XX.—THE ROMAN BRIDGES ACROSS THE NORTH TYNE RIVER NEAR CHOLLERFORD.

By Sheriton Holmes.

[Read on the 26th May, 1886, but since rewritten and added to.]

At the present time when the question of the relative ages of the Roman Wall, the *vallum*, and other works which stretch across England from the river Tyne to the Solway, and in the reign of which of the Roman emperors these gigantic works were executed, is occupying afresh the attention of antiquaries, I have thought that a more careful study of the passage of the North Tyne river demands attention, and that an elucidation of the works erected there might be of advantage as forming a key to unlock the hitherto unsolved problem. With a view to this I have taken careful notes of what remains of the works, and have availed myself of the drawings of the bridge-pier plans accompanying Mr. Clayton's paper on the Roman bridge.[1]

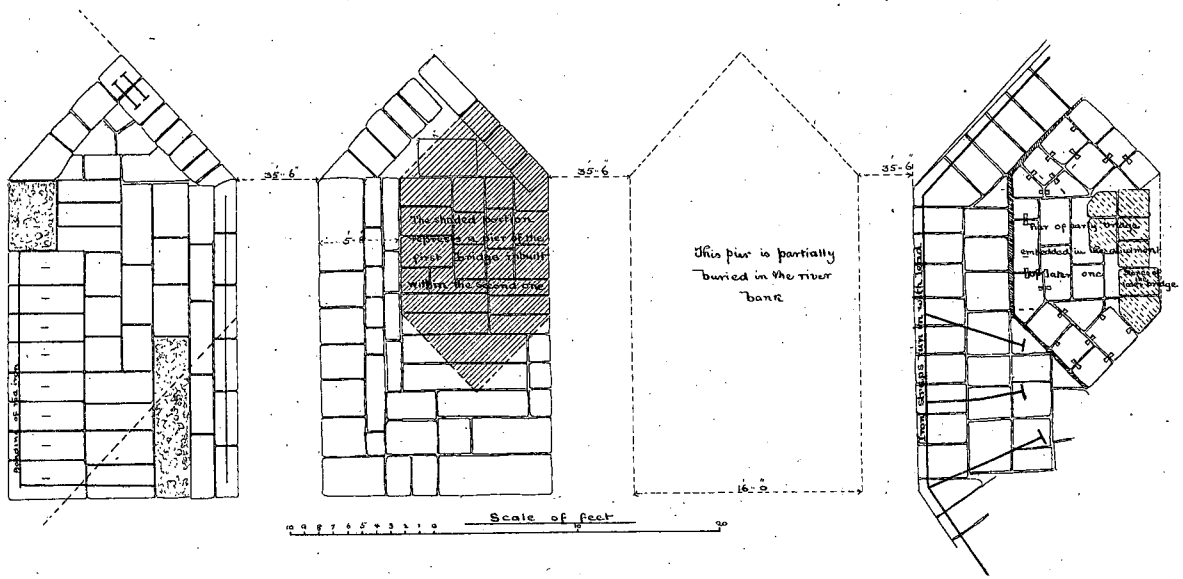
Until recently it seemed as though these questions had been definitely decided and set at rest upon the authority of such eminent writers as the rev. John Hodgson, Mr. John Clayton, and the rev. Dr. Bruce, but closer investigation into the facts has reopened the whole question and tends to upset many of the conclusions previously drawn.

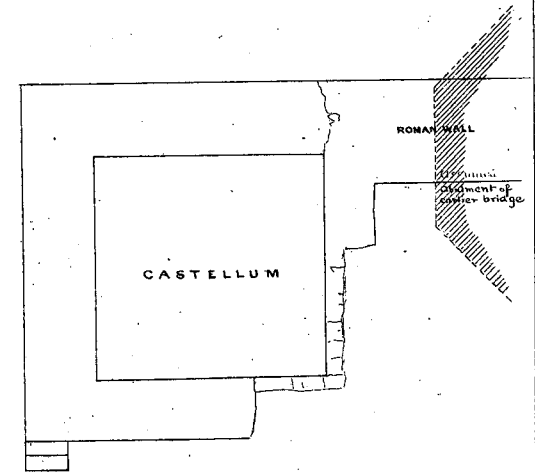
Where the line of the Roman works crosses the North Tyne river there are the remains of two bridges, both of them evidently of Roman construction. The later one consisted of an abutment at each end and three water piers, thus giving four water bays or openings of thirty-five feet six inches span. The parallel faces of the abutment and the piers are twenty-one feet six inches long and the breadth across the piers sixteen feet. The piers are flat-ended on the down-stream side but have starlings or cut-waters on the upper side. The eastern abutment has had very long and massive wingwalls, the southern one having been lengthened considerably, doubtless to provide against a set of the current tending to carry away the river's bank at its

[1] *Arch. Ael.* (N.S.) vol. vi, p. 80.

