The logistics of building bastle houses and associated buildings in Upper Clydesdale – c1600AD.

Occassional Paper No. 2

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Introduction

In this paper attempts are made to answer questions regarding the selection, acquisition and use of materials to build bastle houses and their associate buildings in the Southern Uplands of Scotland, specifically in the upper Clyde valley area.

A series of other occasional papers are intended and which will be a consequence of the fieldwork on post medieval settlement in southern Scotland by Biggar Archaeology Group (BAG).

The purpose here is to better understand the logistics of construction of bastles and contemporary buildings (Pl's 1&2), since a series of them have been investigated historically and archaeologically by BAG and with research continuing. Considerable evidence of their distribution and occupation and use has been established through archaeological survey, research and excavation (Ward 1998), however, few details of their conception in the area and of their construction have been considered.

The following aspects will be discussed here:

- Materials used in construction
- Transport of materials to sites
- Suppliers of materials or acquisition sources
- Costs of materials and builders

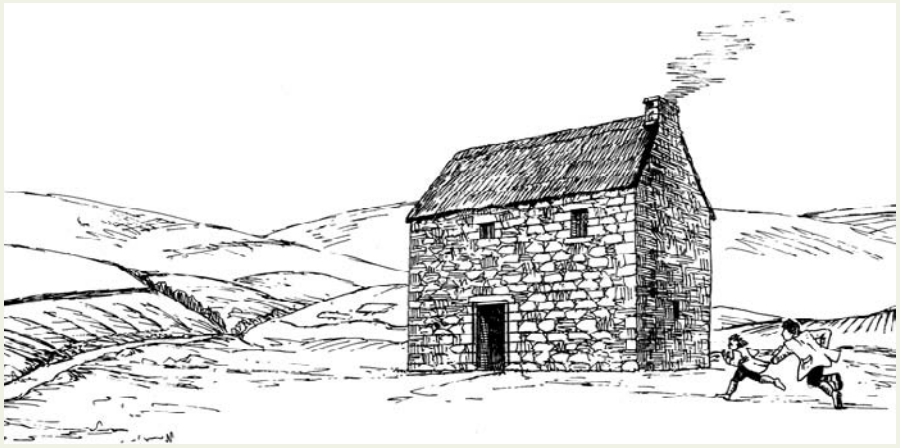

Plate 1 Model of a 'short type' bastle house

Plate 2 Model of a pair of house/byres as found at Glenochar

Materials Used

This is further subdivided into the various materials used;

- Stone, slate, sandstone, sand and gravel, lime, clay
- Timber and brushwood
- Metal; iron and lead
- Glass for windows
- Turf, grass, straw, rush, heather, bracken

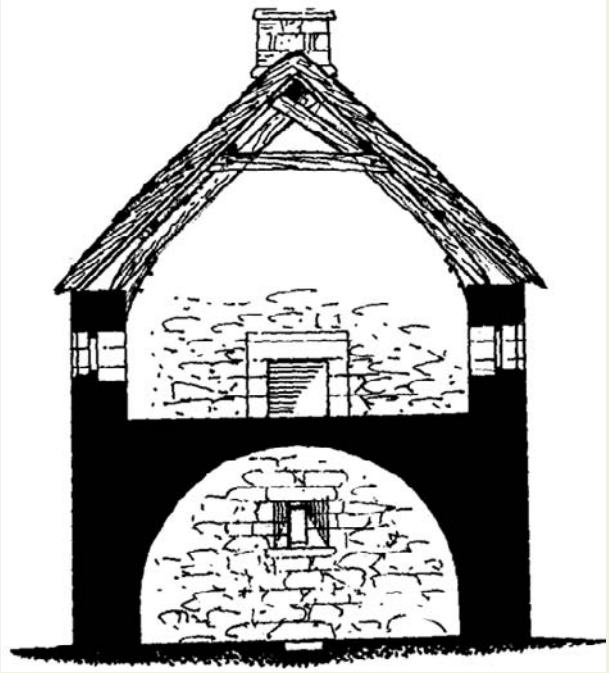

Plate 3 Model of a thatched bastle house with vaulted basement

Stone

The principal material used in the construction of a bastle is stone, the fundamental criterion is the security of a defensive house (which is a bastle) and requires it to be able to resist limited attack and be fire proof.

Bastles in Clydesdale, as far as is known, were built with extremely strong walls being at least 1m thick and with barrel vaulted basements (Pl 3). In some instances roofs were slated, a further fire proofing method, however, others were roofed with some form of thatch and in these instances, assuming the roof material was dry, they could easily be fired, especially as the buildings were only a double storey high and within easy reach of torch throwers. On the other hand if the thatch was damp or wet, it would not have burned easily from an external source of ignition.

Several of the Clydesdale bastles were built with greywacke stone (Pl's 4-7) because of its immediate availability on the landscape which almost entirely consists of that solid geology. Greywacke is a hard, fine to course grained sandstone which was formed in a deep marine environment in the Silurian and Ordovician geological epochs. Other bastles were built using locally available sandstone of Lower Devonian age.

The rock may be acquired by three principal methods;

Gathering from scree derived from outcrops, and which in the case of greywacke has sharp angular edges and flat faces which are excellent for building.

Plate 4 Greywacke stone walls at Wintercleuch bastle

Plate 5 Greywacke stone walls at Wintercleuch bastle

Plate 6 Greywacke stone walls at Smithwood bastle

Plate 7 Greywacke stone walls at Windgate House bastle

Gathering boulders which have seen some alteration due to transportation in glaciers or river systems, causing them to be sub angular or rounded, with or without flat surfaces good for building wall faces, but which can nevertheless be built with skilled hands to form dry or mortared walls.

By quarrying rocks, which offers perhaps the greatest potential for selectivity as the rock will cleave along jointing and or bedding planes giving flat surfaces and it can be modified at source by further shaping if desired, before transportation to the building site.

Scree and quarried stone should be the easier to build with given its main characteristics of sharp, angular and with flat faces. By using these types of rock to build, the joints in a wall face will be narrow, which may result in a saving on the mortar being used, and such joints will allow for the tighter fitting of stones, requiring less pointing and pinning stones and therefore be more stable.

However, much would depend on availability and quarrying was perhaps the most labour intensive, at any rate it appears to have been the least attractive option of the builders.

Gathering stones was a way of clearing the land of unwanted rocks causing problems with cultivation and perhaps even grazing, and it seems that this process was mostly adopted by the builders of bastles and their subsidiary buildings.

Plate 7a Example of plough marked building stone at Logan

Plate 8 Greywacke stairway at Wintercleuch bastle house

Plate 9 Greywacke stairway at Glenochar bastle house

Plate 10 Greywacke stairway at Windgate House bastle house

The use of rounded stones on the other hand means more difficulty and greater skill being required to make good walls (Pl's 4-7), especially with vertical faces, with or without mortar. Here the facing joints are wide, requiring more mortar pointing and pinning of joints with small angular stones in order to stabilize the principal building stones.

Nearly all of the Clyde bastles (perhaps excepting Nemphlar below) have been built with gathered stone and it is likely that this was all found in the immediate vicinity of the building site, perhaps from pre existing field clearance piles and some of which may have been pre historic as such monuments abound in the area. Burn courses would be scoured for stones as the gravel and sand used in the mortar had to be extracted locally and mostly from burn courses.

Field clearance stone was certainly used at Logan (Ward 2013) as many have plough striae with multiple scores, showing that metal ploughs were being used (Pl 7a). These stones are valuable evidence that the settlements pre date the buildings under discussion.

Quoins, door steps, stair treads, cruck positions (Pl's 8-12), and of course walls were all made using greywacke. As far as may be determined door and window openings apart from the external faces of some slit windows, were made using dressed sandstone. Dumfriesshire sandstone as used at Glenochar, Wintercleuch and Kirkhope (Pl 11) and at the latter two, roll moulded stair newels were made from it. Door rybats were found at all and in the case of Glenochar a slot for a draw bar tunnel was found in one piece. Only at Glendorch were quoins made with sandstone.

At Smithwood, warm cream coloured carboniferous sandstone was used for the surviving single rybat of the doorway. At Logan, Dumfriesshire stone was cut to form a doorway with a double rybat (Pl 12a), perhaps for a yett and a door.

Glendorch, clearly a cut above all other bastles, used maroon coloured sandstone of Lower Devonian age, found and quarried between Crawfordjohn and Roberton. It had the following pieces made from it; quoins (Pl 13 & 13a), door steps, door and window openings, one slit window survives with a chamfered edge to the external facing stones (Pl 14), roof ridges, eave drip stones and uniquely, gun loops, and possibly a fire place mantle piece. Many of these stones were recycled into the construction of the adjacent 19th century shepherds cottage, itself now a complete ruin. It is likely that Glendorch was built by the wealthy and influential Foullis family who were granted the lease of the Leadhills mines by James VI, hence the superior quality of the house here.

