

ART. XII.—*The Provisioning of Roman Forts.* By the late Prof. F. HAVERFIELD, LL.D., D.Litt., F.S.A., F.B.A., President: with an appendix by R. G. COLLINGWOOD, M.A., F.S.A.

*Read at Kendal, September 19th, 1918.\**

I WAS lately re-reading the "Life of Agricola," by Tacitus, when my attention was caught by a remark in it which I had not properly noticed before. Tacitus (ch. 22) states that Agricola was not only singularly skilful in choosing strong sites for his forts, but that he also provisioned them with "supplies enough to last a year"; hence, none of his forts was either taken by storm or starved into surrender by blockade.† Maybe my wits were sharpened by recent events; anyhow, I found myself asking a question which no one seems to have asked before: what were these *annuae copiae*, these provisions which "lasted for twelve months"? Were they flesh or cereals? and how were they stored?

I do not suppose that "supplies for a whole year"‡ were often actually needed by a Roman garrison in Britain. But it is plain that a fort like Borrans Ring at the head of Windermere—lately most skilfully excavated

\* The printing of this paper was delayed, by the author's desire, for the completion of the appendix; see p. 138.

† "adnotabant periti non alium ducem opportunitates locorum sapientius legisse; nullum ab Agricola positum castellum aut vi hostium expugnatum aut pactione ac fuga desertum; nam adversus moras obsidionis annuis copiis firmabantur." On the phrase *annuis copiis*, see note 2.

‡ In a sense, of course, the phrase "supplies for a year" involves a certain confusion of thought. The ancient world lived as the modern world does to some extent (in the present war) on the growth of cattle and crops during each past year. If these do not yield supplies which will last till the next crops or growths are ready a year later, shortage of food is inevitable. I do not, however, suppose, that Tacitus, though he must have been familiar with this, had it consciously in mind when he used the words "annuis copiis." But he would have stated the position better, if, instead of "supplies for a year" he had used words meaning the same "supplies to last till the next harvest."

for our Society by Mr. Robin Collingwood—might easily have been isolated, not perhaps for a full year, but certainly for several consecutive months, and the same seems true (or even truer) of other forts in the Lake country. Borrans, indeed, was better off than most of these forts; at a pinch, it could have been relieved, reinforced and re-provisioned by the waterway of the Lake; this resource was not available everywhere. The fort nearest to Borrans westward is a little post, 11 miles away, perched high on a shoulder of Hardknot Fell (800 feet above sea-level), which guarded the rough mountain trail that led from Borrans over Wrynose, then along the headwaters of the Duddon, and finally over Hardknot to the harbour at Ravenglass.\* This fort on Hardknot might easily have been isolated for a longish period in winter. The road, it is true, is rarely closed by snow. But save in fine summers, it is no easy route. Unless a strong Roman force chanced to be available, either at Borrans, or at Ravenglass, the next post westwards (about 10 miles distant), the introduction of supplies might have caused serious trouble. It is not so much that the road is impossible, as that, if beset by a large crowd of Britons, it could have been opened only by a powerful relieving force, which it might not have been easy to concentrate either at Borrans or at Ravenglass. It is, then, worth while to consider the problem of supplies, in event of a blockade. How, under the conditions of ancient life, was it possible to provision a fort with sufficient supplies to feed its garrison, as Tacitus says, for a year?

I will begin by defining the terms, and will arrange the matter under 3 questions, (A) what was a Roman fort

\* Perhaps the Clanoventa of the Romans (*Archaeological Journal*, lxii, p. 83 (1915)). The outline of the fort can still be traced on the edge of Ravenglass harbour, between it and the railway. The walls of the bath-house there are deservedly well-known: see these *Transactions*, o.s., iii., pp. 17-26, where, however, the character of the remains, as a bath-house, seems not to be correctly understood.

and what the usual size of its garrisons? How many mouths were there to be fed? (B) What was the usual food of the Roman soldier, and (C) what conclusions follow?

