educators and anyone interested in our natural and cultural heritage.

- ***Into the Wildwoods*** describes the lives of the Mesolithic wild harvesters. Rooted in an ecological understanding of place and time, the booklet explores the roles of interconnected habitats, natural resources and seasonal change.
- ***The First Foresters*** describes the lives of the Neolithic pioneers who followed long after, and uses today's native woodlands to explore our human response to trees and woodland. The booklet steps beyond the familiar stone circles of Scotland's prehistory to describe the archaeology of our lost timber halls and timber monuments.
- ***A Song in Stone*** celebrates Scotland's internationally significant outdoor gallery of Atlantic rock art and the shared cultural tradition that it represents. The repeating motifs were carved by many different hands over time, each an individual expression but part of a collective whole – a cacophony of voices singing a common refrain. The booklet uses an inspirational blend of objective recording, subjective analysis and narrative interpretation to encourage critical thinking and creative arts.
- ***Dendrochronology*** explores the science and methodology of tree ring dating, presenting activities that range from measuring a core sample to building a classroom timeline of over one thousand years.

As both reference material and learning resource, these booklets use a popular communication style and bold design to prepare the practitioner with detailed knowledge and innovative ideas for their learners.

The impressive triangular lintel above the entrance passage of Caisteal Grugaig. *"Considerable attention was paid to the selection of good quality lintels to bear the weight of stone above"* notes archaeologist Ian Armit (2003, 76).

Building in the Round

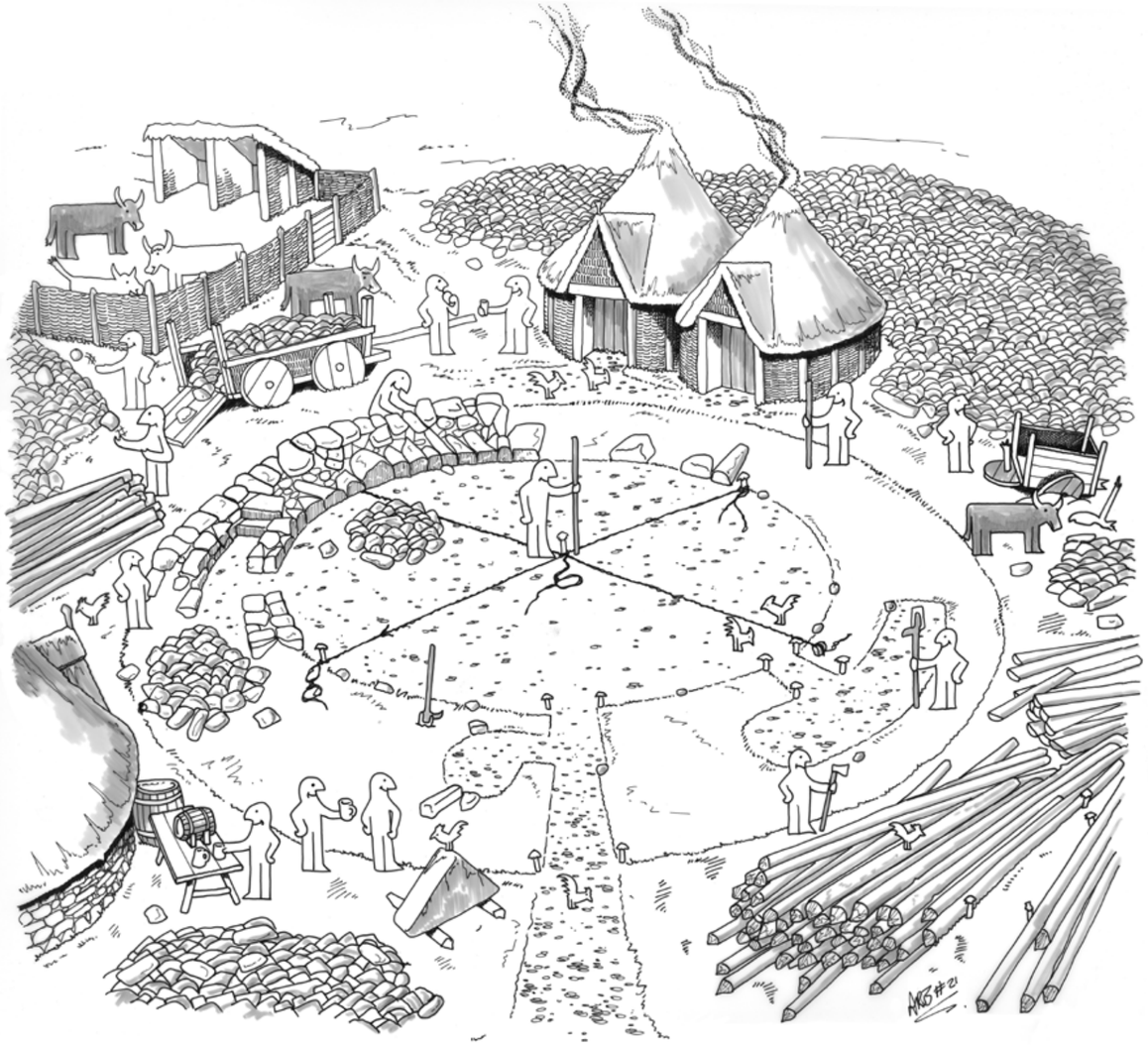
"The Atlantic settlement record of Scotland is characterised by its own variety: there is a diverse range of forms including roundhouses, promontory forts, hillforts, island duns and crannogs, almost all of which are constructed in stone"

Jon Henderson, *The Atlantic Iron Age*, 2007, 151.

Brochs were part of a wider *architectural tradition* of building large domestic roundhouses in both stone and timber. They seem to dominate the Iron Age settlement record of Caithness, Sutherland and the Northern Isles, with significant numbers also found along the north Atlantic coast, in Skye and the Outer Hebrides. Duns were similar in function but far more varied and irregular on plan, and are characteristic of Argyll and the Inner Hebridean islands. Both brochs and duns are considered examples of the drystone *architectural tradition* known as the **Atlantic roundhouse**.

The earliest known examples of simple Atlantic roundhouses have so far been found in Orkney, and appear to have been single storey buildings with solid stone walls dating from around 700 BC. Over time, and particularly in the far north, the Atlantic roundhouse tradition developed more complexity, with cells and galleries built into the walls. Brochs are considered a specific type of complex Atlantic roundhouse.

Over time, in Shetland and the Western Isles, they appear to be replaced by wheelhouses, circular buildings often sunk into the ground, with an internal arrangement of walls that look like the spokes of a wheel on plan. In Orkney, the wheelhouse doesn't seem to have caught on, but some brochs developed extensive series of buildings outside the roundhouse, often including the reorganisation of the roundhouse itself, to become what we know now as broch villages.



A Very Atlantic Roundhouse

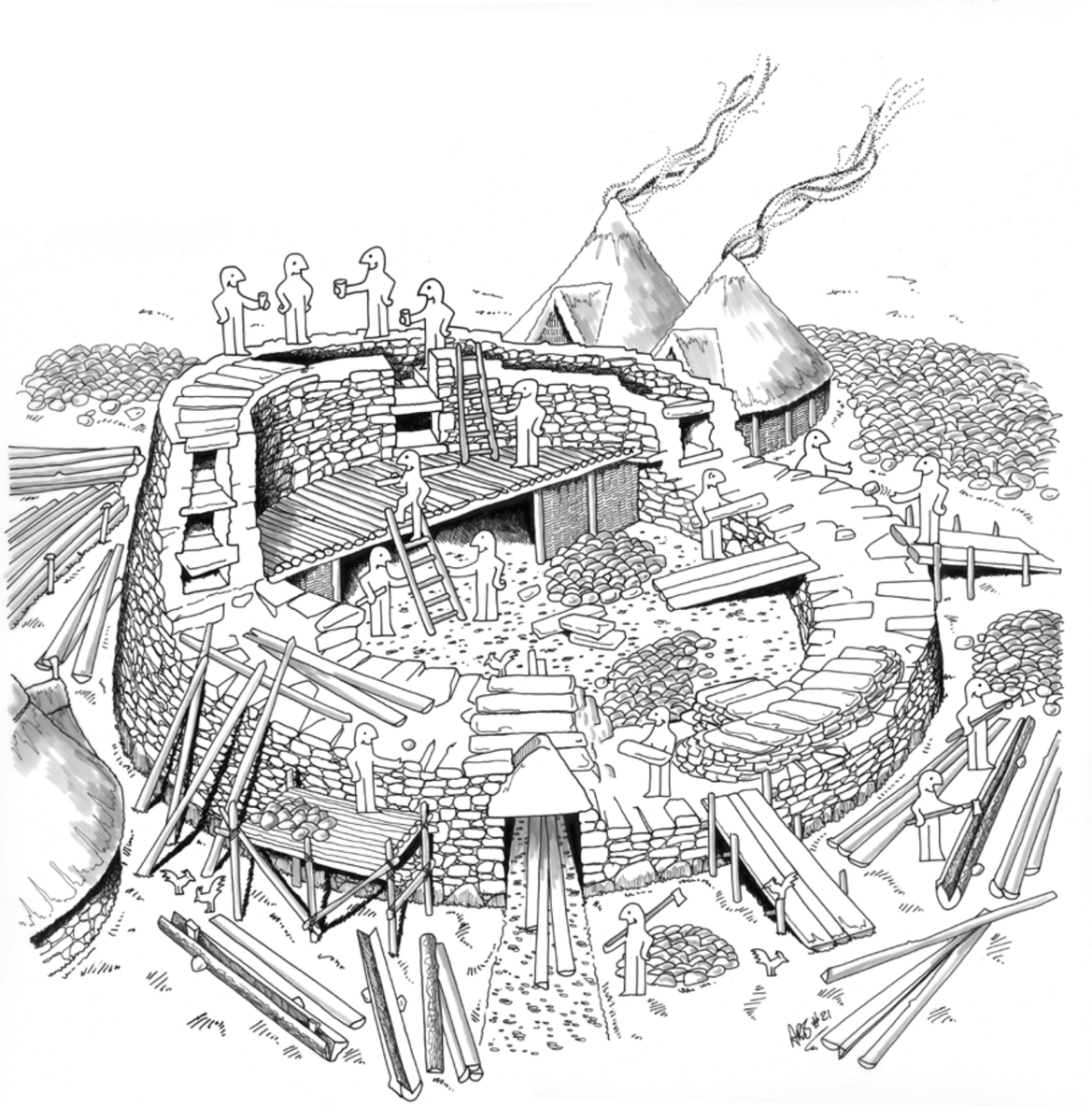
"People lived here for generations, maybe hundreds of years. The last residents would have had no memory of the first. Stories maybe, but not living memory"

Kathleen Jamie, *Who Built Scotland?*, 2017, 53.

A broch is a circular drystone building comprising several distinctive *structural components*. The famous **double walls** – which never have window openings to the exterior – are knitted together with stone lintels reaching across and forming **galleries**, the name given to the space between the walls on the different broch levels. The walls rise to form tapering towers, with individual **cells** and longer and taller galleries set between the outer and inner walls. The **wall footings** can be either *solid-walled* or *ground-galleried*. The style of the **wall courses** depends on the local stone – sandstone and schist laminate into long, even slabs and result in neat walls, while gneiss and basalt provide more angular, irregular blocks.

Access to the broch was by the **entrance passage**, and the door was often set against a **rebate** or door jamb, and barred by a timber that was placed into **bar holes** on either side of the passage. A **guard chamber** is commonly found on one side of the entrance passage, although sometimes there are two, one on either side. The **stairway** to the upper level always corkscrews in a clockwise direction between the inner and outer walls, and forms separate flights that rise from ground floor to first floor, and then from first to second levels.

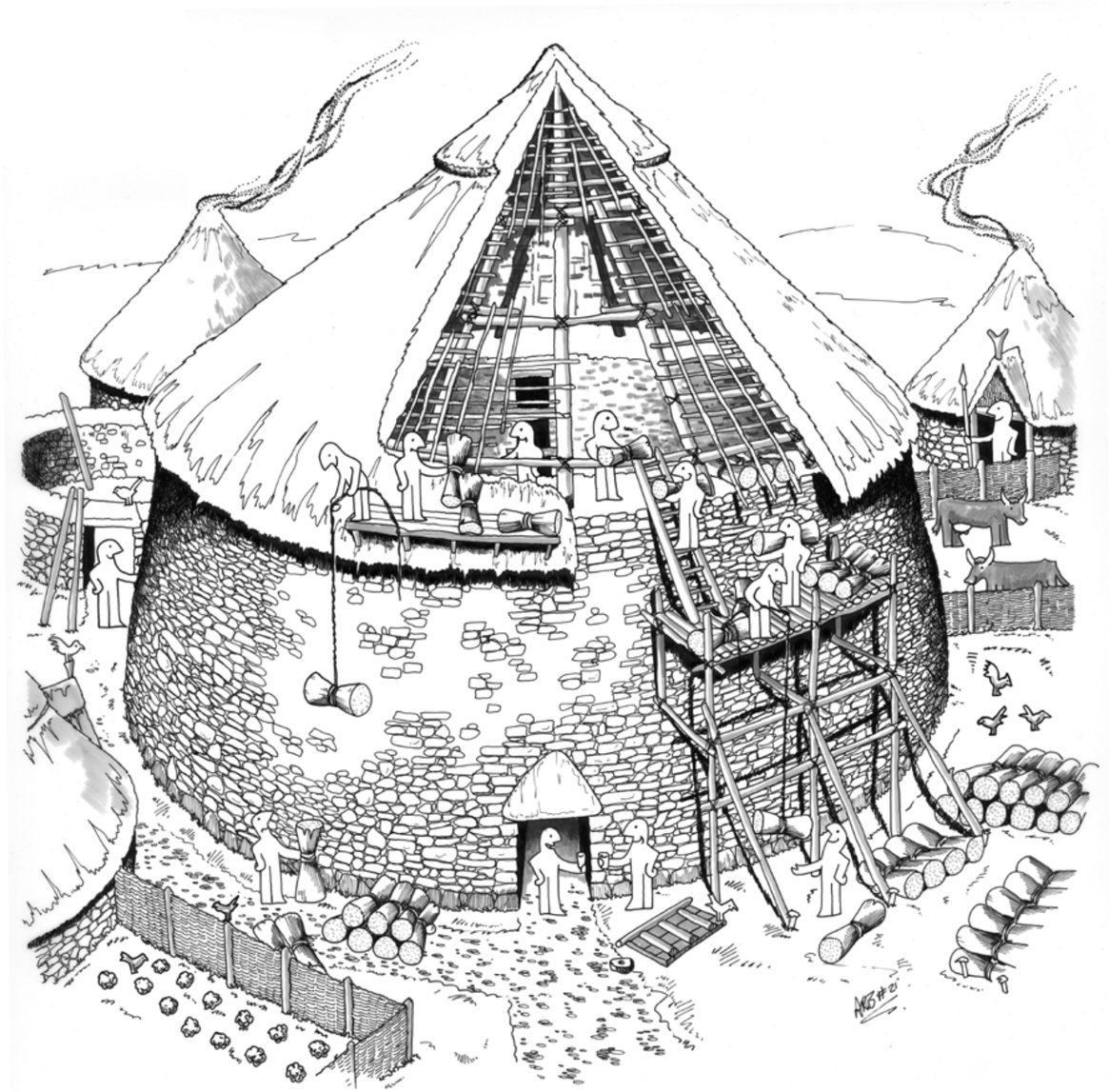
Standing within a ruined broch and looking around the interior, you will see the various entrances to the stairway, cells and galleries. There is also often evidence of vertical **stacked voids** within the inner wall face, often set above the entrance passage and acting to relieve stress on the lintel stones, and a horizontal **scarcement**, a stone ledge likely providing support for a timber floor that formed an upper level. The ground floor level of many brochs is uneven, sometimes allowing very limited headroom, and may have been used like a cellar or byre. Although the iconic broch of **Mousa** on Shetland stands to a height of 13 metres, it is very likely that the great majority of brochs were shorter, although still with upper levels. Remember, there is no 'standard' broch – these distinctive *structural components* were present in different ways within individual sites.



"Although broch towers survive as stone buildings," notes archaeologist Ian Armit, *"we should not forget the large quantities of timber that would have been required in their construction"* (2003, 76). While undressed building stone was sourced locally, timber may have been brought from nearby woods, or sourced from wooded regions further away. In island locations, where the timber resource was limited, the builders may have relied to some extent on driftwood. The amount and type of timber required for a conical thatched roof, internal floors, and fixtures and fittings such as the door is still hotly debated.

Most brochs stood in splendid isolation, although some had surrounding walls or earthworks, sometimes an additional blockhouse, and even, in rare cases, surrounding villages of tightly packed smaller buildings, enclosed by ramparts and ditches. Brochs were often built on exposed bedrock, and usually lack deep foundations. They were built to avoid using valuable fertile land: on rocky knolls, set against hillsides, and placed on coastal cliffs, and can be found on the edge of terraces, set back from shorelines and occasionally placed to occupy islands within a loch. Most can be found on or near the coast. *"Brochs were built in many different landscape locations, as diverse as the Scottish countryside itself"* notes archaeologist and broch investigator Tanja Romankiewicz (2016, 7).

