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ECONOMIC REDUCTION OR MILITARY REORGANIZATION? GRANARY DEMOLITION AND CONVERSION IN LATER 4TH-CENTURY NORTHERN BRITANNIA

Rob Collins

Introduction
The Roman forts of Hadrian’s Wall were built in the 2nd century and retained their basic form and layout well into the 4th century. This architectural conservatism is in stark contrast to the forts found in the other frontiers of the later Roman Empire, where many auxiliary forts of the Principate were refurbished and received upgrades to their defensive architecture or rebuilt in a smaller form inside the larger area of the Principate fort (Johnson 1983). Installations built de novo employed more sophisticated forms and layouts that further distinguished the military architecture of the Dominate. Seen in this light, the forts of Hadrian’s Wall and the frontier zone of northern Britannia can be seen as relict. The Wall and broader frontier zone continued to be occupied at least until the early 5th century and perhaps later (Fig. 3.1), but beneath this general appearance of conservatism a number of changes are visible in the archaeology of the late frontier (Collins 2012). One of the more intriguing changes that occurred repeatedly along the Wall corridor in the late Roman period was the demolition or conversion of horrea, the granaries or storehouses that were found in every fort. Prior to these changes, the granaries from the Wall fit comfortably with evidence for granaries in other parts of Britain (Gentry 1976). This paper examines the evidence for horreum demolition/ conversion along the Wall corridor in detail; horrea functioned primarily, though not exclusively, as warehouses for foodstuffs for fort garrisons, and the demolition or conversion of these buildings provides insight into the changing aspects of the limitanei of the Wall. Fundamentally, changes to the horrea indicate changes to the supply and economy not only of a single fort, but to the entire Wall corridor, as well as prompting further questions of what replaced the space and functions of the horrea?

Horrea demolition or conversion
A number of forts in the Wall corridor have provided evidence for partial or wholesale conversion of horrea. Along the Wall corridor, each fort typically was provided with two granaries placed in the central range immediately to the right or left of the principia. In some instances, a double-granary structure or its equivalent was provided instead, for example at Housesteads. In the late Roman period, one or both storehouses were completely demolished and or reworked for some other type of use. It is worth reviewing this evidence on a site-by-site basis where modern excavation or reassessment has provided a relatively clear sequence, namely at the forts of South Shields, Newcastle, Housesteads, Vindolanda, and Birdoswald (Fig. 3.2).

South Shields
While the fort at South Shields is not directly attached to Hadrian’s Wall, it presumably served as the primary port for the Wall corridor at its eastern terminal on the mouth of the River Tyne. Notably, the fort was converted in the early 2nd century into a large supply-base with an estimated 24 granaries in the Severan period (Bidwell and Speak 1994, 20–33). The later 3rd and early 4th century, between 286
3. Economic reduction or military reorganization?

Figure 3.1: Hadrian’s Wall in the 4th century, showing the locations of the forts along its length

Figure 3.2: The horreum structures from the principal sites under consideration; a. South Shields forecourt granary; b. Newcastle east and west granaries; c. Housesteads “double” granary; d. Housesteads Building XV; e. Vindolanda east and west granaries; f. Birdoswald north and south granaries. After: Bidwell and Speak 1994; Snape and Bidwell 2002; Crow 2004; Rushworth 2009; Birley 2013b; Wilmott 1997

and 318, saw the conversion of the supply-fort back to a more “standard” layout for the period. The Severan granaries to the southeast of the principia in the praetentura were converted into barracks, though it is thought that the eight granaries to the northwest of the principia in the retenura were retained, as was the so-called forecourt granary, immediately behind the principia; but the double granary immediately beside the principia to its southwest was
demolished and replaced with tile kilns (Bidwell and Speak 1994, 20–33). Unfortunately, no modern excavations have examined the granaries in the reententura, and it is uncertain how long these eight granaries were retained, as the raised floors of two of these were removed at some point (Dore and Gillam 1979, 42–44). Therefore, it seems likely that the forecourt granary was the primary granary for the garrison of South Shields in the 4th century.

The forecourt granary was first built in Period 5, during the early 3rd century conversion to a supply base of the forecourt of the principia of the earlier fort, and making use of three of the pre-existing principia walls (Bidwell and Speak 1994, 77). This granary was built in the standard rectangular shape, 22.2 × 4.6 m internally, externally buttressed only along the southwest and northeast walls, with the northeast wall also providing the location of the loading bay. The subfloor was composed of four rows of sleeper walls, simply built on a levelled surface and the stones of which were only bonded by a gritty clay. The granary floor consisted of sandstone slabs, and it is thought that the weight on this floor pushed some of the sleeper walls out of position.

The forecourt granary was retained through Period 6, which is when the building may have suffered from a fire, judging by the deposits of carbonized grain found in the subfloor space, which is aso attested in the southeast quadrant of the fort. Period 7, probably starting in the early 4th century, saw the sealing of the previous sandstone slab floor with a layer of opus signinum c. 0.15 m thick. Opus signinum was not the normal choice of flooring for a granary, but it was used more widely at South Shields in the 4th century. This new flooring suggests the retention of the building as a granary, which continued until Period 8, at which point the opus signinum flooring was demolished, and the subfloor of the granary was filled in. The demolition work, with debris packed into the subfloor, indicates that only the floor was dismantled, and not the entire building due to the absence of other structural elements in the debris. A worn coin of Valens dating to 364–367, East Yorkshire coarsewares, a Crambeck ware mortarium, and a Fowler type D7 penannular brooch were found in the deposits relating to this infilling activity (Bidwell and Speak 1994, 103, 105). Demolition of the loading bay may also date to this time, but truncation of deposits from later Period 9 activity removed any clear dating evidence for this.

