

The Celtic Cuppill and its Implications in Building Construction and Design

by

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The Celtic cuppill is a structural element and form of cruck construction probably originating in Ireland but developing in Scotland and the northern counties of England during the first millennium AD.

There has been a long-standing debate over the origin, nature, composition and construction of crucks.¹ Various theories have been postulated regarding the background history,² date of introduction to the British Isles, the materials used, the adopted methods of construction, the structural principles employed in their layout, and their use in both 'framed' and 'non-framed' structures.³ Some historians argue that the curved principal blades must be cut from a single piece of timber, others accept joints at the 'elbows', or multiple joints. Some argue that the principal blades must carry the combined loads of structure, roof covering, wind and snow, to the ground or to a low base course. Others accept the idea of raised crucks where the butt end of the principal blades are set higher in the wall or even into the wallhead.⁴ There is even an argument for 'straight crucks',⁵ which is a contradiction in terms since the term 'cruck' comes from 'crook' meaning a bend or knuckle and that is the only feature that sets these roofs apart from any other form of timber roof. This discussion continues to the present day.⁶ There is nothing to be gained by continuing the debate in this paper but the serious reader should be aware of the various theories.

The term 'cruck' referring to a curved length of timber⁷ was not used by the Scottish building industry nor was it used by community builders operating in those areas where there was no professional building industry. Instead, crook, sometimes spelled cruck, was used in conjunction with 'links' to refer to a hook and chain or, in conjunction with 'bands' to describe a hinge: the 'crook' being the metal support built into the wall and the 'bands' being the strap of the hinge.

In Scotland the trusses forming the main elements of a roof structure were described as 'cuppill' or 'cupples' whether they were set on a wallhead or carried into the walls or

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extended to the ground.⁸ Similarly there was no distinction made between straight or curved blades. It is possible to find 'cuppills' where one side used curved blades to carry the load to the ground whilst the other side used straight timbers to rest on the wall-head. It is also possible to find curved timber 'cuppills' intermixed with straight timber 'cuppills' in the same structure. This is important since it illustrates that the 'cuppill' was seen as a support and not as a particular design of truss. The terms 'earth cupple'⁹ and 'stone-cupple'¹⁰ also appear for cross walls or arches where a 'cuppill' would normally occur. It might be possible to argue that the term 'cuppill' was part of the vocabulary of a practical builder rather than a 'design feature' in a structure produced by an architect or master builder.

The term 'couple' was used to describe the closely spaced elements of the 'close-couple' roof. This often causes confusion in the appraising tickets produced by 'birleymen' (independent assessors agreed upon by both the landlord and the tenant at a change of tenancy) whose job it was to report on the state of the property and agree either what the landlord had to do to bring the building or buildings to a usable condition or the value of improvements made by the outgoing tenant and the remuneration to be paid by the estate.

The number of 'cuppills' and 'couples' was also used by the birleymen to describe the length of rooms.¹¹ The spaces between 'cuppills' were usually eight to ten feet making a room of one cuppill equal to a space sixteen to twenty feet long by the width of the building. Gables were ignored in these calculations and an eight to ten feet long room is often described as 'panned' meaning purlined, that is a roof spanned between gables.¹²

Very few tenant farmers' houses had close-coupled roofs before the mid-eighteenth century but where they did exist the birleymen continued to describe rooms by the number of couples. Cuppills had measured eight to ten feet centre to centre but couples only measured eighteen to twenty inches centre to centre making the described properties appear to be very much larger to the unsuspecting reader particularly during the period when 'cuppill' and 'couple' were both accepted spellings on both types of roof.

The period when birleymen operated is not clearly defined but they are referred to in medieval documents.¹³ Most of the known manuscript appraising tickets tend to date from the 1680s to the 1720s¹⁴ and the latest reference dates from 1928.¹⁵ Unfortunately, although these give an indication of the overall size of each farm they give little or no indication of the walling material, roof coverings and floor construction. They do not even confirm whether the cuppills were cruck-type elements or simple timber trusses. That type of information has to be obtained elsewhere.

Some estate papers mention that the tenant is entitled to carry away their own timber at the end of the tenancy. This has been interpreted by some researchers as allowing tenants to move crucks from one site to another, but this is not the case. The tenants' timber usually consisted of doors, shutters, partitions, chimneys and furnishings, but not structural elements since the removal of such timber is conditional upon there being no damage to the integrity of the building, particularly the roof and walls.¹⁶ Probably, the misinterpretation came about from reading tourists' descriptions of dismantled sheiling huts.¹⁷ This dismantling was done deliberately to prevent the roof timbers from rotting over a long wet winter when the buildings were unused or from thatch stripped from

roofs in the spring to use as a top dressing for the potato crop before being replaced after harvest,¹⁸ leaving bare roof timbers over the summer months.

As late as 1959 building historians were stating that there were no crucks in Scotland. This is almost as ridiculous as claiming that the French do not eat deep fried potato chips simply because they call them 'frites' rather than 'chips' and they cut the potatoes to a slimmer section.

James Walton produced one of the first papers on the use of crucks in Scotland.¹⁹ His title for the article 'Cruck framed buildings in Scotland' is misleading since the range of structures he describes are not 'crucks' as defined by some later English writers: nor are they 'framed' in that they are not part of a three-dimensional rigid structure with mortice and tenon joints and bracing timbers. The true nature of these structures will form the main subject of this paper.

Geoffrey Stell, then with the RCAHMS, produced a source list of sites where curved principal timbers had been recorded,²⁰ but when this was published it was made to fit a format originally produced by the Vernacular Architecture Group (of England). Similar lists were produced by Alan Gailey and Desmond McCourt for Ireland²¹ and by J. T. Smith for England and Wales.²² Unfortunately, the recorders were more interested in the curved principal structural members than in the overall structures that these curved principals were being incorporated into. This was a major omission but understandable in the early years of examining a new subject, particularly one where all of the most spectacular examples were incorporated in substantial 'framed' structures. Hugh Cheape of the National Museums of Scotland has been working on Scottish structures, incorporating curved principal timbers, using Gaelic sources but unfortunately this study is not yet available.

The purpose of this paper is to re-assess the evidence from Ireland, Scotland and the northern counties of England in the light of building form, structural principles and constructional details – to illustrate how the buildings from these Celtic regions differ from the later cruck-framed structures of England and Wales and how they may have influenced the layout of some of the earlier examples of the cruck frame in York and further afield. Possible links to the Viking Migration Period structures and to the Saxon halls of Northern Europe are also investigated.

THE CELTIC CUPPILL STRUCTURE

The Celtic 'cuppill' structure is not a 'framed' structure as utilised in the English and Welsh cruck frame. Rather it is a series of trusses, usually with curved principal timbers, rigid in themselves but lightly pinned together using a series of 'pans' or purlins, to produce an inherently stable structure, built off the natural land surface without resorting to level foundation, rigid geometry and braced joints. As such it is totally alien to conventional building practice but stems from the complex geometry of the natural form in the same way as Celtic art forms explore the curve rather than the straight line. In its most highly developed form the Celtic 'cuppill' structure can be compared to the structure of Celtic and Viking galleys.²³ There the planking of the ship is connected together to create the overall shape before the internal bracing timbers are added to strengthen this outer skin. This bracing is light and flexible and tends to stiffen specific areas of planking

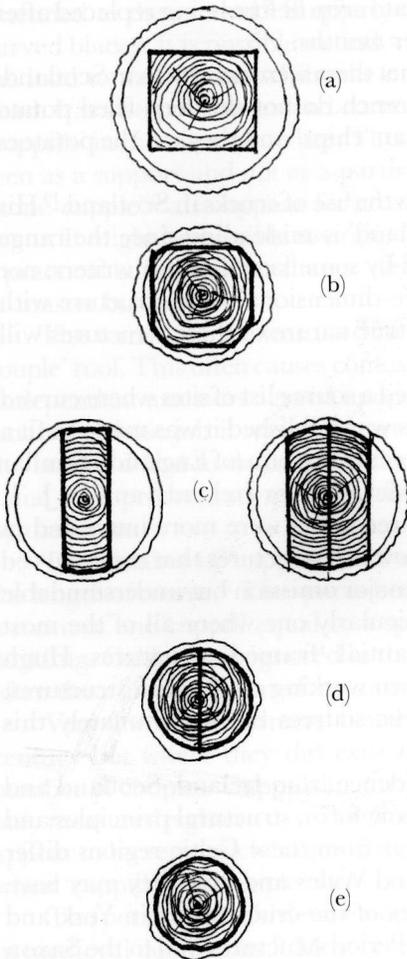


Fig. 1 (above)

Timber sections commonly used as cuppills
 (a) squared timber; (b) roughly squared
 timber; (c) thickened timber;
 (d) split log; (e) log

without forming a rigid structure. Its imaginative use of natural forks and bends results in a ship of extraordinary elegance and beauty, capable of dangerous sea voyages but also capable of being manhandled over land when the need arose. The technique may also be linked to the structure of curraghs, coracles and early birch-bark or leather canoes.

This difference in constructional approach is evident in the basic carpentry. According to Richard Harris, any piece of timber has to have two flat surfaces, at right angles to each other, to allow a carpenter to make a successful joint.²⁴ He admits that French carpenters manage with one flat surface on each timber. When Celtic cuppills are studied the timbers range from four dressed surfaces through roughly squared timber, thickened timber, split logs to round timber and, in a surprising number of instances, the curved principals of a cuppill are formed using whales' jaw

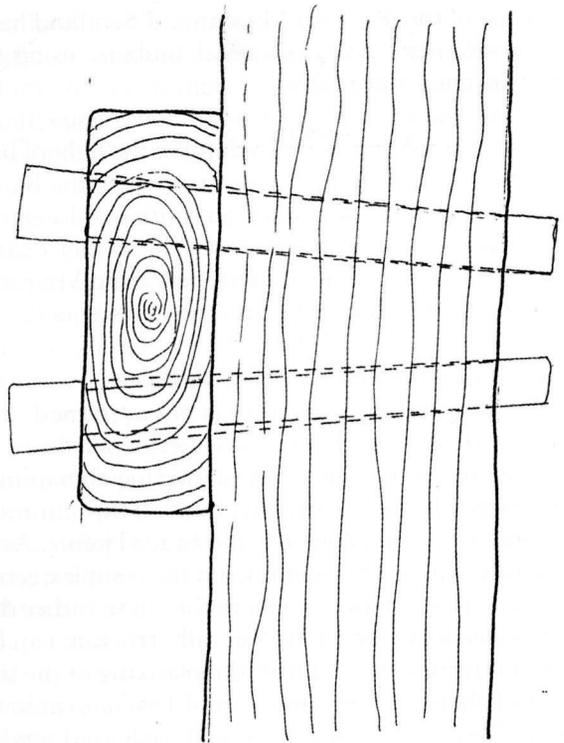


Fig. 2 (right)

Typical flush joint with clasped pegs

bones. There are also a remarkable number of Celtic cuppill formed from sections of twisted hedgerow timber, driftwood, second-hand timber and anything else that comes to hand, skilfully pinned together to form continuous curve with up to seven separate sections in a single curve.²⁵ This is achieved mainly by the use of clasped joints formed

Fig. 3
Varying cuppill types in same structure

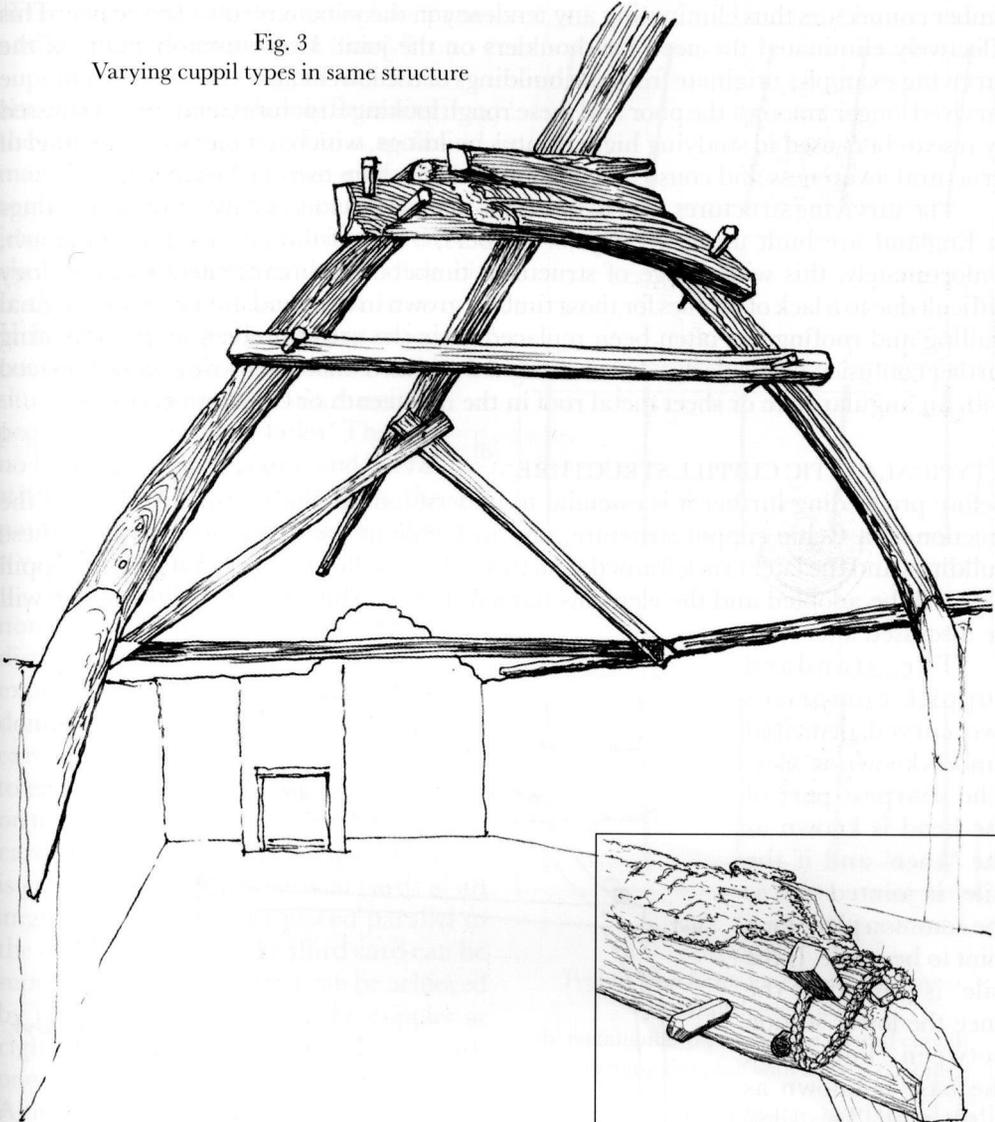
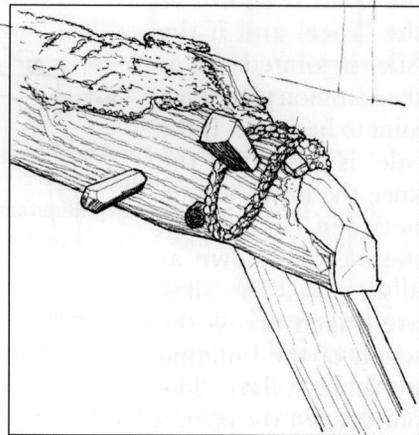


