Surrey Collections.

BRONZE VESSELS OF THE EARLY IRON AGE FOUND AT WOTTON IN 1914.

BY

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[*Reprinted from the "Proceedings of the Society of Antiquaries," Vol. XXVII, pp. 76—94, by permission of the Council*]

THE views submitted to the Society of Antiquaries in 1907[1] with regard to the use of water-clocks by the ancient Britons have met with no serious criticism, but we have had to wait nearly eight years for further light on the subject, and this time it comes in the proverbial flood. It was near Wotton House, the romantic seat of the Evelyn family, that a number of bronze vessels belonging to this category were found within one of cauldron shape, 2 ft. below the surface, in September, 1914. The spot was a little beyond Hollow Lane, west of the Home Farm House, and immediately south of the main road between Dorking and Guildford. The river Tillingbourne, a tributary of the Wey, flows 80 ft. below at a distance of about a quarter of a mile to the south, and being a mill-stream is held up at various points, forming lakes[2] of exquisite beauty. Whether

[1] *Proc. Soc. Antiq.*, XXI, 319.

[2] For the importance of lakes in the Druidic cult, see *Proc. Soc. Antiq.*, XXI, 330.

the ancient Britons stored its water in any way is immaterial, but the proximity of the bronze vessels to an unfailing supply is significant in view of the Baschurch find in Shropshire and another in Moorfields, London, an area turned into a swamp by the Roman wall but traversed originally by the Walbrook.

The exact site was marked on a plan by Mr. H. E. Malden, who saw the excavation in progress in company with the estate agent, Mr. H. C. Bradshaw. With Mrs. Evelyn's permission, the discovery was communicated to the Surrey Archæological Society[1] through its secretary, Mr. Hilary Jenkinson, F.S.A., who brought it to the notice of Mr. Mill Stephenson and the present writer. The next move was made officially by Sir Hercules Read, as Keeper of British and Mediæval Antiquities at the British Museum; and a personal visit resulted in permission being given for the exhibition of the find to the Society. In the interval Mr. Evelyn, apprised of the event at the front, has generously offered the bronzes as a gift to the Trustees of the British Museum, and this addition to an interesting series will be much appreciated in the new gallery to be devoted to the Early Iron Age in its widest sense, covering the periods named after Hallstatt and La Tène, as well as the Anglo-Saxon and foreign Teutonic civilizations.

According to Mr. Malden, the bronzes had been packed together with hay, and the hard sand all round was found, on careful examination, to be undisturbed, so that the objects may be presumed to constitute the entire deposit. Ten vessels can be distinguished, the smaller being in good or fair condition, and now restored to shape with a little solder and wire; but the four larger and thinner specimens have suffered severely. By a fortunate accident the profiles of all can be determined, and the figures accompanying a detailed description show the section on the left and elevation

[1] A preliminary note on the discovery is printed in Vol. XXVII of the Society's *Collections*, p. 149.

on the right, all reduced from diagrams of natural size. The restoration of the remainder will be proceeded with on conservative lines, and due prominence given to a hoard that now seems to have had more than one parallel, not too well described, in the past.

Before proceeding to describe in order the bowls that may be divided into three groups, and were apparently

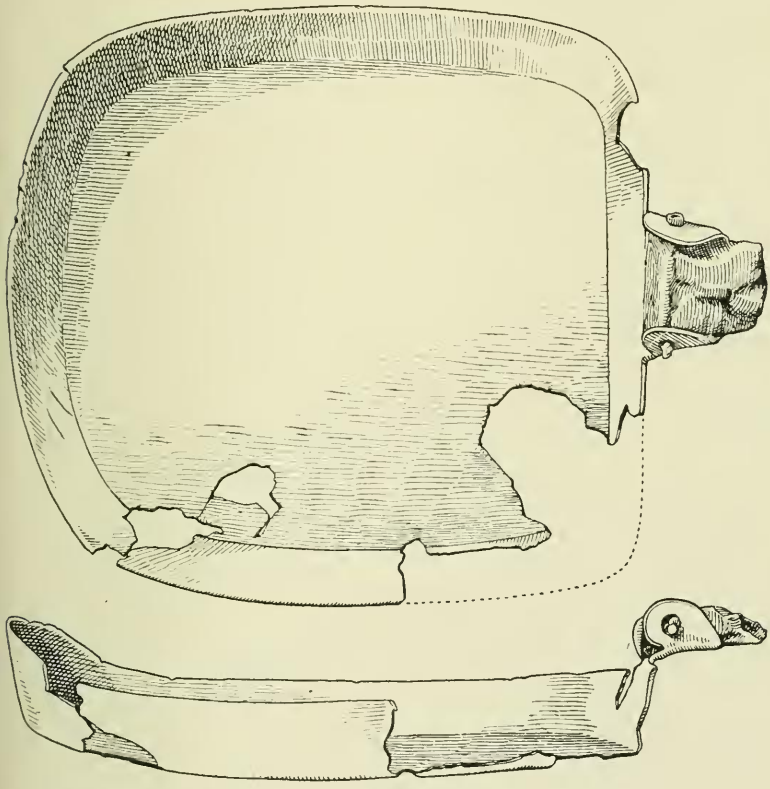

Fig. 1. BRONZE VESSEL, WOTTON ($\frac{1}{3}$).

used for measuring time and for other purposes, it will be convenient to discuss the bronze vessel of frying-pan form (Fig. 1) that stands alone and calls for another explanation. It is of stout metal with base between an oblong and oval, and sides bent outwards but not far from vertical. At the ends the side gradually rises

1·6 in. vertically above the bottom, the normal height being 1·2 in. The base measures outside 9·5 in. by 8·2 in. and is practically flat. All that is left of the handle is a plate 1·7 in. long with a vertical iron rivet and a pair of bronze ears bent over to form a socket and pierced by a stout iron pin still in position, and partly embedded in a ferruginous mass identified by Mr. Lyell as sand cemented by iron rust.