There are well over 500 sites, surviving or on record, which have been classified as brochs. But only around 150 retain any visible evidence of their *structural components*, and only around half of these retain enough height still to appear as towers (or evidence that they might once have achieved such height). There may have been many more, their ruins now lost to *destruction processes* such as collapse, stone robbing or coastal erosion. *"Apart from a few sites that survive to a sufficient height to allow examination of their structural details,"* observes archaeologist Dennis Harding, *"the great majority of field monuments survive only as substantial heaps of stone, so that the recognition of key structural features, such as galleries, scarcements and rebates, is quite impossible"* (2004, 118).



Most brochs saw construction followed by various *phases of occupation*, including alteration and repair, before abandonment and collapse. Recent archaeological excavation at the broch of **Clachtoll** in Assynt demonstrated that it was built in the 4th century BC, but recovered domestic artefactual evidence from only the final decades of use, before it burnt to the ground around the year 1 BC/AD. Evidence of previous occupation – including that of the original broch builders, from over 300 years earlier – had been cleared away. The various *phases of occupation* take place over several centuries, and the *destruction process* takes place over two millennia. They act to create a 'problem of preservation' which, observes archaeologist Ian Armit, *"is at the root of some of the deepest and most long-running disputes between archaeologists involved in studying brochs"* (2003, 15).

The full story of the excavation and consolidation of Clachtoll is told in *Clachtoll Broch: an Iron Age home in Assynt* by Charlotte Douglas. The excavation of the broch yielded astonishing evidence of everyday life in the Iron Age, ranging from domestic objects and craftwork to plant and animal remains. The work also stabilised the dangerous entrance passage and began the process of conservation management. *"The broch's interior was once full of rubble,"* writes Charlotte, *"but the excavations emptied the site to bedrock. Visitors can now walk through the doorway, topped by a huge triangular lintel, along the entrance passage, and into the broch itself"* (2022, 17).

Architecture and society

"In the Atlantic north and west, broch towers almost certainly served not just as dwellings for extended family groups but as strongholds for communal storage of produce"

Dennis Harding, *Iron Age Hillforts in Britain and Beyond*, 2012, 21.

Brochs were secure, built to protect family and stores, and they were domestic, built to provide shelter and a place to live. But they were also impressive, built to demonstrate land ownership and tenure over time. The resources, materials, skills and labour required to build such structures were not inconsiderable. They were *display architecture* – statements of cultural and social identity, and likely testament to personal ambition and evidence of economic power and reach. *"If the brochs are too numerous,"* writes the archaeologist Dennis Harding, *"to represent even a relatively low level elite, then they must instead be the defended homesteads of independent, landowning families engaged in farming and stock raising"* (2009, 288).

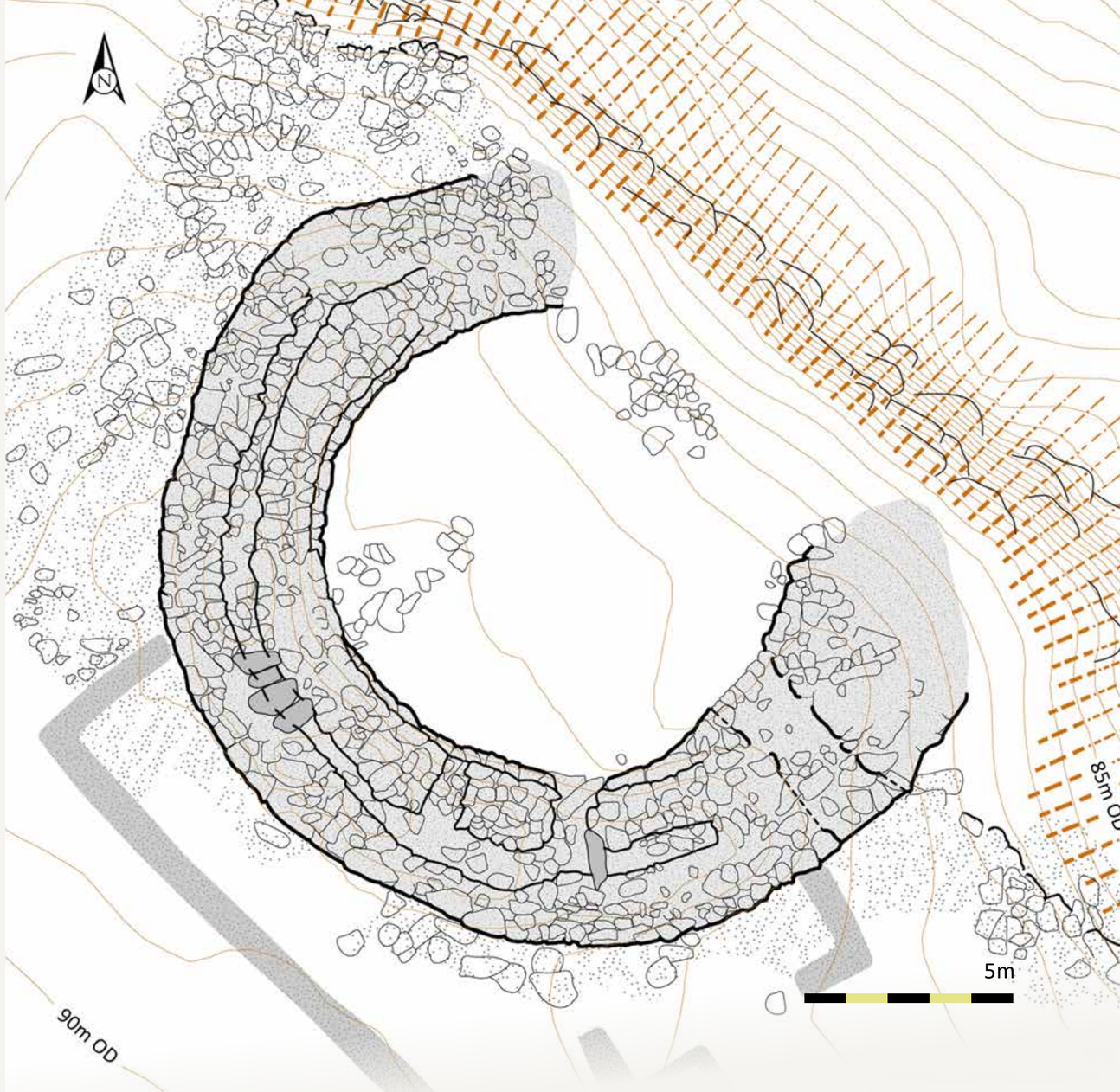
When studying a prehistoric *architectural tradition*, typological comparison between sites helps archaeologists to work out what features may be unique preferences of the individual broch builders, local or regional traditions of the wider community, or symbolic to the whole of society in general (typology is the analysis or classification based on characteristics or categories). *"The architectural language of the broch"*, explains the archaeologist Tanja Romankiewicz, *"allows complex layers of individual preferences, local and regional traditions, and supra-regional communications to be expressed in a single house design"* (2016, 1).

◄ **The broch of Culswick on Shetland.**

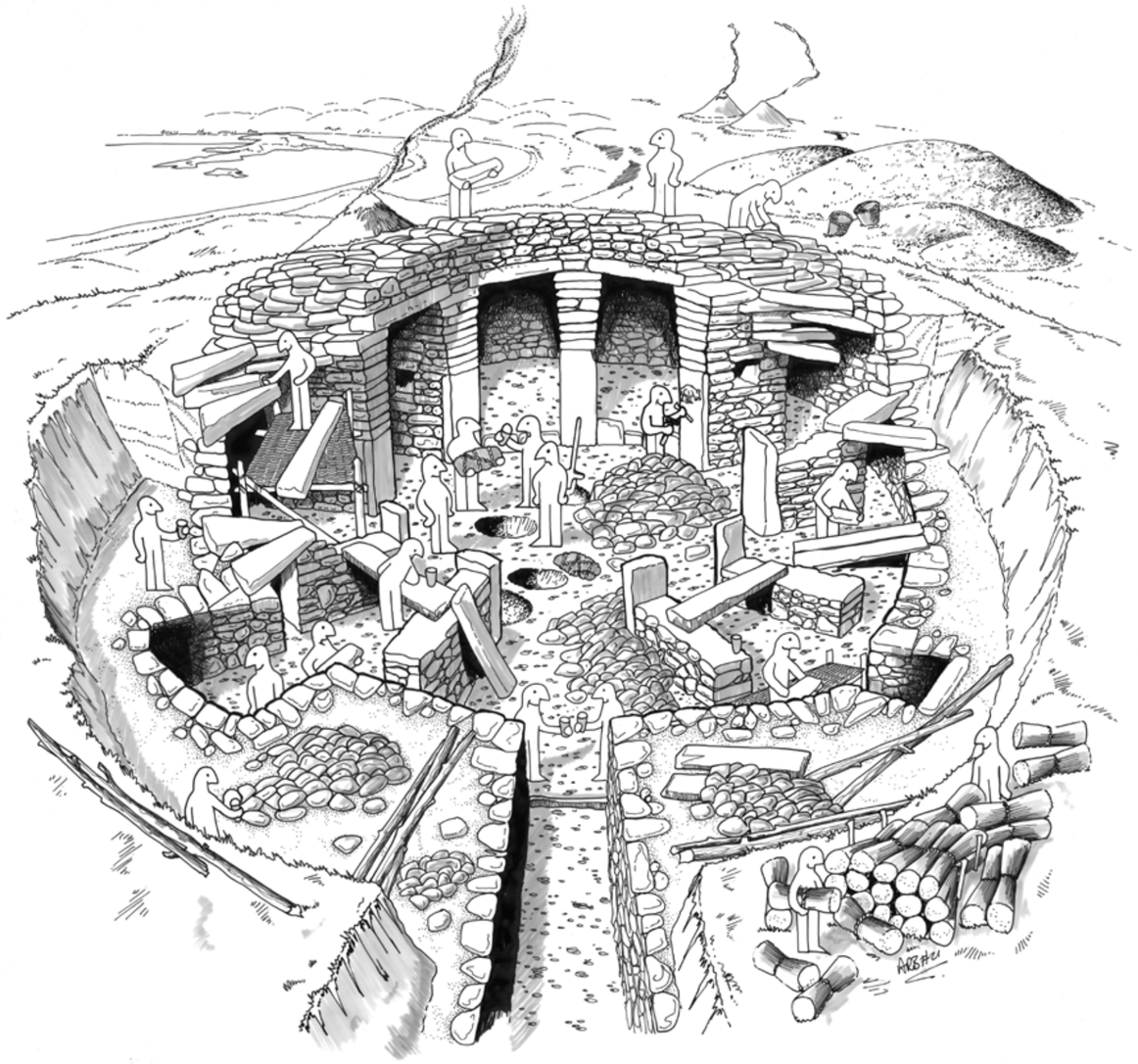
An individual preference in architectural design could be demonstrated by the huge triangular lintel stones above the entrances to brochs like **Caisteal Grugaig**, **Clachtoll** and **Culswick**. A 'local or regional tradition' could be demonstrated by the difference between Caithness, for example, where the openings to cells and galleries within the walls were often clustered around the main entrance passage, and Skye, where an entrance to a cell or gallery can often be found opposite the main entrance passage. The fashion of prestigious tower building is in itself a wider 'supra-regional' statement of identity – the *display architecture* being a strong statement of cultural and social identity across most of the Atlantic coast. The unusual lowland outliers – brochs like **Torwood** near Falkirk – must have been very deliberate statements.

Archaeologist Tanja Romankiewicz has studied the architecture of brochs across Scotland. Her architectural analysis of broch building describes *"a process of experiment and experience, of success, failure and gradual improvement"* and a general approach that attempted *"to reduce material and labour while achieving maximum effect to emulate a certain design"*. The broch of **Dun an Ruigh Ruaidh**, for example, was built on the very edge of an escarpment, the sheer rock face below effectively doubling the height of the broch above when viewed from a distance. Tanja's local broch builders built *display architecture* to an overall broch idea that was *"flexible enough to encompass different regional identities and to continue regionally specific expressions within the overall scheme"* (Romankiewicz, 2016, 20-21).

To appreciate the broch as *display architecture*, we need to think of its domineering external size, both when viewed from afar in the landscape, and when viewed up close on approach. A broch's internal size would also have been impressive, both as a complex building to move around in, and when seated at the hearth in the large main living space, perhaps looking up into the rafters of the roof above. This is architecture that is implicitly designed to impress the visitor and to project the status of the household living within its walls.



The broch of Dun an Ruigh Ruadh is situated on a terrace overlooking Loch Broom, immediately above a cliff over which part of the structure has collapsed. This archaeological *measured drawing* has been produced as a result of modern *digital documentation* by laser scan survey. The entrance passage can be seen in the SE side, now infilled with rubble, and a scarcement ledge runs around the interior. A rectangular sheepfold has been built against its SW side.



Wheelhouses

Towards the end of the first millennium BC, in Shetland and the Western Isles, brochs appear to be replaced by wheelhouses in the Atlantic roundhouse tradition. Wheelhouses were sophisticated drystone roundhouses, characterised by an impressive arrangement of internal drystone piers or short walls, forming a series of bays or alcoves around a central area. Each bay was capped by a corbelled stone roof, which combined to form a strong ring of stone from which a central timber and thatch conical roof was sprung. The ground plan of a wheelhouse is circular, and the radial piers look like the spokes of a wheel. However, unlike a broch, most wheelhouses were built into the ground, or into the remains of earlier buildings, meaning that they had low or no external walls visible to the visitor, who would have seen only relatively shapeless mounds.

Compared to brochs, the low wheelhouses were likely better insulated, and used less of the scarce timber resource. However, they were no less distinctive or impressive, just in a different way. *"Like Atlantic roundhouses"* explains Ian Armit, *"wheelhouses were monumental buildings, requiring considerable skill and resources to construct and maintain… Yet the monumentality of wheelhouses is entirely inward looking, and obvious only to those permitted to enter and observe the soaring interior space. From the outside, they would often have been almost invisible"* (2015, 193). They are *display architecture* from the same *architectural tradition* – but the display element is restricted solely to the internal space.

There are two distinct geographical distributions of wheelhouses: the Outer Hebrides and the Northern Isles (predominantly in Shetland), with a few outliers scattered along the rest of Atlantic coast. Although wheelhouse ground plans seem broadly similar in each area, there are distinct variations. Those examples of wheelhouses surviving and excavated in the Western Isles are predominantly subterranean in character, either revetted into sand dunes or built inside the collapsed rubble of earlier structures. The sites in Shetland are usually built into earlier buildings, and some early examples appear to have internal scarcement ledges and sometimes with external stairs suggesting an upper floor.

There are also differences within their *structural engineering*. Some radial piers are bonded into the external walls only above a specific height to support the corbelled roofs above, with aisles or gaps between the pier and the wall. Some have massive pie-slice shaped piers to support the corbelling above, the piers being thicker at the wall and tapering as they extend into the centre. There are others that have long and thin piers, which would not have been strong enough to have supported corbelling. These may have supported horizontal timbers instead; alongside the evidence of scarcement ledges and external stairs, this suggests the presence of upper floors. This sophisticated *structural engineering* has predominantly been found in Shetland.

Wheelhouses pushed the structural ability of drystone walling to its very limits, and there is as much, if not more, architectural variation in wheelhouse construction as there is in brochs.