(A) As to forts, it is needful to remember that the strategy by which Rome held down the wilder portions (i.e. the north) of Britain, rested on the use of certain military posts which English antiquaries generally call "camps," but which would be better styled "forts," and which the Romans called "castella." These were planted at strategic points among the hills of northern England, where important valleys met, or where difficult hills needed to be watched, or mountain passes or river-crossings to be made safe; in short, they kept communications open throughout the rich network of roads which the Romans used in north England. As a rule, they were some ten miles distant from one another, but their exact sites were naturally dictated by local conditions. They formed a special class of posts, far more numerous, but far smaller than the great legionary fortresses, such as York and Chester. The legionary fortress covered an area of about 50 acres, and had a permanent garrison of perhaps 5,000 legionaries (heavy infantry). The "castella" were very different; they varied from 3 or 4 to 6 or 8 acres in size, during most periods of the Empire.\* Each "castellum" was held by one "auxiliary" regiment of foot (*cohors*) or of horse (*ala*); these auxiliary regiments normally mustered either 500 or 1,000 men. The space needed for 1,000 men with horses (*ala miliaria*) naturally differed greatly from that needed for 500 infantry (*cohors quingenaria*);

---

\* Some of the earlier forts of Agricola along the line later taken by the Wall of Pius seem to have been quite small; the Agricolan fort at Barhill, explored by Dr. Macdonald in 1902-5, seems to have covered less than half an acre within its ramparts, which were probably elaborate and extensive; the fort at Cappuckon Oxnam water was hardly larger. Newstead, by Melrose, also founded by Agricola, was, or at any rate became, much larger, but it is in many ways exceptional.

one can understand why the areas of the forts differed widely.

The "castella" were especially common in northern England. In the peaceful south they were rare; save for a few on the south and east coasts, and for some in "wild Wales," hardly one is known south of Derby.\* But between Derby and the Cheviots remains of ~~between~~ 50 and 60 can be traced. Not all these were occupied at one and the same moment. The conditions of different districts naturally varied from time to time; some grew more peaceful and some perhaps more unruly; in one valley or upland range, some "castella" became superfluous and were evacuated, whilst, in another valley, more forts came to be required and new ones were added. Wales, for example, after Agricola had completed its conquest (A.D. 78), grew more or less rapidly pacified; garrisons could be and were withdrawn thence, and as more men were needed in the second century to hold the developing defences of the northern Walls of Hadrian and of Antoninus Pius, it seems that some Welsh forts were given up and their garrisons transferred to the north.†

The problem, then, which we have to solve, is how far supplies for 500 or for 1,000 men could be stored in forts in quantities sufficient to feed their garrisons for a fairly long siege, if not for a whole year. Here it may be well to turn to my second question and ask what, in all probability, these provisions were.

(B) If I may anticipate my general conclusion, the known facts seem to me to suggest that in the Early Empire, the Roman army was fed mainly on cereals, and ate comparatively little meat, but that, in the later Empire, the consumption of flesh increased. In other

---

\* For the fort at Derby, in the suburb of Littlechester, see my account in the VCH *Derbyshire*, I., 216-221.

† See my *Military Aspects of Roman Wales*, pp. 13, 58, etc.

words, the Roman army which conquered and held down the world, was, at first and in the main, a vegetarian army. History in this respect does not quite support the high value set by modern opinion on a meat-diet.\* Vegetarianism, indeed, thanks to Oriental influences, and thanks also to the warm climate of the south, was not unknown in the classical world; and abstinence from meat played a prominent part in the philosophy of the ancient Greeks and Romans. The south Italian philosopher, Pythagoras, and several other Greek philosophers as well, directly enjoined on their disciples a vegetarian diet and abstinence from meat, and the same rule seems to have been laid upon those initiated into the Orphic mysteries. These ascetic doctrines had some vogue in Rome during the latest Republic and the early Empire.† Later in the Empire, however, more meat was eaten, and in the fourth century, as the historian Otto Seeck observes, it was dear meat, not dear bread, which provoked certain food-riots in Rome.‡

Caesar, when alluding to his soldiers' food, almost always speaks of *frumentum* (corn). Once or twice he notes that meat was used when corn ran short, but he calls meat in effect a famine diet, and his words are repeated almost exactly by Tacitus, writing of a Roman campaign in Armenia (A.D. 60). Meat, however, was

\* Not, however, all modern opinion. The lumbermen in Maine, U.S.A., when they are doing severe timber-cutting in the backwoods, feed themselves, as I am told, by preference on beans.