Pale cream/grey sandstone, certainly carboniferous as fossils were seen in it, was used for windows at Windgate House. The sills and lintels (Pl 15) had been cut for the insertion of two iron bars set 6" apart in the narrow window frames. The door surround here was robbed out completely and it is likely that the same stone was used for it.

Nemphlar bastle has been built using Lower Devonian sandstone of which the Cartland Crags nearby consist of. The technique was to use small brick like stones (Pl 16), perhaps quarried, and which would make for easy building. Different light grey sandstone was used as a mantle piece (Pl 17) and this was removed from the building during recent alterations, it had a date of possibly 1607 and initials carved on to it and may have indicated the date of construction.

Carnwath bastle was built using Upper Devonian sandstone (Pl 18), and which must have been shaped to an extent to build the walls, however a small upper window survives and which had a single iron bar set in its centre to prevent forced access, it has been made with light grey sandstone as is found on nearby Stanemuir and from which much of Carnwath town is built from. Both types of sandstone occur in nearby sources.

Plate 11 Greywacke stairway at Kirkhope bastle house

Plate 12a Double rybat stone from Logan

Plate 12 Cruck pad a slot at Glenochar fermtoun

Plate 13a Dressed sandstone pieces from Glendorch bastle house

Plate 14 Sandstone at slit window in Glendorch bastle house

Plate 15 Dressed sandstone and roof slates at Windgate House bastle

Plate 16 Sandstone 'bricks' used for walls at Nemphlar bastle house

Plate 17 Sandstone mantelpiece at Nemphlar bastle house

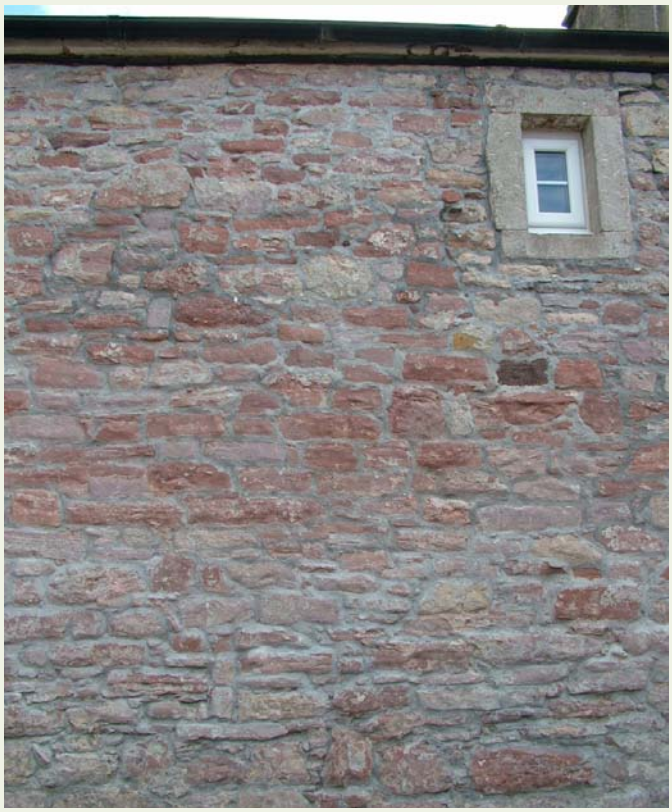

Plate 18 Original upper floor window at Carnwath bastle house,

Plate 18a Slots for window glass at Carnwath bastle house

Plate 19 Blocked up slit window to basement at Carnwath bastle house

Plate 20 Date stone at Carnwath bastle house

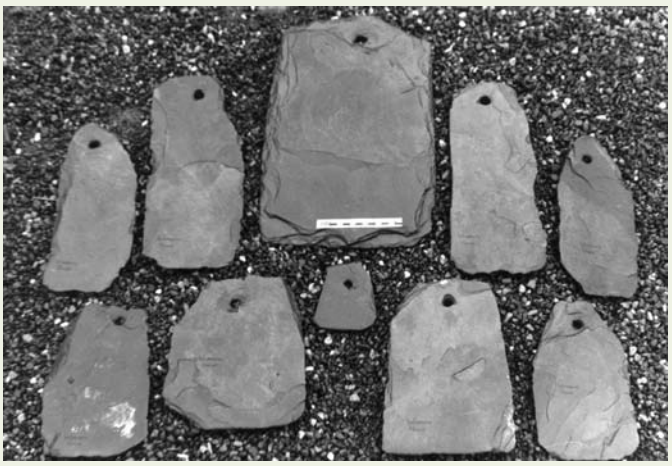

Plate 21 Slates from Windgate House bastle

Plate 22 Slates from roof at Glendorch bastle house

Plate 23 Slates used as floor drain covers at Glenochar fermtoun

Also at Carnwath (Pl 18a) stones from a semi glazed window were re used as door frames at some point of alteration and these are still visible with the slot created for inserting leaded glass of a half shuttered window, presumably from the upper, house part of the building. A slit window (Pl 19), only recently discovered in a long wall, appears not to have been made with a formal dressed sandstone opening. A date stone (Pl 20) which is inserted into a nearby but later wall has 1611 and a set of initials and may indicate the date of construction of this bastle house which is now incorporated into a more modern farm house.

Slates

Slates were used as roofing at Windgate House (Pl 21) and at Glendorch and these were fixed using wooden pegs through holes in the slate around 10mm wide. At Glendorch an 18th century repair to the roof was evident by slates which were fixed using iron nails through small holes (Pl 22). The slates from Windgate ranged in size from 450mm by 300mm down to 150mm by 100mm, showing that great economy was being practised by using the small pieces.

The evidence from others sites which have been excavated are that the roofs were thatched. The slates at both the above locations were Southern Uplands type of which more below.

Slates were also used for floor covering and occasionally as pinning stones in walls. The use of slate was extensive at Glenochar but not for roofing, only floor covering and drain covers (Pl 23) and these were in an 18th century context, not the primary period of building the bastles 100 years earlier.

The slate was Southern Uplands type but not similar to the famous Stobo slate near Peebles which is a harder type. The best known slate quarry in upper Clyde is Glenochar; however the nearby bastle of the same name did not have a slate roof, although in the 18th century much slate was used as floor material. The earliest use of the Glenochar slate quarry is not known but it does seem to be unlikely that the quarry was opened when the nearby bastle house was built, c1600.

Plate 24 Flush pointed lime walls at Smithwood bastle house

Plate 24a Wintercleuch bastle house, restored remains

Lime

The quality of the lime mortar and indeed its use on the bastle houses was high; Samples of mortar were analysed from Glenochar and Wintercleuch in order to give the best match for restoration work and small brick like inclusions were found in them, further pieces of this material were later found in Wintercleuch lime mortar and it is now known that they are baked red clay, possibly pieces of brick kilns within which the lime was burnt.

It is likely that all of the lime is from carboniferous sources of which the two nearest are around Douglas and West Linton. The quality of the Glenochar mortar is self evidently high, with a ratio of 1:3 of lime to gravel. This high quality mortar itself is one of the distinctions of the Clyde bastles compared to those on the Anglo Scottish border, where walls are much thicker, being at least 5 feet, but using squared blocks of sandstone with a weak mortar mix which now crumbles to the touch, whereas the Clyde mortar is solid.

The observations on the cores of the walls of Windgate House, Glenochar, Glendorch, Wintercleuch and Kirkhope shows the walls were cored with lime mortared rubble and the lime must have been liquid enough to be poured, probably hot, as no cavities between stones are observed, which is the type of thing often seen in later 19th century rubble walls where a stiff mix must have been used by the builders. Using a fluid mix means that more mortar would be used and it is the opposite for the other, and this demonstrates that the bastle masons were not considering economy of mortar use, as were their later fellows. Further evidence of using fluid mortar mixes is often seen in tower or castle vaults, where the mortar has poured through the joints in the vault stones, creating a matrix of the timber shuttering, and even showing the wood grain and saw marks of the supporting timber used during the vault construction.

The walls of the bastles were also full or flush pointed (Pl 24), not necessarily harled and this would have the effect in dry weather at least, of a gleaming white building on a landscape of otherwise turf buildings. Eventually the walls would be weathered back, washing off surplus lime, to reveal much of the stone work including the use of pinning stones in the joints.

The bastle houses must therefore have been quite striking and really were buildings before their time, as far as the social status of their occupants was concerned and also by what else was visible in their localities. The only other mortared buildings would have been the laird's castles and towers and perhaps churches.

The original lime would be fairly local produce and the quantities required are indicated by the 28 bags (@ 25 kilos each) of hydraulic lime which were used to consolidate the fabric of Wintercleuch bastle after excavation, and which is only a very small part of the original building (Pl 24a).

Clay

Fairly good clay may be found along most burn courses in southern Scotland, it is part of the makeup of the till and which was formerly called boulder clay. Surprisingly little evidence for its use is seen in buildings in the area under discussion, however it was used in the basal stones which formed most walls of the Glenochar fermtoun, not the bastle which was lime mortared, but the other long buildings which were house/byres.