Timber roundhouses

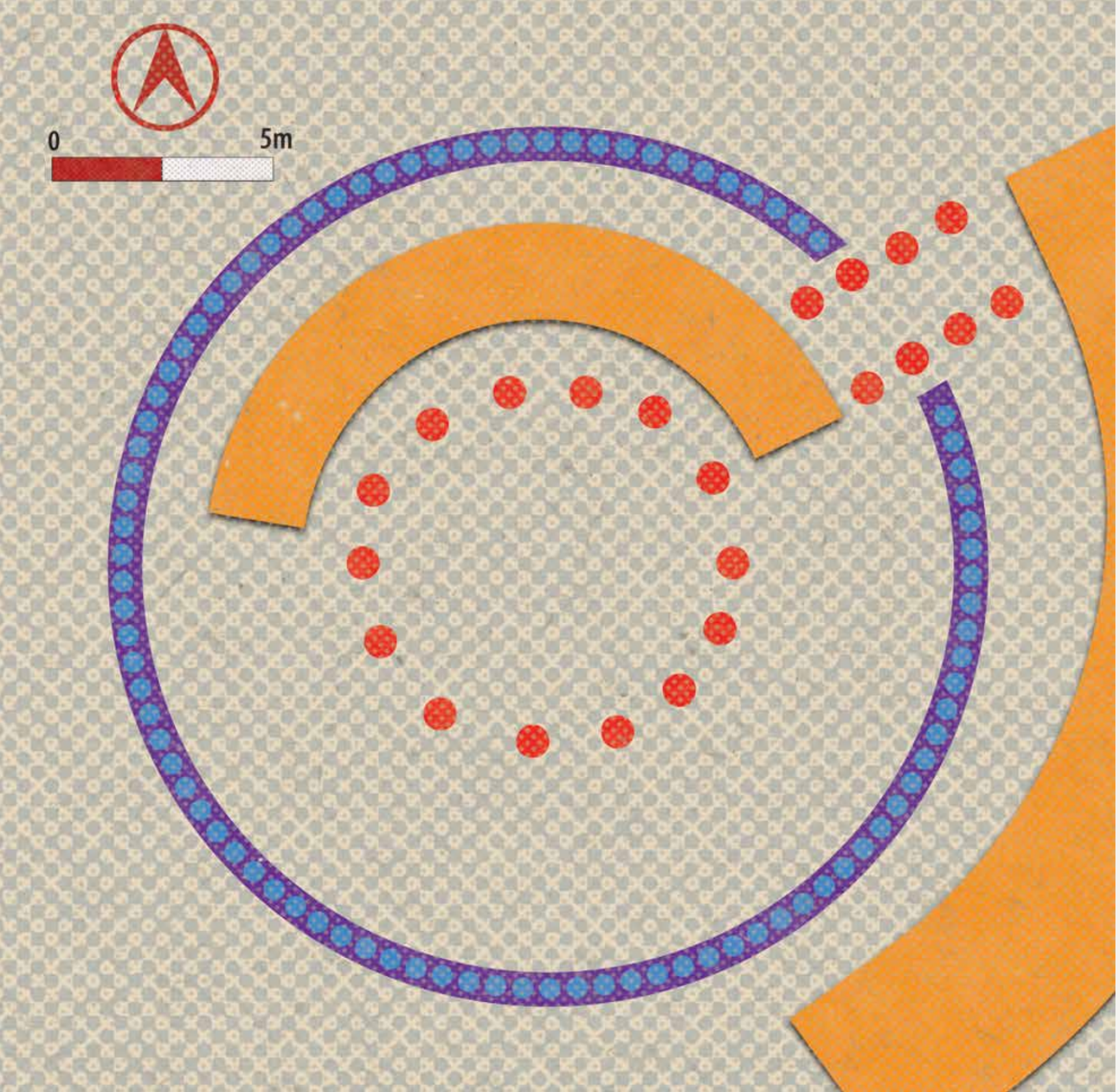
"Control of timber supplies may have been the source of considerable power and wealth in Iron Age Scotland, in communities where so much of one's prestige and status was apparently displayed through domestic architecture, itself dependent on access to plentiful good-quality timber"

Ian Armit and Ian Ralston, 'The Coming of Iron' in *People and Woods in Scotland*, TC Smout (ed), 2003, 50.

Atlantic roundhouses such as brochs were part of a much wider contemporary context of large timber roundhouses. *"In broad terms, these can be divided into a timber building tradition predominantly associated with the south and east of Scotland, and a drystone building one (which still entailed the use of substantial structural timbers) in the north and west"* (Armit and Ralston 2003, 47). The term roundhouse describes the *architectural tradition*, but it doesn't necessarily follow that they were all domestic homes. For example, archaeologists recently discovered the site of an Iron Age craftworking centre at **Culduthel** in Inverness, which appears to have been active between the 2nd century BC and the 3rd century AD. The first phase comprised at least ten workshops, many containing iron smelting furnaces, and four timber roundhouses, while the later second phase included two really large timber roundhouses. The excavation has provided an exceptionally rich and detailed insight into Iron Age metalworking industries and specialist craft manufacture – but it is the size and complexity of the later 1st to 3rd century AD timber roundhouses that is of particular interest here.

The outer wall of the largest timber roundhouse at Culduthel was formed by a closely spaced ring of posts set in a trench (known as a ring-groove) that measured about 18 m in diameter. The main weight-bearing ring of timber upright posts that formed the internal skeleton and held up the entire structure (known as a post-ring) measured about 9 m in diameter; each of these posts were large and deeply set, measuring about 0.5 m in diameter and set up to 1 m deep into the ground. An impressive entrance porch was framed by large timber posts, and these and the inner post-ring were large enough to have supported an upper floor or mezzanine. The second building was of a similar construction.

The excavators described these large roundhouses as *"substantial timber structures that were well-maintained and modified over their lifetimes. The size of the buildings and the range of high-status artefacts recovered from their interiors suggests that these were important buildings within a community of considerable status and connections. The range of tools and debris recovered from both houses show that these buildings were deeply connected with the surrounding industries.*



Given their scale and grandeur, these buildings could have been multifunctional spaces within the craftworking centre; domestic housing, secure storage for precious raw materials, studio space for clean crafts such as leatherworking and a gathering place for the community" (Hatherley and Murray, 2021, 83).

The archaeologist Dennis Harding wrote of the size and complexity of the timber structures found at Culduthel that *"this level of accomplishment in timber should hardly excite surprise, when the example of the brochs demonstrates outstanding architectural skills in stone"* (2020, 256). The same sentiment also supports the likely quality and complexity of the timber fixtures and fittings that would once have been in brochs: the sophistication of a broch's *structural engineering* in stone would certainly imply that similar sophistication was possible in timber.

The timber elements in brochs, such as the internal floor and roof would have required ready access to good quality timber, most probably from managed woodland. The woodland management model supports the idea that brochs were built within communities in stable social circumstances with reasonably secure land tenure. Woodlands needed to be managed for some time to produce suitable timber lengths, and this may also have enabled the broch builders to avoid using freshly cut timber, which can warp as it dries.

The network of regional social and economic connections implied by the *archaeological record* suggests that a trade in prepared timber was also possible, with timber sourced from wooded regions further away – regions that may have seen active management of the woodland resource. *"The use of so many large timbers"*, argue the archaeologists Ian Armit and Ian Ralston, *"must have necessitated a secure supply, whether accessed locally or through mainland trading partners"* (2003, 50). The archaeologist Noel Fojut adds that: *"if timber importation took place, it implies vessels of sea-going capacity by the middle Iron Age, capable of towing or carrying large baulks of timber"* (2005, 199). In addition, during the archaeological excavation at **Dun Bharabhat** on Lewis, traces of some timbers were discovered that had been recovered as driftwood from the shore. The mighty forests covering the east coast of North America would have produced a lot of natural driftwood, which was then transported by the North Atlantic Current to the shores of western Scotland.

◄ **The footprint of the largest roundhouse at Culduthel measures 19 m in diameter. Here you can see how the outer ring of timber posts slotted tight within their trench, while an inner ring of fourteen larger timber posts was placed to support the roof. Outside, a cobbled path led to an impressive porch, while inside a cobbled area curved to the right from the entrance.**

Concept and design

Today, our iconic buildings are museums or concert halls, designed by star architects like Richard Rogers, Zaha Hadid or Norman Foster. Like the Eiffel Tower in Paris, the Opera House in Sydney or the Scottish Parliament in Edinburgh, the people who commission them and the architects who design them want these buildings to become synonymous with a city or a country – icons of their time and place.

When it comes to Scottish archaeology, we don't think about prehistoric buildings as designed by star architects – although we do think of brochs as iconic. We don't really think of these buildings as designed for their beauty of form – but we do admire the elegant upward curvature of a broch like **Mousa** or the slenderness of wheelhouse piers. We don't often consider the complexity of their construction – until we ponder how large lintels or timber posts could have been lifted into place, and how corbelling was balanced.

We also find it difficult to imagine the qualities of their interiors from what survives – but all of these roundhouses could have had tall ceilings, as high as a concert hall, and perhaps with similar amazing acoustics. We may grant an underlying design concept to the pyramids or to Greek temples – but when it comes to Scottish prehistory, it seems more difficult to imagine that buildings were not just constructed purely out of practical considerations, with least cost and effort in mind.

By looking at brochs, wheelhouses and large timber roundhouses from an architectural perspective, considering concepts of design, construction techniques and the use of materials, we begin to see the many similarities between these sophisticated building types, despite their many differences.

For example, they were all designed to a similar structural concept: an internal load-bearing construction carried the bulk of the roof weight while an outer structural element protected the internal structure from wind and bad weather. For the timber roundhouses, it is the post-ring of large timber uprights, set about 1/3 inwards from the outer diameter that supports the roof. The outer wall could have been a wattle screen or a thick and well-insulating turf wall, or a combination of both. For brochs, the roof load rested largely on the wall head, and the inner wall of the double-wall construction carried the downward forces of the roof load to the ground.

◄ **The broch of Borwick on Orkney.**

The outer wall stabilised the inner wall and protected it against the variability of the wind load and seasonal loads such as snow. For wheelhouses, the equivalent of the inner broch wall was dissolved into individual piers. These were then keyed into the outer surrounding wall by a corbelled roof. Splitting the different internal and external loads into separate building parts such as internal walls / piers / post-ring and an outer wall shows a deep understanding of *structural engineering*. This shared structural concept forms a key element of the *architectural tradition* of large roundhouses.

Another shared concept appears in the interior layout. Inner walls, piers or post-rings separated a central area from peripheral spaces around it. Whether a broch gallery or cell accessible from the central area, bays between two wheelhouse piers around the central space or the annular space of a ring-ditch worn down around the roundhouse post-ring, they all indicate a similar use of internal space: a central circular area surrounded by peripheral spaces, which forms another key element of the *architectural tradition*.

With such underlying similarities in structural and spatial design, it seems people in the Iron Age were well connected and shared ideas across large areas. Brochs and wheelhouses may be typical for northern and western Scotland where good building stone is abundant, but some brochs are found in southern Scotland, too. Stone-walled roundhouses are known in Ireland, Wales and Cornwall, and post-ring roundhouses were built in timber all over Britain and Ireland and even in northern France.

Maybe brochs only look so unusual today because we are not used to round houses and don't consider that people in the past would have lived in tall buildings. The way we reconstruct and think about large timber roundhouses, with low walls and huge conical thatched roofs, makes them look very different from the tall walls and modest roofs we reconstruct for brochs, or the semi-subterranean character we have assigned to wheelhouses. It is too easy to see different building types and not make the connections between them, to appreciate their shared similarities.

Architectural design seems to have played an important part in Iron Age society, and was used to express identity and status much as we use architectural design today. These fashionable buildings also signified a sense of place and connection, and displayed creativity and innovation. This was cutting-edge architectural design at the time – like our modern contemporary architecture today – and applies to all Iron Age roundhouses, whether in stone or timber.

The broch of Kilphedir in Caithness is set within an enclosing earthwork bank. ►

The Broch Builders

"The picture emerges of productive households, who expressed their success and connections through elaborate domestic architecture."

Tanja Romankiewicz, 'Land, Stone, Trees, Identity, Ambition: the Building Blocks of Brochs' in *Archaeological Journal*, 2016, 21.

We depict a number of different possible roles associated with building our imagined broch, Dun Seanchas. We tried to ensure that we had balance between the genders, and of young and old people too. However, there are lots of roles we did not illustrate, leaving much scope for the imagination, and we present just one model of family life. *"In the absence of written sources"*, writes the archaeologist Julia Koch, "*it is difficult to reconstruct family structures based on material culture alone. Many variations are possible in the organization of family life and many events can influence it"* (2021, 30). The family lives of our prehistoric ancestors over two thousand years ago may have been very different from our own – and just as complicated. *"Whether children grew up with biological or social parents, how long they stayed with them, and whether they were raised by a man and a woman are questions that can no longer be answered without written and pictorial sources"* (Koch, 2021, 30). Our broch family should not be considered definitive, and we can quite reasonably expect that Iron Age households would have been quite different from those of today, particularly given the unpredictable loss of individuals of all ages due to disease and injury. However, our broch family is a helpful start towards thinking about the broch builders as real people. The extended household would also have included unrelated dependents, such as fostered children, servants and perhaps even slaves.

◄ **The broch builders of Iron Age Scotland were connected to a much wider world of Celtic language and culture. This fantastic embroidered scene reimagines a decorated silver panel from the famous Gundestrup Cauldron, which was found in a peatbog in Denmark in 1891. A goddess is shown crossing her arms on the chest. She is wearing a huge torc and her golden hair is in plaits. She is flanked by two figures, one greeting a hunting dog and one performing an amazing leap. Celtic art and mythology abounds with gods and goddesses, heroes and heroines, most now nameless and their deeds forgotten. Our embroidered wall hanging was made using wool from Shetland Isles, agate, hematite and glass beads, linen thread and Harris tweed.**

Our assumed social hierarchy describes brochs as commissioned by well-to-do *productive households*, when they had the agricultural surplus and resources to devote to building such elaborate high-status *display architecture*. Again, although perhaps the most likely scenario, and relatively easy to explain, it should not be considered definitive. Our imagined model allowed the archaeological narrative to be readily assimilated into our fictional spoken narratives and visual depictions. For example, the wealth and status of the household is on display in their clothes and jewellery, and can be compared to the functional clothing of their retainers or the hard-wearing leather of the stonemasons.

With this in mind, how best to begin imagining people from over two thousand years ago? Well, we started with the names. The names of the characters in our story are taken from a number of mentions of Pictish names in Irish and English sources, and survive as elements in place-names, in some Ogham inscriptions and loan words in Gaelic. The early Pictish and Gaelic languages had common roots in the wider European Celtic languages that were spoken during the Iron Age, when the Atlantic coast formed a rich network of cultural contacts. So the matriarch of our broch, Eithne, has an Irish name and may have been Irish herself, or her family had connections to Ireland. Eithne the Fair was an Irish princess who was converted to Christianity by St Patrick (or Pádraig) in the 5th century AD.

Then it came to deciding what clothes and jewellery our people would have worn. Archaeological excavation at brochs have recovered a range of objects and artefacts – what archaeologists call *material culture*. Lots of pottery has been found, and decorative items such as ring-headed pins, spiral finger-rings, glass beads and long-handled combs, which were possibly for weaving. Rotary querns for grinding grain have also been found, alongside lots of stone lamps to provide light. However, we expanded our search for inspiration to include the wider Celtic Iron Age material culture of northern Europe, and have not restricted ourselves to the 4th century BC of the original broch builders.

Clothing doesn't usually survive very well in the ground, but we are lucky to have some examples of preserved clothing (and bodies) from Europe from the time of the brochs. We also researched lots of images of people in statues, figurines and other objects from the time. For the details, we looked at the wider Iron Age *material culture* from northern Scotland and beyond.

These personal adornments included brooches, armlets, pins and neck-rings known as torcs. Unuist has a copper brooch and a torc based on a set found in Auldearn in the Highlands, and Cinaed has a fine bronze brooch to fasten his cloak, based on one found at Abernethy in Perthshire. Creag is wearing a massive armlet, based on a pair found at Castle Newe in Aberdeenshire. These armlets seem to have had discs of red and yellow glass enamel set into the copper-alloy frame. People are also depicted wearing torcs on the famous Gundestrup Cauldron from Denmark, but not everyone. We decided that it would be the owners of the broch and the warrior who would wear torcs, and based the various designs on examples found at places like Blair Drummond in Stirlingshire and Auldearn.

Eithne's outfit is based on a woman whose body and clothing were preserved in Huldremose bog in Denmark and date to around 350 BC. She was wearing a woollen skirt and top made from a tube of woven wool. Recent work on her clothing revealed she was wearing a linen undershirt, and that her clothing, instead of being brown as it appears after lying in the bog for over two thousand years, was actually dyed blue and red in a checked pattern. The other outfits are based on a style of dress that was found not far from the Huldremose woman. This was known as a 'peplos dress' and is made from a tube of woven wool that is caught at the shoulders, and sometimes folded over to form a deep collar. Ilei is carrying a drop-spindle for spinning wool into yarn ready to be woven into fabric. Tablets for weaving special decorative bands to edge clothing have been found at several brochs, and you can see these woven bands edging several of the cloaks.

The people of ancient Britain were well known for their woollen hooded cloaks and there are various depictions of people wearing them, such as the altar to the Genii Cucullati from Housesteads fort on Hadrian's Wall dating to the 3rd century AD. Talorc is wearing a fringed hood that is based on a surviving piece of clothing from Orkney dating to about 300 AD, found in a bog in Tankerness in the 19th century. Braccae – a form of trousers – were also known to be worn by the Celtic peoples of northern Europe. Captured 'barbarians' on Trajan's column wear them, and warriors on the Gundestrup Cauldron also seem to wear them. Leather shoes have been preserved in bogs, and also in the salt-mines at Hallstatt in Austria. While there are many designs, they appear mainly to have been made from a single piece of leather folded up over the foot and laced with leather thongs. There are hints that there may have been more complex types of shoes with a separate upper and sole, but no complete example survives.

Next was deciding how people would have worn their hair. Hairstyles for the women draw on several sources of evidence. Another woman's body, complete with elaborate plaited hairstyle, was found in Denmark at a place called Elling. Ligach's hair looks very much like that of the Elling woman. By contrast, the women depicted on the Gundestrup Cauldron, also from Denmark, are shown as having their hair being plaited in two pigtails, like Mael.

