The Trade- and Coin-Weights Found at Melandra.

THE exceedingly important observation which Mr. May has made of the relation between certain of the ancient weights found at Melandra and the "Neath" or "Glastonbury" standard, and which he has explained in an article now appearing in the *Derbyshire Archæological Society's Journal*, seemed to impose on the Editor of this Report the task of taking stock of the knowledge we now possess of this curious and interesting set of objects. Since Mr. May undertook the first scientific enquiry into their nature (in his article in the same journal, 1903), ten more specimens have been added from the camp (their number now reading 30); and, although his discussion then placed beyond doubt the nature of some of the purely Roman weights which formed part of the collection, by showing their close connection with the weights of the coins used at different periods of the Empire, many of the details remained, as he frankly pointed out, in some obscurity. My object in making this addition to Mr. May's two articles was to define as precisely as may be how much knowledge we possess of the nature of the weights, and to separate as sharply as possible what was certain from what was merely probable. But the results of a systematic survey proved to be far more interesting than I had hoped. The third Table printed below shows that the collection gives us no less than seven certain denominations of the Keltic standard (hitherto known only in the unit, its double and quadruple), and thereby supplies a most welcome confirmation of the discovery of that standard itself, and of the text in an interesting passage of Cæsar (see below).

TABLE I.

Weights of 1 Bronze and 32 Leaden Objects found at Melandra.

No.	No. in Mr. May's List.	Shape.	Weight in Grains.	Notes.
1	19	Cheese or barrel.	4735 (·4)	
2	Not then found.	The same, but rather more angular.	3535 (·0)	
3	do. do.	Pyramid, cylindric top.	3472 (·4)	Furrow cut along the top; thick layer of carbonate on surface.
4	18	Inverted frustum of cone.	1870 (·4)	
5	17	Cheese or barrel.	1725 (·2)	Much wasted.
6	16	Flat cheese.	1709 (·3)	Found on surface, apart from the others.
7	Not then found.	Cylindric topped pyramid.	1296 (·8)	Shallow groove across the top; iron nail driven into foot.
8	15	Square prism.	1181 (·9)	
9	13	Cheese or double truncated cone.	913 (·4)	Deeply pitted.
10	14	Tall square prism, corners rounded.	905 (·6)	Sockets in top for a ring.
11	12	Half cheese.	617 (·3)	
12	Not then found.	Flat cheese.	555 (·8)	
13	11	do.	531 (·6)	
14	10	Half cheese.	428 (·6)	
15	9A	Cylinder.	402 (·8)	Bronze, with iron stud.
16	—	Coil.	365 (·0)	
17	—	Cube.	351 (·4)	Dice marks on 6 faces.
18	9	Cheese.	323 (·8)	
19	8	do.	312 (·8)	
20	7	Thick circular disc or lozenge.	297 (·5)	
21	6	do. do.	239 (·3)	Much pitted, perforated.
22	—	Flattened cube.	236 (·6)	Dice marks faintly visible.
23	5	Square disc.	215 (·9)	
24	Not then found.	Pierced cone.	208 (·9)	Spindle wheel?
25	4	Pierced disc.	188 (·9)	
26	3	Cheese (rather square).	173 (·0)	With bronze or copper centre somewhat pitted.
27	Not then found.	Pierced disc.	151 (·7)	Broken a little on one side found in the conduit, 1905.
28	2	do.	146 (·8)	
29	1	Cone (or hemisphere).	125 (·5)	Nearly pierced through[1]
30	Not then found.	Bow or D	104 (·2)	
31	do. do.	Disc.	97 (·4)	} Much wasted.
32	do. do.	Pierced cone.	96 (·8)	
33	do. do.	Disc.	76 (·4)	

1. Since Mr. May's weighing, which in general agrees very well with Dr. Lees', gave a considerably higher figure for this specimen (No. 29), I weighed it again myself (with the help of Mr. McKower, Dr. Lees' successor in the Laboratory), and found the figures given above entirely correct.

In several cases, since weighing, I have cleared away the deposit of lead carbonate from the markings to render them more distinct.

Dec. 25, 1905. Charles H. Lees.