A remarkable parallel that clears up more than one doubtful point is to be found in *Archæologia*, XVI, 364, Pl. LXIX. In 1807 Mr. Thomas Walford exhibited "nine thin culinary vessels of copper (probably bronze), which had been discovered 3 ft. below the surface of the earth in the month of May preceding, at the corner of Rodenfield, in the village of Sturmere, in Essex, by the side of the Roman road mentioned in *Archæologia*, XIV, 71, and not more than 90 rods distant from the Roman station there mentioned. They were found closely packed within each other and covered with a large flat vessel." Two hemispherical bowls and one somewhat flatter with flat rim are represented (Fig. 2) with a rod in two pieces, and a flat vessel of frying-pan form with a grip for the handle that was fixed by means of a stout pin exactly like the Wotton specimen; but unfortunately no scale is supplied.

In my former paper reference was made to Mr. Thurston's account of the modern practice of announcing the hour as measured by the water-clock in India. The time taken in filling the bowl by percolation is known as *gari* or *gadli*, and is reckoned to be $22\frac{1}{2}$ minutes, there being therefore 64 in the 24 hours.[1] At each sinking of the bowl a gong is struck by the attendant, and it is just possible that we have here represented from Essex the gong and beater used by the ancient Britons for an identical purpose. In any case, it seems clear that the vessel like a frying-pan formed an essential part of the equipment; and the

[1] A correction due to Dr. Flett was made after this paper was first published. The *ghari*, he says, is the sixtieth part of a day, or 24 minutes; and bowls sinking in $22\frac{1}{2}$ minutes are therefore inaccurate.

corollary is that the Sturmere bowls were also water-clocks, though no mention is made in the brief account quoted above of any perforation. The smaller bowl is half the inner diameter of the bowl with flat lip, and

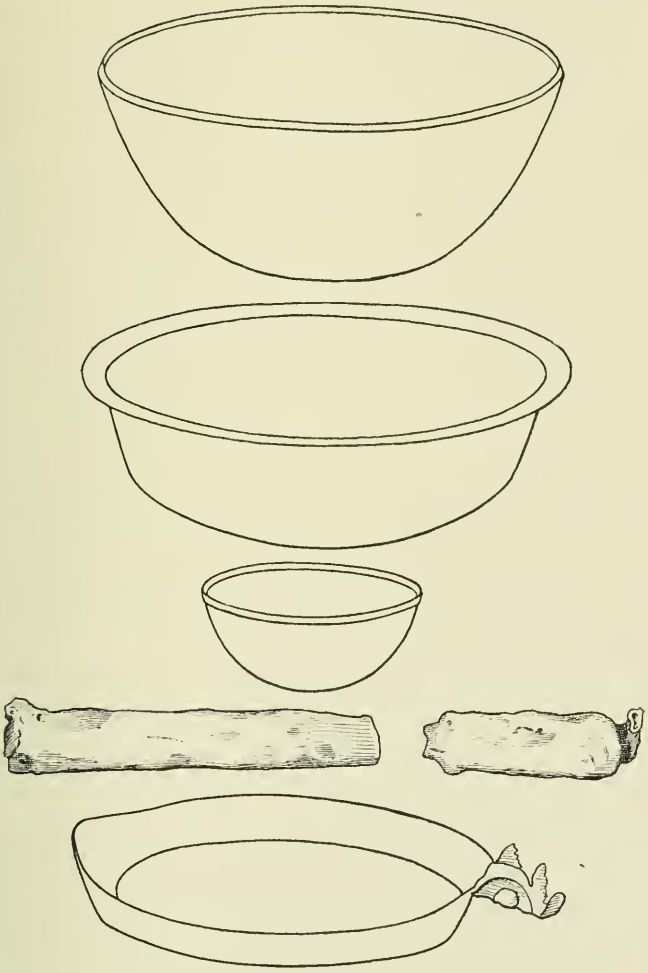

Fig. 2. BRONZE VESSELS, STURMERE, ESSEX.

the latter has practically the same diameter as the larger hemispherical bowl. It may be presumed that the remainder of the find was in poor condition.

In the Westhall series, to be noticed later in another connection (p. 9), there is a flat-bottomed bronze vessel like a diminutive frying-pan, the handle unfortunately missing. It is 6 in. in diameter, and accompanied by a flat bronze bar 5·5 in. long with curved projections in the middle of each side. In view of the Sturmere and Wotton deposits, it is perhaps not fanciful to consider these also as the gong and hammer used by the attendant in charge of the embossed water-clock of which the base remains.

Another discovery of the same sort was recorded in *Archæologia*, XIV, 275, Pl. XLIX, by Sir Joseph Banks

Fig. 8. BRONZE VESSELS FROM FLINTSHIRE.

in 1800, and consisted of eight copper (probably bronze) vessels found more than forty years previously several yards below the surface in sinking a mine-shaft on Long Rake, in the eastern part of Halker mountain, Flintshire.