While the subfloor infilling can be confidently dated to c. 370 or later by the finds, it is uncertain what the use of the building was. Subsequent activity in Period 9 saw the granary walls demolished and paving from the surrounding streets quarried (Bidwell and Speak 1994, 105). Robber trenches, however, contained a number of fills containing artefacts that help date this activity, including a coin of Valentinian minted 367–375 and a fragmentary Fowler type D7 penannular brooch. Subsequently, the large quarry pit in the road outside the northeast end of the granary was repaved, and a Fowler type E penannular brooch was found in association with this paving (Bidwell and Speak 1994, 106). On this basis, forecourt granary demolition and/or robbing may have taken place as early as c. 375. However, on the presumption that the new function of the building with its infilled subfloor lasted longer than a few years, plus the demolition and quarrying activity, it is suggested that this activity extends the use of the building and its demolition into the 5th century, with the latest paving surface representing a subsequent phase of activity.

**Newcastle**

The fort at Newcastle was constructed in the later 2nd/early 3rd century on a small promontory immediately south of Hadrian’s Wall. The size of this promontory restricted the fort size and impacted on the arrangement of its internal space. As a result, the granaries are sited north of the via principalis in a mirror arrangement to either side of the via praetoria creating an east and west granary, rather than being placed immediately beside the principia. Furthermore, the granaries are smaller than most of those found along the Wall, measuring 16.05 × 5.90 m externally. This size has been suggested as a feature of their date of construction, as units are thought to be smaller than in the early 2nd century (Bidwell and Snape 2002, 269–271). Both granaries were buttressed externally on all four walls, and the loading bays appear to be located at the end of the granary opposite the via praetoria. Despite the mirror arrangement of the granaries, there are small differences in their structures.

Both the east and west granaries have evidence for the infilling of the subfloor between the sleeper walls. In the east granary, an opus signinum floor was laid over the infill, with pottery from the fill providing a date of the late 3rd century at the earliest (McMaster 2002, 70–72). A timber porch and/or steps were added to the loading bay at the east end of the eastern granary, and the posthole fill contained fourth-century pottery (McMaster 2002, 72). The modifications to the porch and infilling of the granary subfloor can probably be dated to the same phase of activity.

The western granary also had its subfloor infilled. Overlying this was a deposit of dark soil with clay and mortar patches, and in places there was burnt material and charcoal, reddened clay and lumps of coal. The dark soil contained a sherd of painted Crambeck ware dated to AD 370 or later, providing a TPQ for the activity. A trench hearth was inserted in the centre of the structure near the western edge of the excavation, and this feature combined with the burnt material and coal suggests that the horreum was converted for industrial activity (Snape and Bidwell 2002, 62–66).

At some later date, when the western granary was no longer used, it appears to have been demolished. The walls were levelled at a height of four or five courses, and a
3. Economic reduction or military reorganization?

drain or aqueduct was inserted, running northeast-southwest through the granary, across the *via principalis* and into the northeast corner of the *praetorium*. The drain fed a water tank made of stone slabs and set against the southern face of one of the southern buttresses of the granary. The whole system was inserted at some point after c. 370, but it predated the post-Roman cemetery phase (Snape and Bidwell 2002, 111–114). This activity is presumed to date to a point after which the western granary was robbed or collapsed, due to the different alignment of the drain relative to the Roman building plan, but this may be making too much of such a drastic reuse of the space; at best, the activity can be dated to the 5th to 7th centuries. The east granary was robbed of its stone, its eastern wall reduced to a height of one course, and deposits of mixed clay, rubble and mortar were found in the central area of the building lying over the subfloor infill (Snape and Bidwell 2002, 116). The deposits overlying the latest activities in both the east and west granaries contained human bone, mixed from the early medieval cemetery phase commencing c. 700 (Nolan 2010).

*Housesteads*

The fort of Housesteads was a primary fort attached to the curtain of Hadrian’s Wall in the 120s AD; as such, the fort was built with a Hadrianic layout with a large single structure with a functional capacity of a double-granary built immediately to the north of the *principia*, internally measuring $23.75 \times 13$ m. Cleared in 1930, almost no record of this work under the National Trust was kept, and the following account has been based on subsequent interpretation of upstanding remains and what little archive remains (Birley 1952; Crow 2004, 55–57).