The first thing to be done was clearly to have the present weight of the specimens determined with scientific precision, and the members of our Association are greatly indebted to Dr. C. H. Lees, F.R.S., the Assistant Director of the Beyer Physical Laboratory in the University of Manchester,[1] for his kindness in undertaking the duty, and for his careful report. This I now subjoin, modified by the insertion of the second column, identifying the weights with those in Mr. May's list in the earlier of his articles. I have also slightly amplified the details in the third column, to place the identification beyond any future doubt.

The table proceeds from the heaviest to the lightest, and includes four objects also found in the camp, which it seemed well to weigh, but of which three (Nos. 16, 17, 22) almost certainly, and one (30) possibly, should not be counted as weights at all.

We may proceed now to select from this list those specimens which certainly, or with varying degrees of probability, can be identified as Roman. Both Mr. May and myself have based our work upon the admirably lucid outline of the history of the Roman coinage in Imperial times contained in Mr. G. F. Hill's *Handbook of Greek and Roman Coins* (London, 1899). The fullness of the tables contained in his Appendix diminishes by at least one-half the labour inevitably involved in any metrological enquiry.

The need for an elaborate apparatus of weights of small denominations appears at once when we consider the perpetual changes in the coinage (see Hill, pp. 50—55) in the third and fourth centuries. Of the variations in the gold coins after Alexander Severus (222—235 A.D.) he writes (p. 55): "Then begins a period of hopeless con-

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fusion, such that the scales must have been necessary in all transactions in which gold passed." The specimens we have belonged no doubt to the financial officer of the fort, and as these were not found all together,[2] but scattered over the Northern half of the camp, they had perhaps been discarded from time to time as changes in the currency they were used to measure may have dictated.

Let me first present the table of the weights, in three groups, according to the degree of certainty of their Roman character,[3] and then add a few notes, which future enquiry may, I hope, enlarge, to suggest what coins they were used to measure.

I have disregarded the two dice (17 and 22) and the spiral (16), as there seems no reason for thinking that they were used as weights. (See the figure given on p. 112.)

In the sketches of the weights which follow, no attempt has been made to keep the same scale, which would have rendered the smaller sketches unintelligible. The photograph (p. 99) gives their relative size.

2. Nine of the heavier weights were found in a group at a spot marked in Mr. Bruton's plan. These were the following :—1, 4, 7, 8, 9, 18, 19, 21, 23. Fortune has made what seems an unkindly capricious selection from our two categories.

3. The precise identification of the weight of some of them is not above doubt even in Table II. A. In these cases I have added a ? to the "Presumed original weight."

II. Weights of the Roman Standard.

A. *Certainly Roman weights* (Unit: *Libra* of 5050 grains).

No.	Shape.	Marks on face.	Weight in grains.	Presumed multiple of (a) *Libra* (= 12 *unciæ*).	Presumed multiple of (b) *Uncia* (= 8 *drachmæ*).	Presumed multiple of (c) *Drachma* (= 6 *oboli*, = 18 *siliquæ*).	Presumed original or correct weight.	Notes.
6	Flattened cheese.		1709·3	$\frac{1}{3}$	4	32	1683·3	Well preserved; found at some distance from the rest.
7	Pyramid with summit rounded to a cylinder, with shallow groove across it.		1296·8	$\frac{1}{4}$	3	(a) 24	1262·5	An iron headed nail has been driven into the base.
9	Cheese or two truncated cones, base to base.		913·4	$\frac{5}{16}$	$2\frac{1}{4}$	(b) 18	946·9	Deeply pitted.
11	Half cheese (truncated inverted cone).		617·3	$\frac{1}{8}$	$1\frac{1}{2}$	(c) 12	631·2	
13	Cheese. Obv.		531·6	$\frac{5}{48}$	$1\frac{1}{4}$	? 10	? 526·0	Well preserved.
	Rev.							
14	Half cheese (frustum of sphere).		428·6	$\frac{1}{12}$	1	8	420·8	