They are described as remarkably thin, and fall into four classes (Fig. 3): (1) Like one from Ickling-ham (Fig. 15) in the British Museum, but with two pierced triangular lugs standing up on the rim, like a group of vessels of the Anglo-Saxon period; their diameters at the mouth being 10·5, 11·5, and 14·5 in. (2) A single specimen with open mouth and vertical neck, the lower part being a truncated cone, diameter of mouth 8·7 in. (3) A shallow pan with flat bottom and nearly vertical sides, much like Fig. 1; the diameter is 17·7 in., but part of the side is broken away and it is therefore impossible to say if it ever had a handle. (4) Three bowls with bevelled rims like Fig. 10, the diameters being 4·5, 9·25, and 10·75 in. The series may or may not have included water-clocks, but the shallow pan, when compared with those from Wotton, Westhall and Sturmere, certainly justifies the suspicion that this hoard was originally a time-keeper's outfit.

There is a specimen practically identical with that from Wotton in the London Museum (Lancaster House), found in the City of London apparently in association with Roman remains.

What seems to be another parallel is briefly described and fortunately figured in *Archæological Journal*, VI, 105, and in the Lincoln volume of the Institute (1848), on Plate between pp. xxxii and xxxiii.[1] It is described as an iron ladle about $5\frac{3}{4}$ in. long, with flat bottom ($3\frac{1}{4}$ in. long) and fairly long handle, found at Lagore, near Dun-shaughlin, co. Meath; and is illustrated with a bronze bowl $5\frac{1}{4}$ in. in diameter and 3 in. high, but not further described.

These utensils of frying-pan form cannot have been used for culinary purposes as the Westhall specimen is too small, and it may be assumed that all had wooden handles which would never have stood the fire. Even if not used as gongs for announcing each sinking of the perforated bowl, they were evidently for some

[1] Reproduced in Dr. Munro's *Lake-dwellings of Europe*, 354.

ceremonial purpose and formed part of the water-clock equipment. Apart from the evidence of association, one might be tempted to compare them with the shallow circular *patellæ* with long handles found with late-Celtic remains at Aylesford and Welwyn (*Archæologia*, LII, 378, and LXIII, 18), but in the latter cases there can be no doubt that the bronzes were imported ready-made from Italy, where the system of time-keeping had been different for centuries.

The other bronzes from the Wotton hoard will now be described in order according to their types, the unique bowl being taken first and the others following in three groups. A summary in tabular form is furnished to facilitate comparison with other vessels that are of similar form or bear traces of perforation suggesting use as water-clocks.

No. 1 (Fig. 4). Shallow bronze bowl with vertical sides and indented base, in the centre of which is a circular perforation three-sixteenths of an inch (4 mm.) in diameter. The lip is slightly thickened, and from it to the central boss run eleven pairs of radiating embossed ribs. It is damaged most at the junction of the sides and base, but on the whole is in good preservation, and the rim has now been strengthened with wire. The metal is beaten out thin, but the boss is perceptibly thicker. The patination inside is a fine green, but outside the patinated surface is mostly covered with a brown deposit, and the sides are rather pitted by rust. The maximum diameter is 9·6 in., the lip being a trifle incurved and thickened; the height 2·9 in. When patched, it sank in 18½ minutes.

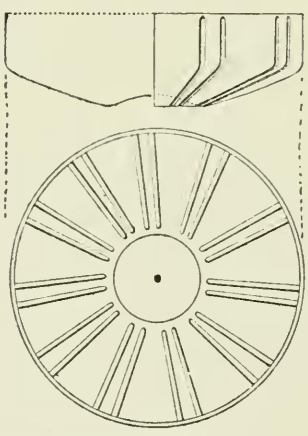

Fig. 4.
EMBOSSED BRONZE BOWL WITH PERFORATION, WOTTON ($\frac{1}{6}$).

A bowl ornamented inside as this is would not be suitable for ordinary purposes, as cleaning would be a difficulty; and the presence of a perforated boss is further support to the theory that this was a water-clock that operated by resting on water and filling gradually in the prescribed time. By comparison with this unexpected form, one is led to identify as the base of a water-clock some embossed bronze fragments

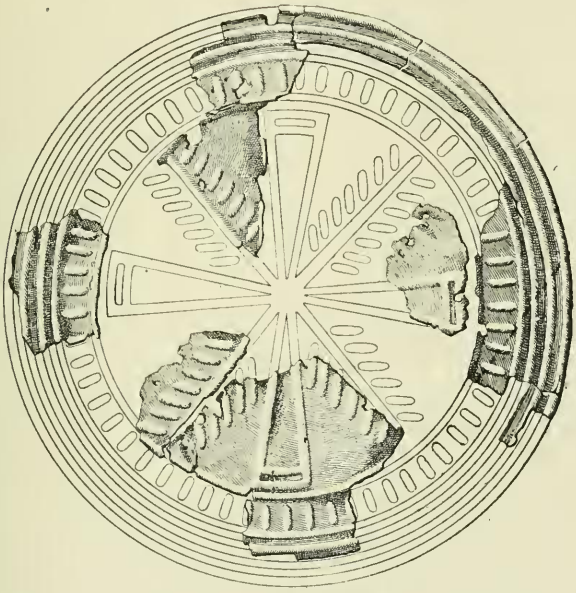

Fig. 5. EMBOSSED BRONZE FRAGMENTS, WESTHALL, SUFFOLK ($\frac{1}{2}$).

(Fig. 5) in the British Museum from Westhall, Suffolk, illustrated sixty years ago in *Archæologia*, XXXVI, 454, Pl. XXXVIII. The existing fragments give a diameter of about 6·3 in., but there is no trace of the angle and nothing to show the original diameter; the centre is also missing, so that the perforation is not certain, but the embossed design leaves an appropriate space for it. The objects found with it are of considerable interest

in themselves, including enamelled terrets and other horse-furniture, bronze ferrules or terminals, a disc embossed with a deer-like animal, a Roman bronze lamp with crescent handle, and a Roman coin of Faustina the Elder (A.D. 138–41), which at least gives a limiting date for the deposit if not for its component parts, of which three others may have belonged to a water-clock equipment. There is also the rim, with fragments of the side, of a small bowl made of thin bronze, with an outside diameter of 5·5 in.

