

Wealden Iron

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1979

Bulletin of the
Wealden Iron
Research Group

WEALDEN IRON RESEARCH GROUP

BULLETIN NO. 16

1979

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Chairman's Note

Obituary

We are very sorry to have to report the death, on March 11th last, at the age of 80, of Mrs Ruth Sewill, daughter of Ernest Straker. Her son, Mr Brendon Sewill tells us that his mother took a great interest in the work of W.I.R.G., was delighted at being made an honorary member, and enjoyed reading our *Bulletin*.

A number of us will remember having the privilege and pleasure of meeting this delightful old lady some years ago when we visited Crawley to see the excavations at Broadfield.

It is interesting to learn that she was a local historian and that in 1950 she published a history of her village entitled *The Freemen of Charlwood* which contained a good deal of detail on the ironmasters of the area. Her son is now in process of reprinting the book with a postscript bringing it up to date.

Historical Metallurgy Society

As many members will be aware, the Society will be holding its annual conference in Sussex from the evening of Friday 7th September, until mid-day on Sunday 9th. Lectures will be held at the University of Sussex, Falmer, in the evenings and on the Sunday morning. Speakers will include the Chairman, Secretary and Editor of W.I.R.G., Bernard Worssam, Henry Cleere and Richard Saville. A tour, on the Saturday, will visit Anne of Cleves House, Lewes, Wadhurst, Garden Hill and Pippingford.

Non-residents are welcome, but should write for registration details to Mr C. R. Blick, Treasurer, Historical Metallurgy Society, 16 Sycamore Crescent, Bawtry, Doncaster, S. Yorkshire DN10 6LE. It is important that Mr Blick should know the numbers of local participants.

Reports on Fieldwork

C. F. Tebbutt

Report of the Field Group 1978/79

Due to the success of the policy of sampling bloomery slag heaps by trenching it was decided to continue this in 1978-9. The results have equalled those of the previous years and pottery has been found on nearly all sites sampled. Once again the results prove that most were of Romano-British date, confirming the findings reported in *Bulletin* 13. Details are given below.

It is probable that no further sampling of this sort will now be necessary. A sufficient percentage of the known bloomery sites in the study area have now been dated to provide a reasonable assumption that the ratio of Romano-British to Medieval, found on the dated sites, would apply all over the study area, and probably over much of the Weald.

The present unchecked total results are as under. They include sites dated by Straker, and others, in the study area.

| | | | |
|---------------------------------|-------------|-----|----------------|
| Area | 182 sq. km. | | |
| Bloomery sites recorded | 261 | | |
| Dated sites | 36 | | |
| Romano-British | 29: | 80% | of dated sites |
| Medieval | 7: | 20% | |
| Excavated but undated | 3 | | |
| Percentage of total sites dated | 14 | | |

Excavations and Explorations

HODGES WOOD, CROWBOROUGH

Three sites are known in this wood and we were able to sample 2 of them by the kindness of Mr P. Rendel.

Site 1 TQ 5270 3256 This occurs in the W. edge of the wood and on the E. side of the stream that forms its boundary and where a branch of the stream turns E., bloomery waste is spilt down the bank to stream level, and indeed can be found across it.

A trench 6.5 by 1m. was dug where the slag appeared thickest, down to the subsoil at 45cm. One sherd of Romano-British pottery was found.

Site 2 TQ 5265 3235 This site was further S. on the E. bank of the same stream, and on the border with Hourne Farm Wood. A large slag heap, c.9 by 7m. was apparent. Tree roots made digging difficult. Two trenches were dug. One, 1m. square, reached undisturbed soil at 60cm. Near the bottom, 3 small sherds of unglazed gritty Medieval pottery were found, probably of 13-14th century date. A second trench, 1m. x 90cm., was dug some 40m. from the first on what may or may not have been a separate slag heap. It was taken to a depth of 50cm. but no pottery was found. It was noticed that some slag from the first trench on this site had a somewhat glassy surface, as is occasionally found on bloomery sites other slag was lighter in weight than is usual.

BINGLES FARM, LYE GREEN, WITHYHAM TQ 5070 3400

This interesting site was dug by kind permission of Mr P.J. Bartram. It is on the lower boundary of a small grass field that extends from the vicinity of Bingles house down to a small stream. Above the site, on the same field, are at least two terraces that suggest house platforms. At the site itself there is an apparent ford with large stones in the stream. Among these there is slag and cinder and a large furnace bottom. This latter has obviously originated from one of the large-type bloomery furnaces, as at Pippingford (W.I.R.G. *Bulletin* 8, p.1B) and Cowpark (W.I.R.G. *Bulletin* 13, pp.2-6). It was decided to dig two trenches from the bank of the stream out into the field.

Trench 1 This was 4 by 1m., near the field corner. Immediately under the turf modern and post-medieval artifacts were found. They included clay pipes, blast furnace slag, clay roofing tiles and bricks, and a small quantity of bloomery slag. Below this came some sherds of medieval pottery.

At a depth of 20cm. this material thinned out and a compacted black layer was reached. This contained almost nothing but bloomery slag, large stones, some showing burning, and pieces of clay furnace lining. One of these latter contained a 'sausage' of clay from the ring method of furnace construction. The bottom of the layer of furnace waste was not reached at 30cm. depth, when work had to be abandoned owing to bad weather. However at this depth came several sherds of Romano-British pottery, including one rim sherd. (Fig.1).

Trench 2 This trench was 3 by 1m. and conditions here were much the same as in Trench 1. medieval and post-medieval artifacts were found down to a depth of 20 cm., where the hard black layer was reached. Below this the N. half of the trench was sharply differentiated from the S. half. At the N. end occurred a mixture of yellow and black (charcoal) which went down to undisturbed yellow subsoil at 40cm. Several possible stake holes penetrated this. The S. half, separated from the N. by a collection of stones across the trench, was a continuous layer of black down to the undisturbed natural. Both these halves contained much bloomery waste and in both were found a number of sherds of Romano-British pottery. (Fig.2).

This is the first site dug, so far, where subsequent periods to the Roman were represented in stratification, but there was no evidence that iron working had been connected with any other period than the Roman.

BINGLES FARM, WITHYHAM

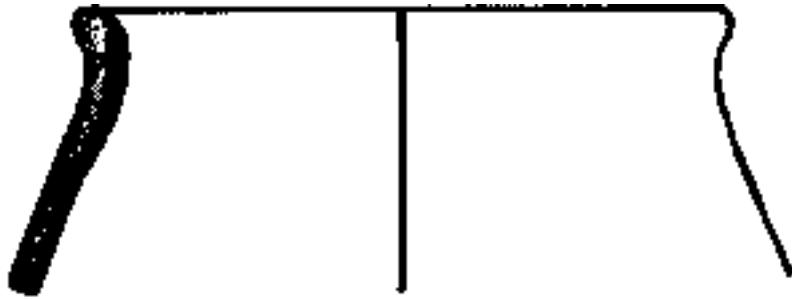


Fig. 1

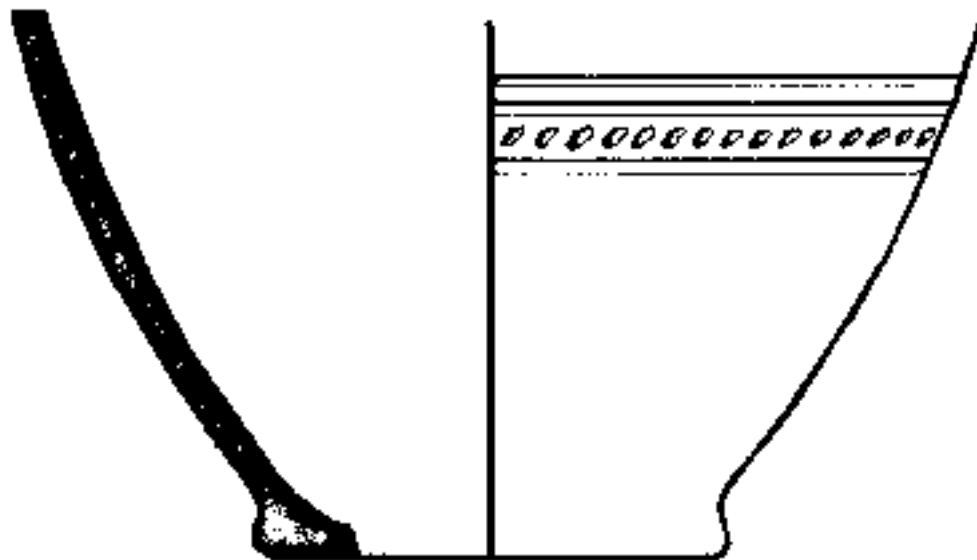


Fig. 2

Scale 1/2

HEMPSTEAD WOOD, FRAMFIELD TQ 490 216

Here we were kindly permitted to dig by Messrs. Pratt Bros. The site consists mainly of overgrown coppice woodland at the junction of two small streams, one with fairly steep banks. There is bloomery slag on the slope to the stream, thinning to a scatter at the top. It would appear that originally the main heap was on the top of the slope and from it some was eroded down the slope. The main heap was then removed.

A number of small trenches totalling 12sq.m. were dug at the top, middle and foot of the slope where tree roots permitted. Clay subsoil was reached at 20cm. and five sherds of Romano-British pottery were found at 15-20 cm. depth.