The original granary was buttressed on all four sides, with two doorways located in the western wall. A series of six large, stone piers ran east–west across the central length of the building, which probably supported the raised floor structure as well as the central roof ridge. There is no further evidence for a subfloor support structure, but there must have been some means of supporting a raised floor, as vents are found in the lowest courses of the north, west, and south walls; stone *pila* were added subsequently (Crow 2004, 56). Modification in the late 2nd or early 3rd century saw the addition of two stone-built walls across the middle length of the granary, immediately to the north and south of the piers of the original structure. It is thought that the southern dividing wall was erected first, as it incorporates the original pier bases into its structure, and then the piers were dismantled; the northern dividing wall was built next. The stone *pila* may have been inserted at this phase, as they are consistent in their form and layout in both the (now distinct) northern and southern granary (Crow 2004, 56); that said, the consistency could also be related to a reflooring episode that occurred between the original erection of the granary and this phase of modification. Presumably, the dismantling of the piers and insertion of the new walls indicates that the former large granary should be seen as two distinct granaries with separate roofs.

Subsequent modification to these granaries is thought to date to the 4th century, but the nature of the 1930s clearance means that the dating is presumed rather than proven (Crow 2004, 95). The northern granary was little changed in form, and the threshold was relatively unworn; it has been suggested that this lack of modification may indicate that the structure became ruinous and collapsed, and that it was never subsequently repaired. The southern *horreum* was divided into two halves with the insertion of a north–south dividing wall across its width (Fig. 3.3).

The western half was probably rebuilt, as there are no exterior buttresses remaining in this part of the southern wall, in contrast to the other surviving walls of the primary granary. The underfloor was infilled and a flagged floor was laid (Birley 1952, 18), while a narrow door was inserted into the eastern end of the south wall to provide access to the building. This may indicate that the loading bay in the western wall was blocked. A “considerable amount of late pottery and the usual debris of occupation” were found on the flagged floor of the modified western half of the granary (Birley 1952, 18).

![Figure 3.3: The 3rd and 4th century plans of the double-granary at Housesteads](image)
The east half continued to function as a horreum, but the stone piers were replaced by sleeper walls that were reported in Bosanquet’s 1898 plan of the site, and a new entrance was inserted into the eastern wall, with access provided by large stone steps (Crow 2004, 95). The presumed collapse of the northern granary cannot be proven, but it does explain the lack of later modification to the structure. This is not simply a result of the 1930s clearance, as Bosanquet’s plan notes the lack of later modification to the structure. This is not simply a result of the 1930s clearance, as Bosanquet’s plan notes the individual pilae of the northern granary and the sleeper walls of the eastern half of the southern granary (Bosanquet 1898). While some storage capacity seems to have been retained in the late Roman period, it is interesting to note the change to presumed domestic occupation in the western half of the southern granary. Overall, this would indicate a reduction of storage capacity in the 4th century to approximately 25% of 3rd century capacity, except that a new storage structure seems to have been erected elsewhere in the fort.

East of the principia on the via praetoria, a new structure (Building XV), built at some point in the late 3rd or early 4th century, seems to have been used throughout the 4th century as another horreum (Leach and Wilkes 1962; Crow 2004, 92–94; Rushworth 2009, 133–135). Measuring 49 × 10.8 m, the lowest courses consist of large stone blocks laid alternately as headers and stretchers; these solid courses had no rubble core or fill, though the northern wall was built with similarly large stones facing a rubble core. Eight buttresses were incorporated into the foundations of the northern wall. Inside the walls, fills were laid to create a level base for flagging, and a series of monolithic post-settings were placed east–west down the central length, based on the discovery of one such stone in the eastern end of the building.

The building was accessed by a 1.5 m-wide doorway in the west wall facing the via principalis and through the middle of the south wall from the via praetoria by an entrance 3 m wide, bearing wheel-ruts in the threshold. The construction date for the building is reliant upon a subfloor consisting of a mixed matrix of rubble and clay; both granaries had flagstone floors placed over the subfloors but the subfloor structures suggests different uses for each building (Birley 2013b, 50–61).

![Figure 3.4: The 4th century plans of Building XV at Housesteads](image)

Vindolanda

The granaries at Vindolanda were constructed c. 211–213 as integral components of stone fort II, and lay immediately to the west of the principia. The granaries ran north–south, with their gable-end fronting onto the via principalis, and can be distinguished as the east and west granaries. The eastern granary measured 25 × 7.5 m externally, while the western granary was slightly larger at 25 × 8 m. Both granaries were buttressed, but the western granary had six evenly spaced buttresses along its length and two on each short wall; the eastern granary also had two buttresses on each short wall but only five evenly spaced buttresses along its length. The eastern granary had a subfloor featuring four longitudinal sleeper walls, while the western granary had a solid subfloor consisting of a mixed matrix of rubble and clay; both granaries had flagstone floors placed over the subfloors but the subfloor structures suggests different uses for each building (Birley 2013b, 50–61).
The western granary appears to have suffered from a fire, evidenced by cracked and burnt flags and internal wall facing stones overlain by collapsed roof material; two coins found between the flags and sealed by the roof debris date to between 260–273 and provide the closest evidence for the date of this event (Birley 2013b, 60). The eastern granary floor was replaced in the early 4th century, evidenced by the shattered flags of the original floor overlain in the subfloor by an accumulated fill. A fill that had built up in the subfloor of the 3rd century and sealed by the shattered flags contained eight coins, seven of which dated to 268–273, but the latest was an issue of Constantine dating 332–333 (Brickstock 2013, table 1).