No. 2 (Fig. 6). A large cauldron-shaped vessel of thin bronze, now in two large pieces fairly well preserved,

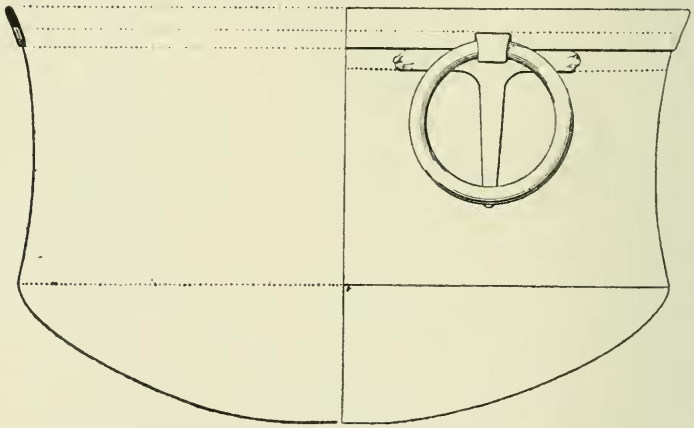

Fig. 6. BRONZE VESSEL WITH IRON RINGS, WOTTON ($\frac{1}{6}$).

comprising the neck and base; the latter has a bronze plug with washer in the centre and another plug an inch distant. Astride the rim is a heavy iron band overlapping the bronze to the extent of 0·5 in. and being itself 1·4 in. deep. At opposite points outside between the rim and shoulder are traces of an upright iron band, evidently to fix the loops that held the iron ring-handles, which survive and are circular in section 0·5 in. thick and 5·5 in. in diameter outside. One of the iron rings is still in its loop, which forms the head of a T-shaped iron

mount, the arms evidently passing round the neck of the vessel below the iron rim, as is clear from the corresponding iron mount with one arm 8 in. long. The one surviving loop is moulded in a manner recalling the bronze handle-loops of Bronze Age cauldrons. The measurements are fairly certain, as the two large portions can be adjusted: height, 13·4 in.; diameter at mouth, 22·1 in., and at the shoulder, 21·1 in.

No. 3 (Fig. 7). Thin bronze cauldron-shaped vessel with the profile complete in one place but much damaged and corroded. Round the lip is a heavy iron band

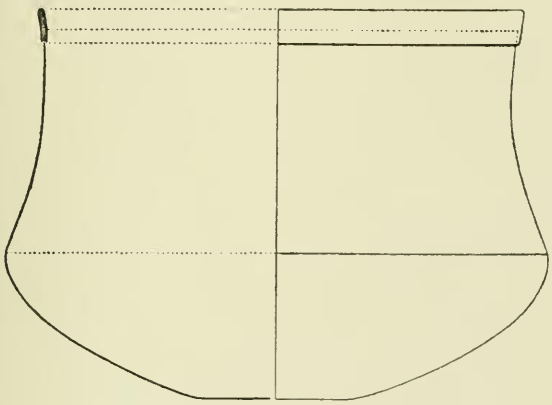

Fig. 7. BRONZE VESSEL WITH IRON RIM, WOTTON ($\frac{1}{6}$).

overlapping the bronze inside and out to the extent of about 0·3 in., and being itself about 1·1 in. deep. The diameter at the mouth (15·8 in.) is as usual rather less than at the shoulder (17·6 in.), the height being now 12·4 in. In its present state the base is flattened at the centre; but as there is a large bronze patch in the middle with many rivets having the head outside, it is probable that the base had originally a continuous curve and was perforated at the centre. Like many others, it no doubt was intended for a water-clock, but was subsequently damaged, or wore out, and was tinkered for some other purpose.

No. 4 (Fig. 8). Very thin bronze bowl with incurved sides and rounded base, most imperfect but complete enough to give the profile. In one place there is an incrustation of iron on the rim, and the former existence of an iron band like those on Nos. 2 and 3 is evident from rust elsewhere. An iron band 2 in. wide, perhaps for a handle, but now much rusted, was applied vertically to the side between the lip and shoulder, and was fastened below the shoulder by several rivets: there is a corresponding plate, but of bronze, inside. The centre of the base is missing, so no perforation can be proved, but the vessel is so fragile that it cannot have been intended for domestic use. Recent repairs consist of two upright stays on the inner side to preserve the profile. Apart from the iron collar, the height is 6·1 in.; and in this case the mouth (10·4 in. diam.) is wider than the shoulder (10·1 in. diam.).

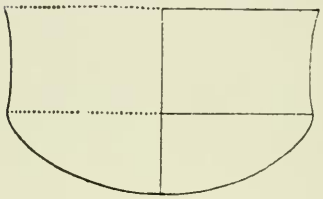

Fig. 8. BRONZE VESSEL (RESTORED), WOTTON ($\frac{1}{6}$).

No. 5 (Fig. 9). Fragments of a very thin bronze bowl of which little remains but the base, but one fortunate join gives the profile, and there are indications of a former iron collar round the rim. There are marks of straw or hay on the oxidised surface, and the base is intact, the centre having been perforated and plugged with bronze, a small washer being affixed outside. The following dimensions have been carefully estimated from the fragments: height (not including the iron collar), 6·5 in.; diameter at the shoulder, 13 in., and at the mouth, 12·3 in.