Fig. 4
Typical joint between
irregular timbers with
clasped pegs



by flattening short sections of the timbers where the joint is to be made holding these together whilst pegholes are drilled at angles which result in the pegs clasping the timbers together (Fig. 2). The pegs used are always of a harder timber than the principal timber and are square or faceted in cross section, and slightly larger than the peg hole. When driven home these pegs cut into the sides of the peghole and form a grip similar to modern timber connectors thus eliminating any tendency in the joint to revolve on the peg. This effectively eliminated the need for shoulders on the joint. Unfortunately many of the surviving examples originate from the buildings of the lower classes, since the technique survived longer amongst the poor and these rough looking structures tend to be dismissed by researchers used to studying higher status buildings, which is a pity since the level of structural awareness and constructional expertise is often extremely high.

The surviving structures tend to be of sub-manorial status and like similar buildings in England are built using a range of timbers,²⁶ one of the commonest being ash. Unfortunately, this wide range of structural timbers often makes dendrochronology difficult due to a lack of profiles for those timbers grown in Scotland. Similarly the original walling and roofing has often been replaced since the original erection, thus creating further confusion particularly where an original rounded thatched roof has been replaced with an angular slate or sheet metal roof in the nineteenth or twentieth century.

A TYPICAL CELTIC CUPPILL STRUCTURE

Before proceeding further it is essential to understand the main principles behind the erection of a Celtic cuppill structure, and to highlight the differences between these buildings and the later cruck framed structures. To best illustrate this, a standard cuppill type will be adopted and the elements named (Fig. 5). Variations to this standard will be discussed later.

The standard cuppill comprises two curved principal timbers known as 'siles'. The sharpest part of the bend is known as the 'knee' and if the 'sile' is jointed this is the common place for a joint to be made. If the 'sile' is jointed at the knee the lower section between 'knee' and the base is known as a 'sile post'. The 'siles' are linked across the width of the building by three collars. The one nearest the apex is

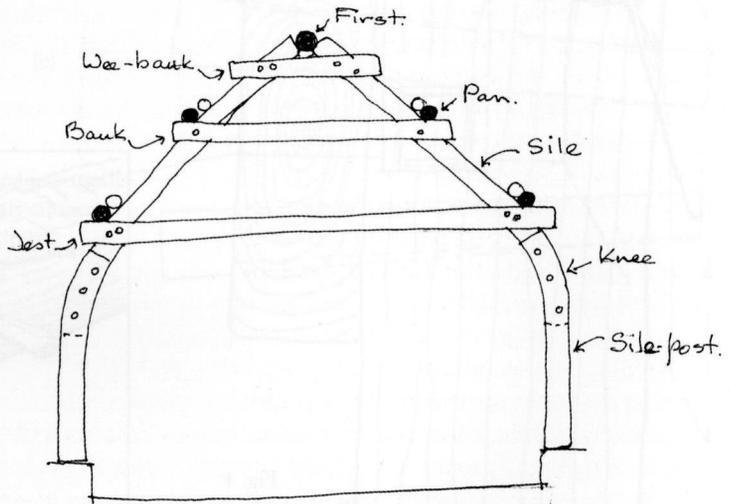


Fig. 5

Section through cuppill structure with named elements

known as the 'wee-bauk', the second or intermediate cross piece is the 'bauk' and the lowest is the 'jest'. The 'cupples' span the width of the building and are usually erected on a parallelogram plan form, that is on a skew to the lateral walls.²⁷ This appears to stiffen the structure and this, along with variations on this approach will be discussed below. The 'cuppill' are linked along the length of the building by purlins known as 'pans' and a ridge tree known as a 'first'.²⁸

The joints in the 'cuppill' elements are usually formed by slightly flattening the timbers where the joint is to be made, binding the two flat surfaces together, boring holes through the joint to take pegs which when inserted clasp the faces together, the binding is then removed although in some Hebridean roofs the binding is carried out using seaweed rope which is left in situ.²⁹ The 'pans' and 'first' are usually pegged into the 'sile' blades. There is no bracing in the structure and lateral stiffness appears to result from the parallelogram configuration or from a variation of this (Fig. 6).³⁰

The parallelogram is quite pronounced and appears to provide a distinct structural advantage. A simple experiment using playing cards can demonstrate this advantage. If two cards are held vertically and parallel to each other and a third card is placed on top to span between the verticals the cards collapse. If the same experiment is carried out with the vertical cards at an angle and the top card placed parallel to the ends of the cards, the third card can be supported. The same effect can be achieved by placing the majority of the cupples at right angles to the lateral wall but with one angled cupple providing the stability. Alternatively cupples that appear to span the building at right angles to the lateral walls can be skewed slightly to the left or right alternately to give the same result. These are more difficult to identify on site due to the irregularity of many of the timbers. Unfortunately even the distinctly parallelogram plan form was not recognised by many early researchers and obvious parallelogram plan structures were recorded as being rectangular.³¹

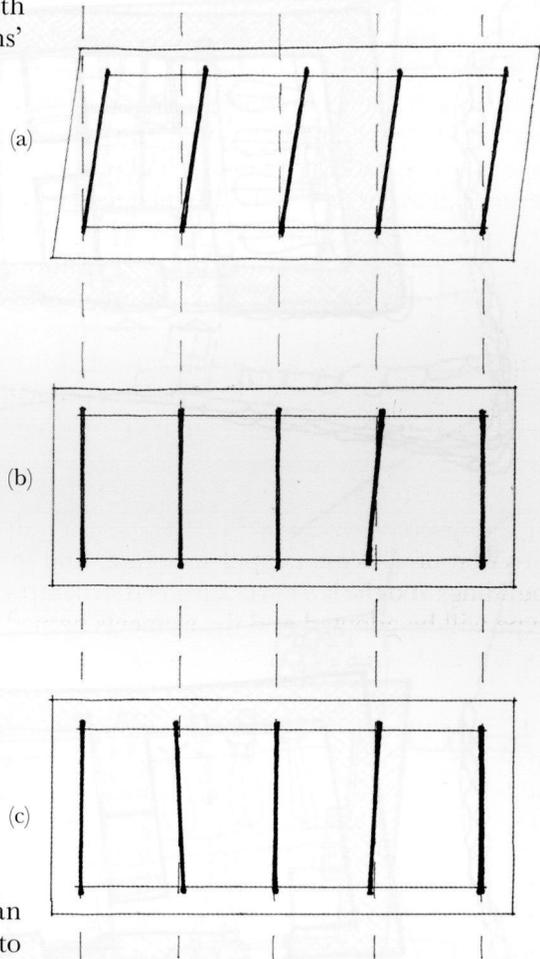


Fig. 6

Typical plan forms for cuppill structures

- (a) parallelogram plan;
- (b) rectangular plan with one skewed cuppill;
- (c) rectangular plan with skewed cuppills