II. Weights of the Roman Standard.

A. *Certainly Roman weights* (Unit: *Libra* of 5050 grains)–*contd.*

No.	Shape.	Marks on face.	Weight in grains.	Presumed multiple of (a) *Libra* (= 12 *unciæ*).	Presumed multiple of (b) *Uncia*, (= 8 *drachmæ*).	Presumed multiple of (c) *Drachma* (= 6 *oboli*, = 18 *siliquæ*).	Presumed original or correct weight.	Notes.
18	Cheese (with hollowed top).		323·8	$\frac{1}{16}$	$\frac{3}{4}$	(d) 6	? 315·6	Well preserved.
19	As No. 18.		312·8	$\frac{1}{16}$	$\frac{3}{4}$	(d) 6	315·6	Well preserved.
23	Square disc.		215·9	$\frac{1}{24}$	$\frac{1}{2}$	4	? 210·4	
24	Shallow cone, pierced.		208·9	$\frac{1}{24}$	$\frac{1}{2}$	4	210·4	Pitted.
27	Pierced disc (bun-shaped).		151·7	$\frac{1}{32}$	$\frac{3}{8}$	(e) 3	157·8	One edge broken.
30	Bow or brooch.		104·2	$\frac{1}{48}$	$\frac{1}{4}$	2	105·2	Perhaps not a weight.
31	Disc with four perforations.		97·4	?$\frac{1}{48}$	? $\frac{1}{4}$	?2	? 105·2	Edge broken.
32	As No. 24.		96·8				? 105·2	Much broken.
33	As No. 27.		76·4	$\frac{1}{64}$	$\frac{3}{16}$	(f) $1\frac{1}{2}$	78·9	

On the last six specimens (24—33) there are no marks.

II. B. *Probably Roman Weights.*

No.	Shape.	Marks on face	Weight in grains.	Possible multiple of (a) *Libra.*	(b) *Uncia.*	(c) *Drachma.*	Possible original weight.	Notes.
4	Inverted frustrum of cone		1870·4	$\frac{3}{8}$	$4\frac{1}{2}$	36	1893·8	Somewhat worn
10	Cylinder or rounded prism, with deep furrow across the summit filled in at one part		905·6	? $\frac{3}{16}$	$2\frac{1}{4}$	18	? 946·9	Did the furrow provide sockets for 2 ends of a ring handle?
15	Cylinder with deep furrow across the summit, and iron nail driven in		402·8	? $\frac{1}{72}$	1	8	? 420·8	Bronze, deeply pitted

Notes on the Roman Weights.

1. In Table II. A, I have marked with the letters (*a*) to (*f*) the specimens which seem to make a series both by their weight and (with the exception of (*a*), No. 7, which is simply $\frac{1}{4}$ lb.) shape and to be multiples of $1\frac{1}{2}$ drachmæ. This weight (No. 33) was that of the *Antoninianus* or base silver denarius of Caracalla (198—217 A.D.).

2. The drachma itself was the weight of the silver denarius of Nero (54—68 A.D.) and the silver coin of Diocletian (284—305 A.D.) to which some authorities attach the name *miliarense* which probably implies a value of $^1/_{1000}$lb. of gold.

3. The only coin I can find of which No. 31, which is punctured four times, gives four times the weight is the quinarius (half-denarius) of Diocletian. Its own weight, however, if we disregard the punctures which do not always (as may be seen, e.g., by comparing 9 and 13) give any numerical measure of the weight, is that of 3 gold siliquæ of Julian (360—363 A.D.).

4. In regard to No. 4 Mr. May in his first article, assuming that its original weight was $4\frac{1}{2}$ unciæ (1893·8 grains)[1] and that it belonged to the same series as those I have marked (*a*)—(*f*), ingeniously calculated that it represented five *stipendia* of the age of Augustus, a *stipendium* being the pay due to a legionary soldier three times every year. If this were sound, it would afford an attractive explanation of the five dots which the weight bears on its face, and one would conjecture that it represented some regular fee of one of the senior centurions, though rather a high one. The annual pay of the legionary in the early Empire

1. In Mr. May's weighing 3 years ago, the result was 1882·08 grains; it has no doubt lost some of its carbonate coating since then, as it now weighs only 1870·4.