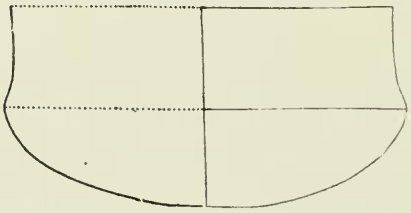

Fig. 9. BRONZE VESSEL (RESTORED), WOTTON ($\frac{1}{6}$).

No. 6 (Fig. 10). Bowl of stout bronze, almost complete but cracked and now mended. The base is indented, and in the centre is a small depression $\frac{1}{4}$ in. in diameter, but no perforation: the lip is thickened and curved inwards. There are some conical patches of rust, especially on the outside, but inside much of the original golden surface remains. The maximum diameter is just below the lip, 12·2 in., and at the mouth 12·1 in., the height being 4·8 in.

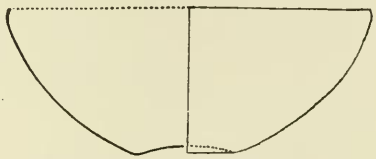

Fig. 10. BRONZE BOWL, WOTTON ($\frac{1}{6}$).

No. 7 (Fig. 11). Bowl of stout bronze with thickened incurved lip and indented base with hole in centre, now cleared of the verdigris that concealed it. Almost complete, but with cones of rust and marks of hay outside with some sand adhering. The maximum diameter is just below the lip, 11·7 in.; the lip is 11·5 in. across, and the height 4·3 in.

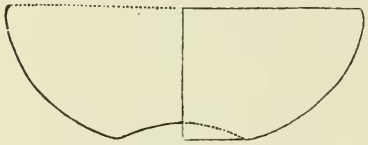

Fig. 11. BRONZE BOWL, WOTTON ($\frac{1}{6}$).

No. 8 (Fig. 12). Bronze bowl of fairly stout metal, in the form of a truncated cone, with narrow lip almost flat and slightly thickened. The base is flat, and has in the centre a plugged hole about three-sixteenths of an inch (4 mm.) in diameter. Inside, the middle zone of the side is engraved alternately with herring-bone pattern and double rows of triangular punch-marks, and there is a rough rope-pattern engraved round the thickened lip. It has suffered from rust most on the base and below the rim, but is rigid and almost

Fig. 12. BRONZE BOWL, WOTTON ($\frac{1}{6}$).

complete. The extreme diameter is 10·1 in., and height 3·8 in., the base outside being 5·5 in. across.

No. 9 (Fig. 13). Bronze bowl in the form of a truncated cone, with waved horizontal lip, in fair condition, but the lip imperfect. At the mouth the

Fig. 13. BRONZE BOWL, WOTTON ($\frac{1}{6}$).

diameter is 11·4 in. (9·8 in. inside), and 4·2 in. at the base, the height being 4·7 in. The metal is fairly stout, with a slight cavity marking the centre of the base. There is some iron rust below the top outside about half-way round, but the surface is otherwise fairly clean.

Dimensions and Weights of Wotton Bronze Bowls.

	Diam. body.	Diam. mouth.	Height.	Weight (Av.).
[2] 1. Embossed and perforated ...	9·6 in.	9·6 in.	2·9 in.	$10\frac{1}{2}+\frac{1}{2}$ oz.
[3] 2. Largest, iron-bound, plugged	21·2 in.	22 in.	13·4 in.	—[1]
3. Similar, iron-bound, patched	17·7 in.	15·8 in.	12·4 in.	—
4. Smaller, same type, damaged	10·2 in.	11·5 in.	6·2 in.	—
[3] 5. Fragments, same type, plugged	13 in.	12·4 in.	6·5 in.	—
6. Basin, stouter, unperforated	12·2 in.	12·1 in.	4·9 in.	33 $+\frac{1}{4}$ oz.
[2] 7. Similar basin, perforated ...	11·7 in.	11·5 in.	4·3 in.	27 $+\frac{1}{4}$ oz.
[3] 8. Truncated cone, plugged ...	—	10·1 in.	3·8 in.	$16\frac{1}{4}+\frac{1}{4}$ oz.
9. Similar, wavy rim, unperforated	—	11·4 in.	4·7 in.	20 +1 oz.

[1] This had iron handles and mounts which must have added considerably to the weight.

[2] With perforated base.

[3] With plugged perforation.

CORRESPONDING FIGURES FOR OTHER VESSELS.

	Diam. body.	Diam. mouth.	Height.	Weight.
Carlingwark Loch ...	25 in.	—	18 in.	—
Cockburnspath No. 1 ...	21 in.	—	10 in.	—
Santon Downham ...	18·5 in.	17 in.	12·25 in.	—
[2] Baschurch	17·75 in.	17·6 in.	12 in.	55¼ oz. + [1]
Walthamstow No. 1 ...	—	19 in. (?)	10 in. (?)	32 oz. +
Irchester No. 2	11⅝ in.	—	4⅜ in.	25½ oz.
[2] Battersea	—	14·75 in.	7·75 in.	20 oz.
Irchester No. 4	10⅜ in.	—	4 3/16 in.	17½ oz.
[3] London	11·8 in.	11·2 in.	4·6 in.	17 oz.
[3] Walthamstow No. 2 ...	—	14·75 in.	7·5 in.	15¼ oz. +
Cockburnspath No. 2 ...	13 in.	—	7·5 in.	—
Sandy	9·1 in.	8·9 in.	3·6 in.	13½ oz.
Irchester No. 5	9⅜ in.	—	3¾ in.	9½ oz.
Irchester No. 6	9⅜ in.	—	3¾ in.	9 oz.
Lakenheath	9·1 in.	8·8 in.	3·8 in.	9 oz.
[3] Icklingham	7·5 in.	8 in. (?)	4·9 in. (?)	9 oz.
[2] Lisnacrogher Bog... ...	—	6·25 in.	2·8 in.	6¼ oz.
[2] Moorfields	—	4·9 in.	2·2 in.	2 oz. 60 gr.
[2] Market Overton	—	4 in.	—	—
[2] Lamberton Moor	4·3 in.	—	2·1 in.	—
[2] Stanwick	—	—	—	—