Julius Caesar famously described the people of northern Europe as 'barbarians with long moustaches'. Statues and other depictions of men from the time of the brochs seem to bear this out. However, Caesar's words must have been a generalisation. Preserved bodies found in bogs in Denmark, England and Ireland certainly show a mixed picture of clean-shaven faces, moustaches and beards, so we decided to show that range in our characters too.

Cinaed has a hairstyle that closely resembles that of Clonycavan Man, a bog body found in Ireland. The most distinguishing feature of the man was his hairstyle, which was raised upon his head in a bun with the help of a 'hair gel' made of plant oil and pine resin, imported from south-western France or Northern Spain. Remnants of a hair tie was also found.

We also debated how Cinaed might wear his sword. There are several statues of warriors from the time of the broch around Europe. A small chalk statuette from the East Riding of Yorkshire showed the warrior wearing his sword on his back, while the Hirschlanden statue from Germany wore a sword held in place by a belt on his belly. The Glauberg statue, also from Germany, wore his on his right hip, and that's what we decided to go for. Cinaed's fish-tailed sword scabbard is based on the Mortonhall scabbard from Midlothian, and his chainmail is based on a piece recovered from the waters of Carlingwark Loch in Dumfries and Galloway.

But what about furniture such as tables and chairs? *"Archaeological evidence for wooden furniture and internal domestic fittings is almost wholly lacking"*, note the archaeologists Ian Armit and Ian Ralston, *"yet it seems improbable that such great feats of carpentry as the timber roundhouse or the broch tower were not accompanied by appropriate internal fitments. Wood must have been used for a wide range of domestic purposes which are seldom seen in the archaeological record: serving and storage vessels, pails and barrels, handles for knives, weapons and agricultural tools, to name but a few"* (2003, 53).

Mousa is unique amongst brochs in being referenced in pre-modern literary sources, appearing in both Egil's Saga and the Orkneyinga Saga. However, the ruins of brochs would have been significant features in the landscape long after they were abandoned. A broch may be shown on a panel on Sueno's Stone, an impressive Pictish carved stone in Forres. On one side the stone bears a large cross, and what may be a royal inauguration; the other depicts scenes from a great battle. Carved in the 9th century AD, Sueno's Stone is a complex blend of symbology and reportage, and this 21st century recreation allows us to appreciate the carving as it once looked. Whatever the central object in this horrifying massacre scene actually is – and it has been interpreted as a broch, a bell or a furnace – it is clearly very important.

ASPIRATIONAL ATLANTIC PROPERTIES

Dun Seanchas

An impressive defended homestead occupying a commanding coastal position with adjoining pasture and arable land

SAFE AND SECURE | EYE-CATCHING PORTAL | OPEN PLAN FIRST FLOOR | AMPLE STORAGE | DOMESTIC UTILITY AREAS | THICK STONE WALLS | HEATHER THATCH ROOF | OVER 226 M^2 OF MODERN LIVING SPACE

The property is a generously-proportioned detached circular drystone tower in the popular *Atlantic Roundhouse* tradition. It offers attractive and stylish accommodation arranged over two floors in a much admired and sought-after location. There are many charming character features, including a distinctive lintel stone over the doorway, a heavy battened wooden door, high intramural galleries and an original open hearth. Access to the upper floor is via a curving stairway set within the walls, and a heather thatch roof with exposed timber beams affords protection from the weather, good insulation and additional storage solutions.

The property is set in a strong defensive location with fine coastal views. Tenure over the wider estate offers a comprehensive range of amenities and exceptional economic potential, including extensive pasture, arable fields, sheltered fishing and managed woodlands. Communication links are ensured as the region is part of an Atlantic maritime network stretching from the Northern Isles and Caithness to include the Hebrides and beyond. Part of the property is currently set aside for ceremonial and ritual use, but it can be adapted to a wide variety of alternative purposes.

Building Dun Seanchas

"Based on the productivity of modern drystone wallers, somewhere around four hundred worker days might have been required for the fitting of the stones to build a broch tower, although this makes no allowance for the lifting of the stones to the upper levels, far less the initial quarrying or gathering, transport and scaffold building"

Ian Armit, *Towers in the North*, 2003, 76.

Substantial preparation must have been required before construction. Stone and timber needed to be gathered, the ground was cleared, and relevant specialists arranged. While the construction of some brochs must have been attempted independently, by dedicated followers of fashion responding to the building of brochs in adjacent bays or glens, there must also have been specialist broch builders for hire. Who else would have had the requisite *structural engineering* and masonry skills to build the unusual lowland brochs such as **Torwood**, or to learn from the *"process of experiment and experience, of success, failure and gradual improvement"* (Romankiewicz, 2016, 20-21).

But where did the labour come from to raise a broch or build a dun? In a traditional North American barn raising, all of the materials required are purchased or provided by the family who will own the barn once it is complete. However, the workforce is provided by the local community, with one or more people with prior experience or with specific skills chosen to lead the project. Older people who have participated in many barn raisings lead their respective teams, while younger people participating for the first time will have watched barn raisings before and know what is expected of them. Only certain specialists are permitted to work on the most critical jobs, such as the joinery and dowelling of the beams. At most barn raisings, the community collective has raised barns before and approaches the task with experience both in the individual tasks and in the necessary organization. It is very likely that Iron Age timber roundhouses and Atlantic roundhouses were raised in a very similar way – and, as we will see, their modern archaeological excavation, consolidation and presentation is very much a team effort too.

Once the broch had been completed – the floor laid, the door hung and the roof raised – it would have stood empty, waiting to be filled with all the sights and sounds of daily life. This must have been a very special *moment in time* – marked for some by a feeling of satisfaction of a job well done, and for others with mounting excitement as they waited to move in. It is this moment that we have tried to describe in the following narrative, alongside the various *structural components* that comprise a broch (and some that can be assumed, such as a *roof* and *hearth*).

The Foundations

My broch is my home. It's on the coast, about two day's sail from here with a fair wind, further towards the setting of the winter sun. It's built on a rocky knoll beside a wide bay, with good pasture all around. I'm a mason and broch builder,[1] like my father before me and his father before him. We built our broch with thick foundations, and the ready slabs of local stone allowed us to build our walls tall and tapering. But when we travel to build, my men and I use whatever is available – good building stone, small pinning stones and strong seasoned timber, that's all we need. Drust is my apprentice – my brother's boy – and he is learning fast. I'm proud of him. He helps me plan the circular footings across the bedrock, and already knows how to keep his wall course level and his pinnings tight.

URGUST

Wall footings

Broch builders knew their maths and were fantastic engineers. It is clear that if a broch was to remain standing, then their wall footings must have been circular; their internal diameters then had to be constant with height, while the external diameter had to reduce with height. Their inner walls rose straight and true, while the outer walls began thick and tapered inward as they rose. Surveys of numerous brochs, for example at **Caisteal Grugaig**, **Alltbreac**, **Clachtoll** and **Dun Telve**, all indicate their amazing circularity.

1. We don't know what word the broch builders used to define their brochs – the word 'broch' is likely from the Old Norse word 'borg' (meaning fort). Gaelic is descended from the Celtic language that would have been spoken by the broch builders, so *dun* (meaning fort), *taigh* (meaning house), *taigh mòr* (meaning big house), or even *dachaigh mhòr* (meaning big home), may be as close as we can get. And we don't know what the broch builders called their brochs, or if they even had individual names. Most brochs are known by their nearby place names, from more recent historical sources or from oral tradition.

Broch builders chose particular locations to build their brochs, and flat land was not the most important factor. The brochs at **Clachtoll** and **Caisteal Grugaig** are both built on irregular and steeply sloping ground; the height difference between the highest and lowest points in their lower courses are between around 3m and 4m. However, laser scan survey demonstrated that at and above the level at which the full circuit of the broch masonry emerged, these inner wall faces were again circular. This demonstrates the ability of broch builders to construct circular walls despite challenging ground conditions and slopes. So all broch towers had to be circular on plan. This is one of the essential characteristics of broch towers. The broch builder was always equipped with a good compass and measuring stick!

Wall courses

"The greatest cost in broch building was quite certainly the quarrying and transport to site of the stone used in the construction"

John Barber, Graeme Cavers and Matt Ritchie, *The Survey and Analysis of Brochs*, 2015, 155.

The broch builders used local stone quarried near to the site. This means that brochs were built from different stones in different areas, depending on the local geology. In some areas, such as the Western Isles, the gneiss is very strong and robust, but breaks naturally into rough, more angular blocks – similar to the basalt on Skye. In other areas, such as Caithness, the flagstone splits easily into flat slabs but is softer and can carry less load (or weight). These different stone types would have posed different challenges to different broch builders.

But regardless of the stone types, the broch builders had to be consistent in their *structural engineering*. The walls always had to have excellent masonry with horizontal courses and tight pinnings (small stones known as pins that were used to fill gaps between the larger building stones). It was critical to have the larger stones closer to the ground and the largest stones beside the entrance area, particularly on the outer wall. The entrance opening interrupts the circle and therefore the loads from the walls above need to be compensated and redirected – the bigger stones help with this. The largest stones were best placed at the bottom, and provided a solid foundation from which the broch could be built up.

The broch of Dun nan Gall on Mull. ►

The Double Walls

This broch is only my second. Master Urgust says it will be a difficult build. The chosen ground is sloping and uneven, but it's close to freshwater and has fine views over the sound. We are building in stages, using the largest stones to define the footings and taking care to infill with tightly packed rubble. Soon we'll start building the inner and outer walls, knitting them together with cross slabs as they rise. We'll use timber scaffoldings to work from, and ramps, ropes and baskets to move stones. Finding good level scarcement stones is my favourite job – that and then tying them tight into the wall so that they can support the timber floor beams. The locals have made us feel very welcome, with lots of good beer and grub, and have been helping with all the heavy lifting. The young 'uns love helping me find the perfect pinning stones.

DRUST

Double walls and galleries

Although from the outside it looks like a broch is just one massive wall, they actually comprise two very thick walls, bonded together through various *structural engineering* techniques including lintels and corbelling. The galleries, the name given to the space between the walls at different floor levels, would have lightened the walls, meaning they could reach higher with less weight (or load) pressing down on the lower walls and foundations of the tower, and less stone between the wall faces pushing outwards. Also hidden within the stone walls are small rooms of various shapes and sizes, usually at the ground floor level in the widest and thickest part of the walls. Such intramural[2] ground-floor features include corbelled **cells** (more on them later) and in some instances longer galleries, although the latter are rare. The double walls likely joined at the top to form a single wall head.

2. Meaning 'within the walls'.

◄ ***"It is clear that the space within the intramural gallery [as it rises] becomes too restricted to accommodate a staircase,"*** **observes archaeologist Dennis Harding *"and we must infer that access to the parapet and roof would thereafter have been by internal timber stairs or ladders"* (2009, 94). The narrowing gap between the outer and inner walls can be seen at Dun Troddan, a consolidated structure in Glenelg.**

Scarcement

Inside well-preserved brochs are stone ledges that project from the inner walls and are usually on the same level as the innermost entrance lintels above the ground floor openings. This *structural engineering* device forms a scarcement[3] that is usually interpreted as a support for a wooden floor. However, some people think that an internal timber structure may have been built instead, forming a network of multi-floor mezzanines and filling the inside of the broch. Others point out that the largely treeless nature of the Northern and Western Isles probably limited the opportunity to use long sturdy timbers for internal structures and furnishings in broch towers. During recent work at **Clachtoll**, a deposit of burnt hazel round-wood was found on the scarcement ledge, suggesting the possible use of wattle hurdles as flooring in its last phase of occupation.[4]

The scarcement at Caisteal Grugaig © Lynn Fraser

3. A geological term for a stone protrusion or stone shelf.

4. One robust wattle hurdle, or two or three lighter layers of wattle hurdles, would construct a floor easily capable of carrying normal household weights, including people. Such hurdles, apparently used singly, furnished the access ramps and floors for scaffolding in major medieval building projects such as castles and cathedrals.

Ladders of modern pinnings at Dun Troddan.
© Matt Ritchie

The Great Door

Our broch will be finished soon. Urgust the mason says that our stones are difficult and cantankerous, but that they'll knit together just fine. He is using the largest blocks to lay to foundations and line the entrance passage and has already set aside our special three-sided lintel stone, ready for lifting into place above our doorway. I'm going to see Creag today about the door. He's our woodsman, and is charged with finding the very best timber to split for the floor and roof beams. I want our door to be strong and sturdy, with good oak and iron nails. Our door must be welcoming to guests when open, but quick to close, and strong enough to withstand any enemy axe. Urgust has already built thick door jambs, and placed the bar holes for the timber bar into the facing passage walls.

UNUIST

Entrance passage

Almost one hundred brochs have surviving entrances that preserve at least some of their original features.[5] As well as allowing access to the inside of the broch, entrances give us an amazing insight into the brilliant *structural engineering* ability of the broch builders. The entrance passage was the only opening in the outer wall face, and this created a weak point in the structure. Large lintels were used to bear the weight and divert the stress of the tall stone wall built above it. On some sites, for example, such as **Clachtoll**, the builders used multiple lintels at the outer end of the entrance passage, specially designed to carry the massive weight of the outer wall across the passage void. There were four massive lintels: the outermost one was triangular and the others were flat, thinner lintels, set on edge.

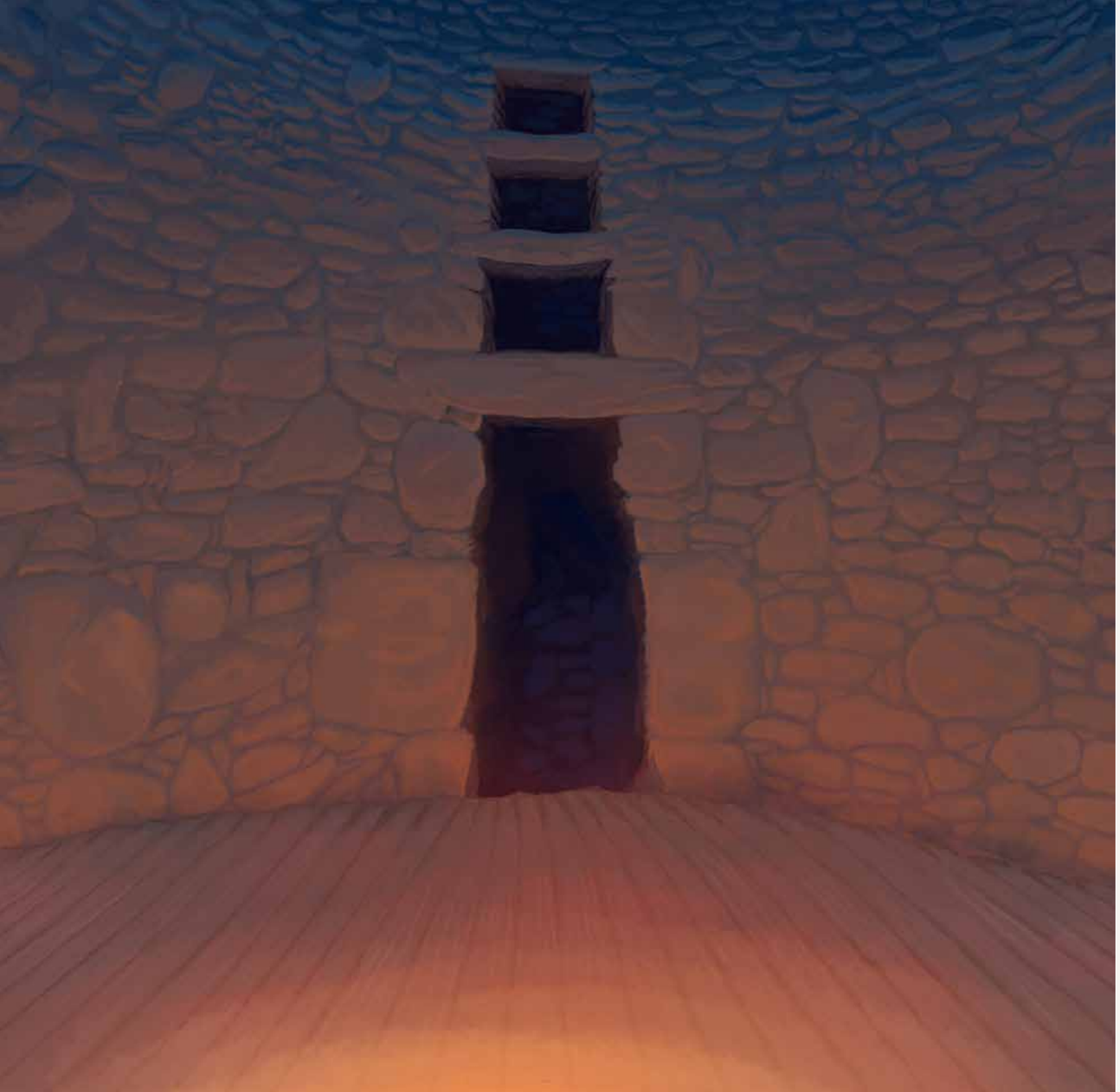
5. A handful of brochs have two entrances and some even have three. However, it is certain that, at each of these sites, all but one of these entrances was added at later dates when people returned to the broch after it had fully or partially collapsed, to build new homes amongst the ruins and rubble. Original broch towers had only one entrance.