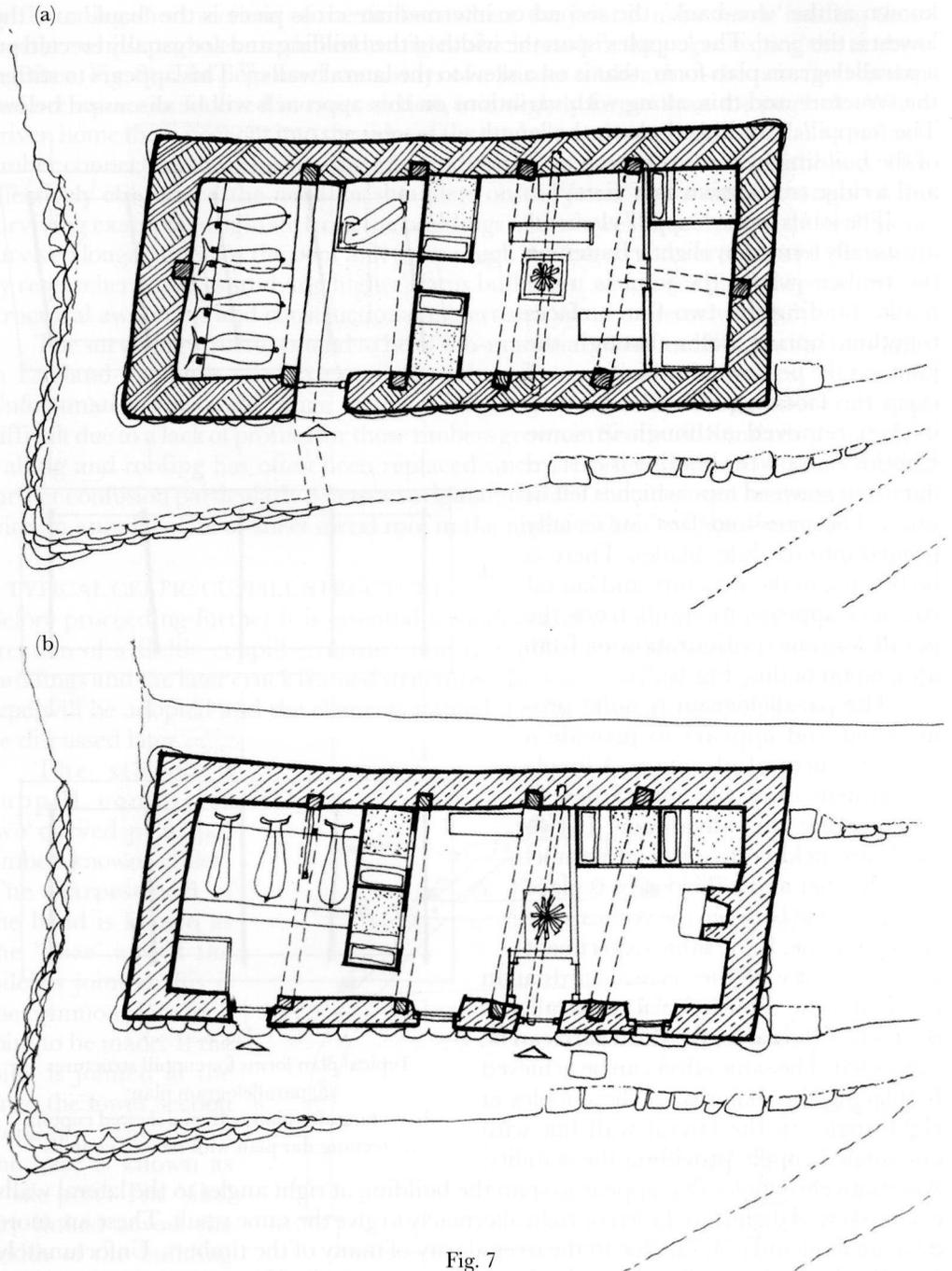


Fig. 7

Lower Chamberbane, Strathtummel, Perthshire

(a) plan as three-roomed dwelling *c.* 800; (b) plan as byre dwelling *c.* 1860

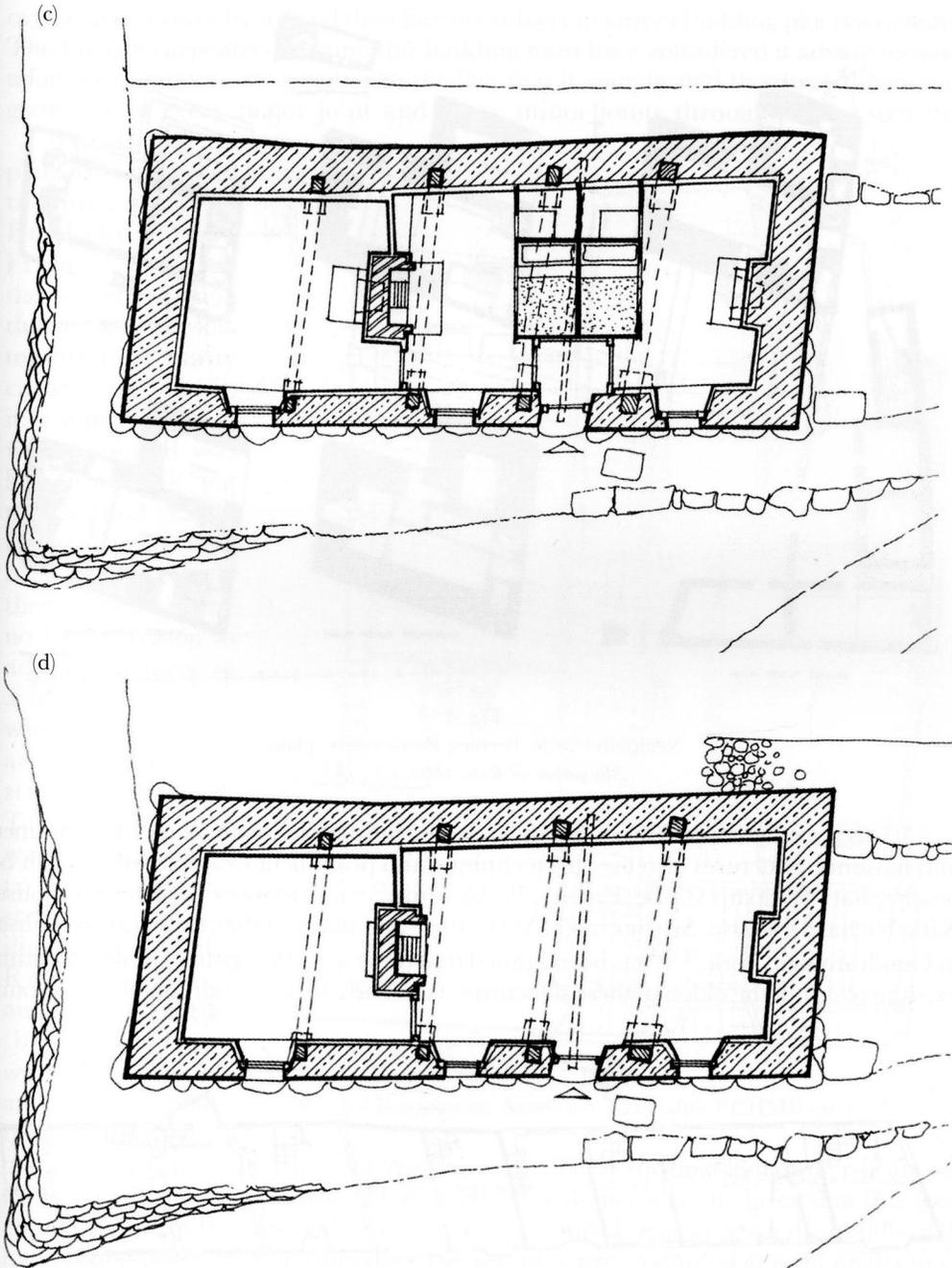


Fig. 7
Lower Chamberbane, Strathtummel, Perthshire
(c) plan as byre dwelling c.1910; (d) plan as surveyed in 1974

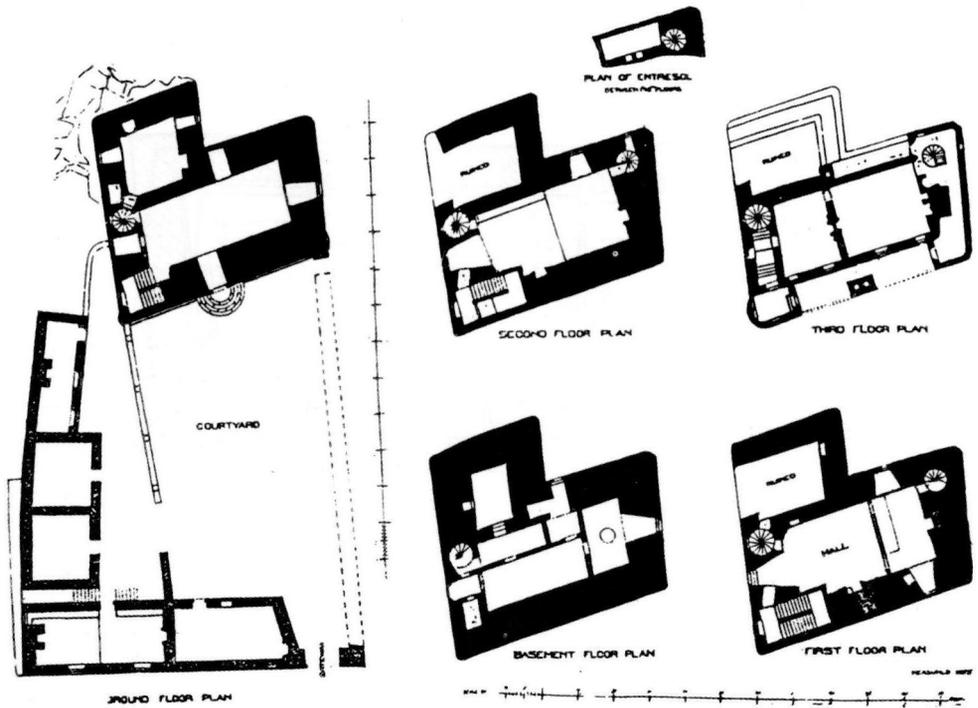


Fig. 8

Neidpath Castle, Peebles, Peeblesshire: plans
Macgibbon & Ross, 1889, v.1., 185

It was not only 'cuppill' structures that adopted the parallelogram plan. Cruck-framed and masonry structures also use this technique and prominent examples of this can be observed at: Neidpath Castle, Peebles, Peeblesshire³² – a five storey L-plan towerhouse; King Richard's House, Scarborough, Yorkshire³³ and many of the cruck-framed houses in Goodramgate, York.³⁴ It has been argued that these were the result of building within existing plots but the oldest of these structures – the Lady Row, Goodramgate – was built

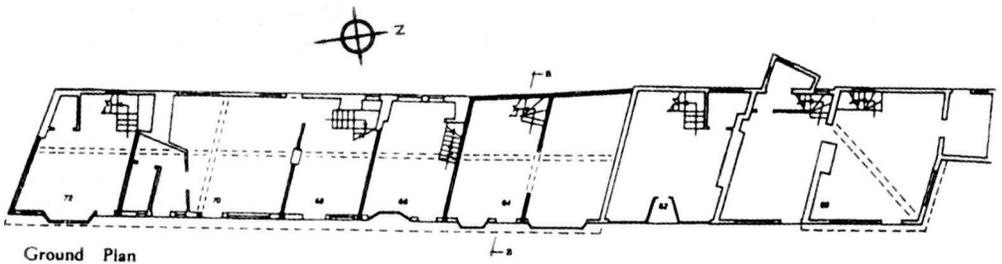


Fig. 9

Lady Row, Nos 60-72 Goodramgate, York – plan (after RCHME survey 1981)

over a former churchyard and therefore not subject to former building plot restrictions.³⁵ The English carpenters erecting this building must have considered it advantageous to adopt this practice, using it despite the fact that it complicated the three-dimensional geometry of every major joint and many minor joints throughout the structure.

Parallelogram plans can be traced to many parts of England³⁶ and France³⁷ and it is the author's opinion that it was in the folk memory of many carpenters. That is, it is something that was done and was known to work, but the original reason for doing it had been lost. Certainly there appears to be no logical reason to adopt this form in a framed structure where the joints are locked and the structure braced. This approach was not restricted to vernacular structures. This is illustrated by King Richard's House and Neidpath Castle (both masonry-walled structures) and it may explain the original layout

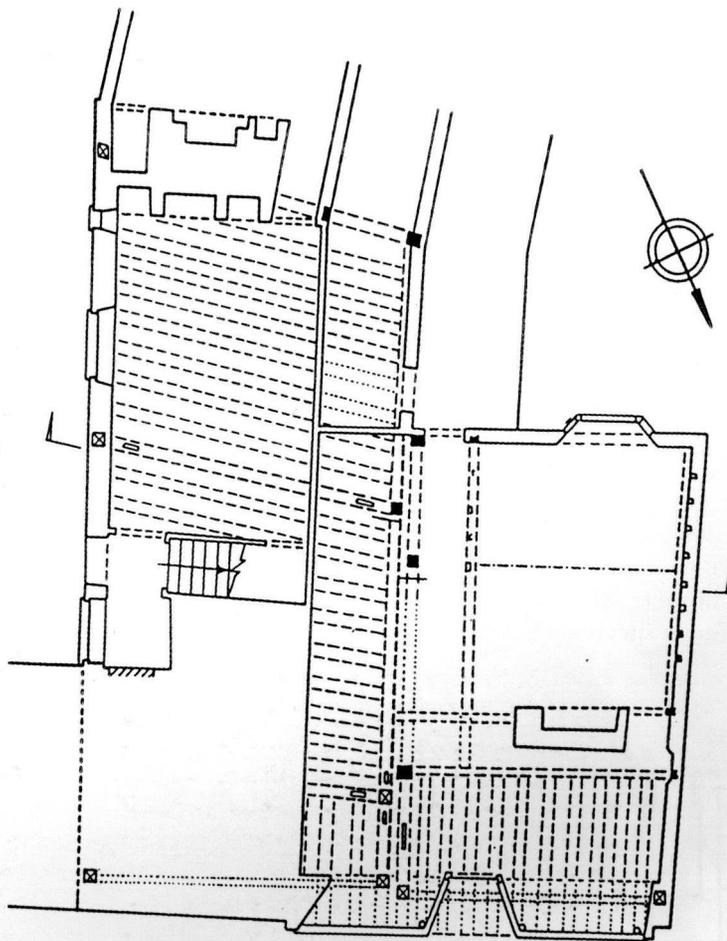


Fig. 10

Nos 4-6 King Street, Sandwich, Kent (after RCHME survey 2005)

of the Great Hall at the Palace of Westminster.³⁸ There the double-hammer-beam roof forms a parallelogram on plan. English Heritage do not seem to agree that this was a chosen option and have postulated some form of central support down the middle of the hall to support the inner terminals of two sets of trusses spanning at right angles to the supporting members on the surviving outer walls.³⁹ This seems a remarkably clumsy solution in a high prestige building and it is much more likely that the parallelogram plan was adopted from the outset.

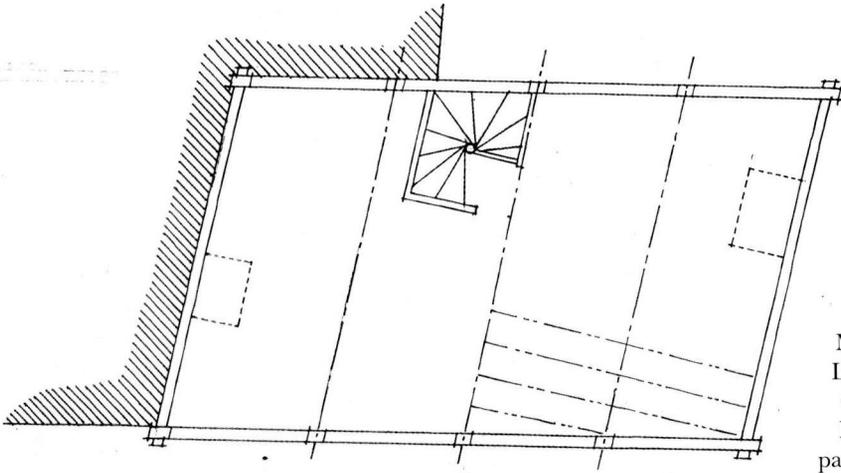


Fig. 11
Maison Dite de
L'île de Canada,
Chateaufard,
Loiret, France:
parallelogram plan

The majority of surviving 'cupple' structures are set on low masonry base courses, wide enough to support either a turf wall or an earth wall. However, some sit on individual stones and may have been used in conjunction with 'stake and rice' (wattle) walls or 'keber and mott' (stud and mud) walls. In the majority of survivals the walls are now either mudwall,⁴⁰ clay-wall⁴¹ or masonry. Early 'cuppill' structures had earth-fast 'sile-posts' and a pocket of these appear to have survived in the vicinity of Inverness where a number were recorded in photographs.⁴² A small peat-shed in Ross-shire is the only known survival of earth fast siles.⁴³

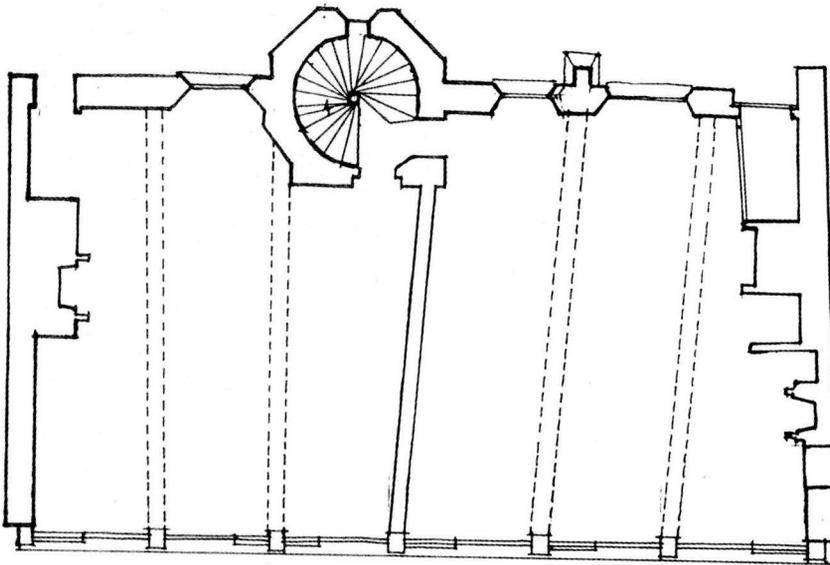


Fig. 12
Maison
Quatrans,
Rue de Geole,
Caen, Carados,
France:
parallelogram
plan

The customary roof covering was thatch, over a layer of turf, supported on either cabers running from eaves to ridge or on a wattle or occasionally straw rope base. The various types of thatch are discussed in *Thatch and Thatching*,⁴⁴ and were mainly community efforts until the recent past.