Some of the specimens in the second list have been already noticed in *Proc. Soc. Antiq.*, Vol. XXI, viz.,

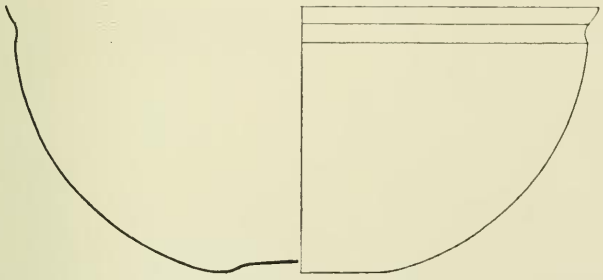

Fig. 14. PERFORATED BRONZE BOWL, LISNACROGHER BOG, CO. ANTRIM (½).

[1] This had iron handles and mounts which must have added considerably to the weight.

[2] With perforated base.

[3] With plugged perforation.

Baschurch, p. 324; Walthamstow, p. 329; Battersea, p. 328; Moorfields, p. 330; Lisnacrogher Bog, p. 331; and Stanwick, p. 330. Those from Market Overton and Lamberton Moor are referred to in Vol. XXII, pp. 53 and 58 respectively. The bowls from Baschurch, Walthamstow, Battersea, London, Sandy, Lakenheath, Icklingham (Fig. 15), Lisnacrogher Bog (Fig. 14), Moorfields, and Stanwick (fragment) are in the British Museum, where they will be joined by the Wotton series.

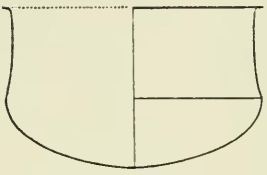

Fig. 15.
BRONZE BOWL, ICKLINGHAM ($\frac{1}{6}$).

Six years ago, in describing for the Cambridge Archæological Society[1] a hoard of metal found at Santon Downham, Suffolk, I ventured to suggest that the cauldron in which the other objects were found was a tinkered water-clock, and compared its dimensions with those of the Baschurch specimen in the British Museum. The addition of one from the Wotton hoard makes the comparison all the more striking, and may lead to the true identification of several cauldrons so patched or damaged at the base that the perforation can no longer be demonstrated.

Dimensions of Water-Clock and two similar Vessels.

	Max. diam.	Diam. of mouth.	Height.
Baschurch	17·75 in.	17·6 in.	12 in.
Santon Downham ...	18·5 in.	17 in.	12·25 in.
Wotton	17·7 in.	15·8 in.	12·4 in.

All three have, or have had, a pair of iron ring-handles with attachments between the shoulder and the mouth; and when it is remembered that these cauldron-like vessels are of thin metal with iron mounts liable to rust, and are for the most part far from rigid or complete, this close agreement suggests, if it does not prove, that the three were all made to the same pattern

[1] *Proc. Camb. Antiq. Soc.*, XIII, 147.

and for the same purpose of measuring time, probably in some manufacturing centre from which they were sent far afield, to the south-east, eastern, and midland areas.

The type with concave neck and rounded base, as Fig. 8, is represented by Wotton Nos. 2—5, Baschurch, Icklingham, Santon Downham, and probably by the Carlingwark Loch and Cockburnspath specimens, though these two Scottish "cauldrons" have not been examined from this point of view. The most striking coincidences have been discussed above, but others are important enough to be mentioned, especially if some margin be allowed for the measurements of very imperfect specimens. Wotton No. 5 has the same diameter as Cockburnspath No. 2, but is 1 in. less in height; and Wotton No. 2 agrees in diameter with Cockburnspath No. 1, the former being about double Wotton No. 4 in all three dimensions, but the weights cannot now be determined.

The Icklingham example, hitherto unpublished, was acquired by the British Museum in 1853, but no further details are recorded. It is damaged but fairly complete, and is of thin bronze slightly turned over at the lip; in the centre of the base is an iron plug, and traces of triangular attachments for a handle opposite one another below the lip, while an iron band is vertically attached in another place, perhaps of the same date as the plugging of the central perforation. The height is 4·9 in., diameter at shoulder 7·5 in., and at the mouth about 8 in. Lakenheath is seven miles distant in the north-west angle of Suffolk, and it is something more than a coincidence that bowls from these two places, though of different forms, are of exactly the same weight (9 oz.).

The basin with incurved lip and indented base, as Fig. 10, is represented by two from Wotton (Nos. 6 and 7), Lakenheath, Sandy and London. Of these, two are of the same dimensions (Lakenheath and Sandy), but differ in weight by about 4½ oz.; and the London bowl and Wotton No. 7 are practically of the same dimensions but differ in weight by about 10 oz. Further, it may be observed that the Sandy bowl is

about half the weight of Wotton No. 7, and that from London about half the weight of Wotton No. 6, though there is little difference in the dimensions.

The London bowl is in perfect condition, of golden colour with black deposit, probably due to contact with Thames peat. There is a small patch to cover a crack in the lip, but no sign of a handle, and its weight may therefore be regarded as certain. The head of the rivet plugging the centre is outside.