Rebates and bar holes

The entrance passage is usually furnished with a variety of features that we would recognise today, including rebates (or door jambs) and bar holes, receivers for a timber locking bar across the door to keep the wind out and the inside of the broch secure. Socketed stones, sometimes called pivot stones, are common finds during broch excavations. The shallow socket housed the foot of the closing stile of the door, acting as a hinge and pivot. These are sometimes found *in situ* beside a door jamb. Although we don't have any surviving doors, it seems very likely that broch doors were wooden: a stone slab would have been too cumbersome to open and close quickly.

A bar hole at Dun Ringill.

CREAG



The Living Room

The broch will be our home. There will be a warm central hearth, built up on a layer of snug stones and clay, with peats burning bright into the evening. Stone lamps will line the walls. We'll keep our stores neat, with preserves in pots and grain in sacks, all stacked safe and dry. There will be meat and fish hung high in the smoke in the rafters and butter and cheese in the cool of the cellar below. We'll fill the broch with furniture old and new. Our two formal chairs come down to us from Unuist's family and were carved many years ago. My favourite chest came with me from my family home over the sea. But the children's beds are new, built for me by Creag to celebrate moving into our new home. We'll have tables and benches, bowls and mugs, rugs and furs – and I'll make sure to keep a space for my mother's old loom. We have all we need to spin yarn, weave textiles and make all our clothes.

EITHNE

Stacked voids

Inside the broch are other wonderful examples of *structural engineering*. Above the lintels of entrances to intramural features like cells, galleries, the stairwell and the entrance passage itself are gaps in the inner wall. Sometimes these are small gaps with one or two stone slabs across them to tie the inner wall circuit together, often triangular in shape, but at other sites they rise up from the lintels high up the inside of the walls, with the tie stones looking for all the world like a stone ladder. The heights of these gaps get smaller as the broch gets taller. These gaps are sometimes known as stacked voids, the idea being that the space between tie stones is being stacked one upon another.

Some people think that these stacked voids were for letting light into the galleries. Others think they were for letting smoke out from the hearth or that they provided ventilation, keeping the broch interior dry and free from damp.

They may well have served these purposes, but their primary reason is yet another clever engineering solution used by the broch builders for relieving weight and hence downward compression forces at the structurally weak positions above and within the lintels over openings. Without the stacked voids the inner wall – and then the whole broch – would have collapsed under its own weight. These voids above entrance lintels at some *consolidated structures*, like the broch **Dun Carloway**, have been filled with smaller stones, because the assumption at the time was that they were where stones had fallen out of the walls. The weight of these new stones has then cracked the lintels, and many now require steel supports to keep the structure safe.

Roof

No broch has any evidence remaining of how it was roofed, nor do we have any Iron Age carvings or other depictions of broch roofs. Even the best preserved, like **Mousa**, provide no definitive answer, but some do provide clues. The well preserved brochs of **Dun Carloway**, **Dun Troddan** and **Dun Telve** indicate that there was no way to walk around on the top of the walls of a typical broch – only at Mousa is it possible to do this, and it has a massive wall structure different from every other broch. Some brochs have a second upper scarcement, which may have provided footings or support for a roof. A couple have provided evidence of a ring of large wooden posts from the remains of post holes, around the interior of the broch, suggesting an internal frame or skeleton structure much like the post-rings seen in the timber roundhouses described earlier. In general, it is believed that the roof was much like those on blackhouses, with a timber framework covered by thatch or turf, and covering the entire internal space. Earlier interpretations took the internal ring of post holes and suggested that the broch was open to the elements with a series of lean-to wooden buildings against the interior wall. The presence of a central hearth on the ground floor was used to support this theory. However, the hearths we know about within brochs are often secondary to the original construction – and the hearth would have flared up like a stove whenever the door was opened, increasing the likelihood of sparks and flames igniting the proposed timber superstructure above. A thatched roof over the whole building would keep out wind and rain, while smoke would still percolate through the roof. Replica wooden roundhouses have shown how effective this can be, not only helping to preserve the wood of the roof, but also to smoke foodstuffs hung from the rafters.

The Hearth

The broch will be my last home. It was such a relief to see it finished and to finally move in. We carried the burning embers from our old hearth to rekindle in the new, and gave thanks for our good fortune. But the broch will be more than just my home – it will be home for my kin for many years to come. While I rest by the fire, I use the time that is left to me to tell my stories to the children – stories of the gods and of legends long ago. Stories of heroic deeds, of great battles and of places far over the sea, but also stories of their own kin past, so that they can tell them to their children in turn. I also keep an eye on young Coblaith the Daydreamer. She means well, but her head is always in the clouds. If I didn't help guide her cooking, the stews would go unseasoned and the *bannucs* would always be burnt!

ILEI

Hearth

Hearths are usually square or rectangular areas demarcated by a stone kerb, usually of low upright stones, and often with a clay base baked hard, holding deposits of ash and fire debris. Most excavated remains of Iron Age hearths in northern and western Scotland appear to have used peat as a fuel, and relatively recent traditions in blackhouses talk of the need to keep the fire going all day and night. Just maintaining the fire would have been an important task in itself, and there is even a specific kind of damp peat (called *mòine tasgaidh*) that can be banked in the fire to keep the embers burning through the night. The hearth was the centrepiece of the room, being a place to cook, keep warm and tell stories. We can imagine families and communities gathering around to undertake activities like needle-work or net-mending, all the while chatting about the things we still find important: what happened yesterday, what needs done today and if anyone has any juicy gossip!

The hearth also allows a variety of different cooking options: stewing in bubbling cauldrons, roasting joints of meat on spits hung over the flame, cooking in pots set at the side, making bannocks of bread on hot stones, or baking meat and fresh fish in the hot ashes using seaweed wraps or clay.

◄ **Our hearth scene includes a version of the amazing Capel Garmon firedog, a Celtic iron stand with two opposing horned animal heads that was found in Wales in 1852.**

The Stairway

Our broch is full of secret hiding places! We use the curving stairs to run all the way from the cellar below to the roof beams above, climbing and hiding when no-one is looking, and snacking on the racks of smokies[6] that Coblaith keeps hung in the rafters. Nana says our stone stairs rise in the direction of the sun as it climbs high in the summer sky. Our old home was a roundhouse too, but was much smaller. The stairs can be a little drafty, but the inner wall keeps the heat from the fire in and the damp out. Some of the spaces between the walls at the top are so narrow that only we can get in, and Nana always worries that we'll get stuck. She says we'd make very noisy spirits!

Stairway

Within the double wall ran a stairway, which wound clockwise around the tower. Some have noted that this replicates the movement of the sun from left to right over the course of the day. The entrance to the foot of the stair sometimes also gives access to a small cell which is usually on the left-hand side while the stairs wind up to the right. Most people imagine the stairway was an unbroken helix running from ground level to the top of the structure but no surviving broch actually shows this. Most brochs have separate flights of stairs that rise clockwise from ground floor to first floor, and then from first to second levels, with a landing in between. The stairway at **Mousa**, one of the most impressive brochs, rises clockwise from some 2.1 m above the current ground level, and several other brochs have stairs that start at some height above ground level: perhaps accessed from a raised floor. Apart from Mousa, no other broch has a stairway extending more than a second floor, and at many brochs the narrowing of the gap between the outer and inner walls as the broch grows taller appears to rule out the extension of the stairway into the higher galleries, and certainly to the wall head – most people wouldn't have fitted between the walls!

MAEL and TALORC

6. Likely saithe, caught by net and fishtrap in shallow coastal waters.
Today, an 'Arbroath Smokie'is a hot-smoked haddock, while a kipper is a cold-smoked herring.

◄ **Torwood near Falkirk is one of a number of unusual lowland brochs.**
© Ed Martin

The Store Rooms

The broch is my home too. I serve my mistress Eithne, tending the garden plots, drying herbs, making preserves, preparing the food and washing the dishes. I look after the children and keep an eye on old Ilei and her chickens.[7]
I make good cheese and smooth butter, using milk from Ligach's best sheep and cows, and everyone says my bread is as good as my mother's. I think it's even better, because I grind my grain for longer! I keep the floor swept, the lamps and fire lit, the pots clean and sealed, and the store rooms neat and tidy.[8]
I'm always busy! I also keep tabs on the joints of meat and fish hung to dry in the rafters – I know we have mice, but mice don't eat smokies do they?

COBLAITH

Cells

Broch interior walls can have up to five entrances at ground floor level which give access to small intramural cells. One further entrance gives access to the stairway. This is usually on the left hand side as you enter the broch interior; only a handful of brochs do not have a stairway entrance in the left half of the broch. The intramural cells are usually roofed by using corbelling and stone lintels (which can form the floor of an upper gallery). Corbelling is a complex *structural engineering* technique, where stones are placed on top of each other, incrementally jutting inwards, until a vaulted shape is achieved. This requires lots of weight, provided by the stones in the rest of the wall behind the jutting stones to keep them from falling inwards, and the same supporting effect is created by each jutting stone pushing against its neighbour. Some brochs, such as **Dun Beag** and **Dun Mor Vaul**, have wonderful examples of fully corbelled cells, but most intramural cells are not that elaborate. These intramural cells were probably used for the storage of goods and perhaps to shelter younger animals at particular times of the year.

7. Chickens were introduced into the British Isles during the Iron Age and quickly became a domestic favourite.

8. Iron Age pottery included a wide range of shapes and sizes (and forms of decoration), giving us an insight into regional cultures and traditions, and to the diversity that must have existed in other more perishable materials, such as wood, leather, basketry and textiles. Coblaith's store rooms would have seen a spectacular array of pots, baskets, bags and boxes, all with different designs and patterns!

The Guard Chamber

The broch is my home, for now. My own broch will be even taller. You'll be able to see it as soon as you enter the glen. I'll build it on the edge of a terrace, by the deep pool where I swim with Coblaith and near the woods where we cut our timber and I hunt with Maragdhu. My broch will be our home – one day. But for now I'm content, sworn to Unuist. I am his sword-arm just as he was sword-arm for my father. I help keep the peace in our land, collecting dues[9] from the smaller farms and training the hunting dogs. Strictly speaking, I should sleep with my dog in the guard chamber by the door – but we usually fall asleep in front of the hearth! When the door is closed and barred, the family and all our stores are safe and secure inside.

CINAED

Guard chamber

The small intramural cells that are entered from the sides of the broch's entrance passage are known as guard chambers. Different brochs had guard chambers with varying sizes and shapes. Most guard chambers are slightly corbelled to narrow the gap to be spanned by lintels. Some guard chambers, such as at **Clachtoll** and **Ousdale**, had additional openings that gave access to the broch interior, but these are very few in number. A minority of brochs have a guard chamber on either side of the entrance, and some brochs do not have a guard chamber at all. What they were actually used for remains unknown, but they usually had very low and narrow entrances. This was to limit the effect of the creation of a structural weak spot in the entrance passage. The occurrence of guard chambers is highly variable and they appear to have been less favoured in the Northern Isles than in the Western Isles.

9. It is very likely that the smaller farmsteads around the broch would be obliged to offer up a share of their produce, likely in grain, meat or dairy. ***"Even in these farming lands,"*** writes Ian Armit, ***"wild plants, berries, nuts, seeds, fruit, herbs and fungi would have been collected for food, drink, seasoning and medicines"*** (2016, 83).

◄ **One of the stacked voids at Dun Telve, a *consolidated structure* in Glenelg.**

The Cellar

The broch is also our broch, the heart of our land. My family have lived here for generations. We look after the herds of cattle, sheep and goats, while others tend the crops in the fields and keep the pigs. We all helped to raise the broch, working where the master mason needed us. We overwinter the best of our breeding stock in pens in the cellar below, and keep our seed grain safe and secure in the store rooms above.[10] We butcher the meat and I help Coblaith prepare the finest cuts for curing.

LIGACH

Ground level

Very few brochs have surviving interior ground levels that were contemporary with their original use. This is because brochs were reused for centuries, before and even after they collapsed. Despite the scant evidence, archaeologists believe that the ground floor level would have had a series of important internal features, such as wells and cisterns. These range from modest holes to elaborate stairways accessing cistern-like subterranean chambers. Although it is difficult to tell through current excavated evidence, there is no reason to suspect that these do not belong to the period when the broch builders first lived in the towers. Many people believe that these were wells for capturing or retaining water, but many do not now contain water in any quantity and it is improbable that they ever did; the same must be true of 'wells' in brochs atop rocky pinnacles. Perhaps these so-called wells had different purposes, and were used for storage or even associated with long-forgotten rituals. These features, and the uneven surface of many ground levels inside brochs, suggest that they were more like cellars or stables than living spaces.

10. Keeping grain stored properly was an Iron Age preoccupation, and grain stores have been found on settlements sites all across Britain.

◄ **Set within two defensive earthworks, the broch mound of Dalsetter in Shetland comprises both architectural decay and great archaeological potential within its buried layers.**

Brochology

ology
noun
INFORMAL/HUMOROUS
1. a subject of study; a branch of knowledge

This booklet aims to help teachers use the study of Scotland's brochs as a cross-disciplinary classroom topic as part of the **Curriculum for Excellence** (Third Level), blending history, geography and the creative arts. Using this booklet, learners will become broch investigators, researching and presenting their own brochs.

At present, there are many strands of brochology where the range of possible answers is wide and fascinating:

- **Why** decide to build a broch in the first place, rather than something else? Was it fashion, status or defence?
- **What** were brochs meant for? As *defended homesteads*, were they domestic homes first and foremost, or defensive or domineering fortifications? Why make them look so strong?
- **Who** decided to build a broch? What was the social structure and how were big decisions about the use of time and resources taken? How well does the *productive household* narrative fit?
- **How**, **where** and **when** did the original idea of a broch emerge and spread?
- **How** much do we really know about the wooden parts? The roofs, floors and construction techniques?

Ask your learners to research and present a broch of their own, identifying and describing the visible *structural components*, setting the broch in its regional context and analysing the *archaeological record*, and exploring their own ideas and interpretations of individual *moments in time* within the story of their broch.

◄ **Some brochs are *consolidated structures*, such as this fine example, Dun Beag on Skye. Its walls have been internally secured by mortar, its passages, galleries and stairways cleared of rubble and its wall heads capped with turf.**

Learning to spot the clues within the structural narrative of a broch will help to better understand the processes at play between construction and collapse. Recognising where a broch has been repinned (with small stones inserted into gaps in wall faces), pointed (with lime mortar introduced into gaps within wall faces), mortared (often with cement inserted into voids within wall cores or onto the tops of walls) and supported (with steel or bronze bars supporting lintels for example) will help to understand the differences between *unconsolidated ruin* and *consolidated structure*.

Undertaking independent research and questioning the evidence is very important – each generation rewriting history in their own way, and, as noted by the archaeologist Dennis Harding, consciously striving to *"generate new questions, new ways to challenge the evidence and seek new insights into key issues"* (2020, 263).

Learning suggestions

- You could predetermine what brochs are investigated across your learning group, to ensure a good geographical spread, or focus on brochs local to you. Use pastmap.org.uk to explore your area.
- Ask your learners to imagine their own broch community. Remember, the 'happy nuclear family' presented here is just one of the many family models that could have existed in the past.

The remote Dun Suladale is an *unconsolidated ruin*, without modern intervention. It retains a much greater degree of authenticity and integrity – but is at risk of gradual unrecorded decay and is itself a potential risk to visitors. Many of our brochs and duns are in a similar condition. Often unrecorded by archaeological measured survey, the components of their architectural narrative are hidden by collapsed rubble and scrub vegetation.

The following short personal features can be used as short reading tasks in the classroom. Ask your learners (individually or in pairs) to read and discuss one of the short features. Learners should become familiar with the concepts defined by our keywords, and will gain an insight into individual career paths in archaeology and conservation.

Archaeological narrative

- *archaeological record:* comprising site descriptions, historical documentation, excavation records and artefactual evidence.
- *architectural tradition:* the aspects of building design that define a type or series.
- *defended homestead:* the function of a broch described in this booklet, implying a secure domestic use.
- *display architecture:* a building type that is designed to impress.
- *material culture:* the objects and artefacts associated with the broch builders.
- *phases of occupation:* the various episodes of occupation, disuse, alteration and repair that can occur before the final abandonment of any individual site.
- *productive household:* a successful and self-sufficient extended family unit.

Structural narrative

- *destruction process:* actions such as collapse, stone robbing or coastal erosion that occur after the final abandonment of any individual site.
- *moment in time:* an individual event within the timespan of a broch.
- *structural components:* the individual features that define a broch.
- *structural engineering:* the construction techniques required to build a broch.
- *unconsolidated ruin:* a site that has seen limited or no masonry conservation.