HIGH HURSTWOOD

Site 1 Front Wood. Bevingford. TQ 4399 2460 This wooded site is on the NW bank of a stream above its confluence with a tributary from the NW. Along the valley, for some way above the site, are what appear to be opencast quarries cutting into the NW. bank. It is surmised that these were dug for ore. The area covered by charcoal-impregnated soil and slag extends from the tributary stream valley on the SW. to some 16m. or so N. and from the Front Wood boundary fence on the W., down to the stream. Badgers' sets have been dug in the slag heap.

A trench 2 by 1m. was dug approximately at right angles to the stream near the N. end of the area. The fill was found to be the usual mixture of bloomery furnace waste, i.e. tap slag, cinder, roasted ore, and pieces of burnt clay furnace lining. Undisturbed subsoil was reached at 35-40cm. Six sherds of Romano-British pottery were found at an average depth of 14cm. (Figs.3-5).

One rim sherd was from a straight-sided vessel (Fig.3) and another had a faint lattice pattern (Fig.4). All appeared to have had a painted surface. Another interesting find was a piece of clay furnace lining pierced with a hole of 2cm. diameter to act as a tuyere.

We are grateful to Mr W. T. Grant for allowing us to excavate.

Site 2 TQ 4853 2618 Here, on a grass ley on the N. edge of an old quarry, is a scatter of slag and cinder, much of it apparently spread by the plough. Where the accumulation appeared to be deepest a trench 3 by 1m. was dug to a depth of approximately 30cm. to the

FRONT WOOD, HIGH HURSTWOOD



Fig. 3

Scale 1/2



Fig. 4

Scale 1/1



Fig. 5

Scale 1/2

natural. The fill was sticky clay but full of bloomery slag, cinder and roasted ore with a few pieces of furnace lining. Unfortunately no pottery was found.

We are once again grateful to Mr R. J. Llewellyn who not only told us of the site of this bloomery but allowed us to dig there.

VISIT TO TUDELEY BLOOMERY, KENT

Wealden Iron p.220

On March 3rd 1979, by kind permission of the Somerhill Estate, a visit was made to Tudeley in an attempt to find the bloomery site described by Straker, and, if found, to assess the probability, or otherwise, of it being subject of the published accounts of 1329-61 (*Archaeologia* Vol.64, pp.145-64).

Following Straker's map, a search was made along the streams W. of Tudeley village from TQ 618 456 upstream to the junction at TQ 619 452. From here the W. stream was followed for about 750m. and the E. stream for about 1.5km. A small bloomery site was found at the top of a steep bank on the left bank of the stream at TQ 6165 4395 with slag spilling down the long bank into the stream. This site in no way tallied with Straker's description, and was a long way from his map marking.

A much more promising site was found at TQ 6202 4470 which approximated to Straker's map and fitted his description. Here, in coppice woodland, a tributary enters the main stream on a bend, and for the last 50m. cuts through a deep bed of large cinder, some of which has been washed down into the main stream. On a tongue of land between the two streams there is a possible levelled platform and a small circular depression resembling a mine pit.

The ploughed field immediately E. of the site (TQ 622 447) was examined and a wide scatter of cinder and tap slag found on its surface. It was thought that this could have resulted from the cartage of slag from the bloomery to an existing lane at the end of the field.

The Group felt that there was a reasonable certainty that this was the site found and described by Straker and believed by him to be the Tudeley medieval bloomery. While there seemed to be a strong probability that his diagnosis was correct, this cannot be brought nearer to proof except by the excavation of datable medieval artifacts.

EXPLORATION OF AREA NORTH OF POUNSLEY AND SOUTH OF HADLOW DOWN

Here three valleys were explored.

1. Starting at Pounsley (TQ 527 219). this was followed up to TQ 532 237, passing the Roman bloomery at TQ 5250 2220, where Samian pottery was found by the Group several years ago. A further small bloomery was found at TQ 5318 2327. Here slag was scattered on the edge of the field adjoining the right bank of the stream but with the main concentration in the stream bank.
2. In this valley a start was made at TQ 540 224, following the stream to a confluence at TQ 537 224 and then proceeding north to about TQ 539235. The first bloomery site found was just south of Dewbrook Farm at TQ 538 225. Here there was a scatter of slag over a flat area c.20m. across, with concentrations at some points. Perhaps a large heap had been carted away. Marshy ground separated the slag deposits from the stream.
Further up the valley, at TQ 538 228, a number of large pieces of slag were found on the field west of the stream, not far from the bank.
3. A stream, originating from a spring just north of Dudsland Farm, at TQ 556 227 was followed to TQ 552 222, beyond which it had already been explored on a previous occasion. Three short tributaries coming in from the south were also explored. A small amount of slag was found in the stream at TQ 552 222 but its origin could not be determined.

Bloomery Sites Reported by Members

Ashdown Forest

- TQ 455 286 Scatter of slag.
TQ 458 284 Fairly widespread concentration of slag at head of a gill.
TQ 4739 3192 Slag can be seen at water level along 4m. of stream.
TQ 4576 3231 Slag can be seen in right bank of stream above Newbridge.

Herstmonceux

- TQ 632 152 Slag on stream bank among which Romano-British pottery
(inf. W. Beswick)
TQ 642 129 Slag found
TQ 627 123 Slag found.

NB If you are directed here from the index,
High Hurstwood is in Buxted parish

High Hurstwood

- TQ 493 277 Slag scattered on field near boundary ditch running to main valley.
- TQ 4853 2618 Large concentration of slag scattered by plough at edge of old quarry. (See above for excavation here).
- TQ 4847 2616 Small scatter of slag along boundary of above field.

Mayfield

- TQ 576 268 Slag in stream.

Cuckfield

- TQ 296 237 Slag on field surface near Highbridge Mill.

Water-powered sites visited by WIRG.

WALDRON FURNACE TQ 566 181

Wealden Iron pp.381-2

The site of this furnace can be approached by a public footpath either from the N. or from the S. through a house garden. The pond is now dry, but the bay, c.80 yards long, is in good condition except where broken through by a small stream at the E. end and the main stream at the W. end. It is c.8 feet high, at both upstream and downstream sides. This may be due to an ornamental pond having been dug, S. of the bay, within the last 10 years and the spoil dumped on its S. side, which has at present a slightly irregular appearance.

Not much glassy slag can be seen except that which has been heaped on to the bay itself, particularly at its W. end.

The channel that goes through the E. end of the bay only continues a short way S. and suggests the site of a wheel pit and a culverted race. Molehills near this end of the bay show intensely black soil.

Where the main stream cuts through the W. end of the bay there are clay roofing tiles and Tudor bricks and in the bay itself pieces of cannon mould.

An unusual feature is a hedge along the top of the bay which contains hawthorn, alder, hazel and oak, suggesting an age of c. 400 years for the hedge.

PIPPINGFORD FURNACE TQ 450 318,

Brick clamp

During the past year or so topsoil has been mechanically stripped from the bed and banks of the pond area, now dry, of Pippingford Furnace. This has revealed, on the west bank of the pond, just above former water

level, at TQ 4493 3141, an area of intense red burnt soil. This consists mainly of disintegrated brick but contains some larger pieces of broken brick, some showing over-burnt glazed surfaces.

From a number of these broken pieces it was possible to determine that they had an average width of 106mm. and a thickness of 53-64m., and all were of rough finish. Their size made it likely that they were of later than Tudor date.

It seemed obvious that the site was that of a brick clamp and a vertical section cut down from the surface showed that the red layer was 100mm. thick and below it was 80m. of almost solid charcoal resting on undisturbed subsoil.

Some samples of the bricks were taken to Pippingford gun-casting furnace, some 160m. to the north, and compared with those used in part of its construction. They were found to be alike in size, colour, and quality, and indeed a slight longitudinal groove along the thickness appeared on samples from both sites. There seemed little doubt that the brick clamp had been used to make bricks for the furnace.

Cannon moulds

Fairly widely scattered over an area just south of the above brick clamp but slightly nearer the pond site, were found a number of pieces of cannon mould. It is difficult to account for them in this position, so far from the furnace.

The Bay

During the past year bushes and undergrowth covering the south (pond side) of the bay, have been removed to facilitate survey work This has disclosed a substantial stone revetment all along the face which appears to be original and was not visible when the furnace was excavated in 1974. (*Post-Medieval Archaeology* 9(1975), 1-37).

Bloomery Furnace Experiments

R. J. Adams

(A summary of bloomery furnace experiments carried out by members of the Wealden Iron Research Group under field conditions in 1978 using charcoal made on the site and Wealden clay-ironstone ore.)

Owing to the wet spring the furnaces had to be built entirely above ground and the driest possible site found.

The first experiment was on May 20, reported in *W.I.R.G Bulletin* 14, using a shaft-type furnace with a single bellows, and a charcoal to ore ratio of 4:3. 110lb. of ore and 9 hours blowing yielded an 8lb. iron bloom (now in Anne of Cleves House, Lewes).