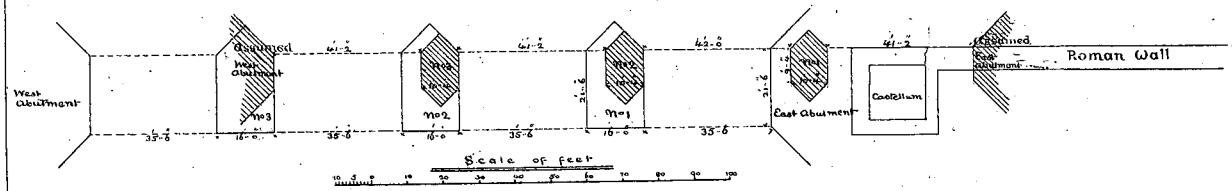
ROMAN BRIDGES AT CILURNUM

Drawing shewing the plans of piers and east Abutment





Plan shewing the relative position of the two bridges



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PLAN OF ROMAN BRIDGE, NEAR CHOLLERFORD.
No I.

previous termination. The river at this point has altered its course from time to time in a westerly direction, so that now the eastern abutment and a portion of the first pier are deeply buried in its bank, and the western abutment is in the bed of the stream.

But this action of the river had been in operation previous to the time when this bridge was built, for, embedded in its eastern abutment is a water pier of an earlier bridge which must have had at least one bay or opening to the east of it, so that between the times when the two bridges were built the river had altered its course to that extent westward.

The roadway along the earlier bridge had been much less in width than that along the later one, its pier faces being only nine feet four inches long with a width of ten feet four inches. The earlier bridge had starlings both up and down stream diverging from the pier faces at an angle of forty-five degrees. It is deserving of note, and unique in my knowledge of bridges, that these piers should be less in length than their breadth across, but as the bridge had doubtless a timber platform, the beams supporting it would require to be cantilevered by others underneath them to give rigidity, and the breadth of the pier would be necessary to afford a sufficient length of base for them. The lowness of the roadway would render angle strutting to the piers useless from the certainty of their being carried away during floods.

The spans of this bridge must have been abnormally long in comparison with the width of the roadway which could only have been about eight feet six inches, for a length from pier to pier of forty-one feet two inches or nearly in the proportion of five to one. If, however, the roadway platform had been projected beyond the longitudinal bearing timbers at each side, a greater width would be obtained.

The builders of the later bridge had taken full advantage of what remained of the former one, for not only had they inbuilt the water pier in their abutment, but had adopted and enlarged the other piers also, by adding a width of five feet eight inches to their western sides, and lengthening them southwards. This is apparent on applying a tracing of the embedded pier (the dimensions of which can be exactly defined) to the plan of the second pier, as given on the accompanying drawing, where the different character of the masonry clearly defines the earlier and more recent work.

The western abutment of the earlier bridge would most likely occupy the site of the third river pier of the later one, and if one bay be allowed to the east of the embedded pier the number of the openings in the two bridges would be equal, only the widths of these openings would be five feet eight inches more in the earlier than in the later one.

It seems pretty clear that the skill of the bridge builders had not improved as time went on, for the masonry of the later bridge, though substantial in character and composed of large ashlar stone throughout, is not nearly so well bonded by snecking and breaking joint with the stones as in the earlier one, though in the mechanical appliances of setting the stones they seem to have advanced, for the lewis had been adopted in place of the hand setting of the former work.

The stones in both bridges have been elaborately fastened together by iron cramps and ties run in with lead, but here again the earlier men seemed to be in advance of the later ones, for instead of the long iron-face straps with T-headed branches running in a sort of haphazard manner into the work, and the few dog cramps here and there of the later work, there are systematic double dove-tailed cramps of good form, neatly let into the stones.

Dr. Bruce inclines to think that the facing stones of the abutment of the later bridge might have been an addition by Severus to what he terms Hadrian's work, but I think that an examination of the plan will show that where these impinge on the embedded pier it could not have been so, and that this casing is an initial part of the second structure, and coeval with the added work of the piers where the same long iron clamps have been used.