Conservation narrative

- *archaeological visualisation:* a reconstruction drawing or illustration that seeks to balance factual understanding and creative engagement.
- *conservation management:* work to protect an archaeological site from damage or improve its condition.
- *consolidated structure:* a site that has seen masonry consolidation and repair.
- *digital documentation:* the accurate survey of an archaeological site or structure using techniques such laser scanning.
- *heritage interpretation:* the presentation of information about natural and cultural heritage.
- *measured drawing:* the detailed recording of a site or excavation in plan, elevation or section.
- *survey control network:* the framework of survey stations whose coordinates have been precisely determined and are considered definitive to the project.

Reading Caisteal Grugaig

ARCHAEOLOGIST **MATT RITCHIE** DESCRIBES THE THINKING BEHIND RECENT CONSERVATION WORK AT CAISTEAL GRUGAIG IN THE HIGHLANDS

The broch of **Caisteal Grugaig** overlooks Loch Alsh, near Skye. It was built against the slope, and its entrance faces out over the water. It now stands higher at the rear, its lower sections having partially collapsed. The broch boasts an iconic triangular lintel, set above a well-preserved entrance passage. A scarcement ledge can be seen running around the inner walls, although this is visibly distorted due to the structure gradually slipping downslope, part of its structural narrative. An intramural stairway rises to reach the upper level, accessed by stepping through an entrance below a stacked void. As the ground surface inside is rocky and uneven, rising towards the rear, the upper floor, resting on the scarcement ledge, would probably have been the main living space. The ground floor could have been used for storage or to shelter animals over winter.

After *digital documentation* by laser scanning, the broch was subject to a flexible programme of prioritised 'light touch' drystone masonry consolidation. The method statement we drafted for Caisteal Grugaig set out the context for this *conservation management* and described the methods that were used to identify, prioritise and record the work. The project aimed to:

- Carefully consolidate displaced stones within the walls and on the wall head, replacing and tightening pinning stones where necessary without losing the authenticity of the structure.
- Stabilise (where possible) critically weakened load-bearing elements such as the lintels spanning important passages, chambers and niches.
- Record all of the areas impacted by the conservation works using laser scanning, before and after fixed point photography and by annotating the record sheets.

The *conservation management* at Caisteal Grugaig meant striking a careful balance between authentic ruin and interventionist consolidation. This has made safe some of the larger displaced stones, and repaired some of the failing wall facing. The walls, passages and cells have now been repinned and stabilised, and displaced stones have been realigned on the wall head. However, areas of collapsed rubble have been retained. To protect the masonry and any buried archaeological deposits below, small trees and saplings were removed, and scrub vegetation was cleared, as their roots can cause disturbance. The dynamic *destruction process* of structural ruination has been slowed but not halted or reversed.

As a well-preserved but essentially *unconsolidated ruin*, Caisteal Grugaig has an important authenticity and integrity. Its extensive structural narrative allows a comprehensive understanding of the period between construction and collapse. Retaining these aspects was a really important element of the conservation project, allowing the visitor to enjoy the broch and read its story within the ruins.

◄ **Caisteal Grugaig** © Lynn Fraser

Consolidating Dun Carloway

REGIONAL WORKS MANAGER **GAVIN DOUGLAS** DESCRIBES THE IMPORTANCE OF SMALL PINNING STONES IN DRYSTONE CONSTRUCTION

Mother nature doesn't do much to help a broch. From the very day that the broch is built, gravity will try to pull it down, plants will start to grow on its walls, birds and small mammals will make nests for themselves, and wind and rain will cause erosion. Over the centuries, this natural *destruction process* has often included stones being taken or robbed to build new structures nearby.

The conservation of brochs aims to protect and preserve the structures as they stand in the present day. Every broch has its own challenges to overcome and all have different structural forces at work, but, broadly speaking, the higher the broch, the more complex the issues become. This is especially the case where only a section of the broch remains standing, but without the rest of its circuit available to spread the forces of gravity out to.

The broch of **Dun Carloway** sits high up on a hillside on the west coast of the Isle of Lewis in the Outer Hebrides. It has seen much *conservation management* over the years, and the condition of the high wallhead today is considerably more stable than it was at the end of the 19th century. These conservation works have included simple maintenance, such as the replacement and tightening of pinning stones, and major interventions, such as bedding the wallhead stones in cement mortar. The introduction of solid mortared masonry into a drystone ruin is far from ideal, as areas of the now *consolidated structure* will expand, contract and react to external forces with differing degrees of movement. It was necessary at Dun Carloway because such a large unsupported section of the double walls remained standing – over which visitors were climbing, displacing stones and causing damage.

Brochs were built using a drystone construction technique that requires each stone to be laid on a stable base, with contact points where the stone sits on the stones beneath it and friction points where the stone touches those around it. Over time, the whole structure will move with gradual settlement, the thermal actions of hot and cold weather on individual stones, and the later addition or removal of stonework. The resulting movement can change the way in which gravitational force is passed through any individual stone by changing its contact points and friction points – changing its stable relationship with the surrounding masonry. These changes in force can make the stone split vertically, or cause wider movement in immediately adjacent areas. In turn, this can have a domino effect on larger areas of adjacent masonry, and while this may not happen immediately, over time such movement can accelerate decay and collapse.

To help manage this effect, small pinning stones are used to fill voids between larger stones, wedged in place to create more friction within the structure. However, pinnings are very susceptible to movement themselves, and regularly become loose and need to be continually tightened. Indeed, it's quite common to find loose pinnings on the ground around a broch, especially after a severe storm. So replacing and tightening the pinnings in a broch needs to be done regularly, carefully inspecting both the internal and external faces of the broch walls and ensuring that the whole structure is tightened sequentially, as any areas that are missed by mistake and left loose would create weak points. Replacing and tightening the pinning stones is just normal maintenance – we do it today just as the original broch builders did it in the past.

◀ **This photograph of Dun Carloway was taken by the Scottish historian and antiquarian Erskine Beveridge in 1900, prior to any modern consolidation works.**

The basics of tightening pinnings are very simple – ideally they are just tapped back into the space that they came from – but over-tightening can cause even more problems, once again changing the contact points and friction points of the surrounding masonry. As a result, replacing and tightening pinnings should only be carried out by an experienced stone mason or drystone waller.

Recognising where a broch has been repinned, pointed, mortared and supported helps us to understand the structural narrative of its *conservation management*. However, while it can be easy to look at an area of masonry that has just been consolidated and see that it is very obviously a modern intervention, it is much harder after two or three decades have passed and moss and lichen have colonised the surface. Tracing the story of conservation in the walls of a broch is very satisfying, like reading the site diaries of my predecessors in the job. I like to think about our work being read in the same way in the future!

Dun Carloway ►

Rescuing Clachtoll

ARCHAEOLOGIST **GRAEME CAVERS** DESCRIBES THE EXCAVATION AND CONSOLIDATION OF AN EXPOSED COASTAL BROCH

The broch of **Clachtoll** is one of the relatively few brochs found on the west coast of Sutherland, the most northerly and westerly part of the Scottish mainland. Built on coastal rocks and facing the brunt of storms crashing in from the Atlantic, the massive wall of the roundhouse has been partially destroyed by the sea, filling the interior with rubble and leaving the *unconsolidated ruins* in a fragile and unstable state.

When local community heritage group Historic Assynt contacted us to ask about the prospect of carrying out *conservation management* at Clachtoll, there were a lot of immediate issues to consider. They were rightly worried about the state of the broch, as unstable lintels and loose stonework were a danger to the many visitors who walk out to visit the site each year. The effects of visitors climbing over the broch walls and the ongoing pounding that the site receives from winter storms were a further cause for concern, and it was clear that the broch was likely to suffer another significant collapse. A broch's *structural engineering* relies on the completeness of the circular tower for its strength, and the partial collapse at Clachtoll had left precarious lintels and unstable masonry. Unless work was carried out to stabilise the fragile walls, there was a real danger of further collapse and major damage to the broch.

Consolidating the broch wasn't going to be straightforward or easy. The broch still stands to almost 5 m in height in places, while the interior was filled to the level of the surviving wall head with rubble. Built directly onto the bedrock knoll and spanning some deep clefts in the rock, a huge hole had appeared in the base of the wall on the south side, directly adjacent to the stair cell, and the only way to repair this was to dismantle the wall so that permanent supports could be put in place. But like unravelling an archaeologist's knitted jumper, if we were to pull at this thread, many more would come loose. Dismantling this section of walling meant that the layers of evidence buried beneath the rubble would be disturbed and would require excavation. We would need to deal with the conservation of the structure as a whole, carefully excavating and recording the deposits and stonework in advance of repairing and supporting the walls.

Archaeological excavation is always destructive: it can only be done once, and when walls that have stood for two thousand years are dismantled, they are irreversibly changed. It is the archaeologist's responsibility to make sure that accurate records are made, that every stone, soil layer and artefact is recorded to the highest standards possible at the time, so that the maximum amount of information about the site and its *phases of occupation* is obtained.

In order to dismantle, excavate and stabilise the broch safely, we needed to fully understand the original *structural engineering*. If we moved that stone, what would hold this one up? To make this one safe, we will need to make sure that one is supported. If we lift that lintel, what will it destabilise? Like the broch builders themselves, we wanted the walls to stay standing and avoid getting crushed by tonnes of falling stone. So it was important to think through every move before doing it, and collaboration and teamwork were essential in everything we did.

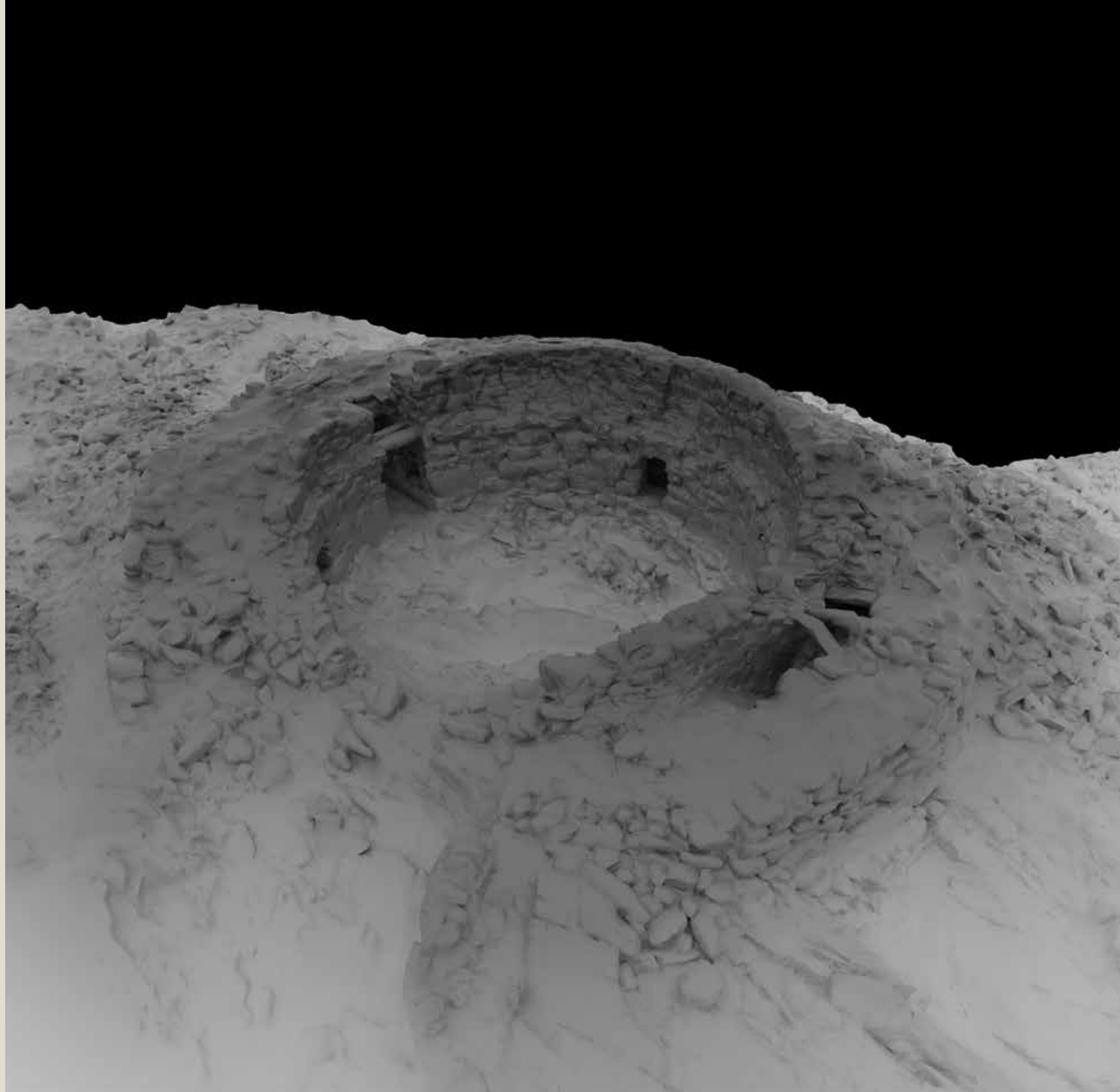
◄ **Clachtoll** © John Town

Analysing individual stones and their arrangements in corbels and cantilevers brought us closer to an understanding of the structural narrative of the broch – of the ways the building had been modified and changed from the original design, and the weights and forces that keep it standing today. With the advantage of modern *digital documentation* technologies like laser scanning and 3D modelling, which allowed us to record the positions of every stone and pore over them on a laptop each evening, we could talk through the next day's plan and work out the strategy for carrying it out safely. With the input of an experienced stonemason and the willing workforce provided by our volunteers and staff, our team must have looked very similar to that of the original broch builders. The chin-scratching and sucking of teeth that took place when standing around a broken lintel stone in the summer of 2017 might have been closely matched by the group standing there in the Iron Age, over two thousand years earlier.

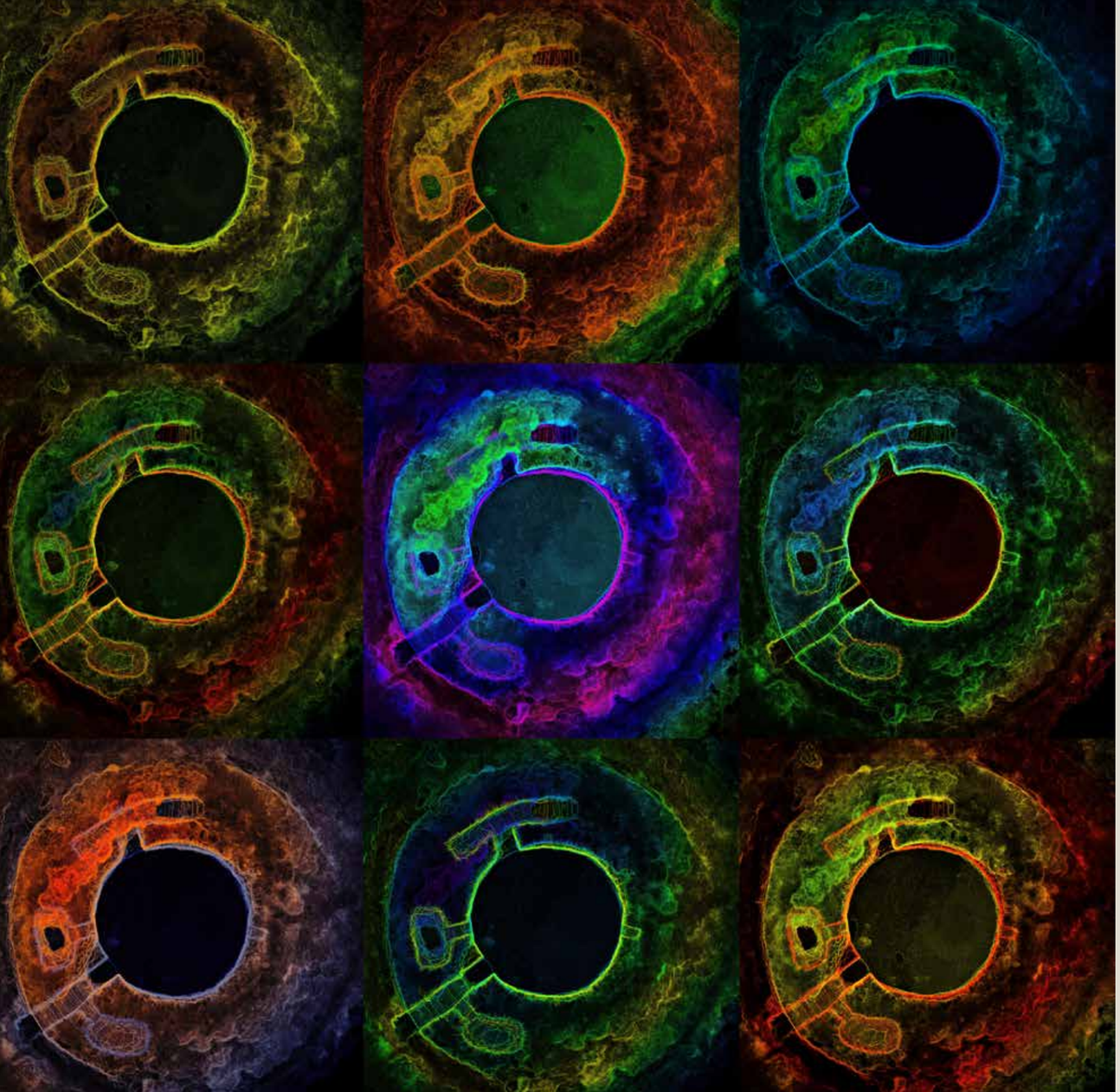
It's hard not to be impressed by the effort involved. The excavation team had to move 300 tonnes of rubble to clear the interior, including many large stones that took six people to move. The technique we devised for doing this involved using a rope cradle with six lead ropes, allowing a team to lift very heavy stones a metre or so at a time. We were glad for the benefit of steel-toed boots, gloves and hard hats, and often wondered what a crushed foot or arm might have meant for an unprotected original broch builder.