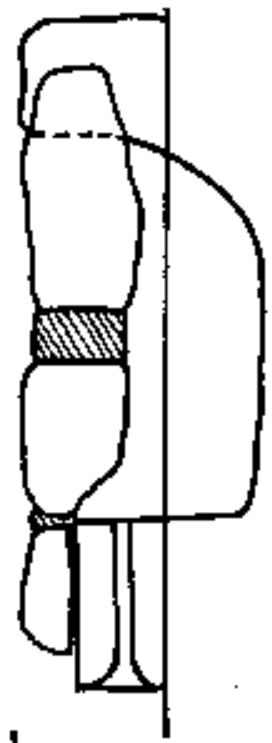
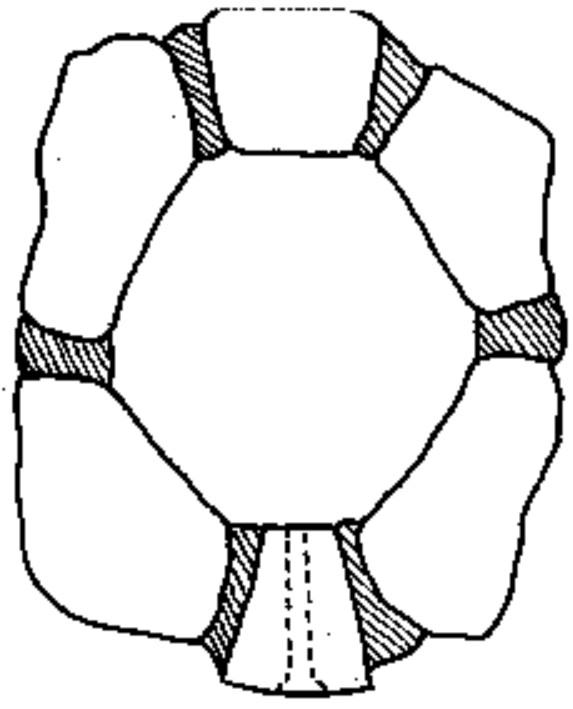
The next attempt was on August 12, using the same furnace, but with a 3:3 ratio, 72lb. of ore and blowing for 5 hours. No usable bloom was made, but the slag block went rusty after rain. The post mortem showed that the blast had been spread out by a slag baffle that built up undetected in the furnace. We were fortunate in having Dr and Mrs Tylecote and many W.I.R.G. members present at this attempt.

On September 9 a new furnace 12in. diameter and shorter, was used. At a 3:3 ratio 60lbs of ore was used. Initial difficulties arose when damp charcoal caused the pre-heated furnace to cool off. 5 hours' blowing produced a 3½lb. bloom.

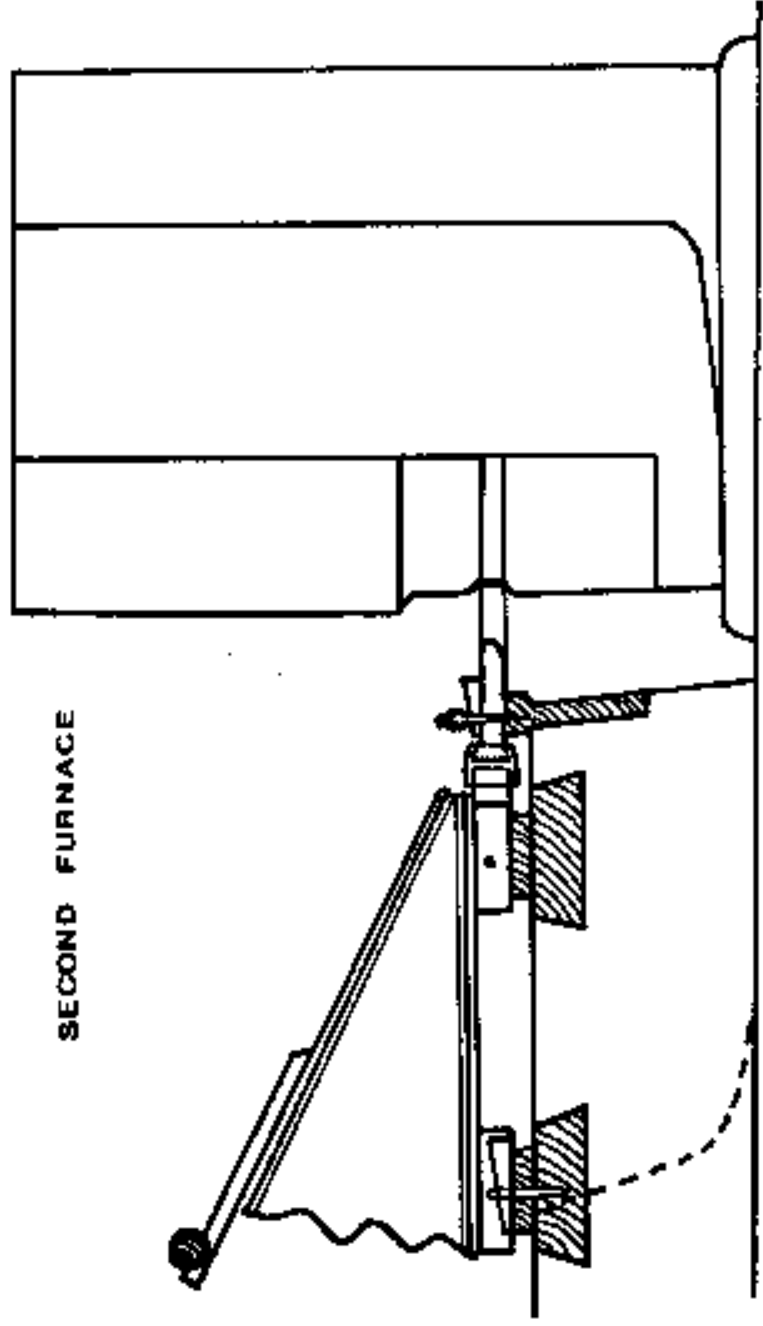
The same furnace was used on October 7, when the tuyere was placed 2" higher than before. This was done to allow more room for slag to accumulate, in case it should be too sticky to run out when a high charcoal to ore ratio of 4½:3 was being used in an attempt to make steel. The bellows were for the first time arranged to have a non-return valve on the outlet, and it was found that only light blowing was needed to maintain a high temperature. 5½ hours' blowing produced a 5½lb. steel bloom. At the finish of blowing slag could be seen running down the furnace wall into the tuyere, which when stripped down was found to be blocked with slag. Identical pieces of tuyere blocked with slag were found in the excavation of a Romano-British site at Chillies Farm, Crowborough (See *W.I.R.G Bulletin* 13, p.7). By December 16 we had built a re-heating hearth based (with some imagination) on the remains of one excavated at Pippingford Cow Park. Using the furnace bellows and a clay tuyere, an attempt was made to forge the steel bloom into a usable condition.

On reaching a near-welding heat most of the bulk of the bloom disappeared into the fire, leaving a nucleus of dense metal about tennis-ball size. After several re-heatings and forgings, first on a wooden block and then on an iron plate, the metal ended up as a small billet 2½ in. long and 1½ in. square. This was quenched from red heat and left in the hardened condition. It seems to be reasonably good steel.