Although clay has been used as a bonding agent for walls in other regions, its use here may have been as a damp course between the boulders of the wall footings, the remainder of the walls were carried up in turf.

Sand and gravel

Gravels and sand were presumably exploited from nearby burns and was sieved to exclude stones above c10mm in size, probably using ½" sieves. The analyses of the mortar from Wintercleuch show this (Pl 25) and few large pebbles are seen in the mortars of the bastle walls.

The mortar which is evident on the buildings was being used as a bonding agent for the stone content of the walls, and although masses of mortar up to 100mm in size are seen, it is clear that stone was generally used to pack the rubble as much as possible to save mortar, which nevertheless was liberally used and in a semi liquid state in order to ensure that no cavities existed within the wall.

The extraction of suitable grade sand and gravel was considerable as demonstrated by the ten tons of concrete sand used to restore the scant fabric of Wintercleuch Bastle.

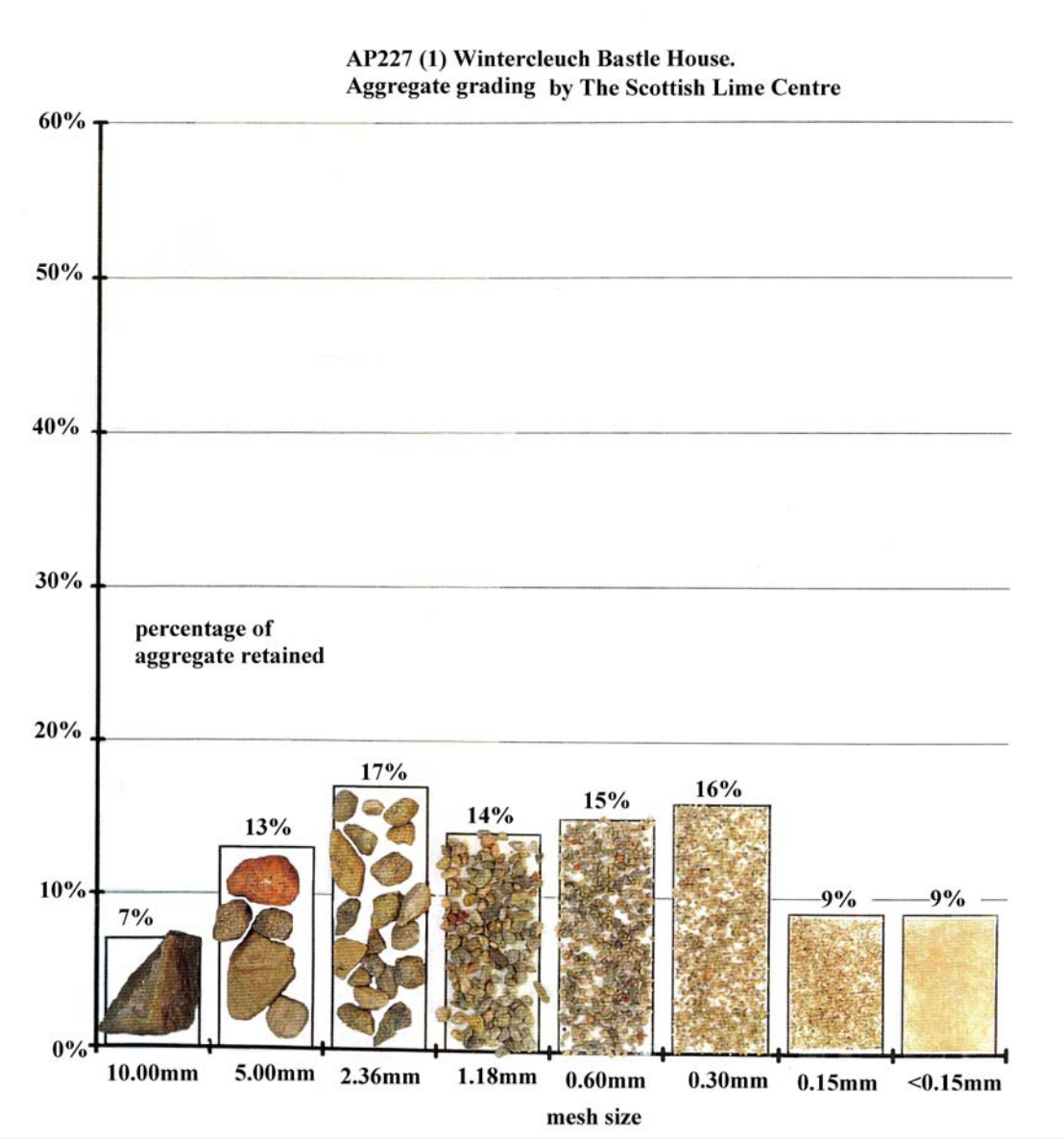

Plate 25 Mortar analyses from Wintercleuch bastle house

Timber

It is well known from literary sources that timber on the southern Scottish landscape was sparse to say the least. Early traveller's accounts from the 16th to the 19th centuries, especially those from south of the border are at one with each other, in amazement and despair at the barren aspects of the landscapes they travel through:

Fynes Moryson in 1598 reports there are many woods in the west side of Scotland but none in the east. (Brown, 1891)

Thomas Morer in 1689 reports:

> "The vulgar houses and what are seen in the villages are low and feeble. Their walls are made of a few stones jumbled together without mortar to cement 'em, on which they set pieces of wood meeting at the top, ridge fashion, and it does not cost much more time to erect such a cottage than to pull it down. They cover their houses with turff of an inch thick, and in the shape of larger tiles, which they fasten with wooden pins, and renew as often there is occasion, and that is very frequently done. Tis rare to find chimneys in these places, a small vent in the roof sufficing to convey the smoke away. — what a smother it makes and what little comfort there is sitting at one of their fires. — The common people deal in peat and turf, cut and dried in the summer". (Brown ibid)

Even as late as 1782 Pennant noted the absence of trees "neither tree nor shrub" while on his journey "through dreary glens and melancholy hills". (Brown, ibid)

However, Sir William Brereton back in 1636 reports on Cumbernauld House:

"there is so much wood encompassed the same as we could not discern the same" but also goes on to say "There is very little or no timber in any part of the south or west parts of this kingdom. I have diligently observed, but cannot find any timber in riding near a hundred miles". Brown, ibid)

So it appears that the general contemporary view is a dearth or absence of timber in southern Scotland, although in other parts it could be had.

The archaeology of the Clyde bastles has shown that hardly any timber is being burnt as fuel, the evidence is for burning peat and indeed turf, practically no wood charcoal is found.

The main use of timber on the bastles was for roofing as they all had barrel vaulted basements and therefore stone stairs and floors in the house and basement parts. Doors, windows and occasional pieces of furniture would have required sawn and dressed timber. Timber may also have been required for internal division walls* upstairs, and for stairs and a floor to the attic spaces in roofs, which almost certainly would be exploited as sleeping or storage spaces, for example see Plate 63 where Mervinslaw bastle near Carter Bar has a window for the attic space. How ornate or plain any woodwork in bastles would have been is not possible to say on site evidence.

*Some English bastles have stone walls in their upper chambers (Pl 64) and which would have supported roof timbers, see below)

