Wealden Iron

First Series No 5
Winter 1973

Bulletin of the
Wealden Iron
Research Group

Contents

Wealden Iron Research Group

BULLETIN

Published by the WEALDEN IRON RESEARCH GROUP

Hon.Secretary
Joseph Pettitt,
42 Silverdale Road
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READING BERKS.

Editorial

This Bulletin is to some degree an interim issue. Henry Cleere has been forced by pressure of work to relinquish the editorship, and I have agreed to assemble the material on this occasion. However, a new and more permanent editor must be found, and if anyone feels able to volunteer, the Hon.Secretary would be delighted to hear. In order to print this issue in time for the January meeting certain items, notably reviews of recent published work, have had to be held over.

DAVID CROSSLEY Acting Editor

Ore for the Wealden Iron Industry by Bernard Worssam

The principal ore for the Wealden iron industry, and the one on which certainly the blast furnace if not also the bloomery industry is based, is known as clay ironstone, and more specifically as siderite mudstone.

Clay ironstone is an older and more vague term than siderite mudstone. It means a rock with a high proportion of iron, and of fine grain size, and some association with clay deposits is generally implied. The word 'mudstone' in the term siderite mudstone refers to the grain size of the material, and does not imply any necessary relationship to clay as a mineral. In the usual scheme of classification of sediments, clay is a sediment of extremely fine grain size, silt is intermediate, being composed of grains between 0.005 and 0.05mm in diameter, while sand, a material familiar to everyone, is composed of grains larger than 0.05mm in diameter. The corresponding rock terms are mudstone, siltstone and sandstone.

Wealden ironstones are sedimentary rocks, which means that they originally formed as a sediment at the bottom of some naturally occurring body of water such as a sea, lake or estuary. Siderite mudstone is a clay ironstone that is composed largely if not entirely of the mineral siderite (pronounced side-erite). An alternative name for this mineral, not generally used since the 1930s, is chalybite. Siderite consists essentially of iron carbonate, strictly speaking ferrous

carbonate, which has the simple chemical formula $FeCO_3$. By substituting in this formula the atomic weights of iron, carbon and oxygen, which are 55.8, 12 and 16 respectively, one can calculate that $FeCO_3$ contains 48.2 per cent by weight of metallic iron. This explains why siderite mudstone was of interest to iron smelters.

Siderite as a constituent of a rock can be identified by reason of its crystalline form. The crystals are not apparent to the naked eye, however. They can only be seen in thin sections of the rock, under a microscope. The making of 'thin sections', ie.glass slides on which are mounted slices of rock ground so thinly that they are transparent, is a standard geological procedure. In thin section, siderite mudstone appears as a colourless mosaic of tiny rhomb-shaped crystals, each less than 0.005mm diameter.

As well as ferrous carbonate, siderite mudstones can also contain small proportions of calcium carbonate ($CaCO_3$) and magnesium carbonate ($MgCO_3$). From the point of view of iron-smelting these compounds are important, because they could act as fluxes. The presence of only a few percent of calcium and magnesium carbonates in the ore may have rendered unnecessary the addition of a separate flux to the furnace charge. It is because of its possible variability in composition, the exact extent of which can only be determined by chemical analysis, that a mineral name is used in preference to a chemical name, even for a material of such simple chemical composition as siderite mudstone. Possibly, too, this is why the name clay ironstone persists in use.

Fortunately for those without microscopes or portable laboratories, once siderite mudstone has been identified as a type, it can generally be readily distinguished in the field. In fresh and unweathered samples it is a light grey, fine-grained rock, very hard, breaking with a smooth fracture. Its general appearance is rather like that which cement takes on if it happens to set before being mixed with sand, but its distinguishing feature is its weight. It simply 'feels heavy' by comparison with similarly-sized pieces of more common rocks such as sandstone. Not surprisingly, since because of its high iron content the density, or specific gravity, of siderite is 3.8, nearly half as much again as that of quartz, the common constituent mineral of sandstones.

Under the action of weathering, which is effective for 10ft or so downwards from the ground surface, siderite (ferrous carbonate) becomes oxidised to limonite (ferric oxide) a dark brown mineral which looks like and is chemically similar to the rust that forms on iron. Weathering commonly starts on the outside of a lump of clay ironstone and works towards its centre, forming successive crusts of limonite, that readily break off. This type of weathering is sometimes knows as onion-skin weathering.