There is a suggestion that the superstructure of both granaries was rebuilt above the floor-level. New stone walls utilized clay bonding instead of lime mortar, and the facing stones were of variable quality. A new flagged floor was laid in the eastern granary, and the mixed size and reuse of flags probably contributed to the formation of a dark soil fill in the subfloor which contained a mix of artefacts, coins, and ceramics all dating to the mid to late 4th century in the northern half of the building. There were fewer objects in the subfloor deposits in the southern half of the building, suggesting a difference in the use of space within the granary. The western granary also had a new floor laid in the 4th century, but due to the solid subfloor, there is less evidence for dating except to note that there was a more even spread of material within and outside the western granary (Birley 2013b, 37–44). Perhaps the spread of 4th-century coins along the via principalis is related to the use and function of the granaries (Birley 2013b, 44).

Subsequently the western granary underwent a significant change (Birley 2013b, 25–27). A new structure was built over the southern half of the former granary, measuring 9.8 × 7.3 m (Fig. 3.5). This structure utilized the top of the south, east, and west walls of the former Roman granary and created a new wall across the former internal width. The new stone walls were bonded with mixed clay and rubble in the core, using diverse (non-uniform) but good quality facing stones. The new, north wall had a central doorway approximately 0.9 m wide. Inside lay a raised floor consisting of diverse monolithic pilae fixed in place in by an opus signinum layer, and carrying a heavy flagstone floor. To the north of this new building, but still inside the footprint of the former granary was a cobbled surface covering the original granary floor and post-dating the construction of the new building. There was little dating evidence for the new structure or the cobbled surface; coins from inside the building dated to the mid-4th century, but perhaps more significant was that the mixed group of artefacts lacked any associated ceramics. On the basis of the datable evidence from the sequence of building activities, the new reduced-size storage building was erected in the mid-4th century, but a 5th century date is favoured by the excavators on the basis of comparison of building technique with other post-Roman structures at Vindolanda and its aceramic deposits.

The eastern granary also saw a reduction in size after the late 4th century, presumably following a collapse or demolition of the structure (Birley 2013b, 31–32). Again, the southern half of the granary footprint was used, with new walls built over the southern, eastern, and western walls. The subfloor was completely infilled and the floor relaid, and a new northern wall was built across the width. This new structure measured 11 × 7 m. A hearth was found in the northeastern corner of the structure. There was no evidence for a paved yard to the north, as there was in the western granary, and unfortunately no direct dating evidence was encountered.

**Birdoswald**

While the fort at Birdoswald was Hadrianic in its construction, the pair of large stone granaries between the principia and the porta principalis dextra were erected in the early 3rd century, probably between 205 and 208 on the basis of the discovery of RIB 1909. The granaries lie east–west, parallel to the via principalis, and can be distinguished as the northern granary and southern granary; they also bear the same plan and construction, measuring 28.38 × 8.26 m with nine buttresses evenly spaced along the southern wall, and two buttresses supporting each gable-end wall (Wilmott 1997, 109–110).

In contrast to other granaries from the Wall corridor, the subfloor structure of both granaries at Birdoswald indicated a number of modifications that would have necessitated reflooring of each granary on at least four occasions (Wilmott 1997, 119–127). The initial subfloor arrangement consisted of a central longitudinal sleeper wall with timber posts to either side. These timber posts were replaced by...
monolithic stone *pila* in a second phase. The third phase saw the replacement of the posts, or rather the connection of posts with sleeper walls; these ran longitudinally in both granaries, though the west end of the southern granary also had a series of sleeper walls that ran laterally, north–south. The fourth phase saw the greatest change in subfloor structures. In the northern granary, the west end subfloor was infilled, creating a solid platform. In the southern granary, the central portion of the subfloor was modified to include sub-rectangular boxes of sleeper walls, which were then infilled. These last phases of modification are dated to the later 3rd century, on the basis of ceramics from subfloor fills. Given that the next major period of activity arguably began in the mid-4th century, this sequence of modification and reflooring of the granaries took place within a span of approximately 150 years.

Period 5, dating from the mid to late 4th century, saw the granaries undergoing a series of modifications, resulting in their changed function (Fig. 3.6). The southern granary had its entire subfloor filled in, and a new stone floor was laid over this. On the basis of the latest coins from the fill, this event can be dated to c. 350; however the ceramics from the fill suggest that a later date of c. 360–400 should be accepted (Hird 1997, 247–248; Bidwell 2005). Above the stone floor were secondary deposits of further flooring surfaces, and two successive hearths at the western end of the building; a coin dating 388–395 and a high proportion of late 4th-century ceramics suggests that this activity occurred in the later 4th century or perhaps even the early 5th century, followed by the collapse of the roof (Wilmott 1997, 203–205, 208, 209; Hird 1997, 249–250).

The northern granary appears to have suffered a roof collapse at the east end of the building, although there is evidence that the western end of the building (which also had the solid subflooring) remained in use. Ultimately, though, it too suffered a roof collapse, sealing a coin dating 350–353 (Wilmott 1997, 205–206, 208). Following the collapse of the roof, the northern granary appears to have been robbed of its building stone, and the subfloor was used for piecemeal refuse dumping. Coins and ceramics from these fills all generally date to the second half of the 4th century, with considerably less “residual” material than seen in the subfloor deposits of the southern granary. These almost certainly attest to the space being used for the episodic, contemporary rubbish disposal (Wilmott 1997, 208).