Plate 26 Internal roof at Hyndford House in Lanark

Plate 27 Internal roof at Hyndford House in Lanark, showing wooden peg

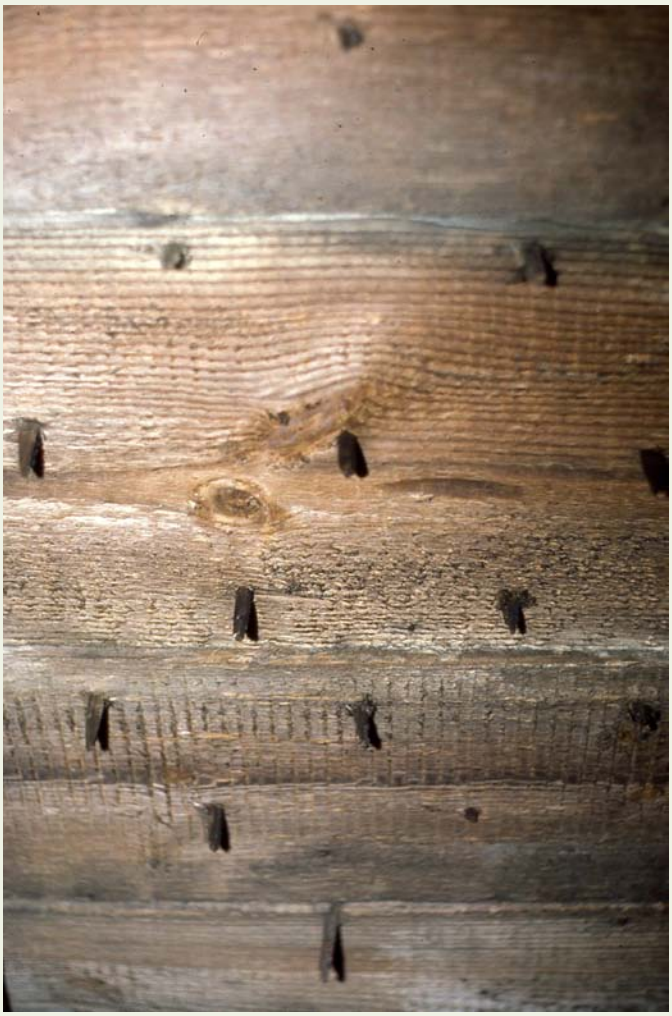

Plate 28 Internal roof at Hyndford House in Lanark, showing wooden slate pegs

Plate 30 Internal roof at Hyndford House in Lanark, showing wooden slate pegs

Plate 29 Internal roof at Hyndford House in Lanark, showing wooden slate peg

It is known that for the slated and thatched roofs, the requirement for timber is substantially different. Slate roofs would be required to be completely planked in order to facilitate fixing slates up to 0.5m in size and down to less than 100mm in length. This must have been an enormous investment of material because not only do the slates need a total coverage of sarking; the sarking also requires good quality squared timber, and straight trusses to support it.

Compared to the roofing requirement for the vast number of vernacular buildings of the time; being turf with cruck roofs, the expense of slated bastle roofs must have been significant. However and regretfully, practically nothing is known at present of either types of roof, other than the evidence presented in the BAG Bastle Project.

Two 17th century buildings in Lanark survive with their original timber roofs intact, these are Jerviswood House, former home of the Baillie family and Hyndford House in the town; the town house of the Earl of Hyndford and built circa 1640. Each of these roofs has been inspected by the writer and the extensive woodwork has been partially recorded. Indeed samples of sarking and roof trusses from Hyndford were retrieved by him during restoration work and these are now in both Biggar and Lanark museums.

The Hyndford roof was trussed with squared timber around 100mm in size and the sarking planks measured up to 5m long by 240mm wide and 25mm thick (Pl's 26-28). The trusses were fixed using wooden dowel pins to fix half lapping joints of cross spars (Pl 27). The sarking was however nailed to the trusses by using iron square shafted and round headed, hand made nails. The original dowels for both the trusses and for fixing the slates (Pl 29-30) could be seen under the roof. Although it is likely but not certain, that most if not all of the present slates will be replacements and be fixed using nails in later repairs.

The timber from Hyndford house has been identified by Dr Jennifer Miller of GUARD as being pine; Pinus sylvestris, and which includes three types; Scots pine, mountain pine and black pine, but which cannot be distinguished on the basis of their wood anatomy. It is likely that the samples are however Baltic pine (Miller & Ramsay 2000, **Appendix I**).

The point being laboured here is that the quantity of timber for building, in a supposed treeless landscape, is vast for a slated roof in comparison to a cruck framed building with a thatch roof, the former being shaped woodwork while the latter is simply used as branches, but which nevertheless still requires a fair quantity of material.

If we use the roof of Windgate House as a model*, then assuming a pitch of about 650, the requirement for sarking both sides with the Hyndford sized planks will be 190 square metres or around 782m of linear timber. Also based on the Hyndford trusses which are set at about 0.5m apart and with the cross couples of 2.4m and 6m, then a total length of beams will be 330m. The two long roof beams meeting at the apex ridge, will have to be 5.6m long probably as single pieces. There is no ridge piece at Hyndford, the beams being half lap jointed with dowels (Pl 26). The couples to connect the trusses at wall head would be 6m long but these could have been made up of shorter jointed pieces as it is likely that internal timber or stone walls would help support some parts of an attic floor, and therefore any horizontal jointed roof beams.

* A 1:20 scale model of Windgate House may be seen in the Moat Park Heritage Centre in Biggar, (Pl's 31-34).

Plate 31 Model of Windgate House bastle at Biggar Museum

Plate 32 Model of Windgate House bastle at Biggar Museum showing slate roof

Plate 33 Model of Windgate House bastle at Biggar Museum showing roof

Plate 34 Model of Windgate House bastle at Biggar Museum showing roof

Plate 35 Main door at Greenhill Farmhouse Museum, double planked

Plate 36 Internal door at Greenhill Farmhouse Museum

Plate 37 Barred half shuttered window at Greenhill Farmhouse Museum

Plate 38 Door latch at Greenhill Farmhouse Museum

Plate 39 Window handles at Greenhill Farmhouse Museum

The sarking planks at Hyndford were at least 5m long and the hypothetical roof trusses of Windgate House are 5.6m long and this leads to consideration of transporting such lengths of timber from source to site (more below).

Dressed wood was required for doors and windows although both these feature types may have been low in numbers. Allowing for a heavy double planked door for the only entrance to the building and perhaps four smaller internal doors, and maybe three upper floor windows, then the requirements other than the roof would have been minimal in comparison. The division of the upper house part is unknown but it is likely to have had separate chambers made with timber or stone walls, cupboards and a stair head doorway. If those upper internal walls were built with timber then an additional allowance in total timber would have to be made.

It was however wood which would have to be worked to a certain standard of quality, the doors may have been plain boards and the windows also plain, perhaps half shuttered in the case where glass was used, but it is likely that the woodwork would have had a minimum of ornamentation. Plates 35 – 39 are of features in the re-constructed Greenhill Farmhouse Museum at Biggar. The internal fittings and woodwork are based on actual examples elsewhere, and although these date to the later 17th century, they are likely to have been similar to bastle features.

Hinges, latches, handles and locks would have been the work of a local smith as may the ¾" square section bars which were used to protect the small upper floor windows.

Slated buildings were unlikely to have been roofed with locally grown timber, more likely it was imported into Scotland, and probably Baltic pine.

The timber component of buildings with non slated roofs would have been substantially less because the main roof couples would probably have taken the form of crucks (Pl's 40 – 43) and these could be manufactured by poorer quality wood, maybe even from a relatively local source. Building No 13 at Glenochar (Pl 44) was 10m long internally and the roof there was supported on only three cruck frames; one at each end and a centrally placed one. Surprisingly one surviving cruck stump was oak and another was birch wood (**see Appendix I**). Shorter pieces of timber were jointed to form the angles of crucks and their cross members, longer pieces if available would be used as ridges, but these could also be jointed (Pl's 40 - 43).

The carpenters would have an easier task of jointing these with dowels as there is generally little refinement in crucks, which may still be seen in a few buildings today. The joints would be simple half lap (the same as Hyndford and Jerviswood) but unlike these two buildings where the timber is nearly all squared off, the crucks were only flattened to allow the joints to fit, by flat overlapping.

Cross sparring between the crucks would be a simple mat of brush wood with a few larger branches inserted. At the 19th century house/byre of Moirlanich near Killin*, the cruck frames are overlaid with branches and then a solid layer of branches are laid to run up the roof rather than across it (see Pl 43).

* This building is owned by The National Trust for Scotland and is open to the public.

The opposite was true of the 19th century Wee Bush Inn at Carnwath in South Lanarkshire, where slats of timber were laid horizontally over the roof trusses to support turf slates (Pl's 45 & 46), the old roof here is now gone after modernisation and two unsuccessful attempts at re creating a thatched roof (Pl 47), and the roof is now slated.

At the nearby village of Covington a row of thatched cottages still survives (Pl 48), however, apart from one re-thatched house, the rest are covered in corrugated tin, but the entire original roofs survive below.

Possibly the best place to see cruck framed buildings is at Auchindrain Township in Argyll, also open to the public (Pl's 49 - 53), and some 19th/20th century thatched cottages can still be seen in places like Caithness (Pl 54) but these are fast disappearing, as indeed they are everywhere as this one at Carluke in South Lanarkshire shows (Pl 55). At Culloden battlefield near Inverness there is a good example of a heather thatched house (Pl 56).

Perhaps straw or heather rope would be used to tie down some of the wood material allowing a relatively secure bed on which to lay the turves, overlapping in slate fashion and themselves held more secure by pegging through each other and latching onto the underlying brushwood. This was the method used in southern Scotland late into the 19th century, straw, heather or rush thatch was rammed between the turves, tied and pegged down and then ropes, nets, wooden boards and weighted ropes were slung over the outside for added stability, and preventing wind uplift of the thatch.