The work generally of the later bridge is of a ruder character than that of the earlier one, and there are many make-shifts apparent, indicating that the workmen had not such intelligent overlookers. This is apparent in the way many of the upper faces of the stones had to be dressed down after being set to admit of the proper bedding of those above. And there is a piece of very unconstructive work where the southern wingwall had been lengthened.

In the beds of the stones forming the earlier pier there are at uncertain intervals wedge-shaped holes, the use of which is not clear. They could not have been used in lifting, and are not holes for joggles

to prevent the stones shifting on their beds. The likeliest use for them is to give point-hold to the crowbars used in forcing along the upper stones to their positions in the process of building.

The earlier bridge must have had at least one of its bays to the eastward of the embedded pier, and if only one, then the abutment belonging to it must have had its position underneath where is now the Roman Wall, and the roadway must have occupied the site of the north wall of the *castellum*. It thus seems clear that neither the *castellum* nor that portion of the Wall could have been coeval with the bridge.

A suggestion having been made that possibly the Wall had been lengthened when the later bridge was built so as to bring it forward to the bridge, Mr. Clayton gave permission to have the face of the Wall opened out eastwards, with the result that to a distance of sixty feet back from its junction with the *castellum* there is no break in the masonry, and the character of it is similar throughout, and very much like the exposed face on Limestone bank, the face stones running from about fourteen inches to nineteen inches in length, and from nine to twelve inches in depth. Writing in his *Wallet Book*, Dr. Bruce says of his portion of the Wall: 'It terminates in a square building or *castellum* formed of stones of the same character as those used in the Wall.' So far from this being the case the stones forming the Wall to the east of the bridge are larger, longer, and rougher than those in the *castellum*, these being nearly square on the face and very much smaller, and there is no true bonding between the two, the *castellum* having apparently been built on to the Wall end at a later time.

Mr. Clayton[2] says: 'There is an apartment twenty-four feet by twenty-three feet six inches under the platform of approach.' This in the hands of Dr. Bruce becomes a *castellum*, and as the walls are well faced all round it could never have been designed for an underground chamber.

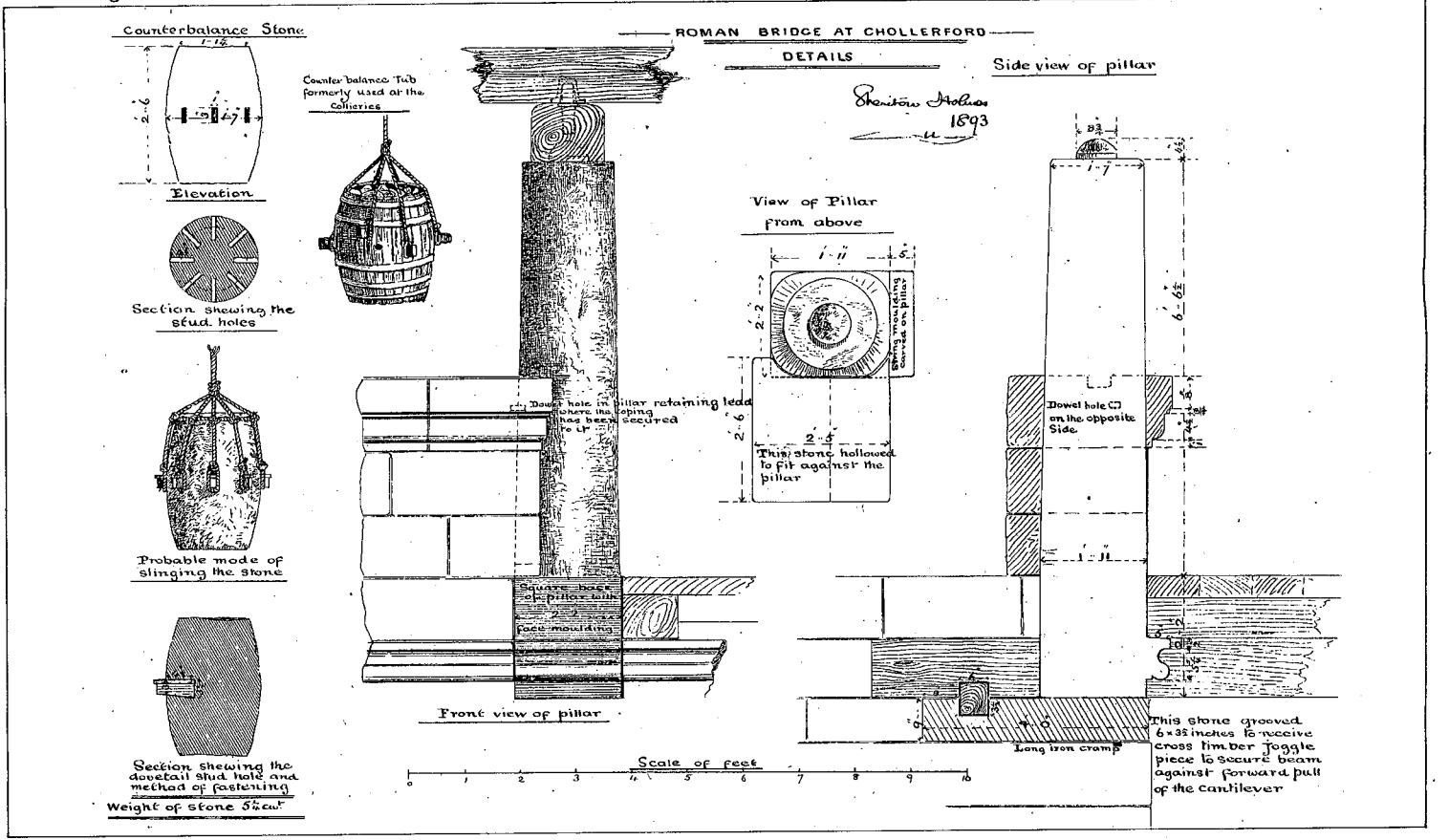
Owing to the dribbling away of material from under the abutment, the central portion, especially towards the face, and the *castellum*, have subsided considerably, but the longitudinal iron bonding of the face stones has held them so well together that no set or crack is perceptible in the masonry. Dr. Bruce thought that this depression of the centre portion was by design and deemed it an element of strength, but I scarcely think that any engineer would coincide in such opinion.