Through the careful excavation of the spectacularly well-preserved floors, retrieval of hundreds of artefacts and the disentangling of partially collapsed structures, the broch's archaeological narrative unfolded. Perhaps built as early as the 4th century BC, the broch had suffered several collapses during its use, and was rebuilt on multiple occasions. The final occupation ended sometime around the year 1 BC/AD, in a huge fire that completely destroyed the building. We'll never know what caused the blaze, a key *moment in time* in the story of Clachtoll – but no one returned to rebuild once more, and the broch lay abandoned from that point on.

Through investigations at the broch and analysis of the findings we have pieced together the archaeological and structural narratives of an important prehistoric settlement in an area where few brochs have been studied. But our work at the broch was about more than just the stabilisation and protection of the physical remains. Sharing the appreciation of the building and the history it witnessed over two millennia ago, and the stories its investigation has presented to us, are essential elements of the new conservation narrative and how we relate to this place. The *consolidated structure* is now stable and safe for visitors to enjoy, while the information it contained has been retrieved through archaeology before it was lost to the sea.



This model of the broch of Clachtoll shows how constant erosion by sea and tide can easily 'carry away another stone' of the broch walls. Without excavation, the fragile archaeological deposits within the exposed and vulnerable interior would have been lost.



Conserving Ousdale

KENNETH McELROY FROM THE CAITHNESS BROCH PROJECT TELLS THE STORY BEHIND THE CONSERVATION OF A CLASSIC COASTAL BROCH

I have been interested in the archaeology of Caithness for as long as I can remember. It's my landscape, my place and my home. I was particularly taken with the county's many brochs – once towering houses, vertical villages, alive with people, but now most no more than lumps of rubble and earth. Every broch I visited seemed to bring with it new understanding and a better appreciation of our archaeological heritage.

One cold and frosty morning in winter, my friend Iain and I went to visit the broch of **Ousdale**, set in moorland above the coastal cliffs along the east coast. I was really excited to explore this broch, one of the best preserved in Caithness. But our hearts sank when we arrived. The broch was close to collapse. Stone was strewn across the entrance, and the broch's stonework was warped and bulging in places, with tree roots pushing out the masonry. Iain couldn't believe that this was the same broch he had visited only a few years prior. We were sorely disappointed – this was meant to be a jewel of Caithness' heritage. We resolved then and there to do something about the broch of Ousdale, unless it was already too late…

A follow-up visit to the broch with a specialist from Historic Environment Scotland gave us some hope, as they believed that the broch *could* be saved. But time was of the essence and, given the challenges involved in such an ambitious *conservation management* project, we needed professional advice. Structural engineers and conservation architects helped to assess the damage before planning the next steps towards saving the broch.

After detailed plans were drawn up by the conservation architects, the first job was to remove the mountain of debris and rubble which had spilled from a collapsed buttress beside the entrance. As the stonemasons sifted through the stonework, Iain and I reflected on the skills and abilities of the original broch builders. The buttress had been constructed in the 19th century, to protect the antiquarian archaeologists then excavating the broch. It is revealing that while most of the original broch has stood for over two thousand years, the first part to collapse was barely only a century old!

The collapse of the buttress led to the collapse of the entrance, which had to be carefully rebuilt by the stonemasons. The work took several months, through the spring and into the summer. Lugging stones, one on top of the other, the stonemasons heaved and shimmied the slabs into place, constantly checking and re-checking, before locking them into their final position. Sometimes the walls weren't reconstructed quite as once was but were put back together in a way that was safe, sympathetic to the original structure, and made apparent that the work was modern intervention.

Because of the nature of drystone construction, the collapse meant that other areas of the broch had started to subside and sag. The stonework moves and shifts before settling into place; the broch is not a static structure.

The stonemasons fixed this by repinning the stone courses, but this time using small pieces (called pins) of super-tough jarrah wood, the same wood used for railway sleepers. These were tapped into specific points to help support and strengthen the structure. Over 200 individual pins were knocked into the broch walls, although you'd need a keen eye to spot these pins from the stonework.

To help understand the current state of the broch, as well as having a detailed record of the entire structure, we asked archaeologists to undertake *digital documentation* by laser scanning. This means that if there are any problems with the broch in the future, we can use the scan as a point of reference. And, aside from providing an important baseline record of the *consolidated structure* for future generations, the results of the scan were magnetic, beguiling and beautiful – a broch-shaped kaleidoscope of colour that would have made Andy Warhol proud!

◄ **Ousdale** © AOC Archaeology

Surveying Mousa

DIGITAL INNOVATION SPECIALIST **SOPHIA MIRASHRAFI** DESCRIBES THE SURVEY OF AN ICONIC BROCH IN SHETLAND

It's not every day that fieldwork begins with a boat ride and a wheelbarrow! In the midsummer of 2018, a small team of archaeologists and surveyors travelled to the broch of **Mousa**, located on a small island just off the coast of Shetland. With scanner and cameras packed safely in their protective cases, the journey across the water to the island was calm and uneventful. Once disembarked onto the island, we were offered a small wheelbarrow to cart our equipment the short walk to the tower, an iconic *consolidated structure* and the best-preserved broch in Scotland. Once there, the real work of *digital documentation* could begin.

The Digital Documentation team records the heritage in the care of Historic Environment Scotland in 3D, as accurately and in as much detail as possible. The 3D data we create is an accurate record, and this is used to inform both *conservation management* and *heritage interpretation*, as well as helping to improve virtual accessibility. The process of documenting such a large and complex structure as the broch of Mousa was accomplished through a combination of *digital documentation* techniques: terrestrial laser scanning and photogrammetry.

◄ **This model of Mousa combines the point cloud created by laser scan survey with photogrammetric texture.**

Laser scanning

Laser scanning is a technique that allows the 3D surface geometry of objects, buildings, sites and landscapes to be recorded in a digital form. A laser scanner works by emitting a beam of laser energy onto a surface, then analysing the wave form of the reflected light to provide a measured distance. It does this up to a million times per second, rotating 360 degrees. Each measurement point has an XYZ coordinate in 3D space, which come together to create what's known as a point cloud, accurately defining the surface geometry. The laser scanner works on the principle of line-of-sight, so scans must be taken from multiple positions with sufficient overlap to be able to obtain the complete coverage of a site, and to allow scans to be joined together. To record the geographical position of the site, and of the different positions we scan from, we establish a *survey control network* and georeference our scan data within a known coordinate system. While seemingly straightforward, the size, shape, and texture of the broch offered unique challenges to its effective capture.

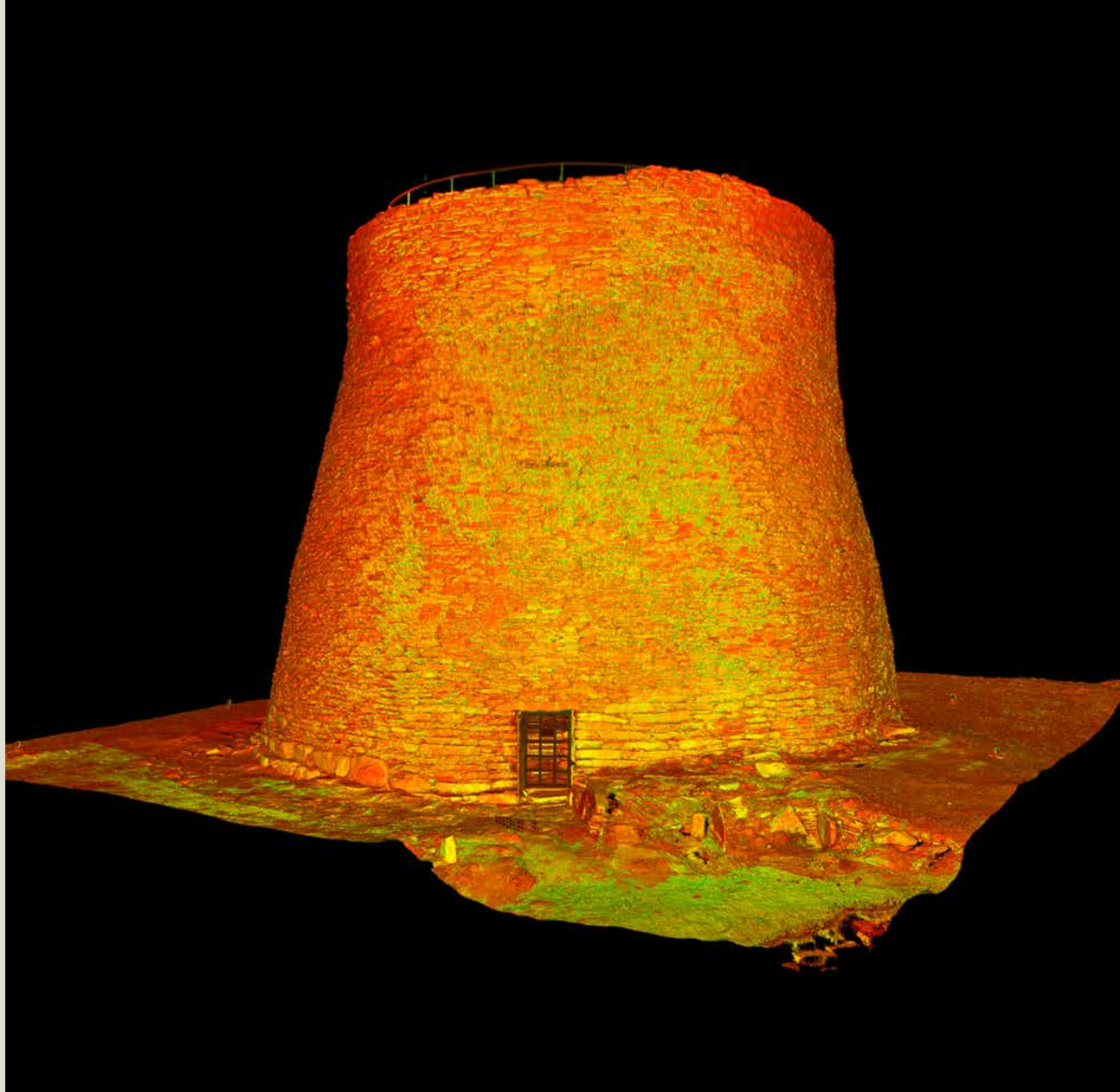
Photogrammetry

Photogrammetry involves capturing multiple overlapping digital photographs that are then processed using special algorithms to calculate individual camera positions from the photos and combine them into one 3D space. This alignment process allows the creation of a high-resolution colourised 3D point cloud with detailed surface geometry. We generally use cameras on tripods or drones to generate photogrammetric models. At Mousa, we used a camera mounted on a tripod to take the hundreds of photographs required. The weather was bright but overcast, and acted as the ideal natural light box, ensuring that there were no harsh shadows in the texture of the final model.

Back in the office, we used specialist software to combine the highly accurate laser scan data with the detailed photogrammetry to create a photorealistic representation of the site in 3D. From this baseline 3D dataset, we can monitor change over time with comparative scans and offer virtual access to a difficult-to-reach structure.

But digitally documenting the physical broch was only one part of our job. We also used a 360-degree camera to provide immersive imagery for virtual tours in and around the broch, and a 3D sound recorder to document what can be heard onsite. After a long and busy day spent surveying the broch, we set up to record the sights and sounds of the midsummer evening, capturing the *moment in time*.

Beyond the sound of the waves gently lapping against the shore, you can also hear a colony of storm petrels, the modern tenants of this ancient dwelling. While relatively quiet during the day, at twilight the broch becomes spectacularly alive with the call and quick wings of the birds coming and going from their tiny nests tucked into niches within the drystone walls.



The point cloud of Mousa. ►

Recording Old Scatness

ARCHAEOLOGICAL ILLUSTRATOR **ALAN BRABY** DESCRIBES THE MAMMOTH TASK OF DRAWING A BROCH VILLAGE

It was always going to be a challenge to excavate and record the large multi-period site at **Old Scatness** on the very south end of Shetland, especially when we knew it had an Iron Age broch at its core. The surrounding broch village comprised a number of smaller drystone roundhouses. The broch village was then superseded by later wheelhouses and multi-celled buildings, which were in turn built over by a Viking settlement. Unpicking all the different *phases of occupation* took skill and patience, creating an *archaeological record* of the various structures through careful excavation, photography and *measured drawing*.

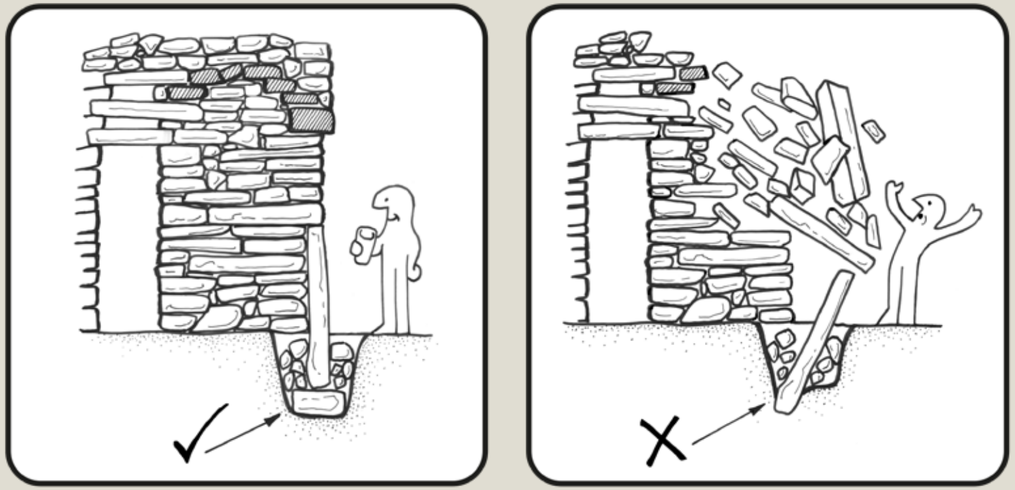
Recording the complex excavation was standardised over the ten summer digging seasons, so that the resulting composite site record was easy to analyse. Horizontal planning was tied to the site grid and *survey control network*. It was undertaken at a scale of 1:20 (where 1 cm on the drawing represents 20 cm in real life on site), and drawing vertical sections and elevations at a scale of 1:10. Initially we were able to plan normally, using paired grid pegs either side of the trench, taping between them and dropping points in at one metre intervals. This worked reasonably well for the first few seasons, although it soon became problematic on anything other than a calm day with no wind.

◀ **The settlement at Old Scatness spans several hundred years. The broch was first surrounded by smaller stone roundhouses, which were then replaced by wheelhouses and cellular buildings. This resulted in a complex series of overlapping structural remains, with later buildings being built over or into earlier ones. Creating a *measured drawing* of the settlement as it was being excavated combined a formal site grid with a number of informal 'floating' baselines.**

As the seasons progressed and our trenches expanded, we started to get down into structures that were often preserved over head height, and it became impossible to continue drawing this way. Frequently the level string line between grid points would be high in the air, and the tapes would flap around dangerously in the wind. We had to abandon the site grid for planning entirely, opting for an innovative new method which is now commonplace on similar complex excavations. Rather than treating the whole site as a single unit, with drawings fitting into a fixed grid system, each structure was now treated as an individual unit. If a floor surface needed to be recorded, a simple 'floating' baseline was inserted with a fixed point at either end, a tape laid out and planning commenced with extra points added as required until the surface was fully drawn. The location of every artefact recovered during the excavation was recorded in 3D for the small find database, and it was simple to 3D record the ends of each individual baseline. In this way, no matter the angle or height of individual baselines, they could be spatially located and drawn up as a composite whole site plan later.

Throughout all the digging seasons we had a dedicated planning team, with a planning hut where we kept all the required equipment – measuring tapes, drawing boards, planning frames, tracing paper and stationery. Having a dedicated team and all our equipment in one place meant that everything was to hand and ready to go. As the planning supervisor, I was responsible for the bulk of the drawing and for teaching the students how to plan and record sections (the vertical rather than horizontal record of building remains and stratigraphy). Some of the students proved to have a great natural ability for technical drawing and planning – they produced clear and accurate drawings and were reasonably quick. These students were offered more responsibilities in future seasons and became proficient planning assistants and teachers in their own right, passing their skills onto the next generation of students that came to work at the site.