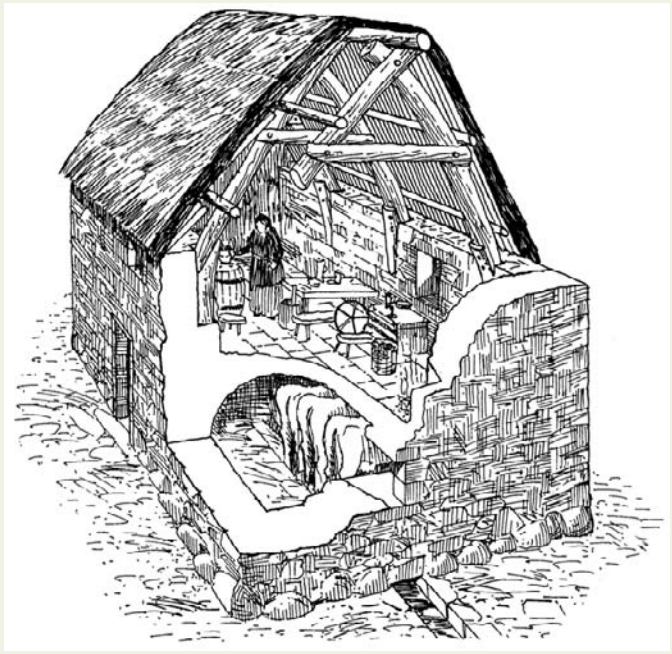

Plate 40 Model of Glenochar bastle house

Plate 41 Model of Glenochar bastle house

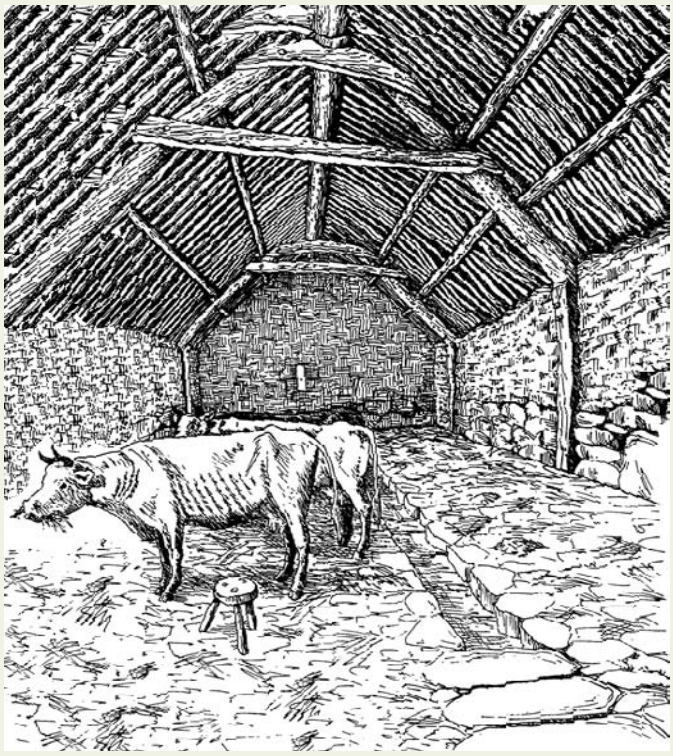

Plate 42 Drawing of cruck framed roof

Plate 43 Cruck frame roof at Moirlanich near Killin

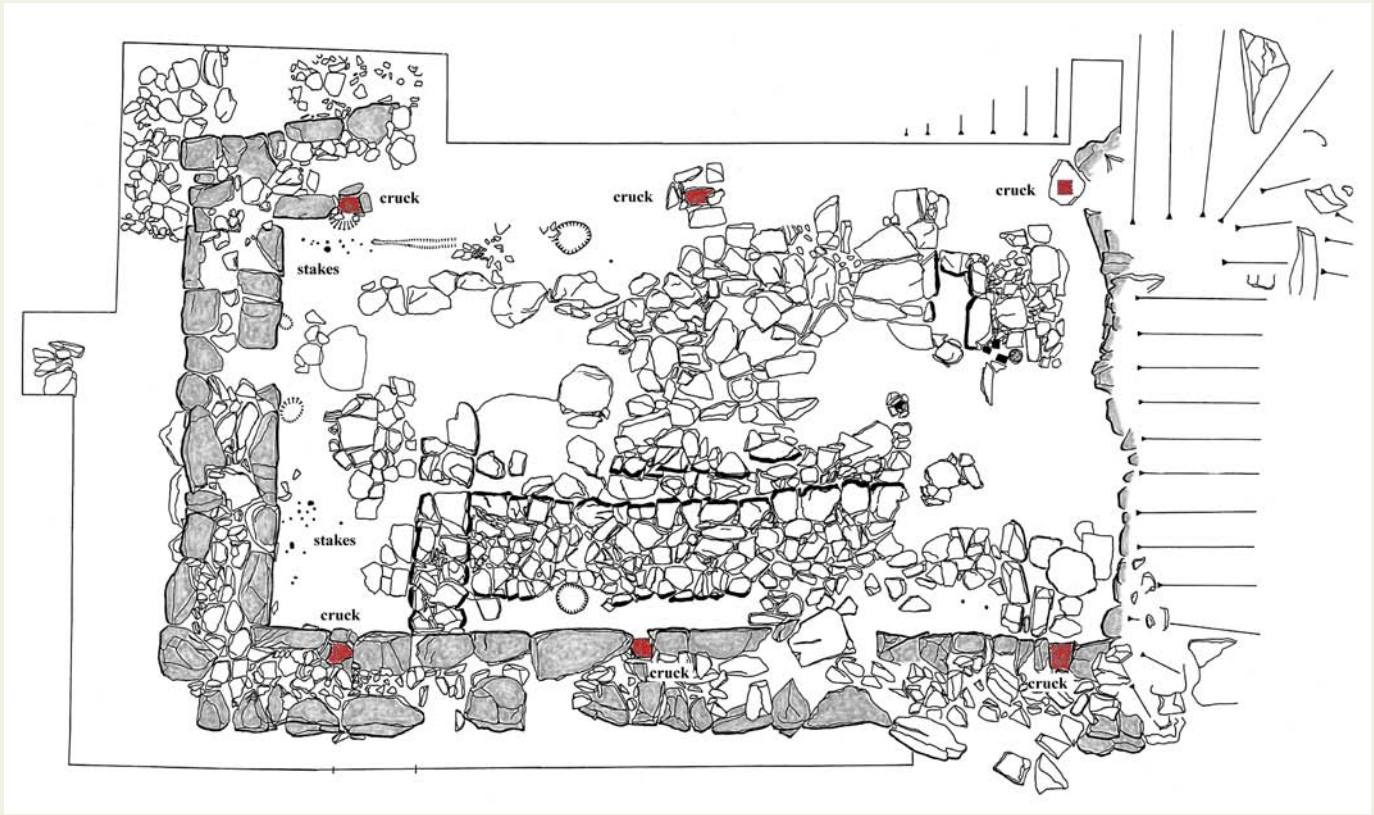

Plate 44 Plan of building at Glenochar fermtoun showing cruck positions and stakes