The northern granary was replaced with a large, timber post-built structure, with the remains of 19 postholes cut into the fabric of the granary walls, with five further postholes extending the length of the building a further 5 m west onto the *via sagularis* (Wilmott 1997, 212). A mix of facing stones and shale in a silt matrix formed a floor level for the building, and between the postholes and the floor surfaces, the building can be estimated to have had a footprint of 31.6 × 8 m. It is uncertain how long this timber building was in use for, but it was replaced by a second timber building on a slightly different alignment. Post-pads indicated five pairs of timber uprights, placed over the central sleeper wall of the former northern granary and in the centre of the *via principalis*, probably to line up with the open portal of the west gate (Wilmott 1997, 214). While material was found in association with this sequence of timber structures, it is best understood as “residual” and not necessarily contemporary to the construction and use of the buildings. On the basis of the TPQ provided by dumping of the collapsed and robbed northern granary, these structures can date no earlier than 367–378, and Wilmott (1997, 217) suggests that the timber buildings were functional replacements for the final use of the southern granary, which collapsed at some point after 388–395. On either reckoning, however, it seems these timber structures were used in the 5th century and perhaps extended into the 6th century depending on the use-life of each timber structure (Fig. 3.7).

**Other Sites**

There are indications of changed use of granaries at other sites in the Wall corridor, though interpretation has been hindered for various reasons. At Benwell, the double *horreum* east of the *principia* was certainly altered in some fashion in the late Roman period, as excavations revealed...
demolition of the northern end of the double *horreum* down to the foundations, with the space subsequently replaced with a paved surface (Holbrook 1991, 43); unfortunately there was no evidence surviving subsequent to the demolition and paving activity.

Chesters has an intriguing range of evidence, but suffers from a lack of modern excavation. Geophysical survey suggests a “standard” granary in the central range to the west of the *principia*, and there is space for a pair of granaries (Bidwell 1999, Fig. 31). However, antiquarian excavation encountered a pair of granaries in the *retentura* south of the *principia* each measuring approximate 14.5 × 8.5 m. Reports of “defective” masonry probably indicate a very late Roman construction (Bruce 1884, 91).

At Stanwix, clay floors and the remains of timber buildings sealed the latest stone building and metalled surface deposits in both the area of the *horreum* and the barracks / stables (Esmonde Cleary 1998, 383). Unfortunately, these excavations have not been published, and a clearer statement of dating and interpretation cannot be offered.

In addition, the granaries at a number of sites have not been excavated, as at Carvoran or Bowness, or post-medieval and modern activity has truncated late Roman strata, as at Wallsend and Castlesteads.

**Discussion**

Table 3.1 provides a summary of the granaries described above, from which a number of points should be drawn out. Of the five sites reviewed in detail above, only Housesteads retained a storehouse structure that seemingly originated in the Hadrianic period, though the *horrea* at Newcastle were also original to the fort’s foundation in the later 2nd or early 3rd century. The main granaries at South Shields, Vindolanda, and Birdoswald can be associated with Severan construction. Newcastle may also be a Severan construction, or was recent enough in its foundation not to have needed a Severan refurbishment, while the Hadrianic *horreum* at Housesteads may have been split into two “new” granaries during the same period.

Subsequent modification, excepting circumstances of fire, generally takes the form of the infilling of the subfloor, either in part or in whole. This occurs partially in both the
northern and southern granaries at Birdoswald in the later 3rd century, where a solid subfloor does not necessarily indicate a non-storage role for the building. The western horreum at Vindolanda had a solid subfloor from its Severan construction. But such a feature probably does indicate that the building was not intended to store grains, for which greater ventilation would be required. Thus, buildings with a ventilated subfloor are generally perceived to have stored grains (Table 3.2).

It seems likely that horrea often had a second storey (Wilmott 1997, 137). The thickness of the walls, the use of buttressing, and evidence in some instances for greater ventilation would be required. Thus, buildings with a ventilated subfloor are generally perceived to have stored grains (Table 3.2).
3. Economic reduction or military reorganization?

internal supports (as at Houseteds Building XV) all provide supporting evidence for a second storey; upstanding remains at Trier, Rome, and Ostia also indicate that two-storey horrea were constructed. This doubles the area available for storage, and upper stories would have provided suitable ventilation for grains provided that structure could bear the weight. Significantly, there is no evidence for the insertion of wooden structures that would function as bins for loose grain, and cereals were almost certainly stored in sacks. Not only would this make transport easier, it makes the actual transfer and handling of the grain easier. Where a solid subfloor occurs from the original construction of the building, or a portion in conjunction with ventilated subfloors, a storage function for the building can still be presumed. Unsurprisingly, detailed sampling indicates zoned use of granary floors (e.g. Huntley and Daniell 2002; Huntley 2013).

The insertion of a solid subfloor across the entirety of a horrea, necessitating the removal of a previous floor surface and then replacing it, was still a considerable investment of time and labour. Such a drastic change signals the possibility of a more complete change of function for the building. Palaeobotanical evidence further underscores this, particularly at South Shields (van der Veen 1994; Table 3.2).