[2] *Arch. Ael.* vol. vi. (N.S.) p. 82.

The peculiar splaying back of the face courses in the northern wingwall seems to be a scientific idea for accommodating the face-line to the different rates of flow in the river, *i.e.* giving a larger area to the more rapid surface water than was required for the comparatively sluggish current nearer the bed of the river, and it seems strange that engineers who could act upon such scientific lines should have made their piers flat-ended on the down-stream side, thereby incurring the danger of having the material eaten away from their foundations and the stones displaced by the regurgitative action of the water, and this, too, with the evidence of the earlier piers before their eyes. It was this action of the water which rendered the lengthening of the south wingwall necessary, and in doing which they further endeavoured to throw the current away from the wall-face by placing the lower courses angle-way to the line of the work. This addition to the wingwall had been built chiefly with stone got from the earlier bridge remains, as is evident from many of the holes for the dove-tailed cramps remaining in positions which, in their new places, are of no use whatever.

It is a question whether in building their large ashlar work the Romans used mortar in the joints, or built it dry as was the custom in Rome under the Republic. In their smaller stone work such as the Wall with its camps, etc., they did use mortar, if indeed it may be so termed. Here and there patches of mortar may be found in a well-set condition, but, generally speaking, in the North of England it had been of a very poor character, the face of the stones merely ipped by a pointing of better mortar, and the hearting filled in with a mixture of badly slaked lime in clot, and soil instead of sand as a matrix, a material more calculated to disrupt than to cement the stones together; for, as the lime became hydrated, it would swell and tend to rend the work asunder. It would appear as if the designers, accustomed to the pozzolanas of Southern Italy and the limes of Tivoli, had looked slightingly on the comparatively inferior limes of the district and had not placed much reliance in their binding power, preferring, in their more important works, to trust rather to the more costly bonding of iron run in with lead.