Plate 45 Detail of 19th C roof of wee Bush Inn at Carnwath

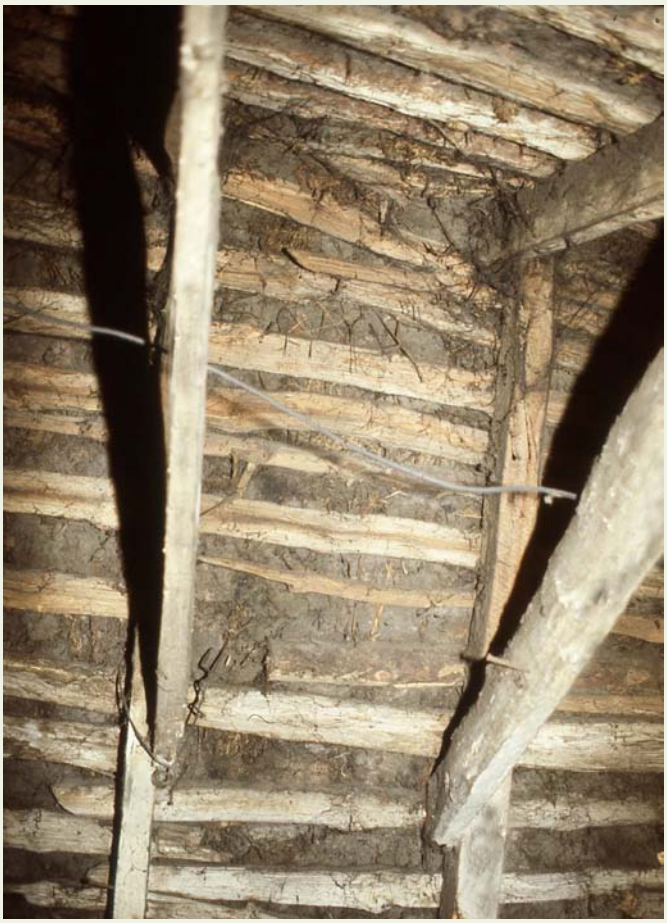

Plate 46 Detail of 19th C roof of wee Bush Inn at Carnwath

Plate 47 Wee Bush Inn at Carnwath thatched roof replacement

Plate 48 Covington village thatched roofs below corrugate tin

Plate 49 Auchendrain thatched building

Plate 50 Auchendrain thatched building

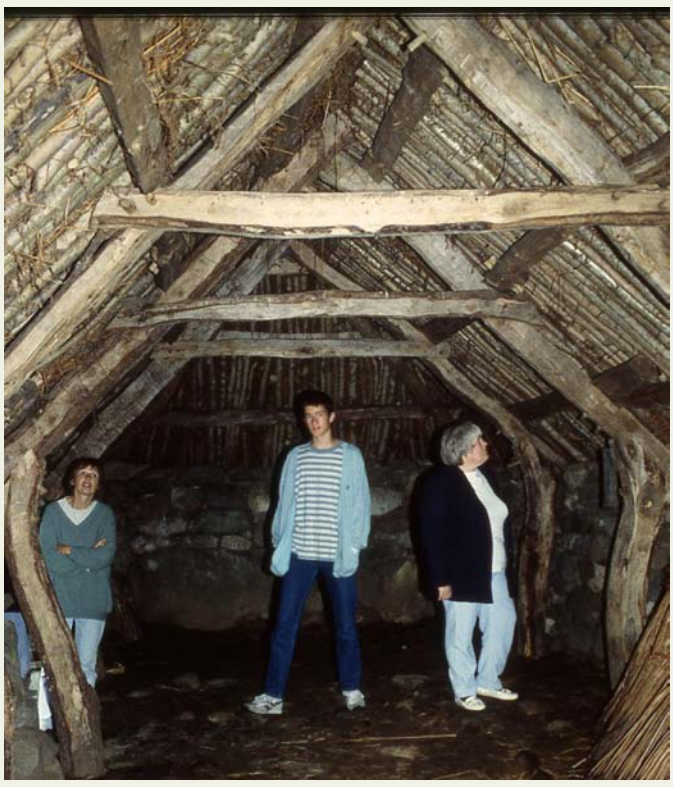

Plate 51 Auchendrain cruck frames

Plate 52 Auchendrain cruck frames

Plate 53 Auchendrain cruck frames

Plate 54 Thatched house in Caithness in 1980's

Plate 55 Thatched house being demolished at Carluke

Plate 56 Thatched house at Culloden in 1970's

Plate 57 Detail of turf slates and thatch at Wee Bush Inn Carnwath

Plate 58 Detail of thatch and knots at Wee Bush Inn Carnwath

Plate 59 Details of turf ridge at house in Carluke

Plate 60 Details of turf slates with pegs at house in Carluke

Plate 61 Long straw being harvested for thatch

Plate 62 Details of replica stakes in Glenochar bastle house byre

Plate 63 Mervinslaw bastle house near Carter Bar

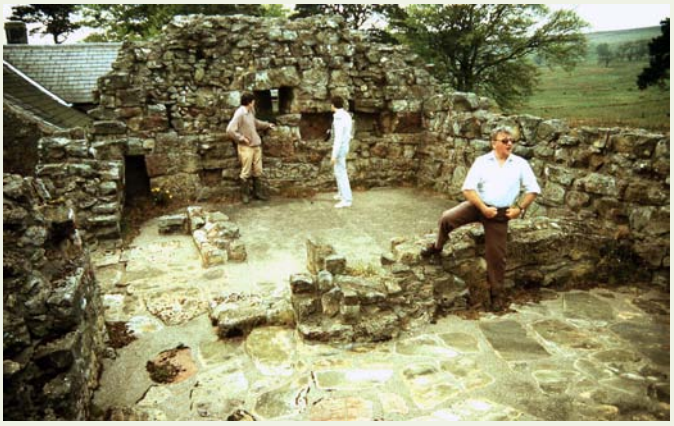

Plate 64 Stone walls in upper chamber of English bastle house

Long grain straw (Pl 61) was certainly used in Lanarkshire in the 19th century for thatch; a handful of straw was bent over in the middle, thus doubling the volume, the fold was twisted to form a knot and this was pushed up between the turf slates, when an area was done, it was tied or pegged down. Such crude (but effective) thatching did require continuous maintenance as is described by visitors, compared to the good quality thatching using reed, as is often seen in England.

Plates 56 to 60 show the roof of the Wee Bush Inn in Carnwath and a house in Carluke (Pl 55) where the use of turf slates, knotted straw thatch and wooden pegs has been recorded.

Another use of wood which has been found in excavations, especially at Glenochar (Pl's 44 & 62) and at Wintercleuch, was the insertion of branches up to 50mm in thickness along the internal walls of byres. These haphazard stakes are presumed to have been a method of keeping fodder up off the ground while feeding animals. Some specimens were analysed and shown to be oak wood (see **Appendix I**).

Turf

Turf was used as a fuel on the 17th - 19th century settlements in Clydesdale and Tweeddale as seen in BAG archaeology. The evidence is the near absence of wood charcoal and the deposits of burnt soil and grit, which is derived from burning turf. Presumably therefore, the roofs were made from these combustible materials and would have been vulnerable to fire, accidental and deliberate. Old roofs could also be re-cycled as fuel. The underside of the roof consisted of small branches and twigs supporting the dry turf, and in the summer months at least, with dry thatch, great care must have been exercised to avoid accidental destruction from within the house.

Most fireplaces were simply created on the floor surface, centrally placed and set back from walls and usually on stone paving, but in unpaved floors the hearth was often still made with stones designating a spot as the fire place, this has been seen on numerous occasions in BAG archaeology. The arrangement in bastles was probably different, at Nemphlar a mantelpiece (Pl 17) was removed from a fireplace and this had a date of 1607 and initials carved onto it, this may have been the construction date of the bastle. At Glendorch an extremely find sandstone mantle piece was found in the adjacent shepherds (ruinous) cottage, it is believed to have been recycled from the bastle house. In such cases a built chimney and fireplace in stone, and perhaps in some other cases with a hanging chimney (a hingin' lum), would have formalised the fire place against a gable wall, and with a chimney.

A point about buildings with open fireplaces rather than chimney flues is that the smoke which would form a pall down to the lowest point of egress, perhaps doors or windows, would act as a preservative for the timber associated with the roof.

The soot which would eventually accrue on any surface within the house, would coat woodwork and prevent fungal or insect attack on the wood. The smoke itself would have been a repellent to insects also. This would have prevented decay of the roof structure to some extent and extended the period of its integrity.

More on turf below.

Metal

Only two metals would have been involved in a bastle construction; iron and lead. Iron was used to make door and window hinges and fittings such as latches and locks, nails, hooks for suspension of meat and implements from rafters or ceilings, and square section bars for window security. Lead was used for plugging hinges and bars into stonework and occasionally for leading small glass panes in glazed windows.

Nails would be numerically and by weight the largest metal component of a building and these were used to fix the sarking boards to the roof trusses, while wooden pegs were used for jointing beams and for fixing the slates. There would have been 46 runs of planks on the roof at Windgate, and given two nails per plank per truss at 19 trusses then 1748 nails would be required. The nails were presumably at least 3" or 75mm long, perhaps slightly longer. Allowing 15grammes per nail then the total weight of nails for the sarking would have been in the order of 26kg, it is however likely that they would have been purchased as objects rather than by weight, perhaps by the gross.

Glass

Glass was used in some bastles and even cott houses (in the 18th century) to make small window panes; these were in the order of 3" to 5" square. The glass was hand spun and probably used in half shuttered windows where a single or double wooden shutter was installed on the lower half to allow for ventilation and perhaps to present firearms in defence, while the upper glazed half would give natural light and allow visibility, a necessary consideration in times of attack (Pl 37). Such glazed windows could be leaded into the wooden shutters or frames or, as seen at Carnwath, the stone window frames were slotted to accommodate glazed windows. Window glass was found at Glenochar, and Glendorch.

However it is known from surviving English bastles that windows in the upper house part were small and few in number, while those in the often vaulted basement were unglazed slit windows, allowing some light and ventilation but with total security in mind.

Procurement and cost of construction materials

Building stone is the easiest to understand as the bulk of it; either greywacke or sandstone is locally and presumably freely available, and in unlimited quantity. The source of building stone would certainly belong to the landowner and therefore present no problems in obtaining it. The gathering and/or quarrying and delivery to the sites may not have been difficult, although how and by whom this was done is unknown. There may not even have been a cost factor if labouring or cottar classes of people were co-opted for doing this work, as part of their duties to the landowner's tenants.

In the case of dressed sandstone for building door and window openings and in some cases stair newels, it may have been a different matter. Quarrying, hewing and transportation may all have to be paid for, at whatever the going rate was. Of course the final aspect of the stonework; the actual building of it, must have been done by professional masons and their labourers and apprentices. However, this appears not to have been such a consideration as in 1649 a masons wages for a day, was 1 penny! or a peck of meal a day!