we know from Tacitus (Ann. 1, 17) to have been 3,600 (Augustan) *asses* =225 *denarii*=9 aurei. Hence a stipendium of that period=3 *aurei*, which, under Julius Cæsar, would have meant $^{3}/_{40}$ of a libra of gold, or 378·7 grains; 5 times this weight would give $\frac{3}{8}$ of a libra or $4\frac{1}{2}$ unciæ, the weight which Mr. May assumes as the original weight of our specimen. We might, then, not unreasonably, say that we had before us the weight of 5 *stipendia* or 15 *aurei* of Julius Cæsar. But under Augustus the weight of the *aureus* (Hill, p. 54) was reduced to $^{1}/_{42}$ of the libra or 120·37 grains (and so remained, though with a tendency to decrease till Caracalla (198—217 A.D.) under whom it became $^{1}/_{50}$lb.). This specimen therefore would represent more nearly 16 than 15 Augustan aurei, and a paymaster was hardly likely to submit to a difference of some 6 per cent. to his disadvantage. It is possible that some explanation may be forthcoming (e.g. the soldier may conceivably have been entitled to the same weight of metal in spite of the reduction of the coin; as in fact he was in the case of the change of the copper *as*, see Hill p. 48 footnote), but until this can be certainly determined, Mr. May's explanation must be regarded only as an attractive conjecture. It might be worth while to attempt by a narrower enquiry than would be appropriate here whether the higher weight of the aureus suited any period between Augustus and Caracalla.

The Keltic Weights.

During the visit of the Branch of the Association to Mr. May's beautiful collection of Roman pottery from his excavation of Warrington in October, 1905, he very kindly handed to me the draft of his second article (now appearing in the current number of the *Derbyshire Archæological Journal*), which pointed out the close approximation of the heaviest specimen of the Melandra weights to the standard which Mr. Reginald Smith, of the British Museum, had shown to be represented by a bronze weight found at Neath (4,770 grains), and another (of basalt) at Mainz (4,767 grains), and by the normal weight deduced from that of a large number of iron bars [1] found in the purely British lake-village at Glastonbury and in other British sites. Some of these iron bars, so far as they have yet been examined, presumably represented double the unit, three the unit itself, and two the unit quadrupled, but as they have, of course, suffered a good deal from rust, the variation in particular specimens is

1. 4,484 grains; the difference is due to the rusting of the iron.

considerable. Mr. Smith's conclusions therefore entirely establish the soundness of the text in Cæsar B. G. 5, 12, 4 *taleis ferreis ad certum pondus examinatis pro nummo.* Details of his exceedingly important determination are given by Mr. Smith in his paper on the "Ancient British Iron Currency" (*Proceedings of the Society of Antiquaries*, xx., 179, January 26, 1905), and in outline in the *Guide to the Antiquities of the Early Iron Age in the British Museum*, 1905, pp. 149f. Both the Neath and the Mainz specimens exhibit the same cheese or barrel shape which appears in four Melandra specimens (1, 2, 5, 12); each of the two is marked I on the face, but the Mainz specimen has a further legend which no one yet has interpreted, I Ɔ ⊂, the last sign apparently a Q tilted to the left.

The peculiar importance of the collection at Melandra appears at once from the table below (III., A. and B.), which shows that we have here represented certainly seven (including the unit), and quite possibly nine, denominations of this standard, whose sub-divisions have been hitherto entirely unknown.

The nature of the sub-divisions is also interesting. Besides the duodecimal principle (in Nos. 2, 3, 8, 25, and ? 21) following that of the Roman *libra* and *uncia*, to which, if I remember rightly, Mr. May's article is to call attention, I think we must recognise not less clearly the quadratic (Nos. 2, 5, 8, ? 12, 20, 28 and ? 21), giving us a division of the unit into 4, 8, 16, 32 and ? 96 parts. Nos. 2, 3, 5, and 21 could belong to either, and 12 may just conceivably be Roman and represent $10\frac{1}{2}$ drachmæ, or 7 times the weight of an Antoninianus.

It would be of course possible to interpret all these weights as representing so many "British drachmæ" (if one may coin such a term for the sake of argument), since 96 is a common denomination for both 12 and 16;

but one seeks a reason for the creation of weights to represent 6 and 12 "British drachmæ," *i.e.*, $^1/_{16}$ and $\frac{1}{8}$ of the "British pound" respectively if there was no other named standard than $^1/_{12}$ of the unit ("British uncia") and $^1/_{96}$ ("British drachma"). And that there was some other such named unit weighing $^1/_{16}$ of this "British pound" (298·1 grains) seems at least suggested by the markings on Nos. 12 and 20, which would then be the weights of two and one such units respectively; unhappily No. 12 is nearly 8 per cent. under its proper weight, on this hypothesis. It is also clear that the markings on No. 8 vouch for the duodecimal system, as Mr. May points out. But Nos. 20 and 28 are unimpeachable witnesses for the quadratic system.