From the evidence existing, pointing as it does to the later construction of the Wall, it may be taken that the earlier bridge was



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ROMAN RRIDGE, NEAR CHOLLERFORD.
No 2.

antecedent to its erection, and the question arises what office was this earlier bridge designed to fulfil? It seems to be generally agreed that previous to the building of the Wall, Agricola had constructed a chain of forts across this isthmus, and as these would almost certainly be connected by a line of road, it is possible that this bridge might have been built in connection with such road, though as subsequently noted in this paper, I think the probability is against it. Then as to the date of erection of the later bridge, it seems unlikely that during the short period between Agricola and Hadrian (about forty years) the river had time to alter its course a distance of sixty feet from its former line, as it has taken 1,700 years since the departure of the Romans to perform an equal distance in the same direction. When Severus returned from his northern campaign, about 130 years after the time of Agricola, would appear to be a much more likely time for the river so to have changed its course and for the later bridge to have been built.

Amongst the *débris* of the bridge abutment there are certain peculiar shaped stones which have evidently been designed for some special use. One of them is a monolithic pillar, nine feet one inch in length, having a rectangular base, two feet two inches by one foot eleven inches, for a height of two feet two inches from the bottom; above this the angles are rounded off, until at the top it assumes the circular form with a diameter of one foot seven inches. The shaft of the column is six feet six and a half inches long and concentrically on its upper end, there is a curved conical boss, four and a half inches deep, with a scarcement all round it of five inches on the pillar top. On the longer face of the base the stone has been cut away to a depth of five inches, so as to leave projecting a face moulding, and as the shape of this moulding is similar to that upon other stones which have apparently formed an ornamental string course along the face of the abutment, the original position of the pillar stone is thereby determined as having been on the face of the abutment and in line with the string course. As another evidence of the position of the pillar stone, there remains one of the stones which had formed the parapet hollowed out to fit up against it.

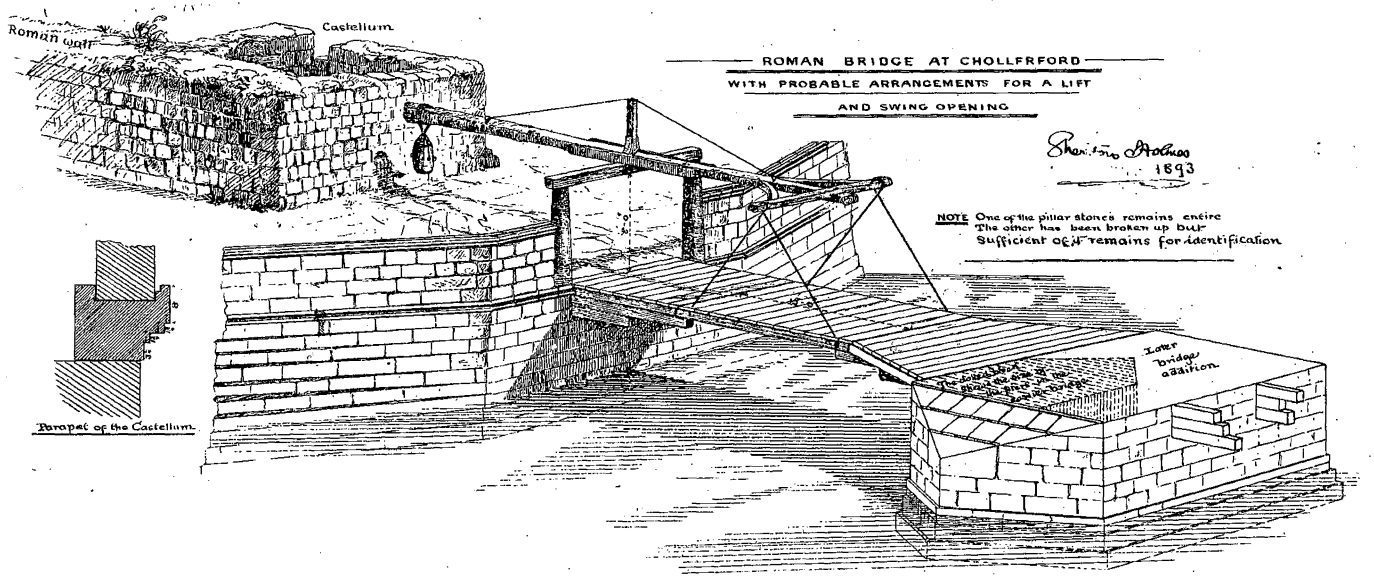
There are also portions of a similar column which had been broken up. The upper end of it is now on the abutment amongst the ruins,

and what appears to be a portion of the shaft, about four feet long, with a dowel hole cut in a similar manner to that in the entire column, is now placed in an angle of the building on the west side of the river.