The lime for mortar would surely have been a cost factor. Its source was almost certainly from the coal producing areas of Douglas and West Linton where the fuel for burning the limestone was also readily available, coal fragments are occasionally seen in the mortar of the bastles, it would have been supplied from Douglas area and the Tweeddale sites would have used West Linton lime, distances of approximately 10miles each as the crow flies.

In the case of Douglas being the supply base to upper Clyde, then the same landowners may also have been involved (Douglas/Hamilton's) therefore costs of procurement of lime may also have been negligible.

The quantity of lime required and the transport method used to get it to site need to be understood in order to estimate the cost of each aspect.

During the restoration of the extant fabric of Windgate House, a ton of cement was used at a 1:5 ratio of cement to gravel. Therefore six tons of material was used and this was sufficient only to re build the internal gable wall and cap off the wallheads around the building. It simply serves to indicate the vast quantity of mortar required to build the complete bastle house. See above for Wintercleuch restoration where 700 kg of hydraulic lime were used for minimal restoration work.

The masonry to build Windgate is estimated at circa 300 cubic metres, assuming a ratio of say 50:1 of stone to mortar, then approximately 6cubic metres of lime mortar was required. If we say the aggregate of lime to gravel was 1:3*, then almost 2 cubic metres of hydraulic lime would be necessary, this would equate to 2750kg, which would be approximately 2.75 tons. This would equate to about 30 horses carrying 100kg each.

*This is based on the analysed samples from Wintercleuch bastle by the Scottish Lime Centre

It is almost certain that no wheeled transport would be available given that roads were non existent, panniers on horses backs were the normal means of transporting loads and it is known that the ratio of load is determined by the size or weight of the horse, some horses being able to carry 15 to 20% of their body weight comfortably. A horse would carry two bolls of grain = about two hundred weights or 100kg and a journey of about 20km were reasonable (Whyte 1979). Based on that it would have been a days journey to transport lime to upper Clyde or Tweed sites.

The sand and gravel would have been extracted locally from the nearest burn and this must have been sieved through ½" riddles judging by the samples which have been analysed (Pl 25). The stone/mortar ratios however may have been in the order of 40:1 or 30:1 in which cases more lime would be used. Assuming a cubic metre of gravel is about a ton then about 40 horse loads would be required to be delivered to the site, although this activity would most likely have been local to the site.

Transport of lead from nearby Leadhills to Leith where it was shipped to the Netherlands took two days (one way) with an overnight halt in Biggar to break the journey. This was originally done by pack horses as bridges over the Clyde and decent roads did not exist. Eventually bridges at Elvanfoot and Wandel, and improved roads meant that carts could be used to greater effect; a horse carried up to two hundred weights compared to the carts which were loaded with seven hundred weights. In 1661 a grant was given to James Hope and Anna Foullis to be allowed carte blanche to repair any roads between Leadhills and Leith by making them 12' wide.

The Scottish Galloway was considered the best pack horse but the breed is now extinct.

Whether horses could carry long timber planks at the same rate and the same load weight as material in panniers is uncertain, however, it must have been achieved, perhaps by a slype (a wooden frame without wheels and pulled by a pony),

The timber requirement for Windgate was:

Based on an estimated roof pitch of about 60º-70º

Planks, sawn and based on the sizes from Hyndford House in Lanark were 5m long by 240mm wide and 25mm thick. The Windgate roof required 782m of planking which equates with 156 planks at 5m long to achieve coverage. A 5m length of such plank weighs 36kg (bone dry weight), therefore the roof planking weighed a total of c5630kg.

Additionally the attic floor space, assuming it was used, would require further planking of c60 square metres to cover the entire area, which would be 48 planks at the size quoted for Hyndford house. This would weigh c1730kg.

The trusses at Hyndford are 100mm by 100mm sawn timber, there is no ridge (Pl's 26&27). Windgate required 19 sets of trusses (set at the same distances to Hyndford) and each truss requires to have two lengths at 5.6m long, with a cross span of 6m and another upper one at 2.4m. Therefore 38 at 5.6m, 19 at 6m and say 10 at 5m (for the 19 upper cross beams) would be required; a total of 376m. 1m of this size truss is 7.2kg (bone dry weight), therefore the total weight of trusses would be c2710kg.

The calculations assume no wastage, it is very likely that the roof trusses and planking were pre cut and the trusses maybe even have been pre fabricated elsewhere, marked and re assembled on the site, as one often sees on old timber roofs, for example at Hyndford House and the 16th century St Mary's Kirk in Biggar where Roman numerals are cut into the beams.

The mass of the timber required, leads to two further principal considerations; cost and transport logistics from the supplier to the site, these are considered below, although at this time costs, if they are available have not been researched.

Assuming a horse will carry 100kg then an animal could carry the weight of two trusses or planks, however the bulk or length may have been awkward, therefore it may have required two animals to carry these items, although the weight may have been distributed between them, so that two horses could perhaps carry four lengths of timber between them.

The timber probably came from Leith or Eyemouth which were the principal ports for North Atlantic trade, and the pine for Hyndford was probably Baltic. Because of the known commerce route from Leadhills to Leith for the export of lead, then Leith is the favoured depot (adopted here) for the timber. The distance from Windgate to Leith is about 45miles direct via Biggar and would take more than one days travel.

That being said; In 1686 Buccleuch Estates imported timber from Scandinavia via Eyemouth and brought it to Hawick over forty miles away – by cart (Whyte ibid), admittedly, roads would have been more developed by this time.

Turf and brushwood

The roof pitch for turf houses was probably much less acute that that for slate roofs and was probably in the range of 80 -900.

The ideal turf for roofing is short mature grass with a good root mat but which inevitably involves a quantity of soil and grit being included (see Pl 57). According to one source; Morer in 1689 (Brown ibid) the turf slab was 1" or 25mm thick. Cutting it at a lesser thickness would probably mean it loosing its integrity as a mat of material or slab. The turf would have to be selected and cut with care to avoid it being without structure, the correct proportions of organic material to mineral content would be critical. Thin slabs would also be less heavy, another important factor for a rather flimsy roof structure of branches and perhaps twigs.

The area of turf required to roof a building such as Smithwood would be in the order of 130square metres, allowing each 0.5square metre turf to overlap by 50%, this would be for a roof of about 850 pitch and and being 150square metres in area. The estimate would vary depending on the pitch of the roof and the size and amount of overlap of the turves.

In order to support the turf a complete blanket of branches (eg Pl 53) would be necessary, this is also required to allow pegging down of the turf so as to avoid slippage (Pl 60), therefore on the basis of the hypothetical roof a blanket area of 150 square metres of branches and brush wood be required.

It is debatable, perhaps doubtful if this quantity of material would have been availably growing in the upper Clyde valley in circa 1600AD. By all accounts the landscape of southern Scotland was practically devoid of any timber, one is therefore left wondering if these accounts are exaggerated or whether the brushwood and light timber required for a non slated roof was imported from outwith the area. Bearing also in mind that numerous lesser quality houses; the cottagers house/byres which lay beside the bastles and made up the fermtouns, and which must also have been located all over the landscape, also had to be roofed and, these buildings, often long house/byres, were more often than not, much larger in ground floor area than the bastle houses.

The requirement for turf and brushwood for non slated buildings amounts to a considerable quantity of material, but much of this could presumably have been dragged to the site by horses without undue wastage, given the fact that the timber may have been simply rough wood, the transport requirement may not have been significant if the material was relatively local, say within 20miles.

Slates

Windgate slates (Pl 21) ranged in size from 450mm by 300mm down to 120mm by 80mm as found in the excavations.

The roof was 17m long by 5.6m from wall head to apex. Using the larger slates and laying say ten courses with an overlap of 200mm then 56 would be required for a row and if ten rows were installed at these sizes 560 slates would cover 2.5m of the length.

Assuming smaller slates of say 400mm by 250 were then laid, 68 would be required for a course and ten courses would require 680 slates covering a further 2.5m.

A third size of 200mm by 150mm or less, would require at least 1130 slates to complete one side, having a total of 2370 slates on that basis.

The double sided roof would therefore require around 4740 slates and it must be born in mind that each slate was fixed with its own wooden dowel or peg, larger slates being fixed by two pegs. Given the small sized slates found at Windgate, it is likely that this number would have been considerably higher, but it does serve to indicate the resource of slate and pegs for the roof of Windgate size. The pegs alone would have resourced a fair quantity of branches.

A 450 by 300mm slate weighs 3.62kg therefore at a broad estimate the total weight of slate for the roof was in the order of 7000 -8000 kg, or between 7 and 8 tons!

Therefore 70 -80 pack horses would be required to bring the material to site at 100kg per horse.

Summary of the transportation of material to the Windgate site:

The figures given here have to be considered rough estimates since several factors are unknown or uncertain; nevertheless a broad picture of the transport logistics may be grasped allowing for that.

Stone

Gathered locally and requiring to be delivered by slype or sled, pulled by ponies to the site. The variables of distance of stone to the site, and how often the timber for the slypes would require to be repaired are unknown. Therefore how many journeys by horse and man are not possible to estimate. However, several horses and men must have been used to keep up a supply of stone for the masons.