The Sandy specimen is slightly thicker than usual, and is perfect except for a hole smaller than a threepenny-piece just under the lip. In the centre is a mere indentation, resulting in a lump on the outside, and the exterior shows wheel-marks in bands with short sloping lines at regular intervals between them. Though not a water-clock, this gives an accurate standard of weight, exactly half as much again as either the Icklingham or Lakenheath specimen. This last is thinner and imperfect, though evidently of the same type; there is certainly a round hole in the centre, but as there are other holes due to corrosion it would be difficult to prove the centre was intentionally perforated.

A third type, not represented at Wotton, is hemispherical, and attention has already been drawn to the close agreement of Battersea and Walthamstow No. 2 (*Proceedings*, XXI, 329); but it should also be noticed that Walthamstow No. 1 is approximately double the weight of Walthamstow No. 2, and the Battersea specimen has no obvious weight-connection with either. It is possible, however, that the iron hoop and rivets, of which traces only remain, brought Walthamstow No. 2 up to the weight of Battersea, and Walthamstow No. 1 to double the weight of either. It is safer in the present case to judge by dimensions, but weight was probably the more important element in the wholesale manufacture of these bowls.

The two sites are about nine miles apart, and half-way between them is Moorfields, where a small ornamented specimen was found. All four may therefore be said to belong to the same district; but the more accurate

measurements, rendered possible by their state of preservation, make the hemispherical examples still better proof that water-clocks were made in stock sizes for wide distribution in Britain.

The long and tantalizing paper on a find of thin bronze vessels at Ilchester, Northants,[1] omits some of the points essential for our present purpose, but the illustrations include four bowls (of which three are patched) of the same type as Wotton Nos. 6 and 7. The accompanying objects are of the Roman period or at least of classical origin, and evidently for ceremonial purposes, three being of skillet or patera form. The eight vessels were found in 1874, packed together some 15 in. below the surface among a number of Roman graves; and measurements are given in an appendix by Sir Henry Dryden, but there is no detailed description of the plain bowls; and from the absence of any mention of holes it must be inferred that they were unperforated. In any case, the weights and dimensions bear some relation to existing specimens; and though the lip is more incurved, they are of the same type as Figs. 10 and 11.

Bronze Vessels from Hoard found at Ilchester.

	Exterior diam.	Exterior depth.	Weight.
No. 2	$11\frac{5}{8}$ in.	$4\frac{3}{8}$ in.	$25\frac{1}{2}$ oz.
No. 4	$10\frac{3}{8}$ in.	$4\frac{3}{16}$ in.	$17\frac{1}{2}$ oz.
No. 5	$9\frac{3}{8}$ in.	$3\frac{3}{4}$ in.	$9\frac{1}{2}$ oz.
No. 6	$9\frac{3}{8}$ in.	$3\frac{3}{4}$ in.	9 oz.

With which may be compared the following:—

London... ...	11·8 in.	4·6 in.	17 oz.
Lakenheath ...	9·1 in.	3·8 in.	9 oz.

Weight relations between bowls of different types might be regarded as accidental, or not so convincing as graduated sets of the same pattern; but in the Wotton series itself the water-clock (No. 1) is half the weight of No. 9; and No. 8 is half the weight of No. 6, the latter

[1] *Assoc. Archit. Socs. Reports*, XIII (1875), Northants, 88, Plates I, II.

bowl being of the same type as that from London but double its weight. Wotton No. 8 and the London bowl are therefore about the same weight but of different shapes; in spite of this, they are both plugged in the centre of the base and may have been made for the same purpose.

So much can be deduced from the Wotton series when compared with other bronze bowls of similar types in the British Museum; but another significance is given to these weights by analysis in the light of the early British bar-currency. It is obvious that the two systems are intimately related; and although the weights of Nos. 2, 3, 4, and 5 cannot be estimated satisfactorily, the others may be tabulated as follows:—

Wotton bronze bowls (corrected weights).	Iron currency-bar standard (for details see *Proc. Soc. Antiq.*, XXVII, 71).
No. 1. $10\frac{1}{2}+\frac{1}{2}$ oz.=11 oz.	Unit weight, 11 oz.
No. 8. $16\frac{1}{4}+\frac{1}{4}$ oz.=$16\frac{1}{2}$ oz.	Unit-and-a-half, $16\frac{1}{2}$ oz.
No. 9. 20 +1 oz.=21 oz.	Double unit, 22 oz.
No. 7. 27 $+\frac{1}{4}$ oz.=$27\frac{1}{4}$ oz.	Two-and-a-half units, $27\frac{1}{2}$ oz.
No. 6. 33 $+\frac{1}{4}$ oz.=$33\frac{1}{4}$ oz.	Three units, 33 oz.

No further proof seems necessary in view of the remarkable and unexpected agreement in these weights; and, even apart from these coincidences, it is clear that both water-clocks and currency-bars belong to the same period, called late-Celtic or Early British in this country and La Tène abroad. The decoration of the perforated vessel corresponding to the unit of the bar-currency (4,770 grains=309·7 grammes) is perhaps significant, and the embossed fragments from Westhall probably belonged to just such another. Though different denominations of currency might be accepted without question, it may appear to some unlikely that bowls would be manufactured of graduated weights even for such a delicate operation as the measurement of time, when so much depends on the size of the perforation. Any doubts on this point can be dispelled by reference to ancient Hindu directions for the manufacture of

exactly this kind of water-clock, referred to on the previous occasion (*Proc. Soc. Antiq.*, XXI, 328); and in this connection it may be well to mention that Dr. J. F. Fleet has prepared two papers on ancient Indian water-clocks to be published in the *Journal of the Royal Asiatic Society*. He kindly informs me that the percolating form was not known to the Hindus till after A D. 350, so that the ancient Britons cannot have derived their system from India. The classical water-clock is known to have been on a different plan;[1] and unless our pattern can be traced to Babylon, the conclusion seems inevitable that it was a British invention.