Clay ironstone generally occurs in round, bun-shaped lumps known as nodules, usually about 3 to 9 inches in diameter. It can also form extensive layers, from an inch or two up to 2ft thick. Although it counts as a sedimentary rock, it is not a simple, mechanically deposited sediment as is, say, clay or silt. The materials making up these latter would have been carried as particles suspended in the waters of streams that entered the former wealden lake, to be deposited on the lake bottom when the currents bearing them along lost their momentum. Iron, by contrast, was probably carried into the lake as ferrous carbonate in solution or

as ferric oxide in colloidal suspension, though the exact means by which it was transported is not certain. What probably happened was that as a deposit of mud built up on the lake bottom, it trapped a certain amount of the lake water containing iron solutions. Bacteria in the mud may have helped to reduce iron oxide to ferrous carbonate. With continual deposition of mud the pressure on its lower layers increased, so that, at possibly a few feet below the lake floor, water began to be expelled upwards from the sediment, the mud began to harden into clay, and the iron carbonate solutions, becoming more saturated, began to crystallise.

In simple chemical experiment, large crystals of copper sulphate can be grown by 'seeding' a saturated solution of copper sulphate with small crystals. The crystallisation of iron carbonate may have started in a similar way, at widely spaced centres, around scattered tiny shell fragments or the like. As each nodule grew, it would have expelled the surrounding still-fluid clay. Fine laminae of quartz silt can be seen to continue undisturbed through some nodules, giving an indication of the slowness of their growth. Many nodules also contain a little interstitial clay. Growth would have stopped when all the iron carbonate available became used up. This manner of growth explains the roughly spherical form of the nodules, flattened along the vertical axis, which was the direction of greatest pressure. It also explains the sharp contact against the surrounding clay that most nodules show. Where the amount of iron carbonate was greater than usual it would have formed continuous layers, but these layers, like the nodules, presumably formed under rather than on the lake bottom.

Clay ironstone nodules, all much alike in appearance, occur throughout the Wealden Beds. They would, however, possibly not be expected to occur in red clays, for these indicate oxidising conditions of deposition, under which ferrous iron compounds would not have survived. At a few levels in the Wealden Beds clay ironstone is more than usually well developed. Presumably at these levels more iron than usual was being brought into the basin of deposition. Ironstone is best developed

1) in the lower part of the Wadhurst Clay, throughout the central Weald;
2) in the Upper Tunbridge Wells Sand formation of the St.Leonard's Forest area, between Horsham and Crawley;
3) in the lower part of the Weald Clay, just beneath the Horsham Stone; and
4) in the upper part of the Weald Clay, at the western end of the Weald, in the Chiddingfold-Northchapel-Fernhurst area.

These separate developments appear to have been the principal sources of ore for the wealden iron industry, and all of them were worked by minepits. Because the ore is widespread, however, it is possible that other, smaller occurrences of it were exploited, particularly for bloomeries, which presumably were not so dependent as were blast furnaces on the presence of large and continuous supplies of ore.