† Bernays' '*Theophrastos' Schrift ueber Frommigkeit*' (Berlin, 1886), p. 4. See Cicero, in *Vatinium*; Seneca, *epist.* 108, 22; etc.

‡ O. Seeck, *Untergang der antiken Welt*, i. 422, 592. The change to an increased consumption of meat has been explained as due to the entry in the later Empire of a larger proportion of northern barbarians (Germans, etc.) into the army. So, A. von Domaszewski, *Rangordnung* (*Bonner Jahrb.*, 117), p. 46, who calls it an innovation of third century. The old Roman military soldier's food, the "*frumentum*" (he writes) came to be superseded by the meat diet of the barbarians. This explanation seems generally accepted; at the same time, it must be remembered that provincials served in certain parts of the Roman imperial army, from the very first. Agricola had among the troops whom he used to conquer Britain a cohort of Usipi, levied on or near the Rhine frontier, just before—though I would not be understood as connecting the incident in connexion with which Tacitus especially mentions them with the subject of this paper.

not absolutely unfamiliar to the Roman troops, even in the earliest Empire, and details which imply its use occur fairly often. For example, the Roman legions and even the "auxiliary" cohorts and *alae* had, attached to their fortresses or forts, certain *prata*, or *territoria*, on which soldiers called *pequarii* were employed. Probably these *prata* were, at least to some extent, grazing grounds for regimental cattle, which the *pequarii* herded—though both terms have been differently explained. Again, a Cumberland inscription mentions certain *venatores*,\* who, perhaps, saw to the provision of fresh meat, as they are coupled in a Roman lawbook with certain *lanii* (butchers). Altogether, it is plain that the Imperial troops had arrangements for supplies of meat which we must suppose that they consumed.

But whatever herds † they had, archaeological evidences show that beasts cannot have furnished the chief foodstuff during a long siege. The internal buildings of the *castella* here afford useful clues. We know the general disposition of these buildings fairly well, from excavated forts like *Housesteads* on Hadrian's Wall, or *Gellygaer* in Glamorgan, of which we chance to possess tolerably complete and obviously typical ground-plans (see fig. 1). These forts are crowded with stone buildings, the special uses of which can be (more or less) determined, and two facts emerge:—(A) There is no vacant ground where further buildings not on our known plans could be added, and (B) none of the known buildings can be explained as byres for cattle or the like. It is then unlikely that these forts contained much in the way of cow-sheds. More-

\* C.I.L., vii., 830; *Lapidarium*, 370, p. 187. Respecting *prata* see Momm-  
sen's note on C.I.L. 2.

† Prof. Haverfield intended to add a note to the effect that the Lake District was not in antiquity a cattle-country. At present cattle can only be kept on the artificial meadows which date from a much later period; but sheep could be kept on the fells then as now, and pigs in the woods. In this case the suggestion has been made, and seems reasonable, that the animals were kept by natives and not, as in a cattle-country, by the *pequarii* of the garrison.  
—R.G.C.

over, beasts, if kept in stall, require from time to time to be turned out to graze ; there is no grazing-space inside these forts, any more than there is normally in the middle of a crowded modern town. If the garrisons of House-