Evidence for complete demolition or drastically changed use of the granaries occurred at each of the five forts in this study. This left no obvious capacity for storage within these structures at South Shields (from c. 370), Newcastle (from c. 370) or Birdoswald (from c. 350–360). While the function of the former granary at South Shields is uncertain, as is the eastern granary at Newcastle, at Birdoswald both granaries appear to have been given over to more social functions. Around 370, the western granary at Newcastle had its subfloor infilled and the space appears to have been given over to industrial use. Half of the southern granary at Housesteads was given over to occupation presumably in the later 4th century, while it is assumed that the northern granary collapsed in the later 3rd or 4th century, quartering the storage capacity. In contrast, Vindolanda seems to have retained the storage capacity of both granaries (assuming that the west granary with its solid subfloor continued to function as a store) until the later 4th or early 5th century. The more significant change occurs in the 5th century when both granaries were demolished. The eastern granary was superseded by a domestic building on its footprint, while the western granary had a smaller horreum reconstructed over its southern half, fronted by a paved yard inside the northern half (Fig. 3.5).

While this may suggest a fairly substantial and consistent reduction in dedicated storehouses in the second half of the 4th century, such an impression may be misleading. The construction of Building XV at Housesteads in the Tetrarchic period, surpassed the capacity even of the large Hadrianic horreum, which still retained approximately 25% of its storage space (Table 3.1). At Vindolanda, the principia forecourt structures and veranda received raised floors,

<table>
<thead>
<tr>
<th>Site</th>
<th>Sample</th>
<th>Provenance</th>
<th>Results</th>
<th>Interpretation</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Shields</td>
<td>12236</td>
<td>3rd c. granary subfloor base</td>
<td>90% of grain; minor chaff &amp; weeds; no germination or infestation</td>
<td>good storage conditions</td>
<td>van der Veen 1994</td>
</tr>
<tr>
<td></td>
<td>12176</td>
<td>4th c. subfloor infill</td>
<td>very low counts of grain; weeds virtually absent</td>
<td>either more efficient processing and storage or not used as a granary</td>
<td>van der Veen 1994</td>
</tr>
<tr>
<td>Newcastle</td>
<td>multiple</td>
<td>3rd c. eastern granary subfloor</td>
<td>followed by wheat, with minor presence of oats and other plant foodstuffs; absence of chaff; evidence of heather</td>
<td>good storage conditions, probably mostly used for grains</td>
<td>Huntley and Daniell 2002</td>
</tr>
<tr>
<td>Vindolanda</td>
<td>multiple (Level 2)</td>
<td>3rd c. fills of eastern granary subfloor</td>
<td>grains, mostly wheat, dominate, with minor contributions of grassland seeds, arable weeds, and chaff</td>
<td>increased presence of grassland seeds may indicate reduced presence of grains, or perhaps these samples were more disturbed</td>
<td>Huntley 2013</td>
</tr>
<tr>
<td></td>
<td>multiple (Level 1)</td>
<td>4th c. fills of eastern granary subfloor</td>
<td>grains, mostly wheat, dominate, with a considerable presence of grassland seeds, and minor contributions of chaff, arable weeds, and tree/scrub seeds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birdoswald</td>
<td>multiple</td>
<td>3rd c. fills of southern granary</td>
<td>grains, mostly barley, dominate, with large amounts of barley chaff with wheat of secondary, some presence of wetland species</td>
<td>primarily grain storage, with possibility of local barley growth and processing, wet conditions</td>
<td>Huntley 1997</td>
</tr>
</tbody>
</table>

Table 3.2: Summary of palaeobotanical evidence from granaries at the sites in this paper
indicating an increased storage capacity within the fort, provided that these changes can be confidently dated to after c. 340 (Birley et al. 1936, 225–228). If these modifications are in fact later and attributed to the early 5th century, then these changes can be seen as an alternative to some of the lost capacity in the granaries. At Newcastle and Birdoswald, where both dedicated granaries were lost, it is feasible that new horrea were constructed elsewhere in the fort where there has not been any excavation.

This raises the question of how we should interpret the limited evidence at Chesters, where the granary and its presumed pairing immediately west of the principia were supplemented by a pair of smaller late Roman horrea. Were the original granaries demolished or reused, their function replaced by the smaller, later granaries? Or were these later horrea an increase in the storage capacity of the fort? Why would increased storage capacity be required?

Supply of the Wall Limitanei

At some level, all of these late granaries will have been linked to taxation and military supply; the question remains as to what scale. Apparent loss of storage capacity in the later 4th century at South Shields, Newcastle, and Birdoswald suggests a decrease in the scale of storage. This may relate to the size of the garrison and population at each fort, or to a declining need to import food and other supplies, if local or proximal provisioning was adequate. Garrison size and local carrying capacity, while linked, are best considered separately.