A third stone demands particular attention. It is in the form of a barrel or the nave of a cart wheel without the axle-hole through it. This stone is two feet six inches long, one foot seven inches diameter at its centre, and one foot one and a quarter inches at its ends. Radiating from its centre are eight recesses cut to a depth of four and a half inches, which, at the face of the stone, form openings one inch wide by three inches long. The lower sides of these holes are cut deeper as they recede from the face, being half an inch deeper at the inner end than at the face, thus forming a tapered or half-dovetailed hole, similar to the lewis holes in the abutment stones. The weight of this stone is about five and a quarter hundredweights, and the most likely use I can imagine for it is in the nature of a balance-weight applied either over a pulley or at the end of a lever.

A reference to the detailed drawings of this stone will show how admirably it is adapted to being slung, for, if in the holes be placed half-dovetailed studs, tapering from two and a half to three inches, they would fall down half an inch from the upper side of the hole, and admit of a flat slip of that thickness being driven in above them, thus securely fastening them in position. Then the studs being left projecting beyond the face of the stone would form attachments for the ropes or rods used in slinging it. A very similar arrangement to this existed until lately at the smaller collieries in the northern counties, when the water was drawn from the pit in tubs by means of a whimsey worked by a horse. To balance the water-tub they had another filled with stone, through which, midway in its height, pieces of wood were put at equal angles, and the projections formed attachment studs in the same manner as those in the balance stone. This stone has, I think, an intimate connection with the pillar stones, and all three taken together may be considered as a permanent frame and balance for the lifting of some heavy structure. What that structure might have been, I will endeavour to set forth further on.

The conical boss on the top of the pillar seems designed to secure a beam placed across the top of the two pillars, which would have cups cut in it to fit the stone bosses.



ROMAN BRIDGE, NEAR CHOLLERFORD.
Nº 3.

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So far, we are on tolerably safe ground; but what had the mechanical arrangement of support and balance to perform? The ancient lever arrangement of the Egyptian shadoof, I think, now comes into play, so that if another beam be placed across the head beam and pivoted thereon, a means of lifting and swinging round a suspended weight would be accomplished.

Now, a permanent arrangement, such as I have sketched out, would not be for a temporary purpose, such as lifting the stones whilst building was in progress, but must have been for some continuous purpose, and I can see nothing more likely than that it was intended to lift and sling out of position a portion of the timber superstructure of the bridge so as to cut off communication along it.

This arrangement I have endeavoured to formulate in the drawing accompanying this paper.

The weight to be lifted would better accord with the narrow platform of the earlier bridge, but as the lewis principle had been used in the balance-weight stone in a similar manner to the setting of the stones in the later one, I think it most likely that the mechanical arrangement had belonged to it, and, if so, a counterweight became a necessity, for the distance between the face of the abutment and the *castellum* is too short to give sufficient pole balance otherwise.

In connection with the timber platform there are large flat-stones which have cut across them grooves three inches broad and three and a half inches deep, which had evidently been intended for the insertion of six inch by seven inch timbers, half let into the stone and half notched into the cantilever timbers to counteract their forward tendency and secure them in their positions. The parapet-coping, of which many face-moulded stones remain, had also a longitudinal groove for the insertion of a tie rod.

In the masonry of the south wingwall there is a hole, roughly circular, about thirteen inches diameter, which might have been for the insertion of a crane post during the erection of the work, as from this point a large area of the masonry could have been reached, and the employment of the lewis would almost carry with it that of the crane.

The utility of thus severing the connection along the bridge may be questioned, as at present the river is fordable at points both above and below, but at the time of the Roman occupation, when the country

was timbered, wet, and undrained, as described by Herodian, the rainfall would be greatly in excess of the present time, and the water would get much more slowly away, the river neither rising so high during rains nor shrinking to such small dimensions during dry weather, so that fording it would be found difficult at any time. The massive piers of the bridge would also obstruct the flow, and dam back the water for some distance above.

'Where the Watling-street crossed the Reed, the bed of the river is paved with large stones; and when a part of the north bank was washed away by a flood a few years ago, two pillars were discovered, which it is supposed might have stood at the entrance to a bridge.'[3] Might not this have been some similar arrangement for barring the passage across the Rede at a time when the wall having become ruinous or the number of soldiers remaining not sufficient to garrison it effectively, they had recourse to the rivers for protection against the invading Caledonians from the north and west.