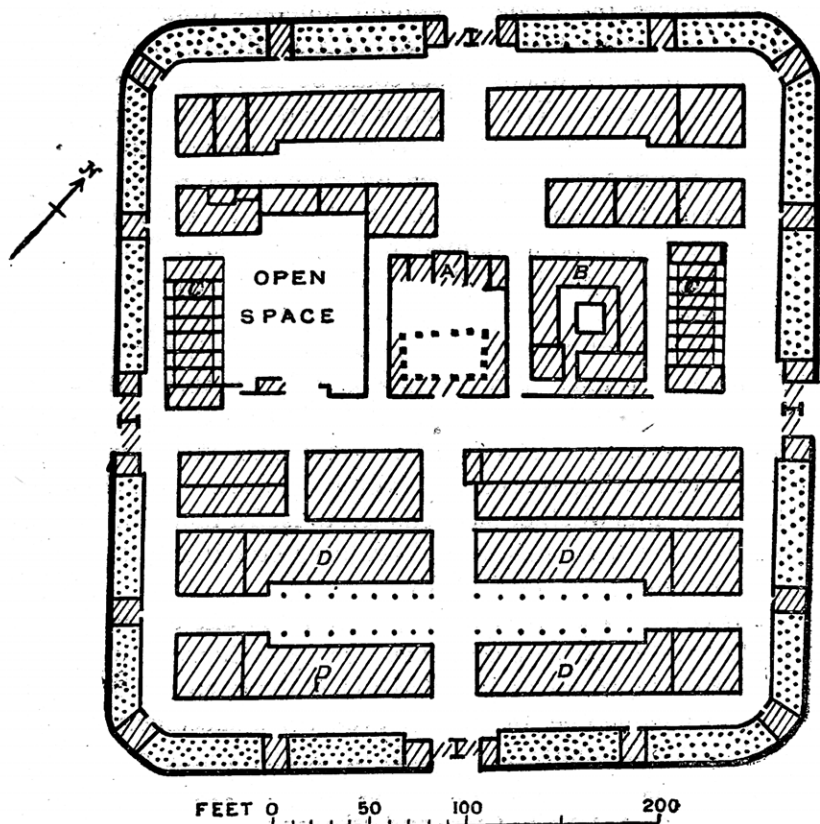


FIG. 1.—ROMAN FORT AT GELLYGAER.

steads or of Gellygaer lived on fresh beef or mutton, they must have pastured their herds somewhere outside. But it is hardly credible that they could have grazed their cattle in safety outside the ramparts. It is true that in the sieges of the Peninsular War, the French armies had

herds of store cattle which were grazed outside their fortresses. In the first siege of Ciudad Rodrigo, a high French officer was carried off by a besieging patrol, whilst he was inspecting the grazing herds. But here artillery makes the modern position different from the ancient. A modern fortress has round it a belt of ground covered by its guns, where beasts could be pastured fairly safe from besiegers. The Roman forts had no guns; on any foggy day or night, cattle turned out to graze would pretty certainly have been stolen by some clever British cattle-thief. The conclusion is that either another method must have been adopted, or else we must believe that the Roman garrisons depended for their food on something else than a supply of fresh meat.

It is possible, of course, that meat was used, but not fresh meat. It may have been smoked. Cumberland farmers, I believe, even in recent times, have killed beasts each autumn, and smoked and stored the meat for consumption during the coming winter months. But I confess to doubts whether meat enough to feed a thousand men for 4, 5 or 6 months could have been stored successfully in any ordinary Roman fort.\*

The decision, however, is given, I think, by one of the buildings of the normal *castellum*. These buildings, at least in Britain, so far as they have been explored, seem always to include one, or two, or even three specimens, in each fort, of solidly built halls or barns, which our antiquaries usually call *horrea* (granaries). These are constructed on a definite type, and alike in their solidity