The original purpose of fort granaries was for the bulk storage of foodstuffs and other essential materiel to support the garrison of the Wall, with the vast majority of these supplies almost certainly imported from outside the frontier zone. Yet these stores were erected in conjunction with the establishment of Hadrian’s Wall in the 120s. By the 4th century, nearly 200 years of military control would have established tried and tested supply arrangements. These may have been altered slightly with the late Roman reorganization of the tax system, introducing the annonis militaris and further codifying in law the preference for local-supply whenever possible (Rickman 1971, 283–290). Ceramic evidence serves to illustrate the annona was put into practice in the northern frontier zone; the main ceramic suppliers were the Yorkshire-kilns in the southeast corner of the frontier zone, and while there is evidence for limited quantities of wares from other British potteries, the importation of ceramics from outside of Britannia was extremely limited (Bidwell and Croom 2010).

Estimations of garrison size in the 4th century are notoriously difficult, but unit sizes of approximately 250–350 men are suggested as likely (Collins 2012, 51–54). Added to the unit strength is the non-soldier population, which by the 4th century had moved into the fort from the now abandoned extra-mural settlements (Birley 2013a; Hodgson 2014). At a conservative estimate, each Wall fort’s total population would have numbered around 500 persons through much of the 4th century. Although the army was not obliged to provide food and supplies to the non-soldiers and dependents in the military community, their occupation inside the fort may still have put space at a premium. It therefore seems likely that any unnecessary structures would be demolished or converted, including horrea.

But could the Wall corridor provide enough food to support the military communities dispersed along the Wall? Roman agricultural terraces overlying vicus structures at Housesteads are testimony to local arable production in the 4th century, but the carrying capacity of the Wall corridor varied considerably. It was greatest in its eastern and western sectors, where the Tyne Valley and Solway Plain provided good farmland. The uplands were a different matter, however. A crude measure for the difference in upland and lowland agricultural value can be gained from the Northumberland Lay Roll Subsidy of 1296, where the ward of West Tynedale covering much of the central sector of the Wall and its hinterlands was assessed at £553 and the ward of East Tynedale covering most of the eastern sector of the Wall and its hinterlands was assessed at £1,430 (Fraser 1968, xxi). While agriculture at this date may have been more productive than during the later Roman period, it would not have been substantially different, and a case can be made for sizable arable production in the lowlands.

As a simple measure of potential, Manning (1975) calculated that in upland conditions with low crop yield, 2.56 km² (1 mi²) of agricultural land would be required to meet the grain requirements of a Roman garrison of approximately 500 people. Certainly there was enough land with arable potential, but subtracted from this are the crops required by the farming community and land necessarily dedicated to growing fodder and pasture for livestock. So while there may have been a fair agricultural base for each fort population, it may still have been necessary to gather supplies from a larger area, if not importing from further afield. Indeed, the tax assessment in the 13th century for the entire county of Northumberland was a fraction of that for the North Riding of Yorkshire (Fraser 1968, xxi). Given the evidence for 4th-century ceramic supply dominated by the Yorkshire kilns and the infrastructure available to distribute those ceramics and their contents, it seems likely that Yorkshire may also have been the breadbasket for the northern frontier; the uplands, consisting of the Pennines and most of the lands to their west would have been well-suited for pasturage (Stallibrass pers. comm.). Forts such as Catterick, Bichester, and Piercebridge, located south of the Wall on Dere Street and at the interface of the eastern lowlands and central uplands may have been crucial within this supply gathering and redistribution network; indeed,
this could very well explain the substantial evidence for
the processing of cattle encountered at Binchester (Petts,
this volume).

Perhaps the differential evidence of horrea space in
the forts examined in this paper can be seen as an upland-
lowland divide. Housesteads and Vindolanda, located in
the centre of the Wall corridor, may have required a more
substantial stockpile of foodstuffs like grains due to the
limited arable potential of their locality. Birdoswald is at
the western terminal of the upland central sector of the Wall, but
may have had greater access to the arable lowlands to its
west, freeing the fort from a need to retain large storehouses.

The construction of Building XV at Housesteads has been
linked to the annona militaris and the reorganization of tax
payment and collection and military pay under the Tetrarchs
and subsequent emperors (Crow 2004, 98–99; Rushworth
2009, 307–309). The argument is that the retained storage
function of the halved southern granary should still be
understood as the garrison horrea, while the new Building
XV was a public storehouse that received the taxes-in-kind
supplied by civilians for the annona militaris, holding such
quantities for subsequent redistribution along the Wall.
There is the further suggestion that perhaps granaries at
other Wall-forts functioned as public storehouses. While the
hypothesis has merits, the basic premise should be explored
further in particular, as to how such a system would relate
to the infrastructure of the Wall corridor.

The fort at Housesteads seems an unlikely location for
a collection point of the annona militaris, sitting on top of the
craggy Whin Sill and detached from the main Stanegate
road. Or does the Knag Burn gateway through the Wall at
Housesteads indicate that collection was made from the
population to the north of the Wall? Could enough tax/
supplies be collected from the rural uplands of the central
Wall sector to justify such a large storehouse?

If a suitable fort site was required in the central sector of
Hadrian’s Wall, then Vindolanda would be more appropriate,
located on the Stanegate road that ran east–west to the south
of the Wall. This need for storing the annona and seeing
it to its redistribution would provide a plausible explanation
why Vindolanda retained both its granaries until the late 4th
or early 5th century, as well as expanding on capacity by
conversion of parts of the principia.