The solution of the actual dates when the various works were constructed will probably have to await the unearthing of more direct evidence in the shape of sculptured stones as history has been unable to give more than an uncertain clue to it, but it is quite possible that the relative dates may hereafter be made out with some degree of certainty from investigations carried on in the works themselves, and it is with a view to this that I have been led to examine the bridges, etc., of the North Tyne river so that the initiation thus given may be carried forward at other points until some definite information shall be obtained.

The results of the investigations made, may, I think, be summed up thus:—

Firstly, the earliest line of works would appear to be the 'Stanegate' and the camps on its line which were probably those instituted by Agricola about the year 78. On referring to the six inch to a mile Ordnance map it will be seen that this road is traced directly up to the North Tyne river near where lately stood Homer's house, as though it had at that point crossed the river and continued on in an easterly direction without approaching the bridge.

[3] *Rambles in Northumberland and on the Scottish Border*, by Stephen Oliver the younger [W. A. Chatto], p. 151.

Starting from this point westward it passes to the north of Fourstones and through Newbrough, and in a very direct course to Chesterholm, where is the important station of *Vindolana*, and hence along to a considerable camp which is seated on the eastern edge of the Haltwhistle burn. Crossing this it goes over the summit of the hill at Sunnyrig, being deflected from its direct course to gain this height. Then falling down it makes direct for Caervoran (*Magna*).

Immediately west of this there are half a dozen important camps which, with the Caervoran station, form an arc of a circle. These being situated on high ground and on the watershed of the country east and west would, I think, form a stronghold in connection with the Stanegate. From this point westward the name is continued on the Ordnance plan in connection with the military way by the side of the Wall and *vallum*, but as this road is evidently the continuation of the one traced by the Wall side from near *Procolitia*, I think the more probable route for the Stanegate from Caervoran to have been along by the line of camps to Naworth, keeping the river Irthing as a northern defence; thence to the north of the camp near Brampton (named 'Aballaba' on the one inch Ordnance map), and the camp near Watchclose, to Red Hills, from which point it is again traced as far as Parkbroom in the direction of Carlisle. The station of Caervoran, which is a little to the south of both Wall and *vallum* but on the line of the Stanegate, would favour this idea.

There appear to have been connecting roads between the Stanegate and the stations of *Cilurnum* and *Borcovicus*, the latter joining the Stanegate at Frendon hill. The Wall along by *Borcovicus* had its accompanying road between it and the *vallum* which would be well protected, whereas the Stanegate is at too great a distance off to have had protection from the Wall garrisons; also, as at the North Tyne river, the Stanegate seems to have had an independent crossing and not to have approached the bridges, the inference is that it was the pioneer work of the district.

Secondly, the Roman Wall would seem to have been a later work than the earlier of the two bridges, for the eastern abutment must (as previously explained) have occupied its site.

Thirdly, the *castellum* commanding the later bridge seems to be yet a later work than the Wall, and might have been added when the

second bridge was built, or even at a date later than that, when it became necessary to substitute for the Wall the line of defence afforded by the rivers Eden, Irthing, North Tyne, and Rede.

Then, fourthly, as to the inscrutable *vallum*, which seems to pursue a perfectly independent line across the river, and indeed to be independent of all around it. Seeming now to be defensive against the north, at other times equally so against the south, and also by its two aggers or ramparts affording as much cover for an enemy attacking as would be given to those defending, the question arises whether it was ever designed for a defensive work, or merely as marking a boundary possibly antecedent to Roman days. And this seems to be favoured by the finding in the recent excavation cut across it near Heddon-on-the-Wall of a bronze axe head and a flint scraper of circular form about one and three-eighths inch in diameter. Also where the *vallum* was recently excavated at Down hill the road in connection with the Wall was cut across in several places. In one of the sections it is found on the northern marginal mound of the *vallum* fosse, showing that when it had been formed the *vallum* works were in existence and, in all probability obsolete.

Against this view may be adduced the similarity of the two fosses, those of the Wall and *vallum*, at the summit of Limestone bank where they are cut through the columnar basalt and each of them left in a similar state of incompletion ; and it seems curious why, if not contemporary, there should have been two ditches cut so close together through such intractable material, and why, if the *vallum* fosse was existing, the Wall builders did not adopt it and build their wall on its southern margin.

These and many other questions concerning the northern boundary works await solution, and it may be hoped that the investigations now being instituted may be the means of clearing away some of the difficulties which have hitherto delayed that result.