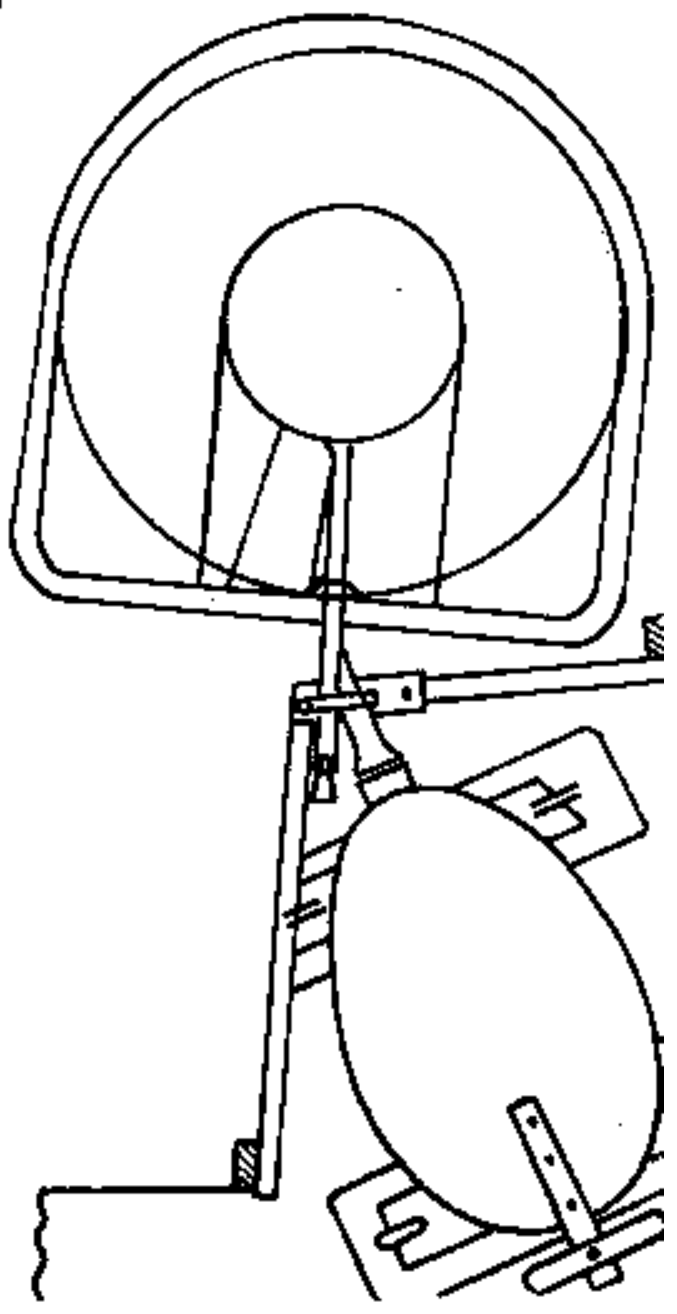
RE-HEATING HEARTH

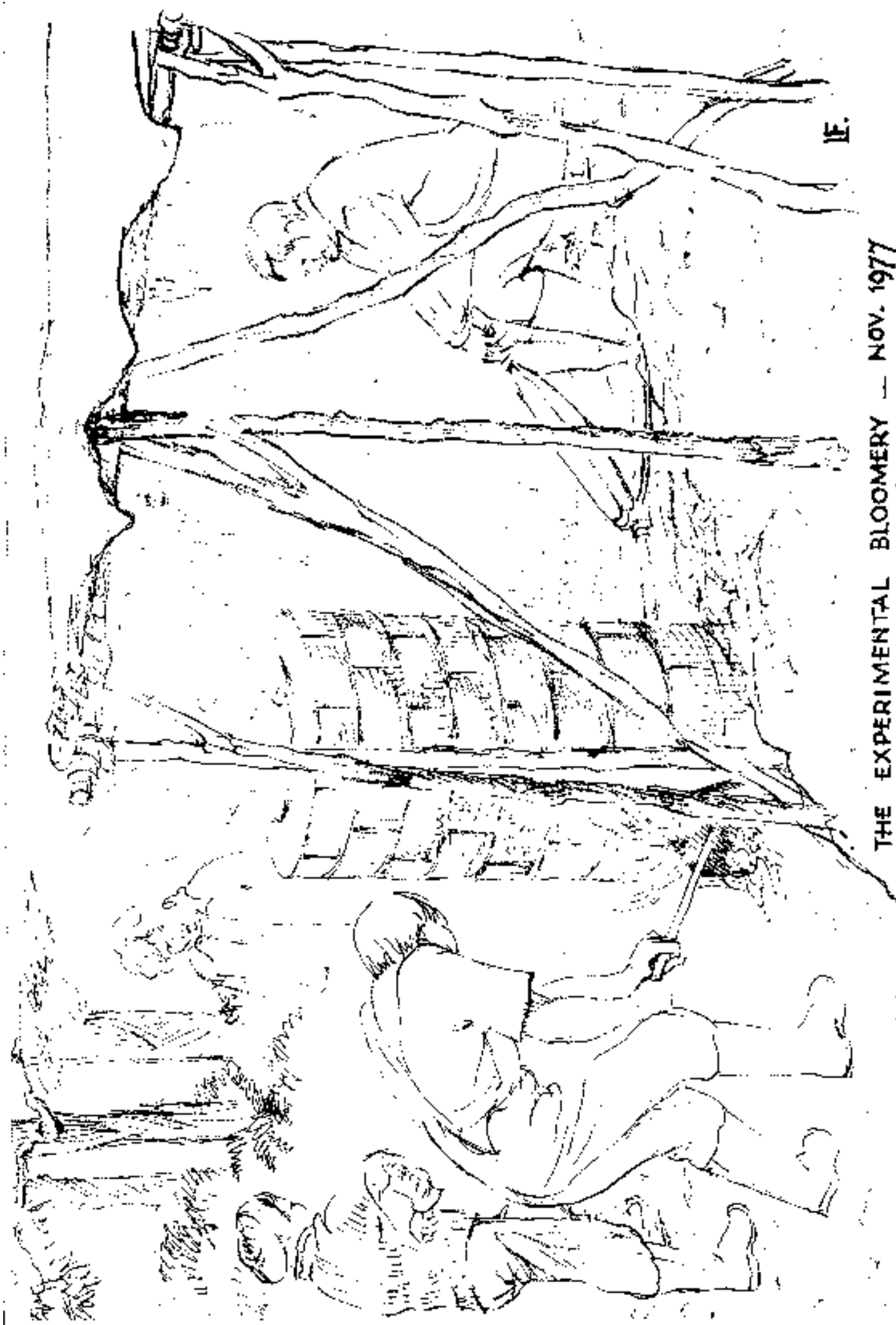


SCALE - ABOUT 1/10



SECOND FURNACE





IF.

THE EXPERIMENTAL BLOOMERY — NOV. 1977
SEE BULLETIN 14 PP 9-10

Investigation of the re-heating hearth after the forging revealed a surprisingly large lump of cinder which looked like tap slag but with vertical dribbles that have been identified on sites. Some small pieces of detached slaggy bloom were also picked out of the charcoal dust. On forging, these produced a further 5oz. of usable steel; one small sphere about $\frac{5}{8}$ in. diameter was forged into two small penknife-sized blades; all the pieces hardened when quenched. A total of 11lb. 9oz. of steel was produced, using 60 lb. ore

20 lb. pre-heating charcoal

90 lb. smelting charcoal

28 lb. forging charcoal

The weights given above are in pounds, the unit most convenient when charging the furnaces i.e. 20 3lb.; ore charges per smelt.

With all the experiments the ore size was about $\frac{1}{2}$ in. diameter down to dust, previously roasted to dull red heat in the charcoal pit; very little unreduced ore was left in any of the furnaces.

The main reason for the present small yield of iron appears to be re-oxidation of the forming bloom when slag tapping is carried out; perhaps greater experience will overcome this.

Fortunately Mr Brian Herbert has been able to provide temperature-measuring equipment and much help. My thanks also to Mr David Crossley and W.I.R.G. members, and to Mr and Mrs Tebbutt for providing the fine site, refreshments and materials etc.

Excavations in the Iron Age Hill Fort and Roman-British Iron-working Settlement at Garden Hill, Hartfield, East Sussex (1968-1978).

J.H. Money and A.D.F. Streeten

Introduction

Garden Hill,¹ part of an area known as 'The Park', is a NE-pointing spur of high ground 1½ miles (2.4km.) east of Wych Cross and 3½ miles (5.6km.) SW of Hartfield (in which parish of East Sussex it lies), between 500 and 550 feet above sea level. The nearest towns are Tunbridge Wells, 10 miles (16km.) north-east, and East Grinstead, 5 miles (8km.) north-west. The ground falls away fairly steeply on the north, south and east sides of the hill, but there is a level approach from the west. The subsoil is Ashdown Sand. The top of the hill is mainly flat, growing luxuriant bracken, with a sprinkling of trees, chiefly sweet chestnut and birch, but including a few very old yews.

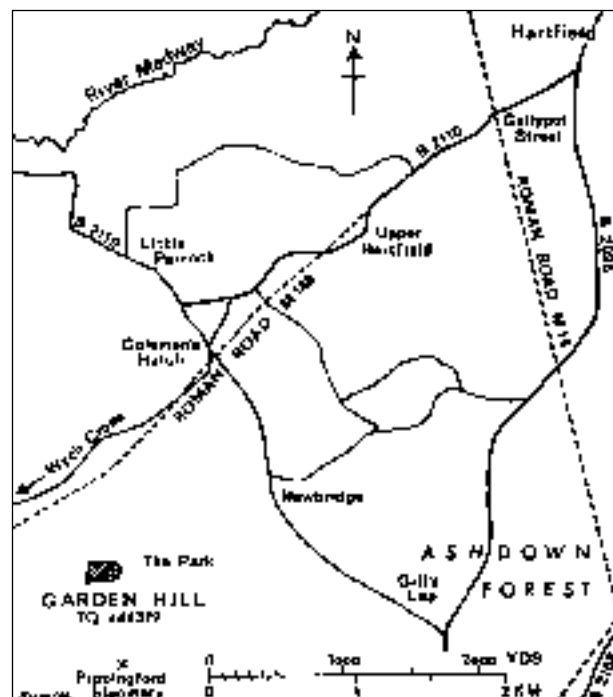


Fig. 1. The location of Garden Hill

Garden Hill lies near a minor Roman road (Margary 148), which in turn connects with the main London-Lewes road (Margary 14) at Gallypot Street.² If, as is likely, a road linked the Romano-British settlement to Route 148, it would probably have been on the NW side, where the intervening ground is flat. (Fig.1).

It is clear from the archaeological excavation that sometime in the past the hill-top was lightly ploughed and, as part of The Park, it may have been under grass. At present, Garden Hill lies within the Army Training Area of Pippingford Park and is owned by the Ministry of Defence.

In 1968 our Chairman, Mr C.F. Tebbutt, discovered the earthwork, which encloses an oblong area of about 6.8 acres (2.7 hectares) on the hill and has been proved to be a late Iron Age hill-fort with a typical inturned entrance at the NE corner there is possibly another entrance at the NW corner.