---

\* Mr. W. G. Collingwood tells me that it was formerly a common custom in the north of England to kill in autumn, and smoke the meat for use during the coming winter. At Cartmel, for instance, no fresh beef was eaten at all, up to the end of the 18th century; cattle were killed at Martinmas and the meat pickled in tubs. "The first cow killed in the summer months, in Cartmel Church Town, or any part of the parish, was by Mr. Alan Waring, butcher, of that place, about the year 1785, and such were people's prejudices that no one would buy the beef; they could not be made to believe that beef killed in the summer months could be wholesome." (Stockdale, *Annales Caermoelesenses*, p. 573). In Iceland meat is preserved by being steeped in sour whey.



and in their dimensions show much uniformity. They may be described (fig. 2) as oblong halls, or barns, not seldom about 20 or 25 feet wide and about 75 or 80 feet long. Their outer walls were unusually strong, and

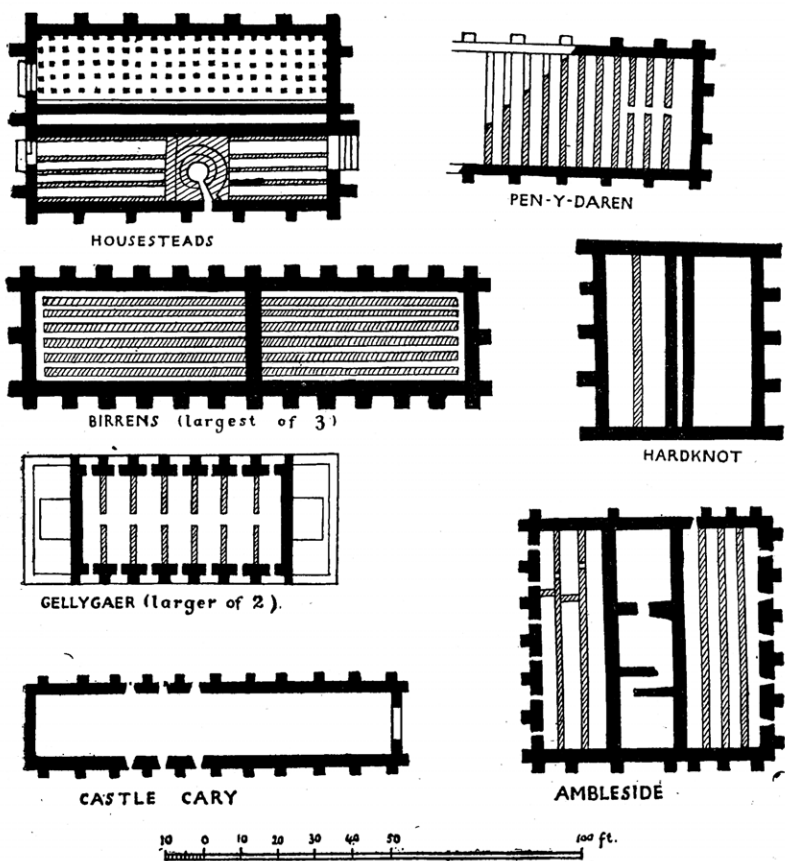


FIG. 2.—ROMAN GRANARIES IN FORTS IN BRITAIN.

seem regularly to have been further strengthened by external buttresses, which in the process of excavation form their most recognisable and distinguishing features. When the spade reveals buttresses, the explorer may ex-

pect to find that he has come upon one of these buildings. Their floors were regularly raised 2 or 3 feet above the adjacent surface level, and were supported by dwarf sleeper walls, or by low stone pillars, so that each hall or barn had beneath it a shallow basement. This basement was, as a rule, ventilated by small openings between the buttresses, which ensured a through draught, so that the barn itself was free from damp or from dry-rot. The floors were constructed, sometimes of very solid stone flags, sometimes of wood-planking.\* Nowhere is there any trace of hypocausts or of heating. The structure above the floor was a large open hall; sometimes two halls stood side by side, a device which ensured abundant room, without requiring unduly wide spans of roof; sometimes a row of columns down the middle of the barn supported the roof. The original heights of the walls and roofs are naturally unknown, but abundance of débris often shows that the walls must once have been high, while heaps of fallen roof-tiles often point to solid roofage. If the roofs were tiled, they would have been free from any danger of being set on fire by fire-arrows (*Flammenwerfer*) of the besieging barbarians. Thus the garrison's food-supply was safe both against fire and against damp. In Britain, the granaries are usually placed near the centre of the fort, on one side or another of the *principia* (Headquarters).