The western sector of the Wall has four prospective locations for annona collection points. The forts of Carlisle
or Stanwix, located adjacent to the Roman town of Carlisle
and also on a main road crossing north through the Wall,
offer ideal sites. Unfortunately, there are insufficient data to
argue for the presence of sizable granaries at either fort site
in the 4th century; nor is there evidence for storehouses from
the town of Carlisle. Birdoswald is another ideal candidate
for an annona collection point; its position at the intersection
of the Wall with the Maiden Way would facilitate collection
from north of the Wall and further utilize the road network.

Yet, there is currently no evidence for the replacement of
lost storage capacity at Birdoswald. The western sector may
yet yield evidence supporting this model.

In the eastern sector, four sites merit attention: South
Shields; Corbridge; Halton Chesters; and Chesters. As the
presumed main port for the Wall corridor, South Shields
was crucial for the transhipment of bulk goods for the
Wall garrisons. While the forecourt granary seems to have
been converted c. 370, the horrea in the retentura remain
of potential interest. When and how were these granaries
altered? The fort of Chesters was located on the Wall
adjacent to the river North Tyne, and in more recent centuries
this river valley provided a preferred route for accessing the
Wall corridor from the north. The situation at Chesters has
already been described above, and while nothing conclusive
can be said, there is at least potential for increased storage
capacity in the later Roman period.

Halton Chesters was built on the Wall just east of the Port
Gate, which guarded the passage of the main north–south
road through the Wall corridor, Dere Street; approximately
one Roman mile north of Halton Chesters, another road, the
Devil’s Causeway branched northeast off of Dere Street.
A granary was partially excavated to the west of the principia
at Halton Chesters, which the original excavator claimed
to have been destroyed by fire in the later 3rd century,
with new 4th-century structures built over the site; modern
 reassessment is more cautious of this interpretation, and
notes that there is no clear evidence for when the structure
went out of use, though there may have been undated
infilling of the subfloor (Dore 2010, 11–13).

The town of Corbridge was located at the intersection of Dere Street and the Stanegate on the River Tyne, and
excavations in the early 20th century revealed urban
storehouses at Sites 17W and 56 (Forster and Knowles
1910, 242–243; 1914, 292–297). While these structures
were argued to be Severan in construction, the evidence
is far from robust and their style of construction compares
very favourably with Housesteads Building XV, suggesting
a later construction (Rushworth 2009, 307). The two large
granaries at Corbridge built facing onto the Stanegate in the
later 2nd or early 3rd century probably continued in use into
the 4th century on the basis of reported coins discovered,
though evidence for late Roman use is ambiguous (Knowles
and Forster 1909; Brassington 1975).

While the supply chain under the annona may have
shortened, the provision of foodstuff could still be variable.
A poor harvest, due to blight, weather or any other reason,
would still create a shortfall in required supplies. Such
failures could be localized, or could occur at the
regional scale or greater, depending on the cause. In such
circumstances, the capacity for collection and storage of
provisions in bulk would still have been a pressing need
for the frontier army, particularly in the more vulnerable
uplands.
Conclusions

Taken at face value, only the town of Corbridge and the fort at Housesteads have clear evidence for substantial storehouse capacity for the *annona militaris*. The other key infrastructural sites in the Wall corridor simply do not provide enough evidence to support or disprove the hypothesis. Furthermore, the late Roman construction of a storehouse is only proven at Housesteads, though modification of the *principia* at Vindolanda sees the relocation of storage capacity to another building. On present evidence, South Shields, Newcastle, and Birdoswald have reduced storage capacity from c. 350–370.

Do these changes represent a reduction in imported supply, or is there a wider reorganization of supply to the Wall corridor in the later 4th century? The dating for the *horrea* at Housesteads and Vindolanda is crucial. Building XV at Housesteads was constructed in the Tetrarchic period; to that end, its original purpose may have been linked in with the *annona militaris*. However, its eastern end is demolished to accommodate a bathhouse in the mid to late 4th century, indicating that the entire building did not need to be retained for storage. While the overall capacity of the reduced Building XV was still quite considerable, it was still a sizable reduction.

Significantly, the changes to the granaries at each of these sites are different enough in date that we cannot ascribe them to a single event-horizon. The addition of storage suites to the *principia* at Vindolanda could have happened as early as the 340s, and the loss of the granaries at Birdoswald may begin as early as the 350s. South Shields and Newcastle both seem to have seen change around 370. The modifications at Housesteads are undated, but probably do not occur earlier than the 340s. Therefore, we cannot ascribe changes to the storage, and presumably supply of these forts to the final years of Roman administration of Britain, or even as a consequence of the Barbarian Conspiracy of 367. Rather, the impression gained is that alterations to *horrea* and storage conditions were made at each fort at the instigation of the local commander, rather than in response to a top-down directive from the *dux Britanniarum*.

Still, this conclusion leaves us asking further questions. To what extent was each fort supplied locally? And how much food had to be imported from further afield? Was retained or increased storage capacity at Corbridge, Chesters, Housesteads, and Vindolanda simply a means of anticipating arable failure or the need for arable imports in upland locations? Indeed, the answers to these questions further frame our understanding of the 5th-century use of the Wall forts in the aftermath of Britain’s separation from imperial authorities, and any presumed fragmentation or collapse of the frontier.

Bibliography


3. Economic reduction or military reorganization?