Combeswell Bloomery – A magnetometer survey — Peter Ovenden

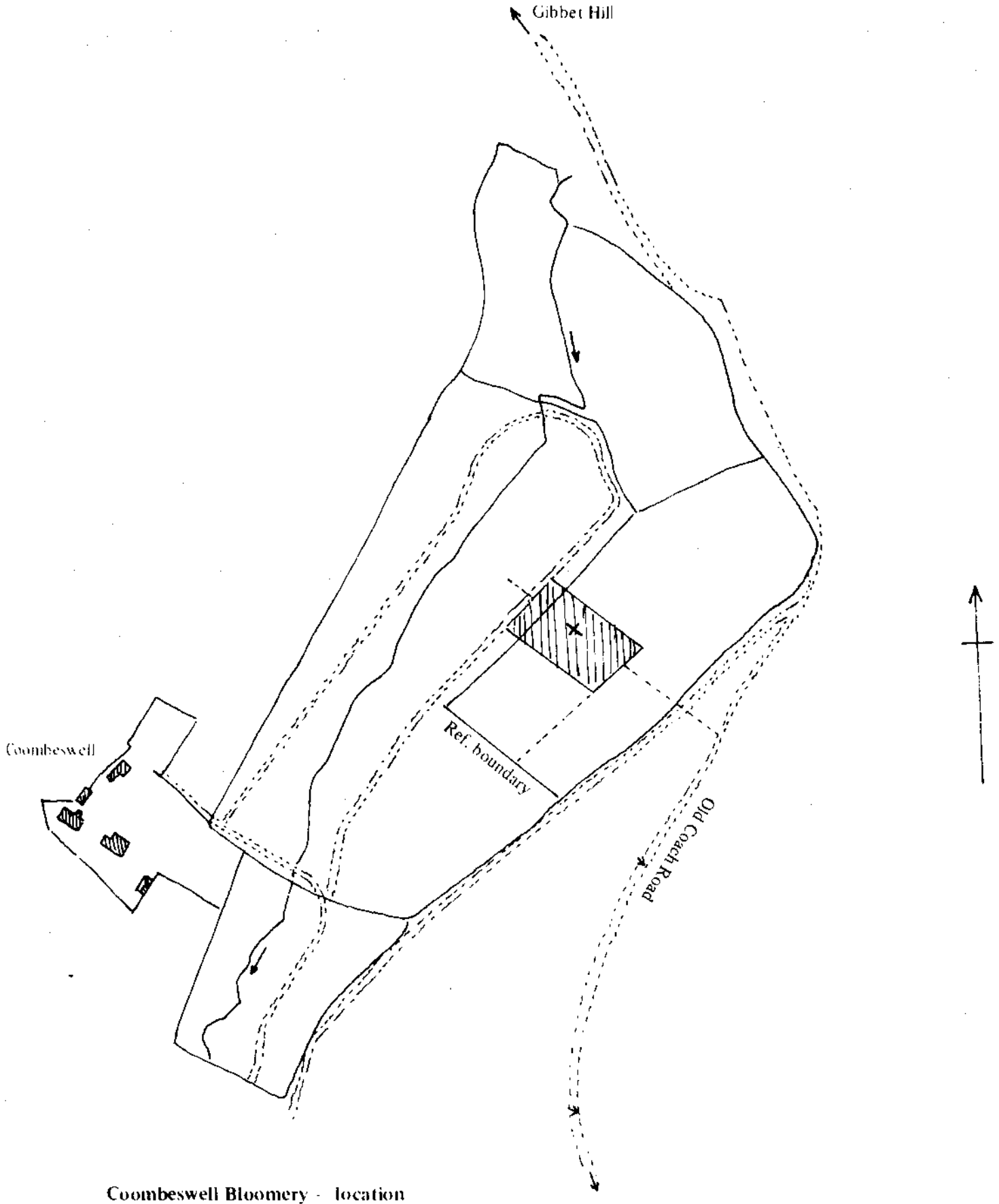
The site (SU 9015 3535) of this bloomery is a derelict field at the bottom of a small, steep-sided valley under the sandstone escarpment north of Haslemere. No surface features are to be seen except a scattering of tap-slag (Straker, type B) in a nearby ditch. Since this is not an uncommon situation with early bloomery sites it would not be inappropriate to describe, in some detail, the manner and results of a survey, made earlier this year, with a proton magnetometer kindly loaned by the Oceanography Department of Southampton University.

With the limited field of view at the site, a somewhat arbitrary procedure was necessary in laying down the reference grid derived from the southern boundary bank shown as a land parcel boundary on the 25" O.S.map (Surrey, Sheet XLIV.4). Owing to the exuberant vegetation, a secondary datum, down the long axis of the field, was unavoidable (dotted line on sketch map). As this may have introduced more error than was desirable, the other co-ordinate was laid parallel to the original reference bank, since the other sides of the field were by no means straight, through the approximate centre of the site as indicated by Mr N. Rosher, who was present at the original discovery, during tree clearing in 1949

The two ordinates were traversed, taking readings at every 2m, the full length of the dotted lines shown on the sketch map. The average of the readings outside the shaded area constituted the background count. Readings were taken, also at 2m intervals, within the shaded area, traversing in alternate directions parallel to the reference field boundary.

The magnetometer provides a five-digit readout that is related to the intensity of the Earth's magnetic field at the centre of the detector coil. The coil is hold, by means of the aluminium probe, 1ft above the surface of the ground. The count is lower the stronger is the field intensity which is locally enhanced by the near presence of magnetic material. Under the conditions of the present survey, only quantities of metallic iron or magnetite could produce significant changes in the read-out and an iron fragment, about ¼lb in weight, would have to be within 3ft of the coil to produce a detectable change in the count. Local weakening (increased count) of the Earth's magnetic field is brought about by a large number of substances which include slag, various rock formations and, therefore, building materials.