Due to the high wind speeds in west coast areas – The Hebrides, Orkney and Shetlands – thatches tended to be restrained from above by the use of closely-spaced ropes or more widely spaced ropes over second-hand nets or later, chicken wire. The chicken-wire types of restraint led to the sleek looking roofs favoured by reconstruction artists but totally inaccurate on historic structures.⁴⁵

As has already been stated, all of these elements tend to blend together in a curvilinear three-dimensional form with no true levels, no clearly defined wall-head, and gently curving roof sections. This is quite different from the cruck frame where floors tended

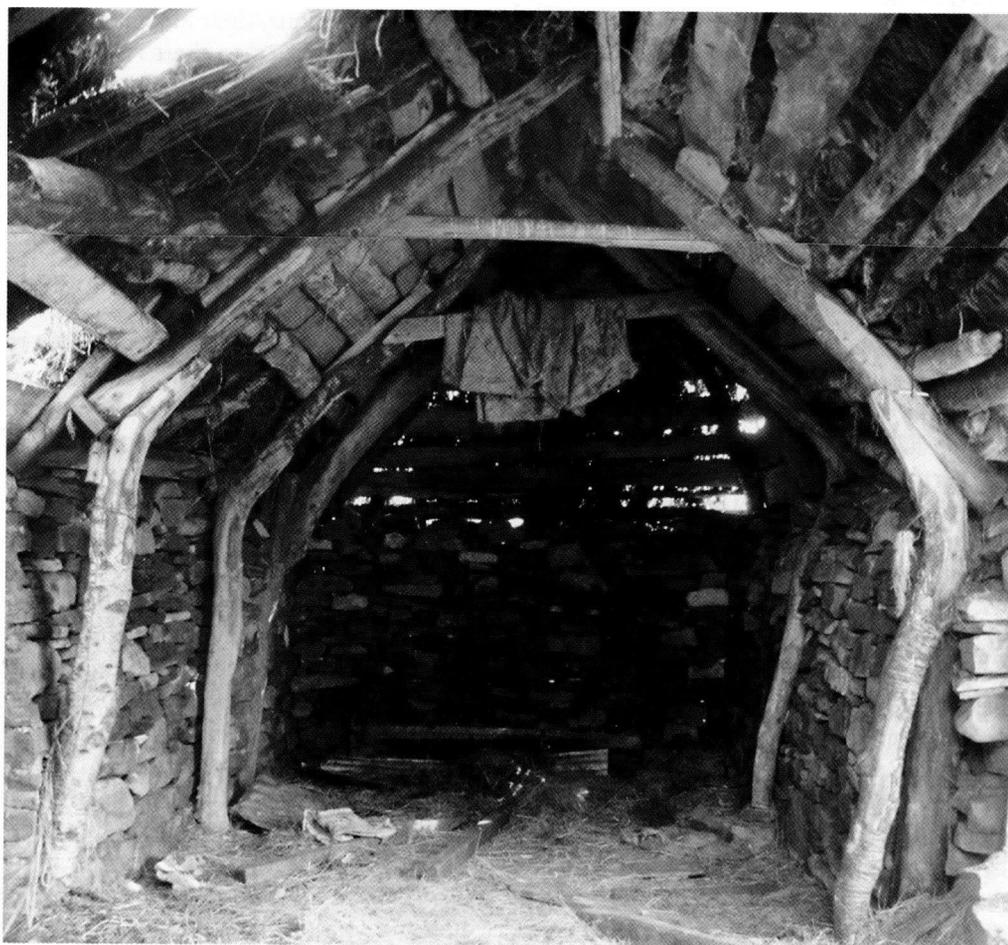


Fig. 13
Earthfast cuppill in Peat Shed, Ross-shire

to be flat, walls vertical, eaves defined and ridges sharp and treated decoratively. These statements are oversimplified but they do represent the differences in approach. The difference is most apparent when corrugated iron replaced thatch in the nineteenth and twentieth centuries.⁴⁶ The requirement to produce sharply angled roofs resulted in many 'cuppills' being adapted from their traditional curved form to sharp ridges and straight lines. This was usually carried out in scientific-section timber, making the added elements distinctive and easy to isolate in typologies.⁴⁷ The alternative to changing the 'cuppill' form was to rake back to the thatch to allow a secondary structure to be formed over the remains of the thatch with considerable voids between the new ridge and the original work.⁴⁸

Stell produced *Crucks in Scotland: a provisional list* in 1981,⁴⁹ in which he states 'this summary is simply intended to give a general indication of the geographical incidence of surviving examples: it does not extend to a discussion of the more detailed matters of cruck typology and dating: of their regional and social variations, their association with hipped and gabled roof forms and different walling materials, or to their relationship with building spans and bay lengths. This limited treatment, it is felt, more accurately reflects the stage that Scottish cruck studies have reached overall, and it reduces the danger of imposing premature and perhaps misleading or preconceived generalisations on the available and sometimes rather patchy evidence'. This is a noble intention, but the article states that it is hoped that this will 'eventually supply a sound working basis for a more detailed study of Scottish cruck framing'.⁵⁰ The choice of the term 'cruck framing' is misleading since there is no direct evidence for 'cruck framed' structures in Scotland.

There is some doubt in Stell's assessment as he states 'cruck construction is here very generously defined to embrace all known varieties of single blade, jointed, and composite crucks together with the two piece 'cruck-like' roof comprising rafters and wall posts'.⁵¹ This last category generates apprehension because it conjures up images of northern European post and beam construction where the beams either span the building at right angles to the lateral walls or form an eaves beam on the line of the lateral walls. Both types have been found in Scotland⁵² since the date of Stell's article and therefore cast doubt on much of his cruck-slot evidence.

The assumption that the 'cruck-building' tradition did not extend to the Outer Hebrides or to the Northern Isles appears to be based on the surviving structures but these were largely rebuilt in the late nineteenth and early twentieth centuries and do not reflect the roof structures of the earlier 'creel-houses' and other turf-walled house types. Recent archaeology appears to confirm this view,⁵³ as does a sketch of a double-end cruck on Raasay by Åke Campbell (Fig. 15).

Stell ends his article with the statement 'the rural fieldworker must be aware of a wider range of possibilities'.⁵⁴ With this thought in mind his gazetteer forms an extremely useful data-base for surviving timber buildings in the countryside. This is much more positive than the statements being made by Fenton⁵⁵ and Small⁵⁶ about the same time. Bjørn Mhyre, a Norwegian buildings expert, had put forward the theory that all the historic buildings of the North Atlantic Region developed from timber structures. A conference was held in Bergen to discuss this hypothesis and, against all the evidence

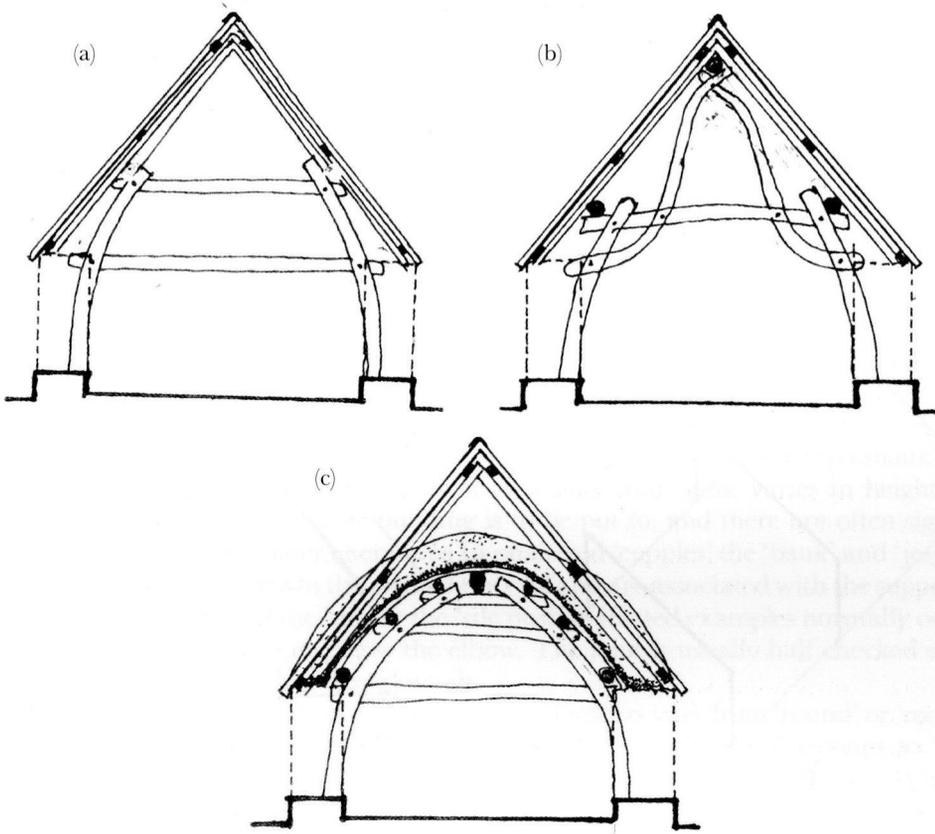


Fig. 14

Cuppill roofs adapted from thatch to corrugated iron

(a) scientific section upper section – commonplace;

(b) Wester Auchraw, Lochearnhead, Perthshire – possibly unique;

(c) lower surface of thatch cut back to take new scientific section timber roof – commonplace

that was being uncovered at that time, Fenton, Small and Stoklund managed to persuade the delegates that Scotland was a notable exception.⁵⁷ This was despite the existence of Stell's article and a number of other papers relating to timber construction in various parts of Scotland.⁵⁸

Although building sizes are often given by the number of 'cuppill' in each room there appear to be two generally recognised roof types: those with 'siles' carrying the weight of the roof into or through the walls and the 'sett on rufe'⁵⁹ where the roof sits on the walls, but not necessarily on a wallplate, as is normal in England. The earliest reference to this type of roof in the *Dictionary of the Older Scottish Tongue* (1680) (*DOST*) is considerably earlier than the first references in the appraising ticket evidence to closely spaced 'cupples' (couples).⁶⁰ This is not surprising since innovations tend to take a long time to move down the social scale.

CUPPILL TYPES

The term 'cuppill' (cupple) is defined in *DOST*⁶¹ as 'a pair of sloping rafters or one of these'. Alternatively the term can be 'used as a standard length (twelve feet) in a building': or it can be attributed with 'biggin' (building); 'feit' (feet); 'room' or 'tries' (trees). A more accurate definition of a single blade of a 'cuppill' would be 'cuppill blade' or 'sile'. 'Sile' appears to be more common in south-western Scotland and is defined in the *Scottish National Dictionary (SND)* as 'a roof or couple, usually one of a pair'.⁶² Jamieson contradicts the idea of the 'siles' being linked by 'jest and bauk' and states 'Two transverse beams go from one sile-blade to the other to prevent the sides being pressed down (out) by the

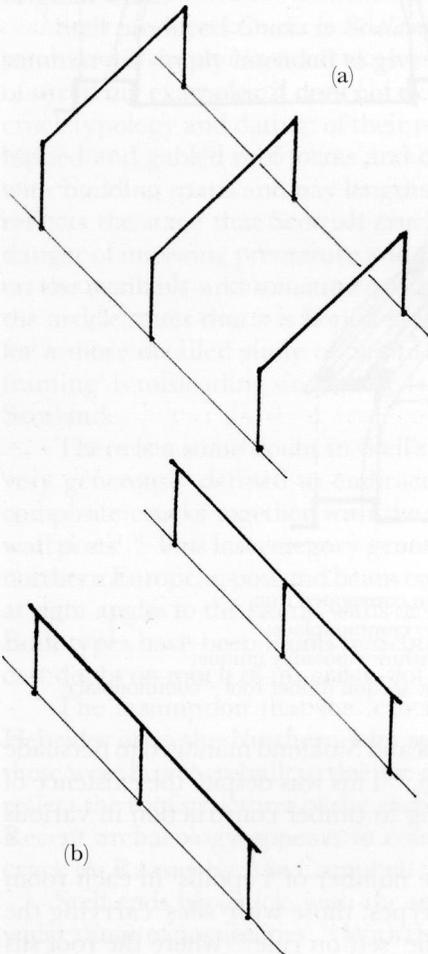


Fig. 15

Post and beam structures recorded

in Highlands

- (a) transverse post and beam
(b) lateral post and beam

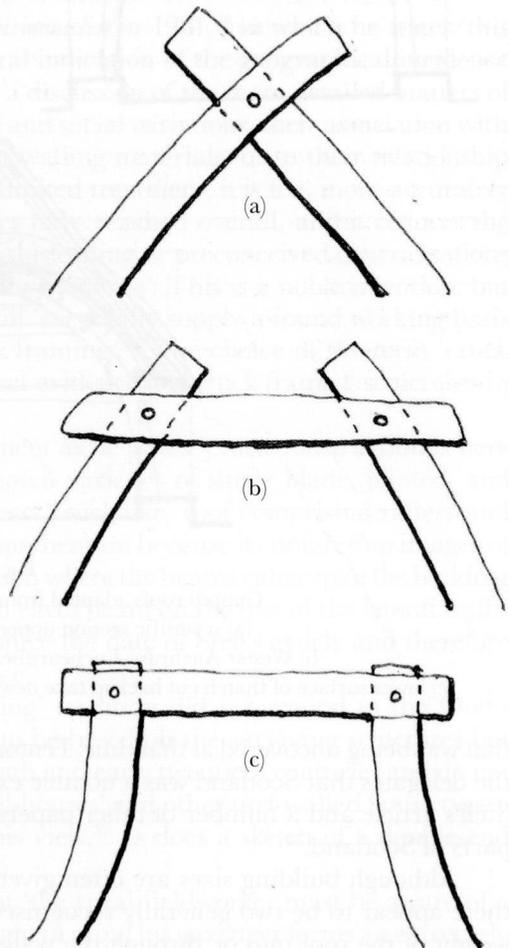


Fig. 16

Apex connections to cuppills

- (a) crossed syles
(b) open syles connected by 'wee-bauk'
(c) open syles and syle-cap

superincumbent load, which would soon make the walls 'skail', that is, splay outwards'.⁶³ The operation of joining the siles together, which is a work of considerable nicety, is called 'knittin the siles'.⁶⁴ The *SND* also gives the terms 'cyle-blade' and 'syle-cap' for the main tie and upper collar respectively.⁶⁵ This takes the place of the 'jest' and 'bauk' mentioned previously.