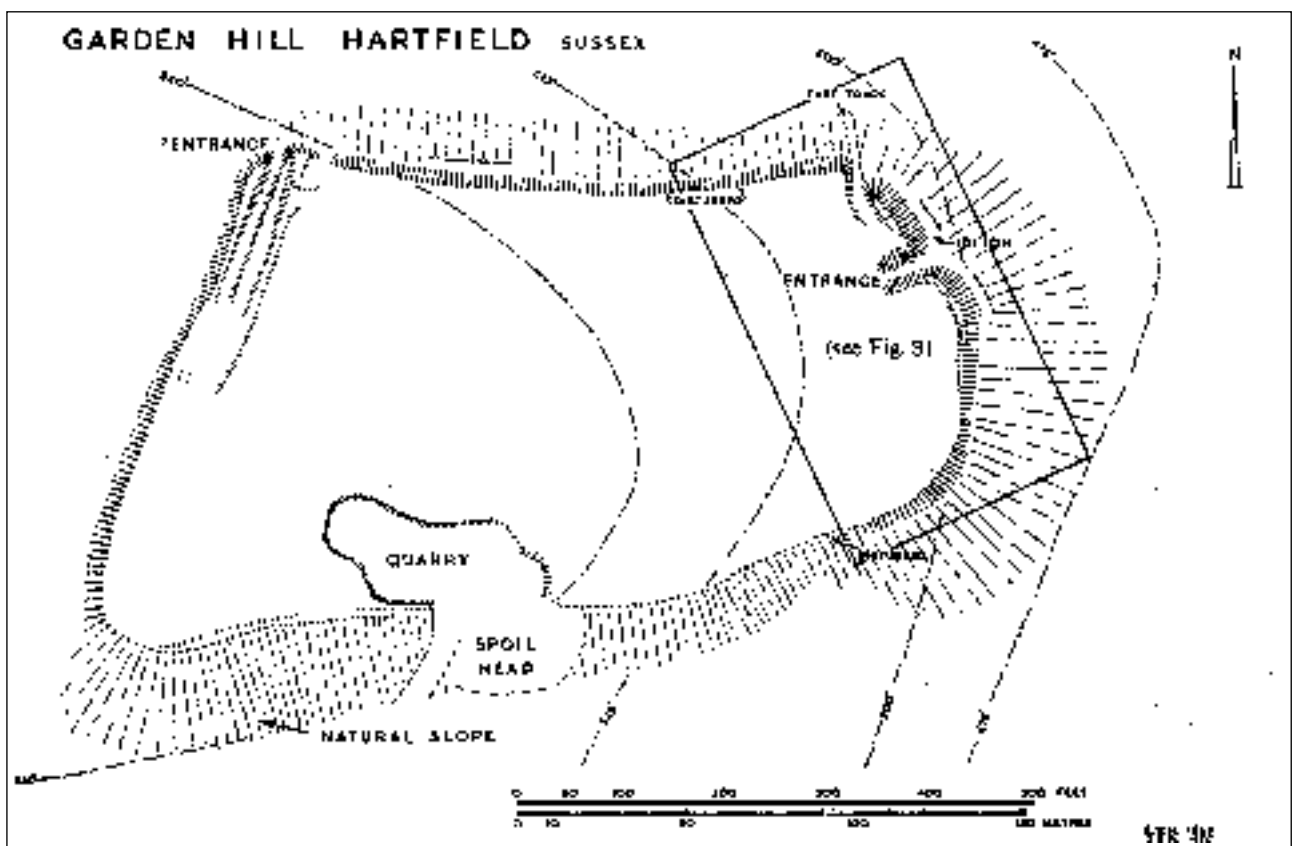


Fig. 2. General Plan of Garden Hill

After promising trial excavations in the SE corner by Mr Tebbutt, in which first-century AD Romano-British material was found,³ the earthwork and the area which it enclosed were scheduled as an Ancient Monument by the then Ministry of Public Buildings and Works, fenced off from the rest of the Training Area and placed out of bounds to troops. The earthwork was surveyed and a plan drawn by Mr E.W. Holden (Fig. 2).

In 1972, a small group, directed by Mr J.H. Money and Mr Tebbutt, investigated an area where buried structures were evident and excavated what turned out to be a small but complete 2nd-century AD Romano-British bath-building.

Following these encouraging results the Garden Hill Excavation Group was formed with the support of the Sussex Archaeological Society, and excavation on a much larger scale has taken place annually since 1973. These excavations have produced evidence of Neolithic/Bronze Age/Early pre-Roman Iron Age occupation of the hill-top and uncovered remains of the late pre-Roman Iron Age and a Romano-British iron-working settlement of the first, second and early third centuries AD.⁴

Summary of Work

After seven years the following chronological account can be given. Reference is made throughout to the gridded plan at Fig.3.

Period I (Neolithic/Bronze Age/Early pre-Roman Iron Age)

An assemblage of 500 pieces of flint includes 68 scrapers, a tanged arrowhead and two transverse arrowheads, part of a polished axe, two knives, two ground-edge blades and 45 other retouched pieces. In 1978 one microlith (a narrow obliquely blunted point) was found. This represents the first positive indication of a Mesolithic presence, although not necessarily occupation, on the site. All the remaining artifacts can be placed in the Neolithic/Bronze Age period. There are also 31 complete and fragmentary 'pounders' or 'rubbers' of a type which has been found on other prehistoric sites, principally Neolithic. They could, however, relate to any period in the occupation of Garden Hill.

In and under the rampart of the late Iron Age hill-fort a few pieces of Bronze Age pottery and other sherds which could be of early Iron Age date were found.

Fig.3. Detailed plan of east end
of Garden Hill

Period II (late pre-Roman Iron Age)

Late pre-Roman Iron Age occupation is indicated by two round-houses (Building D in G9/H9 and Building G in J10/K10), both about 36 feet (11m.) in diameter and established on an artificially levelled area. The perimeter of Building D was marked by narrow grooves. Building G had two entrances, one on the east and the other on the west. There was a centre post and a variety of posts and stakes round the perimeter. In the light of the now-completed work on Building C, it is clear that parts of Building D require further excavation, and this will be done in the current season.

The fort itself (Fig.2) was mainly univallate but probably bivallate on the west, where the approach is across level ground. The inturned east entrance had stone-revetted and palisaded banks, through which ran a metalled road; there were two sets of stone-packed gate-posts (D2/D3/D4).

Stratified pottery from the old land surface under the rampart included a few sherds which could not be earlier than the mid-first century BC and are more likely to be first century AD. This may be the period of the fort; the circumstances which prompted its building are not known.

A section cut through the bank and ditch (B1/B2/B3) just north of the entrance showed a stone-revetted and palisaded rampart behind a broad flat ditch. The absence of significant silting between the bottom of the ditch and fallen revetting stones suggests that the fortifications of Garden Hill collapsed or were thrown down soon after their construction. There was no evidence that the defences were ever used again or the settlement refortified.

Period III (Romano-British: late first/early second century)

The earliest Romano-British remains are the foundations of a rectangular building (Building C in F8/G8/H8) measuring 11 by 30 feet (3.3 by 9m.), with which are associated many iron nails. Subsequently the ground immediately to the west of Building C was roughly floored with stone chips (G8/G9/F8/F9) and bounded on the south by a line of posts, which may represent a fence. The round-house (D) must by this time have been demolished.

Absolute dating is difficult, but Dr M. G. Fulford (University of Reading), who has examined all the pottery from the first six seasons of excavation, has found little datable first century material apart from some which is late in the century. Apart from pottery, portable finds of first century date include: a denarius of Vespasian (AD 70-72), which, being very worn, may have been dropped somewhat later; two strap-unions, a penannular brooch and two 'dolphin' brooches, all of bronze. Period III occupation, therefore, probably belongs to the late first/early second century.

Period IV (Romano-British: second century)

Associated samian pottery suggests that during the second century a timber building (Building B in G6/G7/G8/G9) measuring 30 by 34 feet [9.1 by 10.3m.), substantial enough to be called a 'villa',⁵ was constructed on a stone platform immediately to the east of Building C (which may have continued in use) and over earlier occupation debris. Attached to it on the north side was a bath-building 30 feet (9m.) long, of stone and with a tiled roof [Building A in F5/F6/F7). Building B had an entrance in the SW corner of G7, giving access from the cobbled area of the forecourt, and through Building C (if this was still standing). At the rear was another entrance, and possibly a small room incorporating the platform in H5 and the protruding stone foundations in H6.

The Bath (F5/F6/E7) had a long stoke-hole with position for boiler, a hot room with bath annexe, tepid room, cold room and cold plunge. The cold room had walls plastered with *opus signinum* surviving to a height of about 6in. (15cm.), and flooring of local sandstone set in orange-red clayey mortar; there was a quarter-moulding at the junction of wall and floor; the room was drained by a lead outlet pipe. The cold plunge, which had a step, was also plastered with *opus signinum* surviving to a height of 18in. (46cm.), floored with sandstone slabs and provided with another pipe. The outlets of both rooms drained into gullies, one of which led into a sump near the bath, and the other (D6/E6) ran downhill into a pit (D5) near the Iron Age entrance, which, even if still used for traffic, can no longer have been part of a defensive system.

What were left of the *pilae* of the hot room were made of tiles. In the debris of the hot room the remains of 18 baked-clay 'spacers' were found, one still threaded on its iron hold-fast, for use in the vertical hot-air flues.⁶ In the tepid room, where the heat would not

have been enough to disintegrate the local sandstone, some of the *pilae* were of this material rather than the more expensive tiles.

The construction of the bath as a whole was rough and has the appearance of a local attempt at copying a smarter Roman original.