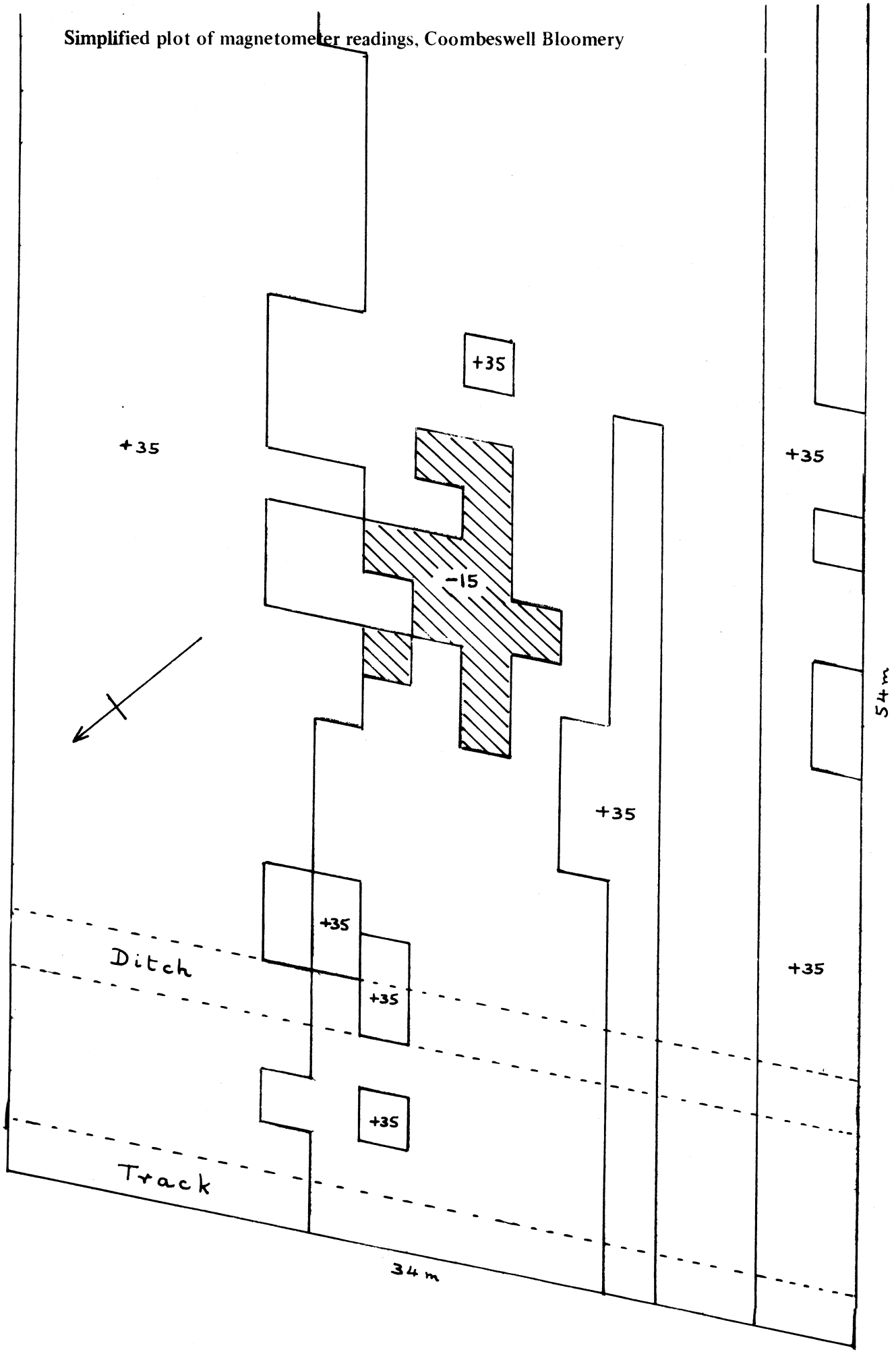
To obtain a realistic picture of the situation a few feet underground, it is essential to determine what constitutes a significant change in the magnetometer count in the locality of the survey. This was arrived at by noting the deviation of individual readings outside the grid from the combined average. On a statistical basis, any reading within the grid must be larger or smaller by twice the deviation to be significantly different from the average count. In this survey the background was 50425 with a deviation of 5, hence grid counts had to be less than 50415, to indicate the



Coombeswell Bloomery - location

(Sketch based on 25" County Series, Surrey Sheet XLIV.4, Ordnance Survey, 1916).