The 'syle-cap' may be the distinctive mortice-and-tenon jointed connector commonly found in the northern counties of England and southern Scotland. The most northern known example in the west is the Old Manse of Croy, Dumbartonshire, which carried late seventeenth and early eighteenth century dates on the lintels of the doors serving a cross-passage. The use of mortice and tenon in this construction is unusual and tends to suggest a later method of forming the collar, usually associated with ogee timbers rather than the more common single curve. Unfortunately this building was burnt down shortly after being recorded by RCAHMS.⁶⁶ The Owl House, Falkland, Fife is the most northern known example in the east.

The common types of 'cuppill' apex are: crossed, collared with 'wee-bauk' and collared with 'sile-cap'. The arrangement of 'bauks' and 'jests' varies in height and position according to the use the building is to be put to, and there are often signs of change to accommodate later alterations. In unaltered 'cupples' the 'bauk' and 'jest' are normally evenly spread down the pitch of the roof and are associated with the support of the pans. The junction of the 'sile' to the 'sile post' in jointed examples normally occurs at the elbow or just above or below the elbow. The joint is usually half checked either parallel to the curve or at right angles to it.

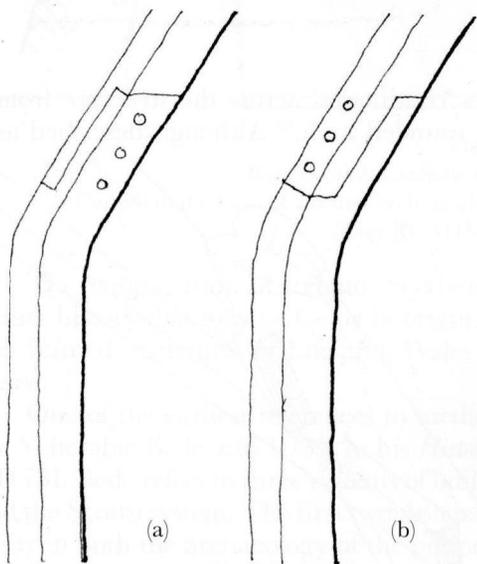


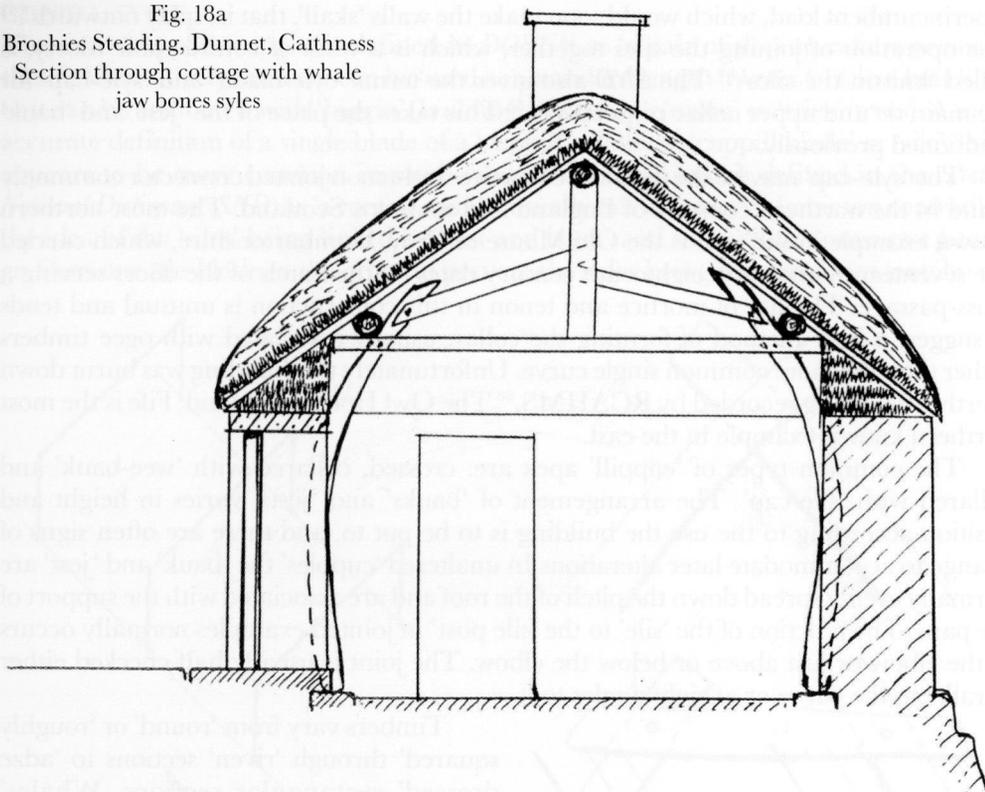
Fig. 17

Jointed cuppill knees

- (a) lateral half-lap butt joint
- (b) transverse half-lap butt joint

Timbers vary from 'round' or 'roughly squared' through 'riven' sections to 'adze dressed' rectangular sections. Whales' jaw-bones are also used for 'siles' (Fig. 18). Some of these are massive, the largest known Scottish example, formerly used as a gate-arch in Cellardyke, Fife and now in the Scottish Fisheries Museum, Anstruther, Fife⁶⁷ is similar in size to one in Barnet, Hertfordshire where each jaw is twenty-four feet long and weighs three-quarters of a ton. This came from a ninety-foot Blue Whale. In 2001-3, a nineteenth-century house in Dunnet, Caithness was excavated.⁶⁸ This had whale's jaw-bone 'siles' and exploratory trenches through the floor showed that it stood on Dark Age or earlier foundations. Reconstructions based on building width, the 'sile' dimensions, checks and pegholes for joints indicated that the 'bauk' and 'wee-bauk' were replaced by angled timbers supporting a king post sitting in the 'jest'.⁶⁹

Fig. 18a
 Brochies Steading, Dunnet, Caithness
 Section through cottage with whale
 jaw bones syles



In the most flimsy structures the 'sile' is 'continuous' across the structure from one 'sile post' to the other in the form of a rounded arch.⁷⁰ Although described as 'continuous' the arch is made up from an assortment of twisted wood, straight wood (sile-posts), driftwood and ships' timbers (part of the stem cut to accommodate the ends of the planking and part of an oar or sweep). The ingenuity of the jointing and pegging is remarkable. The largest members are the 'sile posts', which are of six inches (150mm) in diameter. The span is twelve feet and the headroom seven feet six inches. There are no 'bauks' or 'jests'. This particular example can be seen in the Laidhay Crofting Museum, Dunbeath, Caithness, where it forms part of the original structure.

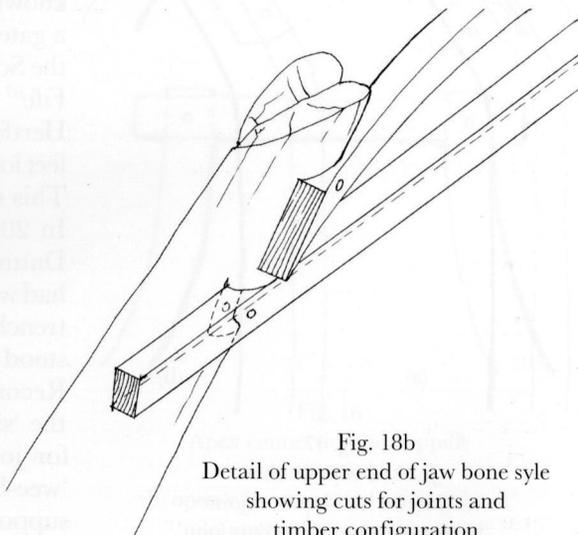


Fig. 18b
 Detail of upper end of jaw bone syle
 showing cuts for joints and
 timber configuration

BACKGROUND HISTORY

The Laidhay structure (Fig. 19) is remarkably similar to those used by the Sea Sammi of West Finmark, Norway,⁷¹ where the structure was covered externally with turf laid as a thick battered wall, gradually evolving into a double or triple layer of turves over the roof. These would be turves from a peat bog and would be waterproofed by lighting fires throughout the building to generate enough heat to bake the oil in the turf, thus rendering it waterproof. This technique is well documented in the Hebrides⁷² where buildings of this class appear to be the forebears of the nineteenth- and twentieth-century black houses.

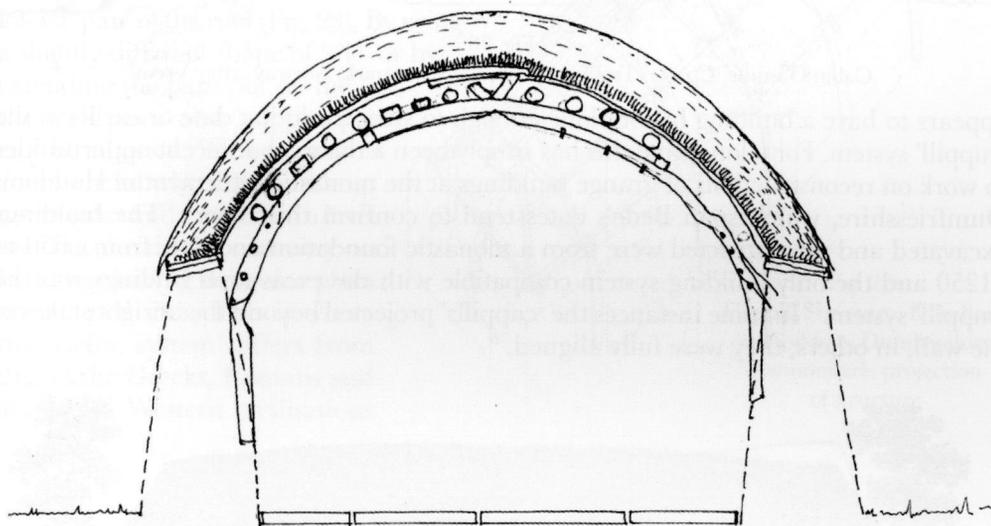


Fig. 19

Barn cuppill, Laidhaycroft, Latheron, Caithness

Cuppill in the form of a round arch, made up from various cuts of timber and wood
(after RCAHMS survey 1969)

The 'cupple' roofs of Ireland, Scotland and northern England appear to have an earlier history that may be Celtic in origin. All the evidence suggests that they predate the 'framed' structures of England, Wales and the rest of Europe by several hundred years.

One of the earliest references to methods of building in Britain was produced by the Venerable Bede (c.673-735) in his *Historia Ecclesiastica Gentis Anglorum*, completed in AD 731. Bede refers to three systems of building:⁷³ log or block work, stave or mast work and the Scottii system. The first two systems are self explanatory and can be recognised easily in both the archaeology of the period and in later surviving examples mainly in Nordic and Alpine situations.⁷⁴ The third system refers to that practiced by the Scottii who originated in Ireland before moving to the western Highlands of Scotland and whose chief monastic settlement was on the island of Iona. Unfortunately, the Scottii system is not described in detail but the only building system in these three countries that

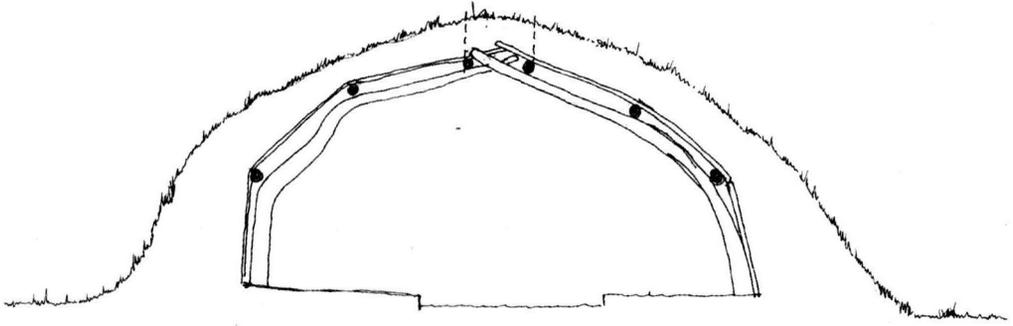


Fig. 20

Cabin Gamme 'Coatte' Trollbuet, Lebesby, Finnmark, Norway (after Vrein)

appears to have a building history long enough to stem from that date or earlier is the 'cuppill' system. For a long time this has simply been a theory, but recent opportunities to work on reconstructions of grange buildings at the monastic settlement of Hoddom, Dumfriesshire, which span Bede's dates tend to confirm this theory. The buildings excavated and reconstructed were from a monastic foundation and date from c.650 to c.1250 and the only building system compatible with the excavation findings was the 'cuppill' system.⁷⁵ In some instances the 'cuppills' projected beyond the upright stakes of the wall, in others, they were fully aligned.⁷⁶

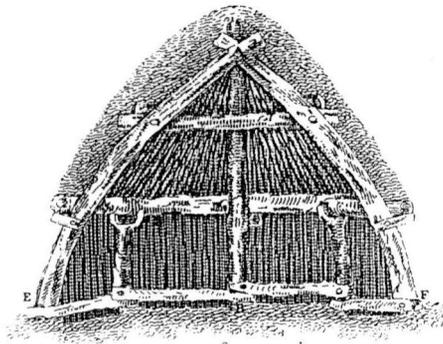
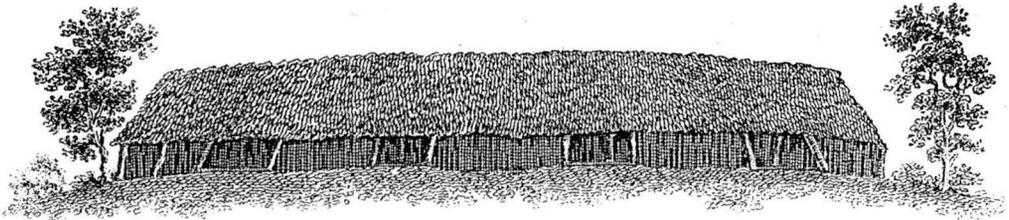