Beside the cold plunge, fragments of an almost complete pane of Roman window-glass (9¹/₄ by 10in.; 23.5 by 25.5 cm.) were found, and this is described by Dr D.B. Harden, as 'a piece of prime importance for Romano-British archaeology'; it has been acquired⁷ by the British Museum. There may have been other panes in the bath-building, and there were certainly a number of panes in the villa. Fragments of window glass have been found on the platform of the villa and elsewhere on the site. The largest pieces, representing several panes, were found in two pits (E2 and E3), probably water reservoirs, where they were dumped with other rubbish when the settlement was tidied up at a later date (see below).

North of the bath there were two other pits (D5 and E/F5); the former was probably a sump at the end of the drain of the cold room/cold plunge and the latter a reservoir for bath-water.⁸

Period V (Romano-British: following period IV)

Until the 1978 excavations the evidence suggested that the final phase at Garden Hill, represented by Building H, the hearth in K3, the pit and hearth in G7, and the re-use of the hot room of the bath-house for purposes other than bathing, was one of decay. Buildings A and B had collapsed or been pulled down, and debris from them used to fill earlier pits; those in D5, E2, E3, E/F5 and K3 all contained debris from the villa and bath, and the infilling of those in K6/K7, J9/K9 and K10 may also be contemporary.

This now seems to have been part of a widespread tidying-up and levelling operation, indicating more substantial occupation, probably based on Building E (L9/L10/M9/M10), which was previously attributed to period IV. This building, which measured 30 by 40 feet (9.14 by 12.80m.), was of timber resting on stone pads; there were posts as if to support verandahs on the north and west sides, as well as internal posts. Part of the building lay over earlier flattened ore dumps. The fence which runs N-S down the east side of the site belongs to this last phase. So also may the timber structures and fence systems adjacent to Building E (see below).

Iron-working (Romano-British)

Iron-working at Garden Hill is represented by quantities of natural ore (K10, K11, L9, L10, L11) dumped on or near the remains of Building G (round-house); two roasting furnaces (J9/10 and M7), of which the latter has a provisional archaeomagnetic date in the third century; two smelting furnaces (F2/F3) (Fig.3); a forging hearth (K5), with provisional archaeomagnetic date in the first century; and two small metallurgical hearths (K5) of uncertain purpose. There are three dumps of slag - one (E/F2) derived from the smelting furnaces; the second (low down in the filling of the rampart quarry K3/K4/L3/L4), from the nearby forging hearth (K5); and the third (O10/O11), of uncertain origin.

All the furnaces, hearths, ore dumps and pits were deliberately flattened or infilled before the end of the Romano-British occupation. It was hitherto assumed that most of them belonged to period III and had been put out of use in period IV, to make way for the complex of Buildings A, B and E. The excavation in 1978 of a newly-discovered pit (E2), however, compels a revision of this conclusion. The bottom of the filling included tap-slag from the smelting furnaces; the middle, window glass from the villa or bath-building, and hot-room spacers; the top, more tap-slag; there was Romano-British pottery at all levels. A post-hole found in the very top of the pit-filling, with another in the slag-pit of the smelting furnace (F3), forms part of the fence which ran N-S across this part of the settlement. These discoveries imply that the furnaces were in operation both before and after the demolition of the villa and the bath, but the F3 furnace at least must have been out of action by the time the fence was built.

Oven and hearths on rampart (Romano-British)

The Romano-British occupants made use of the clay make-up of the rampart to dig an oven, possibly for baking bread, at the SE corner of the site (L3), and two hearths of uncertain purpose, but possibly for baking or roasting, near the entrance (E2/E3). Samples of them have been taken for archaeomagnetic tests, the results of which are awaited.

The Pottery

Apart from the Bronze Age and Iron Age pottery, substantial quantities of local and imported Romano-British pottery have been found since 1972. Imports included Samian, Spanish amphorae, mortaria, Nene Valley colour-coated ware and some sherds which might be from Colchester. In date these imports range from the late first century

to the early third century. The great majority of the pottery, however, consists of local grog-tempered fabrics, represented by forms which can be related not only to late pre-Roman Iron Age types but also to forms found in the third and fourth centuries.⁹

Other portable finds

Other portable finds include: fragments of first/second century window glass (including the pane in the British Museum, another, three-quarters complete, in Barbican House, Lewes, and many other pieces, some joining, found in 1978); pieces of glass bowls and bottles; glass beads; the *denarius* of Vespasian and bronze ornaments already referred to; part of a glass-paste intaglio representing the goddess Ceres; iron nails; quartzite pebbles used as pestles; part of the upper stone of a rotary quern; and blocks of sandstone used variously as mortars and for sharpening metal implements.

Vegetation

Stratified samples of charcoal collected during the excavations show that species present in the vicinity of Garden Hill during the late pre-Roman Iron Age or earlier included oak (*Quercus* sp), ash (*Fraxinus* sp) and birch (*Betula* sp). These trees are also represented in Romano-British contexts, together with the following - beech (*Fagus* sp), alder (*Alnus* sp), hazel (*Corylus* sp), wild cherry, bird cherry or blackthorn (*Prunus* sp), and a representative of the family *Rosaceae* subfamily *Pomoideae* very similar in structure to mountain ash (*Sorbus* sp)

The function of the Romano-British settlement

From the evidence provided by the excavated features, portable finds and archaeomagnetic tests, some tentative conclusions can be drawn.

Iron-working on a small scale took place at various times throughout the Romano-British occupation from late first century until the early part of the third century, but may have been to produce mainly domestic items required on the site.

Garden Hill is likely to have performed managerial rather than industrial functions, which could have included the supervision of nearby iron-working sites like those discovered and, in two cases, excavated by Mr C.F. Tebbutt.¹⁰ Building C belongs to the first phase. In the second century there was expansion, with a timber villa (B) and bath (A), some of the water for which was collected in a number of pits. Eventually the villa and bath-building collapsed or were pulled down.

Unwanted debris from them was thrown with other rubbish into the disused pits, and the site as a whole was tidied up, levelled and reorganised. A number of fences were built, which may have been either for the penning of livestock or for enclosing the industrial areas the roasting furnace (M7) and smelting furnace (F2) could still have been in operation. The main building of this last phase was probably Building E.

Plans for 1979

The eighth season at Garden Hill will last for one month from Saturday 4 August until Sunday 2 September, with preliminary work on the weekends of 14/15, 21/22 and 28/29 July, and on Thursday 2 and Friday 3 August.

In detail it is planned

- i. to complete the rampart/ditch Section (K1/K2), pits (E5 and G2/H2) and squares (13/14/half I5), which were begun in 1978;
- ii. to excavate the southern and south-eastern fringes of the Romano-British settlement up to the crest of the rampart of the fort, in order to complete work *inter alia* on the partially explored timber structures in LMN/456 and the rampart quarry O10/O11 filled with pottery, slag and other rubbish other iron-working remains are also likely to be found.
- iii. to re-examine Building D (round-house), parts of which were not fully excavated in 1974.

Future Work

In 1980 attention will be transferred to the west end of the hill fort, where it is hoped to find prehistoric settlement undisturbed by Romano-British occupation. A suspected entrance in the NW corner and the western defences, which, because the approach is level, are likely to be more substantial than in the east, will also be examined. At the same time any residual tasks in the Romano-British settlement will be completed.

Publication

Full publication will eventually be in *Sussex Archaeological Collections*. An interim report was published in 1977 in *Britannia* VIII, and private interim reports will continue to be printed annually until the work is complete.

Footnotes

1. In the Parliamentary Surveys of Sussex (1658) the hill is called "Gardine Hill", see *Sussex Archaeological Collections (SxAC)*, 23 (1871). 251; the late 18th-century Hartfield parish rate-books call it "Garden Hill".
2. I.D. Margary, *Sussex Notes and Queries* xvi, 330 and *Roman Roads in Britain* (1973), 37 and 59-62.
3. C.F. Tebbutt, "Garden Hill Camp, Hartfield", *SxAC* 108 [1970], 39-49.
4. J.H. Money, *Current Archaeology* 41 (1973), 185-8; *Britannia* VIII (1977), 339-50; see also *Britannia* iv (1973) 321, 333; V (1974), 458; vi (1975), 282; vii (1976), 373-4; and ix (1978), 467, 481.
5. This account is based on suggestions by Dr Graham Webster.
6. Note by J. H. Money in *Antiquaries Journal* liv (1974) ii, 278-80.
7. Note by D. B. Harden, *op cit.* 280-81.
8. The E/F5 pit lies immediately under the hearth and stonework of Building H, and is not shown in Fig.3.
9. An interim report on the pottery by Dr M. G. Fulford and Mrs C. Eade is published in the article on Garden Hill in *Britannia* viii; see footnote 4.
10. C. F. Tebbutt and H. F. Cleere, 'A Romano-British Bloomery at Pippingford Hartfield', *SxAC* 111 (1973), 27-40; and C. F. Tebbutt, interim reports in *Bulletin of Wealden Iron Research Group* 11, 4-5; 12, 34; 13, 2-6 and forthcoming in *SxAC* 117 (1979).