Simplified plot of magnetometer readings, Coombeswell Bloomery



certain presence of iron or magnetite, or greater than 50435, for the presence of any other anomaly. In the diagram, the first three digits have been omitted since they did not change over the area surveyed. Any arbitrary division of the results, e.g., dividing the range of readings into any convenient number of steps, tends to produce a more complex picture that is more difficult to interpret. As it is, the region of positive anomaly, the "iron-rich" area is unambiguous and locates the probable bloomery working area (shaded on the diagram) with sufficient accuracy for the purpose of excavation. The regions of negative anomaly (weaker field; higher count) are also well defined but, because of the manifold likely causes (v.s.), remain ambiguous.

The possibility of building foundations causing the negative anomalies on the right hand side of the diagram (S.W.) cannot be ruled out. The locality, at present, is a quiet backwater but there is evidence of almost continuous human occupation from the Stone Age until the 18th Century. Only for this reason the presence of the bloomery is not surprising; it is, otherwise, 1½ miles from the nearest clay ironstone and no evidence of the gritstone, found at the top of Weaver's Down (Straker, p.450) appears on Gibbet Hill, above the coombe. An unrepresentative analysis of a single piece of tap-slag favours the clay ironstone as the probable source. If this conclusion is subsequently confirmed then dating of the site will provide the latest date for the discovery of the clay ironstone that supplied the Industry in the Western Weald (see B.C. Worssam, Proc. Geol. Assoc., 1964, **22**, 529). Finally, the nearest source of clay, for the furnace lining, appears some distance to the S.W.in the bed of the nearby stream; at the site the Atherfield Clay is covered by a thick layer of detritus from the valley walls. At present, it would appear that the choice of site for the bloomery was made on social grounds.

Acknowledgements

The West Sussex Group is indebted, for the notification of this site, to Mr G. H. Kenyon, who kindly passed on the original (1949) correspondence with Mr .A. Chandler, the previous owner. Our debt to Mr Neville Rosher, who provided the background information, supported by an impressive collection of finds, and guidance to the site, is equally great. We would also wish to take this opportunity to record our appreciation of the active interest of the present proprietory Mr J. E. Attew.

Excavations at Pippingford 1972

A brief excavation took place in June 1972 at Pippingford Blast Furnace, Hartfield (TQ 450 316) to determine the exact whereabouts of the furnace and its wheelpit. The latter was not found, but the position of the furnace and its casting house are now clear, although the stonework has been meticulously robbed. The meagre finds from the site support the documents in E.S.R.O. which suggest a date about 1717. Work will continue on a larger scale in July and August 1973, and helpers will be most welcome. They should contact the Chairman or the Acting Editor.

D. W. C.
C. F. T.

Chingley Furnace — David Crossley

The furnace, sited at (N.G.R.) TQ 684 327 is known from documentary references to have been in operation in 1565 and 1574, and to have been derelict in 1588. It is doubtful whether it was subsequently rebuilt. It smelted iron ore from the adjacent Furnace Pit Shaw with charcoal from local woodlands. This year's excavation completed work begun in 1969-70, and the site will be flooded when the Bewl Dam is built.

The furnace complex formed a compact unit on the north-east side of the valley of the Bewl. A comparatively short dam had been built across the valley, and immediately downstream a platform had been cut into the sandstone of the valley side. On this was built the stone tower of the furnace, the bellows structure and, during the life of the site, a store building. A wheelpit and tailrace had been cut into the edge of the platform on its stream side.

The furnace was a stone tower, surviving near its centre to 4-5 ft.above the platform. Its lowest course was well built with ashlar facings and a heavy rubble core, although the pillar between the bellows and casting arches was of poorer quality at this level. Although the footing course may in any case have been of better build than the stonework above, it was clear from the stratification of the north-west foundation trenches that all the upper surviving stone work of the furnace was a replacement. It was of poorer material, bulging in places, and with clay rather than rubble core.