Fig. 21

'Sketch of Sheep Cot lately erected at Coul'
Mackenzie 1809

Had the post holes projecting beyond the line of the wall been further from the structure they may have been interpreted as being similar to the Saxon halls of northern Europe which have been variously interpreted as having buttress posts against the eaves beam⁷⁷ or as having an external colonnade similar to those round stave churches.⁷⁸

The slight projection recorded in the Hoddom excavation seems to stem from the 'cuppill' structure projecting beyond the wall to allow the tops of the wall posts to be tied to the lowest 'pan' of the roof (Fig. 23). By using a slightly different shape of 'sile' or by extending the pans out on the 'jest' the wall posts and 'cupple' posts can be aligned. This is easy to comprehend when the buildings are regular and erected on a level site, but the details can vary on buildings having irregular plans on inclined sites. This is where this Celtic system differs from that of the Greeks, Romans and almost all Western civilisations

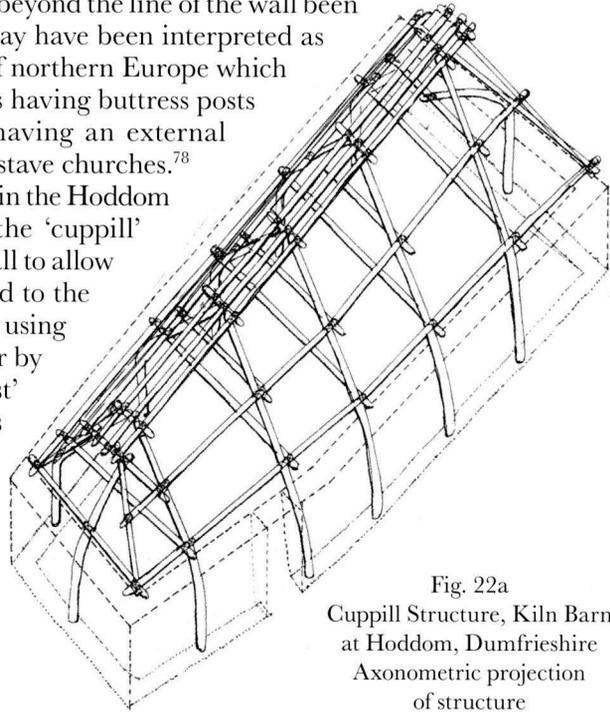


Fig. 22a
Cuppill Structure, Kiln Barn
at Hoddom, Dumfriesshire
Axonometric projection
of structure

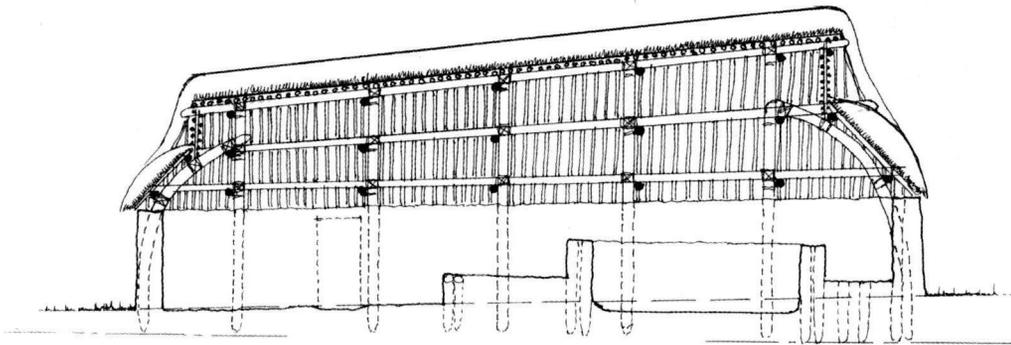
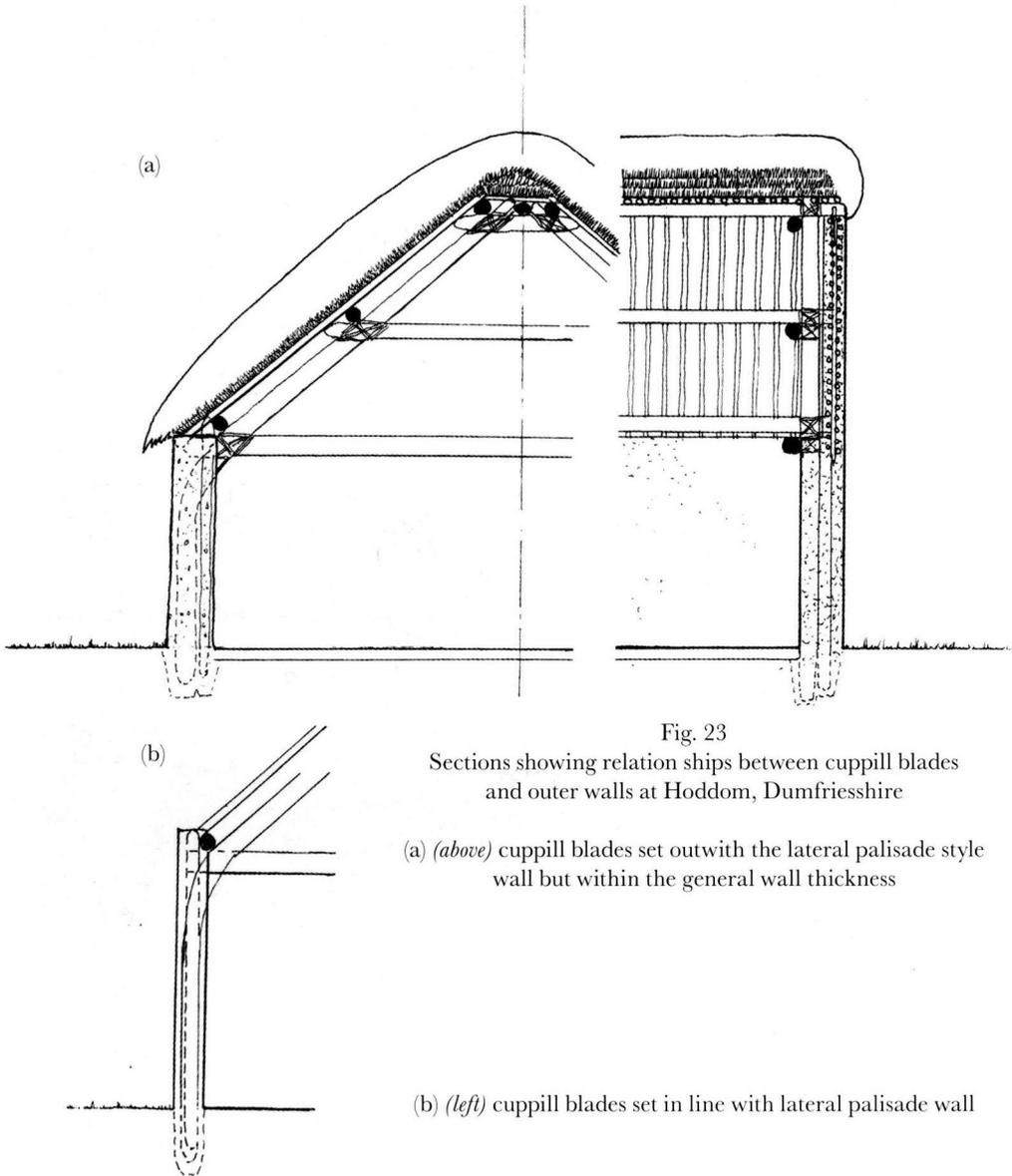


Fig. 22b
Cuppill Structure, Kiln Barn at Hoddom, Dumfriesshire
Longitudinal section

since then. As has been stated already this flexibility and appreciation of the flowing line is apparent in Celtic jewellery and art. Celtic cross-slabs, particularly those of the Picts, depict wattle panels in stone.⁷⁹ This takes the form of intricate basketwork based on geometric designs (Fig. 24), yet when the Pictish sculptors came to represent these patterns they were not laid out as pure geometry but they allowed for the bends, and offsets necessary to produce these patterns using 'oziers' or 'withies'.⁸⁰



Other recent excavations of buildings of much later date but using similar structural and constructional methods show the flexibility of the technique on irregular terrain. The fifteenth-century byre or stable at Inchmarnock⁸¹ illustrates this extremely well (Fig. 25). This structure narrows as it runs uphill but ends up with a level ridge tree or 'first'. This shows a remarkable grasp of geometry on the part of the builder and a flexibility of approach which was ideal for the rugged terrain of pre-improvement Scotland.



Fig. 24

Pictish cross-slabs at Aberlemno, Angus showing basketwork patterns on face of cross

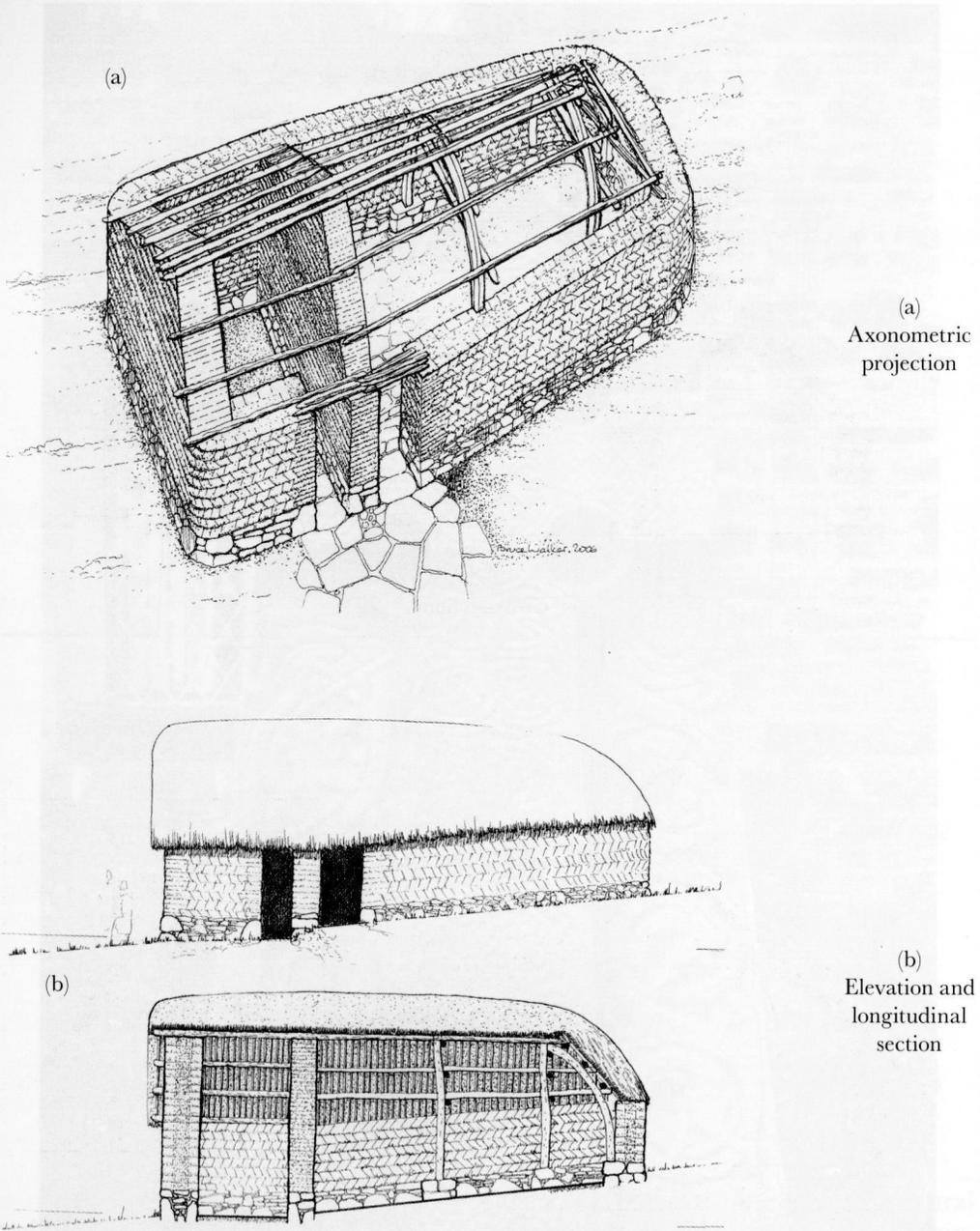


Fig. 25
Partially cuppilled structure at Inochmarnock, Argyll and Bute:
reconstruction drawings