That these buildings were granaries is so universally accepted that it needs no special argument here. But two or three bits of proof may be mentioned: (a) In several examples, as at Ribchester and elsewhere, largish quantities of blackened grains of wheat have been discovered in them. At Ambleside, an open space between two not quite contiguous halls was appropriately utilised to accommodate what I take to have been a baking-kiln.

---

\* Now and then the iron nails which fastened the planks are found lying below.

(b) At Corbridge, and elsewhere, inscribed stones have been found in or just outside the halls, which refer explicitly to a *horreum*. I will add (c) that the basements seem often to contain the bones of rats and dogs—rats, which crept in through the ventilating holes to get the grain, and dogs, which followed to get the rats.

These *horrea* occur in the *castella*, alike in Britain and on the German "Limes." They are, however, perhaps both commoner and also more elaborately built in our island than on the continent.\* Examples occur there which can be dated to the reign of Augustus (i.e. to the earliest empire), as at Haltern. The English examples are seldom so nearly datable.

If we assume, as seems reasonable, that these buildings were really granaries, we get further light on the food of the soldier. It must have been largely vegetarian; in a table at the end of this paper, I am attempting to calculate how far certain excavated granaries could have contained corn enough to feed the probable garrisons during any probable length of blockade. My calculations suggest to me that the buildings were in general quite large enough for the purpose, and I therefore deduce the conclusion that each fort had a substantial structure intended for the storing of grain for the troops stationed there. This seems to supply a useful clue to the food used by the garrison, and as some of the granaries date from the earliest empire and several from the first century A.D., the clue helps us to date the use of cereal food.

With the *horrea* I may combine another chance bit of archaeological evidence. In the summer of 1915, Mr. M. Reay found at the Roman fort of Carvoran (on Hadrian's Wall), in a marsh just outside its north-west corner, a large bronze vessel which appears to have been

---

\* An excellent short account of the German examples may be found in E. Ritterling's *Das frühromische Lager bei Hofheim in Taunus* (Wiesbaden, 1913), pp. 35 foll.

a measure for corn.\* Its capacity, as measured for me by experts in Newcastle, is the merest trifle less than 20 pints, whether of dry or liquid measure. Alike its shape and the absence of any spout for pouring, or any handle by which it could be lifted when its contents were to be poured out seem to shew that it was meant for solids; I imagine that it was used to measure the grain supplied to the forts to be ground into flour for the "fort-bakeries," which, as we have evidence, were used in each fort. It bears an inscription of the emperor Domitian, dated to A.D. 90 or 91, and appears to be an official measure which had been formally tested somewhere. It belongs to the earlier empire, and to the days when meat-eating had not yet become common or predominant in the imperial army.

(C) The conclusion of the whole matter seems to be that much converging evidence is consistent with the view that the Roman soldier—at any rate during the earlier empire—lived on a cereal diet. No one would, of course, maintain that it was a purely cereal diet. The evidence which I have quoted above implies that meat was eaten, and the many bones of edible animals which occur in the ruins of all forts point the same way. Smoked or dried meats—the Italian was very partial to ham—doubtless added variety to a chiefly vegetarian diet, and lightened the task of the Roman food-controller in each little remote *castellum*.

---

## APPENDIX.

BY R. G. COLLINGWOOD, M.A., F.S.A.