Can we conjecture from this that we have here the result of the imposition of the Roman system of 12 ounces and 96 drachms upon a Keltic system of dividing the pound into 16 parts? And that therefore the essential characteristic of our modern "Avoirdupois" measure goes back to the Early Iron Age? I must be content to leave this inference for students of metrology to develope or confute. My object is primarily to provide material for their enquiry, by a preliminary clearing of the ground. A similar case of the imposition of Roman divisions upon a local unit occurs at Pompeii; see *The Mensa Ponderaria of the Naples Museum*, App. I. to my edition of the remains of *The Italic Dialects*. And examples more important for northern lands will be found in Appendix C of Prof. Ridgeway's *Origin of Metallic Currency and Weight Standards*.

No. 3, which has been considerably cut about, and does not correspond in shape to No. 2, looks like a Roman weight cut down to the Keltic standard.

Here follow the weights which are certainly or probably Keltic; and after them two or three which I do not feel able to identify with enough probability to insert them in either category.

III. Weights of Keltic Standard.

A. *Probably Keltic* (Unit: Neath weight 4770 grains).

No.	Shape.	Weight in grains.	Presumed fraction of unit.	Presumed original or correct weight.	Marks on face.	Notes.
1	Cheese or barrel	4735·4	1	4770		Somewhat worn, but not deeply pitted.
2	Cheese or barrel	3535·0	$\frac{3}{4}$	3577·5		Much worn
5	Cheese or barrel	1725·2	$\frac{3}{8}$	1788·75		Much wasted
8	Square prism	1181·9	$\frac{1}{4}$	1192·5		Presumably a local triens, or quarter-pound
20	Thick disc or circular lozenge	297·5	$\frac{1}{16}$	298·1		Well preserved
25	Disc with large perforation	188·9	$\frac{1}{24}$	198·8		With thick layer of carbonate
28	Shallow cone pierced	146·8	$\frac{1}{32}$	149		Deeply pitted .

III. Weights of Keltic Standard.

B. The following three specimens may conceivably belong to the same standard:—

3	Pyramid, with summit rounded to a cylinder with deep furrow cut in the surface	3472·4	$\frac{3}{4}$	3577·5		With thick layer of carbonate
12	Flat cheese	555·8	$\frac{1}{8}$	596·25		
21	Short cylinder or thick disc, perforated	239·3	$\frac{5}{96}$	249·5		5 local drachmae (i.e., $\frac{5}{8}$ of the local uncia)?

IV. Doubtful.

No.	Shape.	Marks on face.	Weight in grains.	Possible multiple of (1) *Libra* (= 12 *uncia*). (*a*)	(2) *Uncia* (= 8 *drachma*). (*b*)	(3) *Drachma* (= 6 *oboli*, = 18 *siliqua*). (*c*)	Presumed original or correct weight.	Notes.
26	Cheese, squarish with bronze centre		173·0	? $\frac{1}{12}\frac{3}{4}$	$\frac{1}{24}$	20 obols ($3\frac{1}{2}$ drachmae).	? 175·3	Somewhat worn cf. 23.
29	Cone or hemisphere nearly pierced		125·5	? $\frac{1}{19}\frac{5}{2}$	$\frac{5}{96}$	15 obols ($2\frac{1}{2}$ drachmae).	? 131·5	Much worn; cf. 27.

R. S. Conway.

Note.—On the eve of publication I had the advantage of a conversation with Mr. Reginald Smith, who referred me to an article by Lehmann, *Zeitschrift für Ethnologie*, xxi. (1889) p. (245) ff., entitled *Altbabylonisches Maass und Gewicht und deren Wanderung*. On p. (277) some interesting conjectures will be found as to the origin of the Avoirdupois standard, but not as to the principle of division. Indeed the writer leaves it undecided whether the pound was originally based upon the ounce or the ounce upon the pound. Mr. Smith also tells me that some weights not yet publicly described, but said to correspond to the Neath standard, have recently been found in Somersetshire, and are now in the Castle Museum, Taunton (*Curator*, H. St. G. Gray, Esq.).