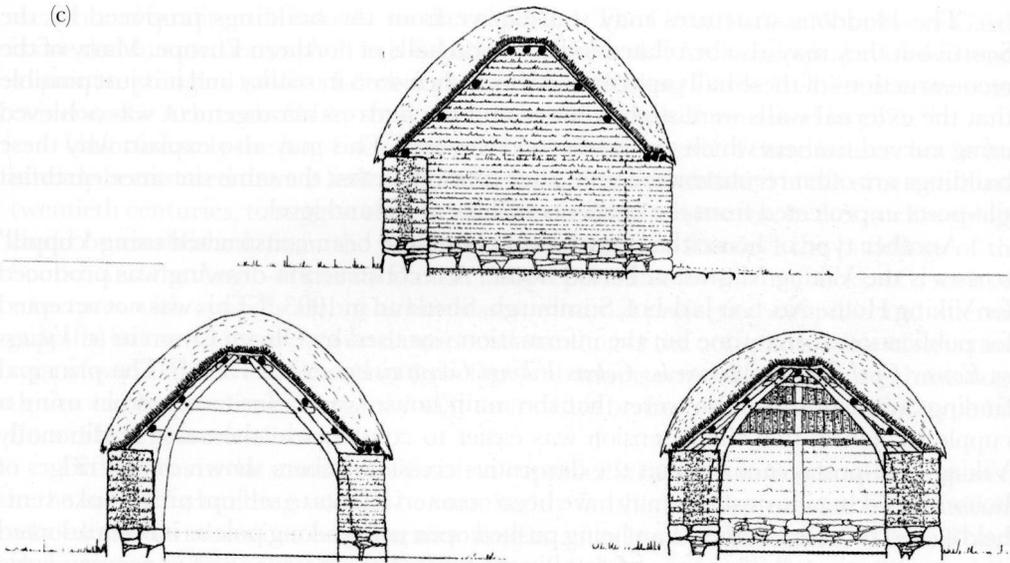


Fig. 25
(c) Cross-sections

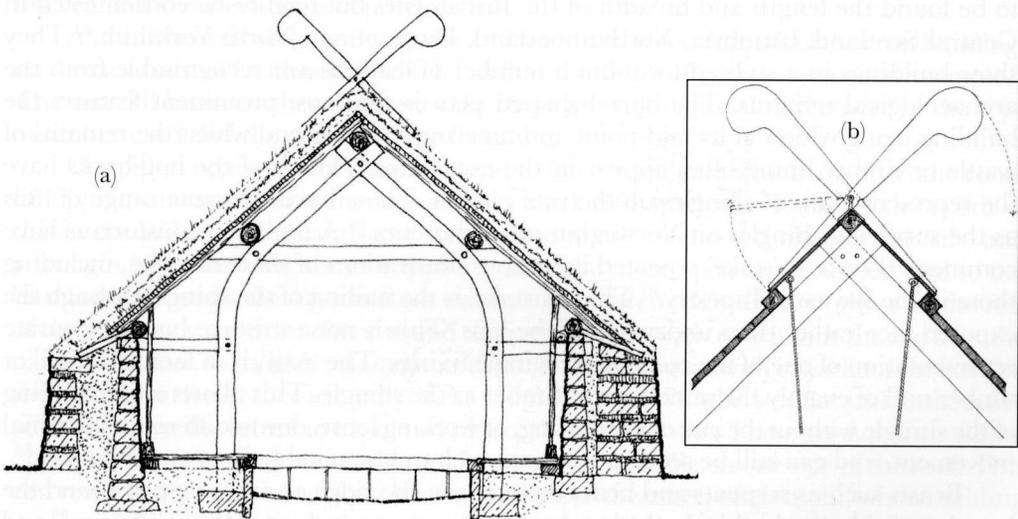


Fig. 26
Viking houses No 6, Jarlshof, Shetland: reconstruction drawings
(a) cross-section of house

(b) cross-section of ventilation control flaps showing control ropes and counterbalance weights

The Hoddum structures may well derive from the buildings produced by the Scottii but they may also be related to the Saxon halls of northern Europe. Many of the reconstructions of these halls appear awkward when seen in reality and it is just possible that the external walls were slightly lower and the buttress arrangement was achieved using curved timbers which project beyond the roof. This may also explain why these buildings are often reconstructed time after time on almost the same site since earthfast sile-posts unprotected from the elements will rot at ground level.

Another type of house that may have at one time been constructed using 'cuppill' trusses is the Viking Migration Period house. A reconstruction drawing was produced for Viking House No. 6 at Jarlshof, Sumburgh, Shetland in 1993.⁸² This was not accepted for publication at that time but the information was used by Olwyn Owen in *les Vikings en Ecosse: Quel Type de Maison les Colons Vikings Construisaient-ils?* in 1999.⁸³ The principal findings from this exercise were: that the main house was easier to construct using a cupple structure; that the extension was easier to construct in the more traditionally Viking goal-post structure; that the decorative crossed timbers shown on the ridges of houses in Viking illustrations may have been counterweights to self opening smoke vents held closed by a rope rather than being pushed open using a long pole as is often adopted in reconstructions.⁸⁴ This type of detailing is typical of a people used to moving large weights both on land and at sea. It is certainly much easier to pay out a rope to open the vent than to lift the entire weight on a wooden post and strap this to the structure to counteract the action of gusts of wind.

The original report also makes reference to the possibility that hog-backed tombstones are three-dimensional representations of this class of house. Hog-backed tombstones are to be found the length and breadth of the British Isles but tend to be concentrated in Central Scotland, Cumbria, Northumberland, Durham and North Yorkshire.⁸⁵ They show buildings in a stylised form but a number of features are recognisable from the archaeological remains. The barrel-shaped plan is the most prominent feature: the building being widest at its mid-point and tapering to either end whilst the remains of wattle or timber lining often appear in the excavations. Many of the hog-backs have the representations of shingles on the roof pitches. These have the same range of tails as the surviving shingles on Norwegian stave churches.⁸⁶ A number of historians have commented on a 'mistake' repeated in various illustrations of these shingles, including those in the Bayeux Tapestry.⁸⁷ This 'mistake' is the nailing of the shingle through the exposed face rather than under one of the laps. This is not a mistake but an accurate representation of one of the recognised shingle fixings. The 'nail', is in fact a 'trenail' or timber nail of exactly the same type of timber as the shingle. This allows a tight nailing of the shingle without the risk of its splitting, or working loose, due to differential thermal movement, and can still be seen on some stave churches, notably Borgund, Norway.⁸⁸

Beasts such as serpents and bears often adorn the ridge or are wrapped round the junction of ridge and gable. In the hog-backs these are carved out of the solid stone⁸⁹ and therefore integrated into the mass of the structure whilst on the Norwegian stave churches they project in a much more dramatic form, but the symbolism remains constant.⁹⁰

Since hog-backs are likely to represent houses at the very highest levels of society it is not surprising to find shingled roofs represented. Shingled roofs were a sign of great

wealth and quality well into the medieval period. The Great Hall at Winchester Castle is one documented example,⁹¹ as is Salisbury Cathedral.⁹² Archaeological evidence tends to point to shingled roofs at Edinburgh Castle and Stirling Castle,⁹³ whilst documentary evidence for Arbroath Abbey shows that some shingles still remained in 1571.⁹⁴

Unfortunately the hog-backs fail to record the structure of these houses, but as has already been stated there is little, other than an opinion established in the nineteenth and twentieth centuries, to suggest they were not 'cuppilled' structures. In fact, a chronology could be established, from the Saxon Halls of Northern Europe, the buildings of the Scottii, and the Anglo-Hiberno-Danish halls represented by the hogbacks, of a series of structures with cuppills acting as buttresses; minimal projection cuppills; and internal cuppills, but much more data on dates, social standing of the occupants, scale of structure, type of woodland available and so on before embarking on producing such a chronology this would be practical. They may well turn out to be from the same building type but from different levels of society.

Differences in the standard of finish in cuppilled structures in Scotland are apparent in the surviving building stock. The most highly finished are represented by beautifully adze-dressed timbers in a building now used as a hay barn at Auchmore, Wester Ross.⁹⁵ Here the 'cuppills' are identical above the knuckle, but some rest on the wallhead whilst others have 'sile-posts' sitting on the base course. The pegs holding the knuckle joint have circular tops and are arranged in the same way on every joint. The design is simple and the quality of finish is excellent. It seems very unlikely that a hay barn or its earlier use as a sheep cote is likely to be its original use. Similarly the timbers forming the cuppill roof at Fearnraig, Wester Ross have an adze-dressed finish but there the timbers are uneven and show evidence of previous use.⁹⁶

At the other end of the scale are the driftwood and wood cuppills of the croft buildings on the east coast of Caithness of which Laidhay, Latheron, Caithness is a good example.⁹⁷ The rest fall between these extremes but there are still regional differences in the type of timber used and the quality of the finishing.

Cuppill structures from Cumbria tend to have 'ogee' siles which are often the result of lopping unwanted branches to obtain a slack S-shaped sile. Those to the north of this in the Western Highlands and Argyll tend to use coppiced timber for the 'sile' and a straight 'sile post'. Highland 'cupples' tend to be more open and rounded and so on. Similarly, although the Wester Ross examples are often adze-dressed, those in the rest of the country vary from either round or riven timber, with or without the bark on the natural surfaces, to roughly squared axe dressed timbers again with or without the bark on the natural surfaces. Occasionally, these roughly squared timbers or natural timbers are pit-sawn down the centre to make two siles of the same profile. These are not always used opposite each other but are used to achieve a regular profile on one side of the roof. This can result in a change of roof pitch from one side to the other, often useful when building against a natural slope, or where there is a particularly strong prevailing wind.

Sadly, only buildings from the lower end of the social scale survive. Fragments of more superior buildings may be found in these lower class structures but by far the best representations occur in Dark Age and early Medieval sculpture. The hog-backed tombstones have been mentioned in respect of overall appearance and roof and wall details

although the detail is out of scale with the structure as a whole. The Pictish cross-slabs perhaps give the most accurate representation of the type of finish that may have been used in upper class dwellings with intricately woven decorative basketwork providing an internal wearing surface to earthen walls.

Cuppills were still used for new houses in the second half of the eighteenth century. Expenditure against the crops of 1762-5 on the Mansfield Estates based at Scone Palace, Scone, Perthshire,⁹⁸ notes:

‘Crop 1764.

32. By cash paid John Marshall for mounting the feal of the walls, Kebbering, devoting, and thatching the Smiddy at Newbigging per recet10shs £6: -: -.

33. By an accot. Paid Charles Duncan for cutting timber, binding couples, cutting kebbers, sawing and making roof trees and lentils, and making doors and windows, furnishing a lock, crooks and hinges, and 10 dozen kebbers for said Smiddy of Newbigging per discharged Accot £1: 10: 4 str £18: 4: -

Similarly the form of Ardinaw (Ard na dabh) (NN573173) was destroyed by fire and a statement of costs was drawn up by birleymen for its rebuilding on 22 June 1762.⁹⁹

For cleaning to foundations	0.3.0
Quarrying and leading additional stones	0.4.6
Rebuilding the stonework of the said house with the	
Divoting the same	1.16.0
Casting and leading fail and divot etc.	0.15.0
Thatching with straw or ferns	0.11.8
Each couple with pantrees 8 in number	
8 shillings in all	3.4.0
16 cow stalls to be sett in the house	0.8.0
Two doors and three windows	0.8.0
To buy cabbers	0.12.0
To leading the whole timber from Ardvorlich	
at Lochearnside being upwards of ten miles	
bad rod if no timber be allowed in the Barony	3.15.0
for binding the couples	<u>0.,5.0</u>
To each of the Comprissors on Shilling	

TOTAL £12.2.2

Donald Buchannan
D B.....(/)
Patrick Fergusson
Donald McFarlane
Robert Buchannan'

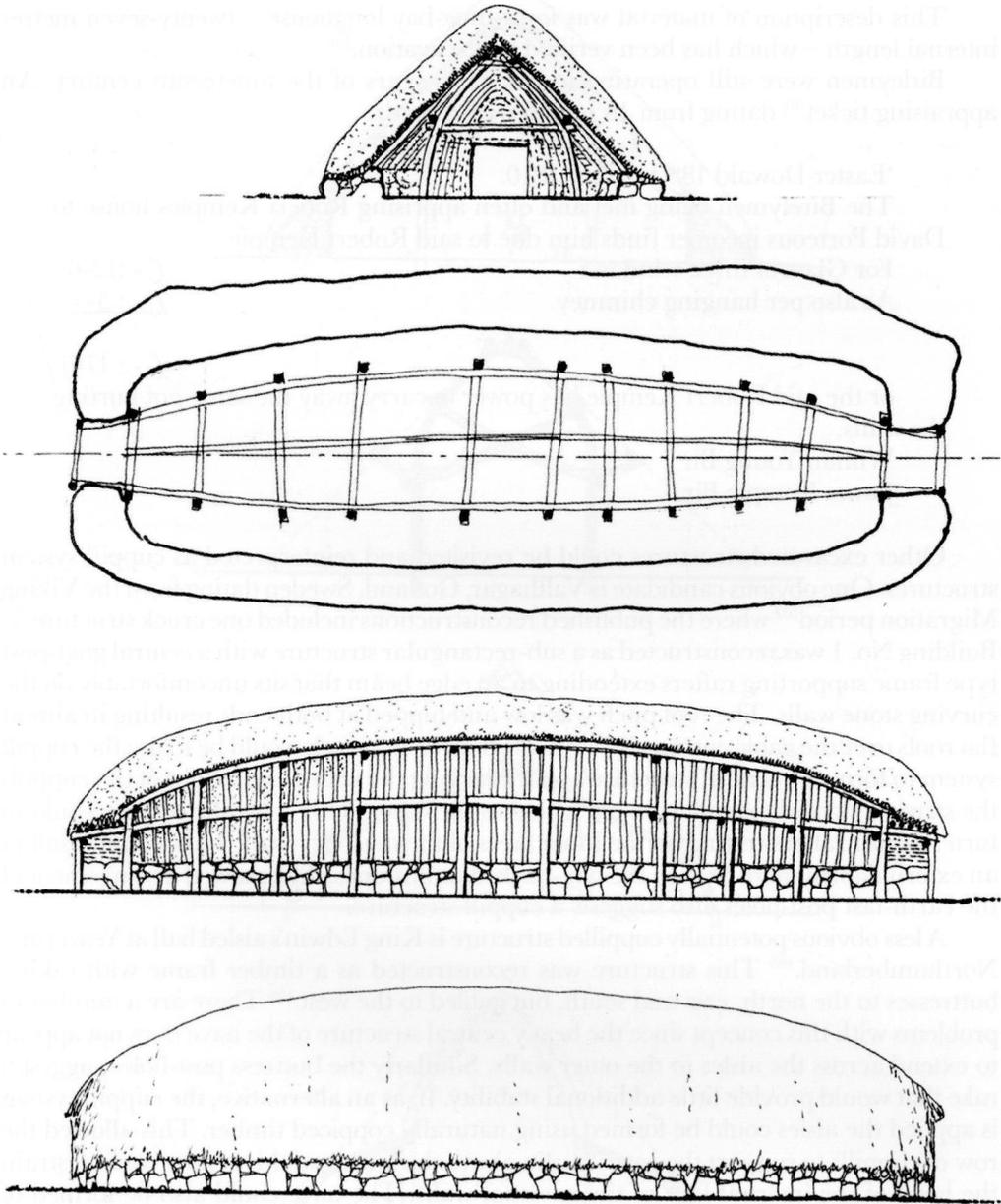


Fig. 27
Vallhagar, Gotland, Sweden: House 1
Alternative reconstruction drawings using cuppill system

This description of material was for a nine-bay longhouse – twenty-seven metres internal length – which has been verified by excavation.¹⁰⁰

Birleymen were still operating in the early years of the nineteenth century. An appraising ticket¹⁰¹ dating from 18 January 1810 reads:

‘Easter Dowald 18th Janaury 1810.