It was Professor Haverfield's intention to add an appendix to the foregoing paper, containing figures as to the probable capacity

---

\* See my account in *Archaeologia Aeliana*, 1916 (vol. xiii.) pp. 93-102, where I have described it fully and collected all other examples known to me of similar measures of Roman date, and have figured most of them. The vessel, which I have ventured to christen the "modius Claytonensis" (or if Latin purists prefer it, Claytonianus), is now in the Chesters Museum, where I have examined it. It has several points of interest, into which I cannot here enter.

of various known granaries in Roman forts, and its relation to the amount of bread necessary to support the garrison for a given length of time. Unfortunately he has left no notes on this subject: but I had the privilege of spending some time working out figures with him while he was collecting materials for the paper, and I therefore append here certain data which I have reason to believe he would have used had he written this part of the paper.

The first two sections of this appendix consist of facts which I had to some extent discussed with Professor Haverfield; for the third section I am alone responsible; for though he was in possession of the facts he did not, so far as I know, make any suggestion to account for the excess of storage-space in Roman granaries over that demanded by one year's wheat-ration for the garrison concerned.

(1) *General considerations.*—The figures for the consumption of wheat by a given number of men for a given space of time, worked out on the hypothesis of an exclusive or almost exclusive bread diet, are as follows. For purposes of a short siege, even 1 lb. of bread a day per head might be sufficient, but this only in cases of extreme need, and for a short time. A man cannot be well fed on much under 3 lbs., and therefore we shall adopt this figure as the provisional basis of calculations. Three pounds a day is a trifle under 10 cwt. a year. Allowing for the difference in weight between grain and bread, this implies about 7 cwt. of grain. For practical purposes therefore we may assume that a ton of grain will feed three men for a year, on the basis of a 3 lb. bread-ration. In such a rough calculation as this it is hardly necessary to reckon waste in storage, which might on average be anything from 10 to 20 per cent.

Taking the average weight of wheat, a cubic yard will contain about 14.5 cwt., that is to say a ton will occupy 1.4 cubic yards. Half a cubic yard, therefore, holds 7 cwt. of grain, which was what we allowed for a man's yearly ration. If therefore we find that the granary of a Roman fort contains in available space half the number of cubic yards that the garrison contains men, we may infer that the phrase of Tacitus at least represents a possibility.

(2) *Capacity of Roman granaries.*—The following table\* represents the floor-area of certain granaries in Roman sites:—

---

\* This table was left in MS. by Professor Haverfield, with the figure of Ambleside left blank. I have filled this in and corrected certain other entries which seem to have been hastily worked out.

|                |    |    |      |                   |
|----------------|----|----|------|-------------------|
| Ambleside      | .. | .. | ..   | 273 square yards. |
| Barhill        | .. | .. | ..   | 202 "             |
| Birrens        | .. | .. | ..   | 332 "             |
| Caersws        | .. | .. | ..   | 253 "             |
| Chesters       | .. | .. | ..   | 213 "             |
| Corbridge      | .. | .. | ..   | 500 "             |
| Gellygaer      | .. | .. | ..   | 263 "             |
| Hardknot       | .. | .. | ..   | 157 "             |
| High Rochester | .. | .. | ..   | 390 "             |
| Housesteads    | .. | .. | ..   | 266 "             |
| Newstead       | .. | .. | ..   | 393 "             |
| Penydaren      | .. | .. | over | 180 "             |
| Rough Castle   | .. | .. | ..   | 101 "             |

In order to infer storage-capacity from floor-area, two factors must be borne in mind. First, the available height. It is evident that the massive walls of these granaries were intended to stand to some height, though there is no evidence how high they were actually built. But it must in every case have been possible to store grain to a height of 6 feet. Secondly, the necessity of access. Professor Haverfield expressed his opinion in conversation with the writer that the grain was stored in bins: this doubtless implies a gangway down the centre of the long building with bins on either hand. Such a gangway would most conveniently be about 3 feet broad; and as a granary is in general some 15 or 20 feet broad internally (though there are exceptional cases of a granary a good deal broader than this) the gangway would occupy about a fifth of the floor-space.

Subject to these conditions, the foregoing granaries would contain the following amount of wheat in tons:—Ambleside 455, Barhill 336, Birrens, 553, Caersws 420, Chesters 355, Corbridge 833, Gellygaer 438, Hardknot 361, High Rochester 650, Housesteads 443, Newstead 655, Penydaren over 300, and Rough Castle 122.