Batsford Furnace 1978

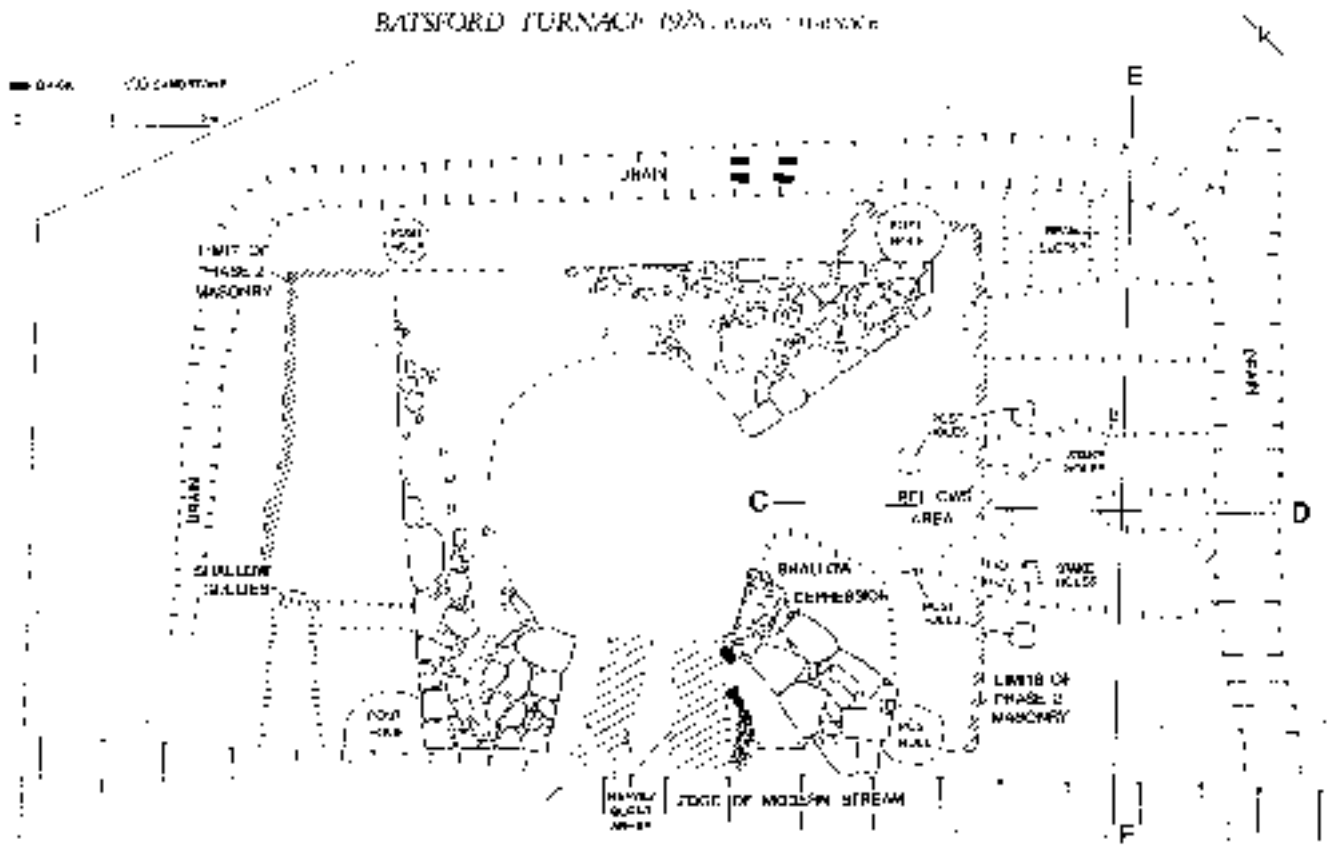
O. R. Bedwin

Batsford Furnace is one of those mentioned in the 1574 list of Wealden Ironworks.¹ The site lies in a narrow valley between the villages of Cowbeech and Rushlake Green. The bay still exists to a height of about 3m; there is no pond, however, and the stream, known as Furnace Brook, has broken through the south-western end of the bay. Considerable blast furnace slag was present in the area behind the bay, and three 'bears' were visible here, one of them embedded in the bank of the stream.

During the summer of 1978, work began in the valley on the construction of a fish farm. The tree cover was first removed, and large-scale earthmoving undertaken to form a series of dams across the valley. It became clear that any archaeological site in the vicinity was threatened with destruction. This was brought to the notice of the Sussex Archaeological Field Unit by Mr C.F. Tebbutt, and it was decided to excavate the furnace in October and November, 1978.

Trial-trenching immediately behind the bay located the remains of the furnace on a terrace cut into the south side of the valley at the extreme end of the bay, adjacent to the modern stream. The siting of the furnace in such a position is similar to that found at Chingley.² The terrace measured 15m. by 10m., and the furnace plus ancillary structures had been compactly fitted into this area.

Fig.1. Plan of the phase 1 furnace.



Two phases of furnace were identified; the first (Fig.1) was a small, well-built furnace, 5m. square. Only a single foundation course survived; this consisted of well-finished sandstone blocks. Four large, circular post holes were found, one at each corner, indicating the existence of a substantial wooden scaffold, external to the furnace masonry. The casting arch and bellows arch were well-defined. Surviving traces of the bellows structure consisted of four post holes in a trapezoidal arrangement, and two sets of stake holes, set near the ends of two shallow depressions. Of the bellows themselves, no trace survived, though about 20 short, flat-headed iron nails were found around the stake holes. These may well have been used for nailing the leather of the bellow on to their wooden frames.

Around three sides of the furnace was a shallow gully, draining at its northern end into the head of the wheel-pit (Fig.2). Its southern end, as excavated, petered out before reaching the tail-race, but since there had been a certain amount of disturbance here, it is probable that it originally drained into the tail-race. Within this drainage gully, on the south-west side of the furnace, were two pairs of bricks, on edge. These perhaps supported sandstone slabs, providing a suitable place to cross the gully.

Slight traces of the charging ramp were found, in the form of a ledge of sandstone blocks, set in the side of the valley about 2m. above the level of the terrace (Fig.2). As excavation proceeded, it was realised that the wheel-pit and tail-race had lain where the modern stream runs. The stream was temporarily diverted in order to excavate the stream bed. This revealed, unexpectedly, the remains of much of the wooden sides and floor of the wheel-pit and tail-race, with part of the waterwheel *in situ* (Fig.2). The wheel, which was overshot, measured 45cm. (18m.) across and was 3.90m. (12ft. 6in.) in diameter. Finds from the fill of the wheel-pit and tail-race included fragments of late-sixteenth-century pottery and some waterlogged leather footwear.

The second phase of the furnace (Fig.2) was a considerably larger structure, 8m. by 5.5m., though poorly built. The surviving foundations consisted of an irregular mass of sandstone (burnt and unburnt), brick, and slag lumps, constructed directly over the remains of the first furnace. The south-eastern edge of the second furnace was particularly ill-defined, and it may be that this furnace was originally faced with good-quality sandstone blocks,

BALFOUR FURNACE 1978
 PHASE 2 PLAN

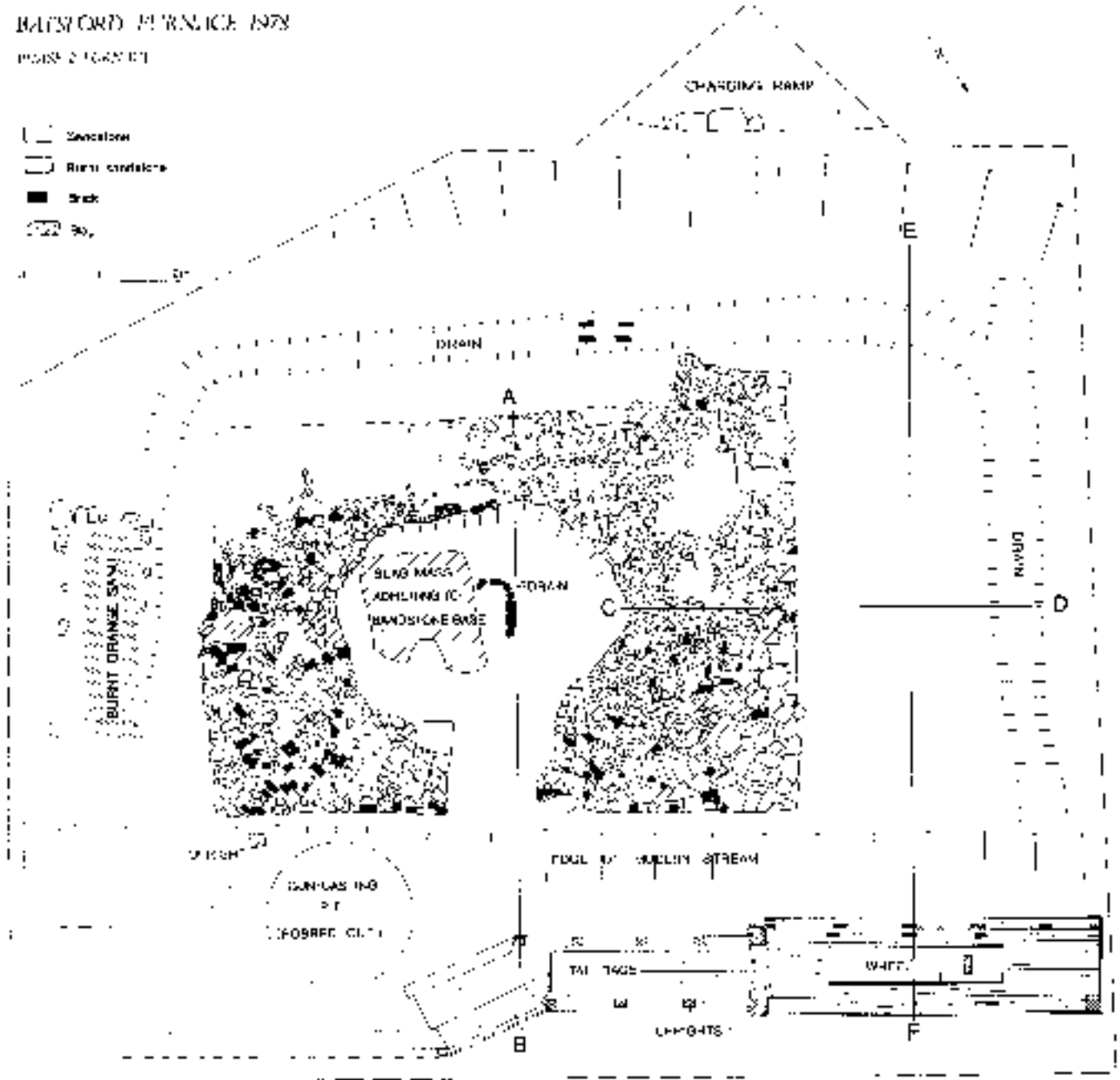


Fig.2. Plan of the phase 2 furnace.