The Birelymen being met and often apprising Robert Kempies house to David Porteous incomer finds him due to said Robert Kempie

For Glass of three windows £ - :12-6

As also per hanging chimney £ - : 5- -

£ - : 17-6

or the said Robert Kempie has power to carry away the same not hurting the walls.

Willian Young Bir

James Kempie Bir.’

Other excavated structures could be revisited and reinterpreted as cuppill system structures. One obvious candidate is Vallhagar, Gotland, Sweden dating from the Viking Migration period¹⁰² where the published reconstructions included one cruck structure.¹⁰³ Building No. 1 was reconstructed as a sub-rectangular structure with a central goal-post type frame supporting rafters extending to an edge beam that sits uncomfortably on the curving stone walls. The roof pitch was low and hipped at both ends resulting in almost flat roofs over the gable entrances.¹⁰⁴ An alternative approach would be to use the cuppill system to form the central structure and by varying the width and height of the cuppills the structure could extend from one gable to the other. This central structure could in turn support rafters resting on the inner faces of the masonry wall. This would result in an external form more akin to the hog-backed tombstones. The skewed arrangement of the earth-fast post-holes also suggests a cuppill structure.

A less obvious potentially cuppilled structure is King Edwin’s aisled hall at Yeaveering, Northumberland.¹⁰⁵ This structure was reconstructed as a timber frame with raking buttresses to the north, east and south, but gabled to the west.¹⁰⁶ There are a number of problems with this concept since the heavy central structure of the nave does not appear to extend across the aisles to the outer walls. Similarly the buttress post-holes suggest a rake that would provide little additional stability. If, as an alternative, the cuppill system is applied the aisles could be formed using naturally coppiced timber. This allowed the row of cuppills to support the eaves purlin above the knee and this in turn could restrain the head of the internal face of the external walls. The nave could also be formed of larger cuppills possible cut from the curved limbs of large trees and jointed to vertical posts. These larger cuppills could be braced using the same type of cuppilled timber as used for the aisles but turned upside down. This arrangement allows an even spacing of purlins down the main pitch of the roof. It also separates the nave cuppill joints from the aisle cuppill joints. The aisle structure can be skewed to sweep round corners and

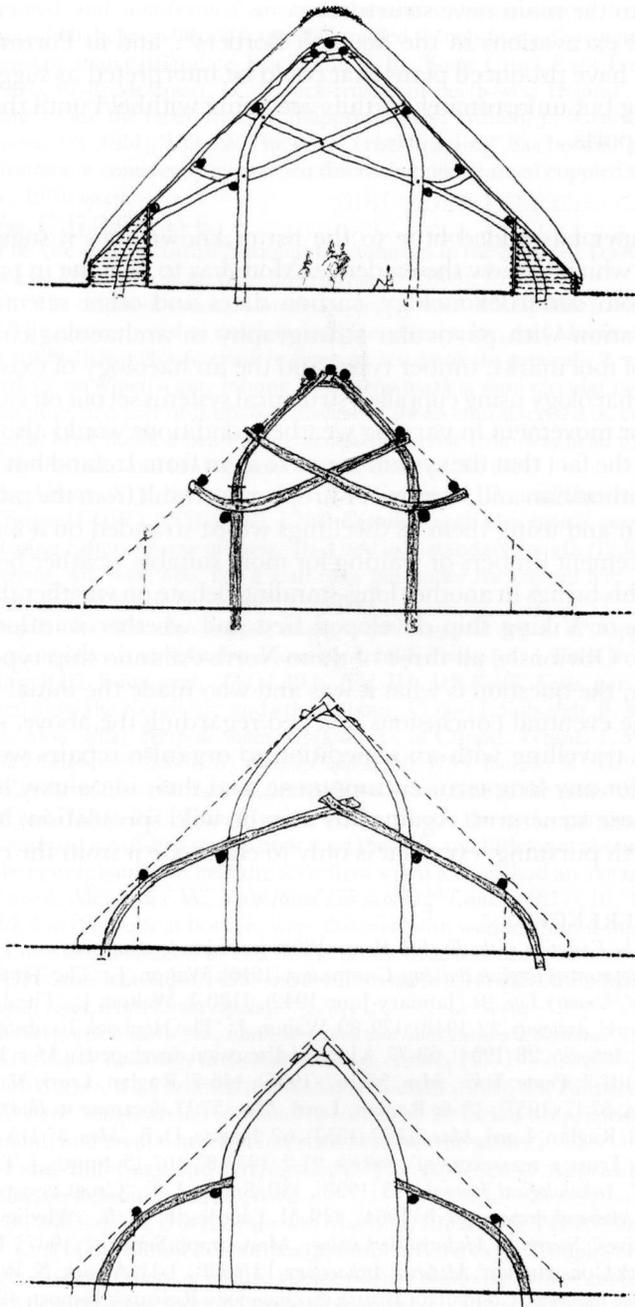


Fig. 28
King Edwin's Hall, Yeavinger, Northumberland
Alternative reconstruction drawings using cuppill system

provide stability to the main nave structure.

Other recent excavations in the Scottish Borders¹⁰⁷ and at Portmahomack, Ross and Cromarty,¹⁰⁸ have produced plans that could be interpreted as suggesting a cuppill system of building but unfortunately details are being withheld until the publication of the excavation reports.

CONCLUSIONS

Although this paper has added little to the list of known sites it suggests a different perspective from which to view the evidence. More has to be done in producing dating evidence both from dendrochronology, carbon dates and other scientific methods to dating by association with particular stratigraphy in archaeological excavation to detailed studies of tool marks, timber types and the archaeology of existing thatches.¹⁰² Experimental archaeology using cuppilled structural systems set out on various plan forms and monitored for movement in varying weather conditions would also be helpful.

As to origin, the fact that the system seems to stem from Ireland but be connected to structures in Scandinavian and Northern Europe, may result from the practice of turning ships upside down and using them as dwellings whilst stranded on a foreign shore and looking for replacement timbers or waiting for more suitable weather before continuing with a journey. This brings in another long-standing debate on whether the Pictish galley, Hebridean galley or Viking ship developed first and whether it influenced the other two types of ship. Obviously, all three of these North-Atlantic ship types derived from something earlier, the question is what it was and who made the initial breakthrough.

Whatever the eventual conclusions reached regarding the above, shipwrights and ships' carpenters travelling with an expedition to organise repairs would have acted as housewrights for any long term encampment, and their ideas may have formed the inspiration for these structures. Again, this may be wild speculation, but it is a line of investigation worth pursuing, even if it is only to eliminate it from the equation.

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3. The terms 'framed' and 'non-framed' are crucial to the understanding of the structural principles adopted. All too often the term 'cruck-framed' is applied to 'non-framed' structures. The Irish writers tend to differentiate at an earlier date. See Evans, E. E., 'Some Cruck Roof Trusses in Ulster', *Ulster Folklife*, 13 (1967), 61-8; McCourt, D., 'Cruck-trusses in north-west Ireland', *Gwerin*, 3:4, 165-85. Others continue to use the term 'framed' inappropriately: Walton, J., 'Cruck-framed buildings in Scotland', *Gwerin*, 1:3 (1957), 109-22. The term 'cruck-framing' has become so universal that it is difficult to eliminate it completely even when discussing non-framed cuppled structures.
4. Alcock, N. W., 1981, *op.cit.*
5. Walton, J., *Man*, 57:17 (1957), 15-6.
6. Walker, B., 'The Use of the Scottish National Dictionaries in the Study of Traditional Construction' in Kay & Mackay, *Perspectives on the Older Scottish Tongue* (2003), 153-78.
7. Alcock, N. W., 'The origin of crucks: Innocence or Naiveté? A Response', *Vernacular Architecture*, 37 (2006), 50-3. The nearest word to cruck is cruik, see Grant, W., and Murison, D., *Scottish National Dictionary*, III (1929-1976), 263-5; cruik is given as 1. a hook (in general), 2. a hook (1) by which a door is fastened, (2) on which a gate is hung, 3. a sheep mark (a semi circular notch in one side of the ear), 4. a misfortune, 5. a holt or limp, 6. a disease of sheep characterised by curvature of the neck, 7. (2) crook-bank, kruk baulk a beam lying across the house from waahead to waahead above the fire, from which the links and kruk (crook or hook) descend (Sh1914).
8. Craigie, W. A., Aitken, A. J., Stevenson, J. A. C., Watson, H. D., and Dareau, M., *Dictionary of the Older Scottish Tongue [DOST]* (1931-2002), 1.781. *Cuppill*, *Cupple* also *kuppill*, *cuppel*, *cuppoill*, *cupill-ile*. 1. A pair of sloping rafters or one of these. 1b. Used as a standard length (12 feet) in a building. 1c. attrib. with *bigging*, *feit*, *room*, *treis*. For ij wall rasis put under the cuppill feit: 1523; v.1. To couple, unite, join together 2. to frame (a roof) with couples. *Ibid.*, 1.711. *Coupill*, *Cowpill* n. also *couppell*, *couple*, *coople*, *cowpell* 2. A pair of clopping rafters or one of these. For coupling of xv coupill to the chapel roof: 1496 *Treas. Acc.*, 1.302: Greit treis of asche sawn to be couppillis; 1567. Edinburgh. *Test*, 1.49.b. *Ibid.* III. 413 *Kepill*, *Keple*, var. of Cuppill... To are workman to red (tidy) the Kepill feit. and uther labour: 1555-6 Edinburgh. B. Reco II 367. *Ibid.*, III. 439 *Kippil(l)* n. Also *-ell(e)*, *kyp(p)ill*, *kipell*, *kip(p)le* (var. of Cuppil). Grant, T. W., and Murison, D., *Scottish National Dictionary* (1929-1976), *Couple*, *Cupple*: Fife 1795 *Stat. Acc* XVII.140: 'The oak couples were of a circular form, lined with wood, and painted in the taste of the times': Moray 1830. Lauder, T. D., *Moray Floods* (1873), 231. 'Syne I cut the ceiling aboon the bed, - pat the door atween the tua chair backs - and laid a caff-bed on the door - set the wife and little ones aboon that - an then gaed up mysel' to the couple baulk, an'held the door firm wi mi feet an' had an axe ready to cut the house roof in case o' need'. Alexander, W., *North Rural Life in the 18th Century* (1877), 10. 'The roofing 'cupples' firmly embedded in the walls at bottom, were fastened with wooden pins a-top to a short cross bar, the roof-tree extending from end to end of the house over this bar and between the points of the couple-legs: [Old Scots has *coupill* 1496: *couple* 1689: *cuppill* c.1420 (*DOST*): Mid Eng. *Cuppil*, *coupill*: Old French *copla*, *cofle*, from Latin *copula*].
9. Walker, B., McGregor, C., Little, R., *Earth Structures and Construction in Scotland: A Guide to the Recognition and Conservation of Earth Technology in Scottish Buildings*, (1996), 127.
10. Fenton, A., and Walker, B., *The Rural Architecture of Scotland* (1981), 53; Pennecuik, A., *Works* (1815), 58 note. There were 'rough arches of stone, 18 inches by 20 inches deep, springing from the walls, meeting at a point, and set at 6 at 7 feet intervals between the gables'.
11. Walker, B., 'Farm Buildings and Archaeology: The evidence of Appraising Tickets', *Scottish Archaeological Gazette*, 8 (Summer 1985), 8-12.
12. *Ibid.*; Walker, B., 2003, *op.cit.*, 170-1; Grant and Murison, 1929-1976, VII.25 Pan n2. Also *pann*, *pawn*, *pau-*, *pand-*. 1. One of the number of horizontal timbers fixed to the Couples or rafters of a roof and running at right angles to them, a purlin. Hence *pan and couple roof* [where couples were used] or *pan and kaiber roof* [where the pans spanned from gable to gable].
13. Craigie, Aitken, Stevenson, Watson & Dareau, 1931-2002, *op. cit.* 'Cuppill' fourteenth century.
14. Walker, B., 1985, *op.cit.*
15. Grant & Murison, 1929-1976, I.134 *Birlie* 2. *Birlie-Burley-*, *Birla-*, *Birlaw-*, *Barley-*, *Birley-man*: a man who estimates the value of a crop [or building] hence a petty-officer appointed to settle local disputes,

- a parish arbirer, a member of the *birlie-court*. Banff, 1928 'I min fin the vailiations for the oot-gyaan tenant wis dean by the birley man'.
16. Mansfiels Estate Papers, NRA (Scot) 10988 – Murray, 1810 [This typical example reads:] Easter Dowald, 18th January 1810. The birleyemen being met and often appraising Robert Kempies house to David Porteous incomer finds him due to said Robert Kempie. For glass of three windows £-:12:6. Also per hanging chimney £-:5: -. Total £0:17:6 or the said Robert Kempie has power to carry away the same not hurting the walls. William Young Bir. James Kempie Bir'. Walker, B., 'Farm Buildings and Archaeology: The evidence of Appraising Tickets', *Scottish Archaeological Gazette*, 8 (Summer 1985), 8-12.
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