(3) *Conclusions*.—According to our previous calculation, a garrison of 500 would require some 170 tons of wheat in a year. Allowing 20 per cent. for wastage, this might be brought up to about 210 tons. Even if the bread ration were as high as a 4 lb. loaf a day—a week's ration as we knew it not long ago—the yearly consumption would not be much over 250 tons. Now the average capacity of the granaries in forts with a garrison of 500 appears from the above list to vary round 400 tons.

Thus not only is it true that these forts were well able to store

a full year's supply of grain for their garrison ; it appears that in general they could store twice as much, and indeed more if the grain was stored more than 6 feet deep. What explanation can we offer of this fact ?

(i) It can hardly be that we have overrated the depth to which grain could be piled. The heavy walls and buttresses of the granary are plainly designed to resist a severe thrust, and 6 feet would seem in this connexion rather an under than an over-statement.

(ii) Possibly other things besides grain may have been stored in the granary. If, however, these consisted of hams, mutton or bacon, averaging say 5 lbs. each (for the Romans had not our improved strains of pigs producing 10 lb. hams), and other smoked meat, they would be hung, not stacked in the bins ; they would therefore not take up floor-space. (It may be worth pointing out that such hams, hung in the roof of a granary, would run to about 50-70 lbs. per yard super ; in a 450-yard granary this would mean 10-15 tons of meat, enough to give the garrison about 1 lb. of meat per week per head for a whole year).

(iii) In some cases grain was no doubt also required for horses. Chester's was garrisoned by a cavalry regiment (ala II. Asturum ; see *Notitia Dignitatum*) ; but it is curious that here the granary is rather below the average size. But in most of the forts above mentioned there is no reason to suppose that many horses were kept. It may here be pointed out that hay could not have been grown in the Roman period near Ambleside or Hardknot, the modern hayfields of the Lake district being represented at that time by marsh and scrub. Consequently it seems unlikely that these granaries were ever used as barns for hay.

(iv). The hypothesis may also be suggested that the granary was intended to feed not only the garrison but the hangers-on of the fort, the inhabitants of the surrounding "canabae" ; but in the absence of evidence in its favour such a suggestion can only be considered as speculative.

(v). It seems permissible, therefore, in view of the disproportion between the probable storage capacity of the granaries and the probable yearly consumption of the garrison, to offer a further suggestion. Britain was a notoriously rich wheat-growing country, and it must have been easy for the army to get, at harvest, as much grain as it thought fit to demand. Professor Haverfield interprets Tacitus' "annuis copiis" as meaning a store laid in at one harvest and sufficient to last till the next. But it is not in fact necessary to use grain less than a twelvemonth

old. During the war we were frequently using wheat much older than that. If only sufficient grain were stored to last till next harvest, an insurrection at harvest-time (not, it is true, the likeliest time for a rising in an agricultural country) would result in immediate famine; and even a partial failure of the local harvest would be a serious inconvenience.

Our suggestion is, therefore, that sufficient storage-space was allowed for, in the design of the average Roman fort, to accommodate a two years' ration from the time of any given harvest. It may be taken as proved by the foregoing figures that in most forts such space actually was provided: the only question is whether it was deliberately intended for that purpose, and if so how this squares with the phrase of Tacitus. Professor Haverfield observes that in any case Tacitus' language shows "a certain confusion of thought." If "*annuis copiis*" means "supplies for at least a year calculated from any given period—e.g., in mid-July," then Tacitus is ascribing to Agricola the origin of the system by which 500 men were given storage-room for something like 400 tons of grain. It seems to the writer that the phrase, admittedly vague, might possibly bear this construction; in which case the results of this analysis of archaeological evidence, set on foot but not carried to a conclusion by Professor Haverfield, may serve to determine the precise meaning of Tacitus' words.