Having noticed a small round hole in the base of a bronze bowl included in a hoard of the Roman period from Lamberton Moor, Berwickshire, now in the Edinburgh Museum of Antiquities, I expressed in 1908 my suspicions that this was another example of the Celtic water-clock, though another bowl in the hoard has a rivet in the centre of the rounded base holding a bronze button on the inside. In reply to further inquiries, Mr. Alexander Curle has kindly sent me particulars, and is inclined to think that the round hole was meant to have a rivet in it like the other, though he does not explain the purpose of the rivet. On my theory the hole was intentional to admit the water, and the other was plugged because it was no longer required for use as a clock but as an ordinary bowl. There is an exactly parallel case in the British Museum, the Battersea specimen being perforated, and one of the two from Walthamstow plugged, though both were evidently made for the same purpose.

The plugged bowl from Lamberton Moor is 3·6 in. in diameter and 2 in. high; the other is slightly larger, 4·3 in. across and 2·1 in. high, with a round perforation 0·1 in. across. One inch below the lip, which is slightly

[1] Max C. P. Schmidt, *Kulturhistorische Beiträge*, Heft 2, *Die Entstehung der antiken Wasseruhr;* G. Bilfinger, *Die Zeitmesser der antiken Völker.* For ancient Chinese water-clocks, see also Report of Smithsonian Institution for 1891, I, 607, reprinted from *Chinese Repository*, July, 1851.

everted, the larger bowl has a narrow metal hoop with a row of almost contiguous small bosses, the other having probably had the same ornamentation but now retaining only a trace of the hoop. The same pattern occurs on the lip of two small bronze bowls in the British Museum, one from the Londesborough Collection having a single row (diameter, 5·4 in.), and the other from the Thames a double row (diameter, 6·6 in.), but neither has any trace of a perforation in the base and the larger is quite perfect.

The Lamberton Moor find encourages the belief that water-clocks were used in Scotland, and there are two well-known hoards that have many points in agreement with the Santon Downham find, in which the "cauldron" had been patched at the base and used to carry odds and ends of scrap metal. In a haugh adjoining the Water of Eye at Cockburnspath, Berwickshire, two large vessels of extremely thin sheet bronze were found about 15 in. below the surface, lying on blue clay below the peat. One was inverted over the other, and they contained a variety of ornaments and tools apparently of early Roman date. "The larger one had obviously been much exposed to the fire, and repeatedly repaired; the smaller one had had handles fastened to it on opposite sides by three rivets, the holes for which remain, and it had probably been strengthened by a rim of iron, without which it would collapse, from the extreme thinness of the metal, if lifted full of water. It is probable that all were contained in a large wooden pail, as there were two large rings with staples and nails, the latter bent in and indicating a thickness of $\frac{3}{4}$ in. for the staves. The rings measure $4\frac{1}{2}$ in. in diameter."[1] The above account, which is quoted almost verbatim, is good and independent evidence that the bronze vessels were not "cauldrons" in the ordinary sense, and the accompanying objects lend colour to the theory that they were once water-clocks of the ordinary British pattern. The dimensions are also an interesting point. The larger

[1] *Proc. Soc. Antiq. Scot.*, I (1855), 43.

is 21 in. by 10 in., agreeing in diameter with Wotton No. 2, which is 3½ in. higher, but this difference might be reduced by the addition of an iron rim to the Scottish specimen. The smaller is 13 in. by 7·5 in., again agreeing in diameter with a Wotton specimen of the same type (No. 5), but being 1 in. higher: possibly the Wotton example had an iron rim to bring this dimension into agreement.

The other Scottish hoard in a "cauldron" was found in Carlingwark Loch, Kirkcudbrightshire, and the containing vessel is exactly of the Baschurch type, but considerably larger than any known specimen. It measures 25 in. by 18 in.,[1] and was dredged up containing part of a bronze vessel 4 in. by 3 in., the bronze handle of a bucket (of late-Celtic type), a number of iron tools, portions of chain-mail and glass marked with letters in relief, no doubt of Roman origin. The containing vessel is formed of very thin plates of bronze, the bottom consisting of one large sheet and the sides of various smaller portions, all riveted together. It is patched in various places with additional bronze plates of various sizes riveted on.

The discoveries of several bronze sets having so many features in common implies social or commercial intercourse between widely separated communities which, as we know from Cæsar and Tacitus, were often rivals and sometimes enemies; and as it is unlikely that any civil or military power of the period controlled all these districts, it is not unreasonable to ascribe these common attributes of civilization to the widespread influence of the Druids. In my former paper may be found some comments on their achievements in astronomy, geography, physics and theology, as recorded by Cæsar (*Commentaries*, VI, 14), and by Pomponius Mela (Book II, cap. 2) about a century later; and the mere fact that the caste in Britain enjoyed greater prestige than their Gaulish colleagues, justifies us in assuming that their influence spread at least all over what is now

[1] *Proc. Soc. Antiq. Scot.*, VII, 7, Pl. I: the diameter is given as 26 in., but see *Cat. Edinb. Mus. Antiq.*, p. 158.

England, not to mention Wales, where they were concentrated during the Roman occupation. It is easy to say too much about the Druids, and Dr. Rice Holmes's few pages on the subject (*Ancient Britain*, pp. 289–98) show how Celtic scholars contradict themselves and each other in dealing with the few scattered notices to be found in classical texts; but if the water-clock was invented or adopted by the Druids for the study of astronomy and the control of the calendar, specimens ought to be found in France, and a tour round the principal museums would probably bring some to light.