The transport of dressed sandstone is a different matter as it is not local, being carboniferous. Perhaps a pack horse train of about ten animals and one man would suffice to bring that to the site from the Douglas area and in a single journey.

Lime

The lime is estimated at 2.75 tons and would require 30 horses carrying 100kg each. Say a ten horse string with a single driver over three days.

Gravel

Sand and gravel for the mortar would be locally sourced in the burn courses and would require a constant flow to keep the masons busy. Perhaps about five horses and men would be required until sufficient quantities had been gathered.

Timber

For both slated and non slated roofs timber delivery must have been a major aspect of the work considering the quantities involved. Especially for the two slated bastles which required sawn timber. Regardless of source, presumably from a port, whether Leith, Eyemouth or perhaps Dumfries, the sites are both land locked and centrally placed from the sea ports. It is estimated here that 130 – 150 horses would be required to bring the timber to the site at say two horses being used to bring four pieces of either plank or truss between them. Therefore around 70 journeys of pairs of horses could be equated to say about 8 journeys of 8 horses and perhaps four drivers.

Slate

The two slated bastles of Windgate and Glendorch certainly utilised Southern Uplands slate but from what source cannot be said with confidence. Stobo is ruled out on the texture of the slate and the only other known major quarry is at Glenochar which may have been the source. Glenochar quarry would certainly be the source for the drain and floor coverings at the nearby settlement in the 18th century, but the quantities used are hardly a consideration for the purposes of this paper. Nevertheless, transportation of roofing slates which are assumed to have been dressed at source would amount to between 7 and 8 tons. Therefore 70-80 pack horses would be required to bring the material to site at 100kg per horse. We may imagine strings of horses of about ten in numbers with a single driver.

Metal

The iron metal could be delivered as a single journey to the site by a couple of horses and one man. The lead would have come from Leadhills and therefore be negligible.

Discussion

All bastles in Clydesdale were built with high quality lime mortared walls and used local stone for the most part of their construction. Some were roofed with slates and the others with some form of thatch, and apart from roof types and the sizes of the houses which are found as two categories; 'long' and 'short' types (Pl's 31 & 41); there is little principal difference between them.

It is likely that the costs of construction of all may have been negligible in terms of the stone for the main building and for the roofs of the non slated bastles. Lime for mortar may have been a relatively expensive commodity, but in the scale of things and if the land owner was paying for it, and possibly supplying it from his estate, perhaps Douglas in Clydesdale for some bastles, this may not have been a major consideration.

It would appear the slated roofs would have presented the largest cost factor and procurement logistic; the two known bastles with slate roofs are Windgate and Glendorch, the Baillies of Lamington must certainly have owned Windgate and it is suspected that Glendorch was built by the wealthy Foullis family. The likely timber used was pine and it is suspected that it would have been imported through Leith from the Baltic. Analyses of wood from Glenochar show that oak, pine and birch were used for various aspects of the site and at Wintercleuch birch, hazel and rowan were available for building (see **Appendix I**).

The variety of wood types is quite surprising if we are to believe the accounts of early travellers in Scotland (above), it seems that some local timber was available to house builders and it is likely that every scrap of wood growing near to the sites may have been utilised – but not for firewood.

Glendorch also had the most sophistication in stonework having by far and away the most dressed sandstone features than any other bastle in the area, however, the sandstone was local and the principal cost would have been the hewing, carving, transport and building, and it seems the labour costs were not high.

Although this paper is not comprehensively researched, being for the most part based on data from BAG excavations and the observations of the writer, it does nevertheless lay down some parameters for future research of the subject matter.

Notwithstanding that, it begins to emerge that building rural vernacular houses, sometimes described as 'cott houses' in the Scottish Lowlands in the 17th century and later, and until houses were being constructed in more familiar styles with stone and slate from c1800 onwards, was a cheap and simple matter. In almost every case the occupant and his family and friends would simply build their house from what was immediately available around the house site, which is stone, turf, thatch and timber/brushwood, of which the latter may have been collected further afield.

The builders of the bastle houses on the other hand were trailblazing in the world of rural upland architecture in this part of the country, creating house types never before seen on the land in question. The status symbols of the lairds in their tower houses and castles was being

emulated by a new class of social society with their new home types; being the tenant farmers who by necessity rather than want, were forced by the political climate of lawlessness, to live in strong defensible houses able to protect them, their immediate families and some of their wealth, part of the latter being on the hoof.

In the light of this research it appears that even building bastles with non slated roofs may not have been an intolerable expense, the more secure returns in rental perhaps outweighing the initial building costs, and which may have been borne by the landowner, rather than the occupier.

Perhaps the most inexplicable aspect of these bastle houses is their ruination. The Lowland Clearances are now easier to understand in terms of the labouring classes and the cottars, and their lowly houses on which little resource had been expended.

The peasantry were considered to be a liability on the estates of the landed gentry and had to be cleared off to improve the efficiency of farm land, thus supplying greater funds through increased rentals, to meet the increasing selfish indulgences of the landowners, mostly for activities and lifestyles south of the border.

However, to deliberately demolish the bastles which were occupied by rent paying tenants and which houses represented financial outlay, by either the land owner or the occupier, seems incredulous. The bastles were only around 150 years old when they were abandoned to be demolished, and the settlements deserted.

With minimal maintenance these buildings could still be occupied as is seen in the numerous examples in England and a few in Scotland, for example Nemphlar, Carnwath and New Abbey.

The policy of clearances also must have been done with a degree of collusion among the landowners, as it happened quite suddenly, across the board, in the middle of the eighteenth century as attested by census returns showing rural depopulation and by the archaeology of BAG.

Considerable effort was expended on the demolition of bastle sites to ensure that no one could return to squat in any building, although it is clear that in the case of the bastles, materials were re-cycled for use elsewhere, perhaps to build new farm steadings which now embraced larger land holdings than that which previously existed.

All that being said, one has to reflect on the luxurious lifestyles of the mid 18th century improvers; the landed aristocracy, and in the case of upper Clydesdale; the Hamilton/ Douglas's, the Hopetoun and Earls of Selkirk estates, and consider the houses these people were occupying, a bastle house would not have been fit accommodation for their hunting dogs! And therefore be of no consequence whatsoever.

Finally the writer accepts that this work merely begins to explore the subject matter of post medieval settlements, and that the various hypotheses presented above may be seriously flawed. Considerably more research is required to further elucidate on the problem of Lowland Clearances and the rise and fall of the bastle houses and associated settlements in the Southern Uplands of Scotland. Hopefully this work may be useful as a starting point.

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Appendix I

Results for Glenochar Fermtoun, Wintercleuch Bastle House and Hyndford House, analyses of wood samples.

Dr Jennifer Miller and Susan Ramsay, GUARD, Glasgow University. 2000

Glenochar Fermtoun

GO.W.1 Glenochar Building No 9, Cruck No 1 (stump)

Wood very wet and soft, features filled with fungal contamination.

1 x Betula (birch).

GO.W.2 Glenochar Building No 9, Cruck No 2 (stump)

Full of roots and soil, dry condition. Wide rays – from very large tree, contains live insects.

1 x Quercus (oak).

GO.W. 3 Glenochar Building No 9, stake remains

Small fragments of wood, very dry condition. Wide rays – from large tree, contains live insects.

All Quercus (oak).

GO.W.4 Glenochar bastle house, pegs (?) North Gable Exterior

Four pieces sectioned, rest scanned.

All Pinus sylvestris type (pine)*.

GO.W. 5 Glenochar bastle house, fragments inside bastle

Five pieces of wood.

3 x Quercus (oak).

2 x Pinus sylvestris type (pine).

GO.W. 6 Glenochar bastle house, stake remains.

Bag of numerous wood fragments, slightly damp.

Five pieces sectioned, rest scanned.

All Quercus (oak).

GO.W.7 Glenochar bastle house, stake remains.

All Quercus (oak).

GO.W.8	Glenochar bastle house, stake remains.
	Poor condition
	All c.f. Quercus (oak).
GO.W.9	Glenochar bastle house, stake remains.
	Very small, crumbly. No identifiable features remain.
	All indeterminate
GO.W.10	Glenochar Building No 8, remains of doorpost.
	Sample mainly inorganic.
	Very small indeterminate cinder and wood only.

Wintercleuch Bastle House

Slab of wood with hole cut through – Betula (birch).

Stakes (x 3)	2 x Corylus (hazel)
	x c.f. Sorbus type (rowan type)

Hyndford House, Lanark.

Roof beam	Pinus sylvestris type (pine).
Roof sarking	Pinus sylvestris type (pine).

* Pinus sylvestris type includes P.sylvestris (Scots pine), P.mugo (mountain pine) and P.nigra (black pine). The three cannot be distinguished on the basis of their wood anatomy.