which have since been robbed out, leaving only a rubble core. The casting arch in this later furnace was clearly defined, but the bellows arch was not, nor was there any trace of bellows structure. (Part of the phase I bellows structure was overlain by phase 2 masonry, and cannot therefore have continued in use during phase 2; see Fig.1). In the centre of the phase 2 furnace was a large mass of blast furnace slag adhering to a flat sandstone base. This presumably represents the final furnace bottom of phase 2.

Immediately outside the casting arch and offset from it was a totally robbed-out gun-casting pit. This consisted of a circular pit, 2m. across, filled with building rubble, cut into the clay subsoil. No trace of lining remained *in situ* though part of a single wooden hoop of the type found at Maynard's Gate³ was recovered from the rubble fill. The gun-casting pit was not fully excavated because of the danger involved in digging out a deep feature in unsupported waterlogged clay. Probing established that it was at least 2m. deep.

The discovery of the gun-casting pit threw light on the interpretation of another feature. Adjacent to the south-east wall of the furnace was a narrow, rectangular patch of heavily burnt sand, about 2m. long, enclosed within an incomplete rectangle of sandstone blocks (Fig.2). The appearance of this feature suggested that it was an oven or a hearth. The presence of the gun-casting pit strongly supports the idea that this is the first excavated example of a hearth for drying and baking cannon-moulds immediately prior to the manufacture of cannon. The size and shape of this hearth, and its proximity to the gun-casting pit all favour this view.

Documentary sources indicate that 7 acres of marshy land at Clippenham (a nearby farm) were leased for the construction of a furnace in 1574.⁴ It is not clear from historical references, however, when the furnace went out of use. The complete absence of clay pipe fragments from the excavation indicates that the furnace is unlikely to have been working after 1620/30.⁵ Batsford Furnace would therefore seem to have been in existence for 50 years at most, and it could have been much less. During its period of operation, the furnace was completely re-built at least once, on the archaeological evidence.

The manufacture of cannon does not seem to have been an original function of the site, for two reasons (i) the hearth, which, it is suggested, was used for baking the gun-moulds, was built directly over the top of the drainage gully running round the furnace (Fig.2), and (ii) the tail-race appears to have been diverted from a straight course to accommodate the gun-casting pit. It is plausible to connect the enlargement of the furnace with the conversion to cannon-manufacture, though no stratigraphic proof of this was obtained during the excavation.

I would like to thank the many members of WIRG who helped on site at Batsford. It is hoped to publish the full report in *Post-Medieval Archaeology*.

References

1. E. Straker, *Wealden Iron* [1931), p.360.
2. D. W. Crossley, *The Bewl Valley Ironworks*, Royal Archaeological Institute Monograph. 1975.
3. D. Bedwin, 'The excavation of a late 16th/early 17th century gun-casting blast furnace at Maynard's Gate, Crowborough, East Sussex 1975-76', *Sussex Archaeological Collections* 116 [1979), forthcoming.
4. C. Whittick, pers. comm.
5. D. R. Atkinson, *Sussex Clay Tobacco Pipes and Pipemakers* [1977).

Reviews

C. F. Tebbutt

Cannon Boring by Animal Power

***Animal Powered Engines* J. Kenneth Major. Batsford 1978. £5.95**

Human inventiveness produced a great variety of machines to reduce human labour that could not, in the days before steam, be conveniently served by the natural power sources of wind, water and tide. These were powered by human labour and a variety of animals, mainly the horse, donkey and dog. This book describes many such machines covering industrial and agricultural processes, from medieval to recent times.

Much has been learnt of the process of early cannon boring in the Weald through the excavations and finds of WIRG members, but this always involved the use of water power. It is therefore interesting to learn that in the 18th century some cannon boring machines were powered by horses, and this book contains an illustration of such a machine taken from Diderot's 18th-century encyclopaedia. The boring machine is a vertical one and the process is described thus:-

'The cannon is held rigidly in a heavy frame so that it can be lowered as the work progresses. The boring tool is mounted at the head of an upright shaft which is turned by two horses harnessed to arms at its lower end. As the tool turns the cannon is lowered by men operating a pair of single rim tread wheels.'

It is stated that such a machine was used at John Wilkinson's Bersham Foundry near Wrexham, where the two-storey boring house still remains.

It is interesting that the techniques evolved for cannon boring were adapted to cylinder boring in the age of steam.

There is much else in the book to fascinate those interested in early forms of machinery.

Wealden Ironmasters in the Age of Elizabeth

The above is the title of a chapter contributed by Dr J. J. Goring to E. W. Ives et al (eds), *Wealth and Power in Tudor England* (Athlone Press, University of London, 1978), and is a confident and succinct account of his subject. This confidence comes from a thorough and exhaustive research into many of the surviving relevant documents that throw light on the Elizabethan ironmasters, their business methods, financial success or otherwise, social aspirations and religious beliefs.

The author first explains what he regards as the definition of an ironmaster, actually not a contemporary term, and accepts J. W. Gough's definition of an industrial entrepreneur from his *The Rise of the Entrepreneur* (1969): 'He is more than just a manager; he is a leader in business, an initiator, a policy maker. He must either himself supply capital or have some control over the supply of it. He must also be a producer or developer and be personally involved in his enterprise, although not necessarily alone in it.' The word ironmaster, by Dr Goring's definition, is not applied to people who were merely owners or managers or ironworks but only to those who had a definite stake in the business. From the well-known 1674 lists 61 men were judged to qualify under the above definition. These again can be subdivided into tenants and owner-occupiers, and further subdivisions can be made.

The need for large amounts of capital resulted in a number of partnerships, an unusual feature in early Tudor business life but which became common in the second half of the 16th century. Some of these did not survive for long, but others provided the advantage of control over raw materials. Nevertheless most Wealden ironmasters worked alone and nearly all lived near their works, sometimes one would think uncomfortably near, and hardly any originated from outside Kent, Sussex and Surrey.

While the ironmaster might have good managerial skills, or could employ a manager possessing them, the necessary technical 'know-how' did not exist among inhabitants of this country in the early 16th century. It was therefore necessary to employ foreigners, and Frenchmen, Flemings and even Germans were recruited to manage the furnaces and forges. There would however be no problem in finding native colliers, miners and millwrights.

In the early days the business was almost entirely in the hands of peers and upper gentry operating a profitable sideline, but by 1674 this had changed and the majority of ironmasters were below the magnate class and were engaged in the industry as a full-time occupation. Whether they could be classed as yeomen or gentry often differed not only in documents but in their own and their neighbours' estimation. Some ironmasters, as they grew prosperous, nourished ambitions to rise in the social scale. Some managed to register pedigrees with the heralds and to acquire coats of arms. Others built prestigious new houses or purchased manors. A rise to the estate of an esquire was not easily accepted by neighbours with an established title, but a fortunate marriage might cement the change.

Not all ironmasters prospered. Why some failed Dr Goring has found difficult to determine. Bad debts were one obvious cause, and badly sited works probably another. The efforts by the Crown to limit by licence the manufacture of guns, and prohibit their export in the interests of national security, were only partially successful. The temptation for firms, short of orders, to sell arms illegally to foreign buyers was often too great to be resisted.

The religious side of the ironmasters' characters is a subject that Dr Goring has not missed. Most he found were protestants, and a sizeable minority puritans. Only three were known to be recusants. Even among the wealthy ones wills do not record any outstanding charitable bequests.

After what must have been long, patient, widespread and exhaustive documentary research Dr Goring has presented us with a coherent picture of typical, and some untypical, Elizabethan ironmasters. As an entrepreneur he exercised, mainly successfully, his drive and business acumen in an industrial undertaking quite alien to the locality. Many thus acquired wealth and enhanced social status, and performed a great service to their country's economic health and military security.

My only criticism is that it is a pity that a piece of local historical research of such outstanding interest is not published in a form more easily obtainable.

ERRATUM

In J. S. Hodgkinson's comments on the Carriers' Accounts of Robert Knights in *Bulletin* 14 (1978), footnote 4, page 13 should read P.R.O. W.O. 51: 211...