The excavation of Old Scatness was an amazing experience. However, it was also very challenging. We had to be extra careful where we stood and walked, because there were so many deposits and features we were trying to record, and some of the structures had restricted access or were difficult shapes to work in. There were also numerous occasions when the wind was howling and the rain was coming in sideways and the site was 'rained off' – although the poor planning team were normally left on site to get the planning finished. Sturdy boots, good waterproofs and a sense of humour were all essential!



▲ **A simple but effective instance of clever *structural engineering* ensures the stability of the whole wheelhouse. By placing a large flat stone under the base of the slab of stone standing at the front of each pier, the weight of the pier and roof above it is supported. Without this stone, the vertical stone slab is driven downwards, causing the pier above to collapse.**

This fine replica wheelhouse was built at Old Scatness by Shetland Amenity Trust. ►

Interpreting Gurness

CULTURAL RESOURCES ADVISOR **RACHEL PICKERING** DESCRIBES RECENT WORK TO PRESENT A FAMOUS BROCH VILLAGE ON ORKNEY

Many of the best brochs in Scotland are cared for by Historic Environment Scotland. As one of the first types of archaeological site to be considered for protection and presentation to the public as nationally important heritage, their conservation narratives often stretch back over one hundred years. Maintaining and interpreting these *consolidated structures* poses many opportunities and challenges. My job is to ensure that the archaeological value of these sites is carefully managed, that they are protected for now and in the future, and that the fascinating stories of these sites is shared and celebrated. Our ancestors invested a great deal in designing and constructing these monumental buildings, and it is now our duty to ensure they survive for future generations to visit, explore and enjoy.

One of the biggest challenges that we face is how to present these complex sites (often with several different *phases of occupation*) to visitors in an accessible and easy to understand way. We want to ensure that everyone who visits these sites can understand what they are looking at, when it was built, how it was used and what it may originally have looked like. A great deal of work goes into the preparation of our *heritage interpretation* – especially the *archaeological visualisations*, scale models and reconstruction drawings, which are a powerful and effective way of helping people to imagine and understand these sites. It takes a whole team of people to produce this interpretation, from our interpretation experts to external specialists and the artists themselves.

We recently updated the *heritage interpretation* at the broch of **Gurness** on Orkney, drawing on the latest archaeological research to create a scale model of the broch and village, and produce several new artist's illustrations. Usually we show complete brochs – often as a cut-away image to show how they may have looked inside – but this time we wanted to experiment, to show something a bit different. We decided to depict the broch under construction.

In addition to my own research, drawing on archaeological evidence from Gurness and other broch sites on Orkney and the Atlantic coast, I worked closely with other archaeologists and specialists to build up a base of evidence which would inform the artist's brief for the illustration. We then worked together to develop the reconstruction, focusing on the lower levels of the broch tower during construction.

Researching any project like this throws up just as many questions as answers. Where did the stone come from, and how was it brought to the site? Who was involved in building the broch? What was the surrounding landscape like – and what other structures were contemporary? What methods were used to construct the walls? Some of these questions are easier to answer than others!

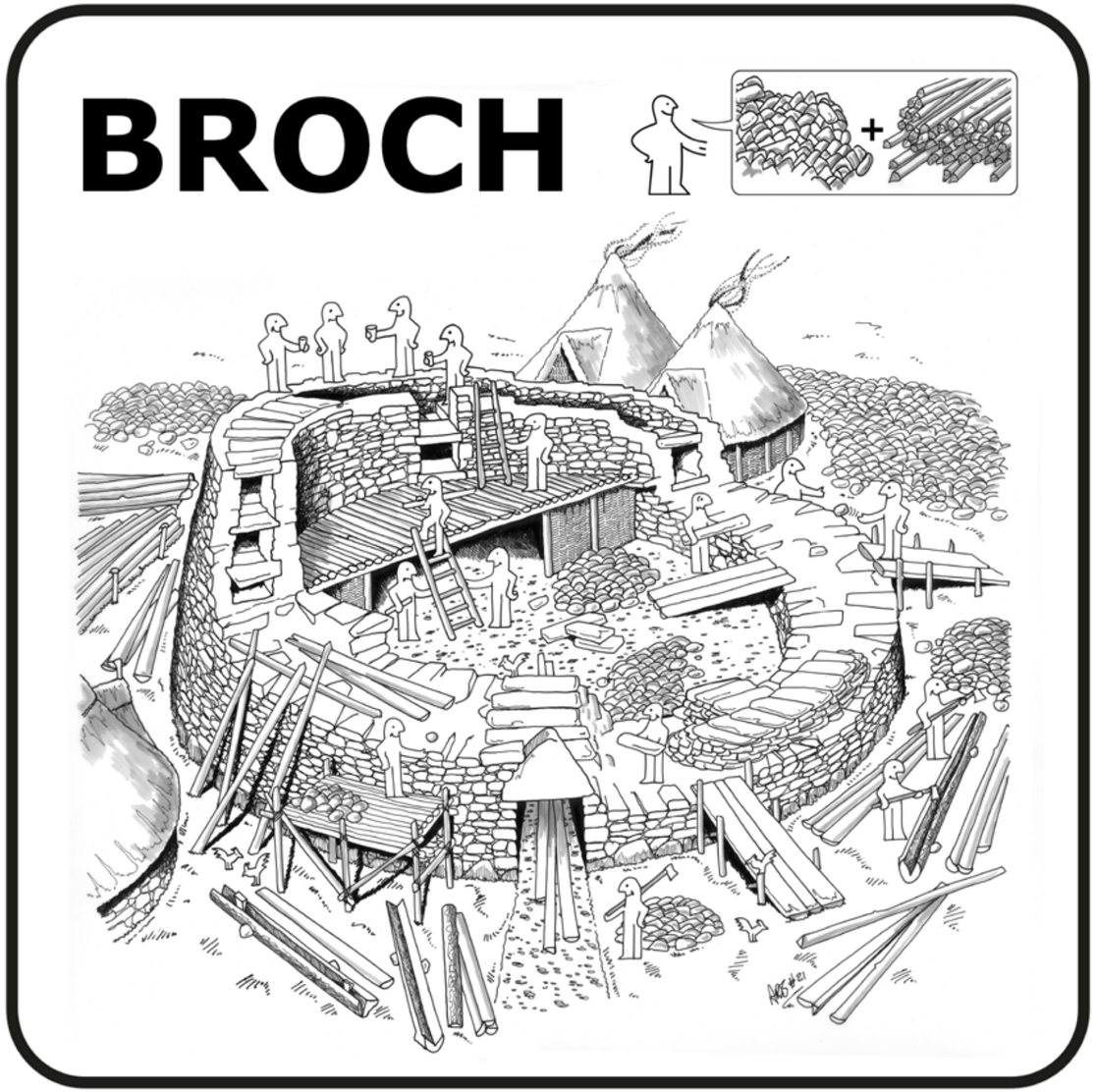
We decided to show the lower walls of the broch tower being built course by course by a mixed workforce, with both the inner and outer walls constructed concentrically at the same time. The whole community could feasibly have been involved – although we also chose to suggest that one individual was in charge, perhaps a head builder or architect controlling the whole scheme. We show the use of wooden ramps or ladders that may have been used to lift stone and provide access to the wall-heads as construction progressed. And we chose to show the use of animals to transport some of the materials.

◄ **Gurness** © Hamish Fenton

As far as possible, from the appearance of the stonework to the inclusion of *material culture* like appropriate objects and clothing, and the vegetation in the surrounding landscape, we always try to base our reconstruction drawings on appropriate evidence. But there is always a degree of educated guesswork, because the evidence is often ambiguous or limited and so many questions remain unanswered. We always seek authenticity in our illustrations but recognise it is impossible to ever get it completely 'right'. The important thing is to get people thinking and talking!

I love working with these fascinating structures. Collaborating with colleagues from different backgrounds and specialisms encourages me to look at the archaeological remains in a new way. I can't count the number of times I've been asked a question about something I'd never really thought of before! Working through these puzzles to create new *archaeological visualisations*, develop new *heritage interpretation* or tackle difficult *conservation management* issues helps us to engage with these enigmatic ruins.

The scale model of Gurness by Paul Tyer from Peedie Models; and the new *archaeological visualisation*.



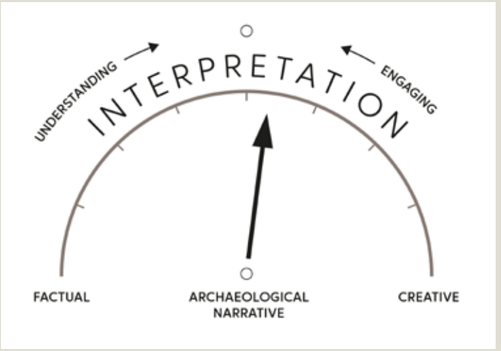
Imagining Dun Seanchas

WORKING TOGETHER, **MATT RITCHIE** AND **ALAN BRABY** UNPACK THE METHODOLOGY BEHIND THEIR ARCHAEOLOGICAL VISUALISATIONS

We love working together to imagine life in the past – working out what to include in the image and planning the visual story it will tell. A good *archaeological visualisation* will have a central narrative theme, a composition rooted in archaeological reality and a creative, engaging style – and although the blend will change depending upon subject matter and artistic style, it's really fun finding the right balance.

Archaeological visualisations are an important element of *heritage interpretation*, presenting and explaining information about natural and cultural heritage. Because interpretation is often most memorable when it is provocative, it must be accurate and honest to the evidence, but it must also be compelling and interesting, creating connections between the audience and the subject matter by stimulating or provoking an emotional response.

Some visualisations focus on life inside a historic building, on the objects and *material culture*, or on the clothes that people wore at the time. Some focus on the architecture, on its walls and structures. Some try to set the site within its contemporary landscape. Others illustrate a historical event, a *moment in time* or an archaeological idea or process. So the same site could be illustrated by several different drawings, each showing a different aspect of its history. But each drawing should have an archaeological narrative – a purpose such as a theme to explore or a story to tell.



To prepare a visualisation with an archaeological narrative, the archaeologist and the artist must work together as a team to balance factual understanding and creative engagement.

- The factual element is educational and informative, using archaeological information and methodology to lead to understanding.
- The creative element is inspirational and imaginative, using narrative and drama to lead to appreciation and emotion.

The two elements are often balanced by using a central theme, particularly when describing a historic place or site. Themes can focus on an event that took place at the site; on the site itself, explaining its construction or architecture; on its setting, showing the site in its wider contemporary landscape; or on an idea, explaining an archaeological concept or process.

Using a narrative cutaway style

Our core set of illustrations aims to help imagine the building of **Dun Seanchas**, and the various *structural components* involved. The central theme of this series is construction, and our anonymous builders have been deliberately designed not to distract from this purpose. Our narrative cutaway style allows the construction sequence to be best appreciated – from laying the foundations through suspending the timber floor to raising the roof. The cutaway is part of the story and not an intrusion. We also wanted to emphasise the huge quantities of stone and timber required, and these are depicted within the surrounding building site as ever diminishing piles. The building of the broch can be compared to the building of the wheelhouse, where only limited amounts of timber or driftwood was used.

Using survey to inform

Archaeological measured survey creates a baseline record that can inform research, *conservation management* and condition monitoring. The results can include maps, site plans, architectural elevations and 3D models. Creative *archaeological visualisation* can take these products one stage further. We used the *digital documentation* of **Caisteal Grugaig** to inform the layout of Dun Seanchas, rooting the reconstruction drawings in reality.

Using colour to connect

Lizzie Robertson used warm colours, contrasting light and shadow, and the texture of the timber fixtures and fittings to explore the domestic character of Dun Seanchas in the manner of an estate agent's property brochure. Daylight from the morning sunrise captures the dust dancing in the welcoming open doorway, while night time firelight escapes from the guard chamber and lamplight illuminates the top of the stairs. The first floor is snug and cosy, the roof is warm and dry, and the barred door is safe and secure. The broch is no longer an old ruin but a new home.

Using characters to relate

Alex Leonard populated Dun Seanchas with our extended family, imagining their first meal together around the hearth. The image blends the towering architecture of the broch's interior with the homely domesticity of cooking over the embers. The feeling of having just moved in is palpable.

Archaeology calling

SIMON GILMOUR, DIRECTOR OF THE SOCIETY OF ANTIQUARIES OF SCOTLAND, LOOKS TOWARDS THE NEXT GENERATION OF ARCHAEOLOGISTS

This book has told a story about building a broch. Using evidence carefully gathered by many different archaeologists over many decades, it paints a remarkably compelling picture of an imagined *moment in time* over 2,300 years ago. However, there's still a lot we don't know, like why, when and where did people start building broch towers? Who was involved, and who were the people who lived in these magnificent buildings? Why did brochs stop being built and why the dramatic change from tall domineering structures to low buildings like wheelhouses? And how did these communities interact with their wider world?

Brochs, roundhouses and wheelhouses are only part of the broader Iron Age realm; there are also hillforts, promontory forts, souterrains (underground cellars) and crannogs (island dwellings). There is also an enormous range of *material culture* to explore, from the remains of a princely chariot burial found at Newbridge outside Edinburgh, to Roman glass beads found at the Cairns broch in Orkney. And the Iron Age is only one part of the fascinating story of human activity on this land we now call Scotland. There's still plenty to discover, and perhaps you are just the person to find out!

Archaeologists are constantly adding information to the picture of the past and bringing it into focus. Anyone who studies the human past through material remains is an archaeologist, even people who perhaps wouldn't consider themselves as such. Archaeology is a process with an enormous number of different techniques, expertise and points of view; even a quick look at this book makes clear the wide range of different skills, ideas and processes that can be brought to bear – and that's just on researching brochs!

There are numerous career paths and opportunities in archaeology; you will find archaeologists working in universities, conservation charities, national and local government bodies, commercial companies and private enterprise. Archaeological research is conducted through the planning process ahead of building developments, by universities and colleges and by local community volunteers. It has its own *Chartered Institute for Archaeologists* that ensures standards of work and proficiency, just like architecture, engineering and other professions. Archaeological skills are transferrable, meaning you will find archaeologists in all walks of life. And by using cutting-edge technology and ever-evolving methodology and expertise, archaeology is always pushing the boundaries of what can be discovered, and how it can be analysed and presented.

There is an entire industry waiting for anyone with an interest in discovering and sharing information about the past – and we hope that by telling stories like the one in this book, we can inspire a whole new generation into taking up the trowel or setting up the laser scanner, looking down the electron microscope or even using the remote sensing satellite, and to help people learn about and learn from the past. Could you have an archaeological calling?

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The conservation work at **Caisteal Grugaig** was undertaken by Forestry and Land Scotland as part of our stewardship of Scotland's national forests and land. The conservation work at **Clachtoll** was organised by Historic Assynt as part of the Coigach and Assynt Living Landscape Partnership. The conservation work at **Ousdale** was organised by the Caithness Broch Project and funded by Historic Environment Scotland. Successful partnership working supports the delivery of *Our Place in Time: the Historic Environment Strategy for Scotland*, through *Scotland's Archaeology Strategy* and the *Historic Environment Skills Investment Plan*, helping to ensure that our heritage is passed on with pride to future generations.

◄ ***"The lichen was cut first, to show white paper, and then light green, mid green, blue, pale grey, mid grey, and finally black, all from one block,"*** **explains the artist Liz Myhill.** ***"They were printed in that order so that the green would have white paper shining through from behind to make it as bright and zingy as possible. I knew I'd be printing several different tones of grey on top so it wouldn't matter if the background was unevenly inked, as it would be covered over by another two layers and textures. It's often a challenge with multiple colours to decide which need to go down first so that the colours stay true and aren't affected by the ones in lower layers."***

Step back in time to imagine the construction of a broch in stone and timber, and ask yourself what it meant to build a broch.

Brochs are a truly unique aspect of Scotland's rich prehistoric tapestry. They are part of an Iron Age settlement pattern of defended homesteads found all along the Atlantic coast of Scotland. They were commissioned by well-to-do productive households and constructed by experienced builders.

The authors explore the archaeological investigation of brochs, considering both architectural design and structural engineering, and explain how we can read the ruins today, describing the various structural components that can be found in both unconsolidated ruins and consolidated structures. Fictional voices from the past describe the building of a broch, while contemporary voices from across Scotland's vibrant heritage sector describe a wide range of cutting-edge work, including archaeological excavation, conservation management, heritage interpretation and digital documentation.

SCOTLAND'S ARCHAEOLOGY STRATEGY

Forestry and Land Scotland | Coilltearachd agus Fearann Alba

HISTORIC ENVIRONMENT SCOTLAND | ÀRAINNEACHD EACHDRAIDHEIL ALBA

AOC Archaeology Group

CAITHNESS BROCH PROJECT