The hearth had been rebuilt on several occasions, as is to be expected, and the substantial fragment which remained in place in the central square of the tower was built over a cavity or sump which was itself cut into the natural sandstone of the platform. A worthwhile section of the hearth lining was obtained. The sump was connected to drainage channels, one of which led to the porous filling above the tailrace, but the other was apparently incomplete. The furnace tower had been braced with timbers, and fragments of vertical posts were in place at three of the corners.

The bellows area was of great interest, giving as complete an indication of its equipment has has yet been seen in this country. The bellows were probably within a building between the dam and the south-east of the furnace: a substantial sleeper beam was in place along the southeast edge of the excavated platform, marking the fringe of the dam, and the latter was revetted by horizontal edge-set planks set behind vertical timbers which could support a roof spanning over to the furnace, above the blowing arch. Within this area were the base-frame and pivots for two sets of bellows, whose boards were apparently raised by cams on the wheel shaft; these presumably fell under their own weight, no doubt assisted by weights at their extreme ends. A substantial fragment of the shaft was approximately in place, where it had dropped after having its extremities, with their bearing surfaces, chopped off. The cam holes were intact, although the cams themselves

had been removed: each set of bellows would operate 3 times per revolution of the shaft, thus giving a draught six times per turn of the waterwheel. The massive wooden bearing block for the north-east end of the shaft survived, although its bearing had been removed.

At the southwest end of the shaft lay a substantial fragment of an over-shot waterwheel in a timber wheel pit, and beyond it, stonework on which a shaft bearing would have stood. The wheel, exactly eleven feet in diameter, was twelve inches wide between 1-1½-inch-thick sideboards, with well shaped curved bucket boards nailed to the sides and strengthened by dowels against their backs. This was not the first wheel to be used, as fragments of straight bucket-boards lay in the lower silt of the wheelpit. The wheelpit had a plank floor, pegged to cross-sleepers, and the frame of the pit was built using mortice-and-tenon joints. Several of its uprights had continued above the level of the upper rails of the pit, to support the penstock. The latter had been fed through a trench cut in the top of the dam, which was sectioned to show the beam slot on which a wooden shoot or flash must have been built. The clean material in this trench suggested deliberate filling.

The tailrace was also of timber, culverted with planks. This was notable for being set close to the casting arch of the furnace, running beneath the casting floor, whose sand lay on a thick deposit of slag which had bean tipped over the culvert. This layout allowed a compact platform, as well as permitting a shorter wheel shaft than would have been necessary had water channels been taken, open, well clear of the casting floor. The south-west side of the tailrace timber was set into the original alluvium of the valley.

The original unit had been completed by the excavation of a neatly cut drain trench along the north-east and north-west sides. This had tapped springs along the foot of the scarped hillside, taking water to the point in the tailrace where culvert boarding ended. It seemed that a good deal of the water collected must also have seeped across the bellows area to the wheelpit, particularly as the drain, although filled with a porous ash and covered by boards, seems to have been forgotten and covered by uneven material, including clay, associated with the rebuilding of the furnace walls. A later addition was a poorly-built structure, perhaps a storehouse, against the north-west side of the furnace, its walls standing over the foundation trench associated with the poor-quality rebuilding of the main structure.

Thus the elements of a charcoal-period furnace were present; indeed the only feature missing was the charging bridge, which need have been no more than planks from a shelf at the top of the dugout scarp to the furnace top.

The finds confirmed the documentary dating. There was no pottery which suggested use of the site into the 17th century, and the balance of the local earthenware and imported stoneware suggested activity in the middle of the 16th century. Among other objects, a substantial fragment of a pig of iron and fragments of the bellows were of particular interest. The bellows area produced prolific nails and scraps of leather.

Thanks are due to the Department of the Environment for funding the excavation, the Society for Post-Medieval Archaeology for handling the grant, the

Nuffield Foundation for use of equipment bought out of a fieldwork grant and the Wealden Iron Research Group for the use of equipment and facilities; Mrs C. Hussey for allowing excavation on Scotney Estate land and the Medway Water Board for permitting access through land it has acquired for the reservoir. Mrs Parsons kindly allowed the excavation camp to be placed on a field in her tenure and Miss Fevan, as well as allowing access, aided our work in numerous ways; Mr and Mrs Veitch on whose land we had worked in previous seasons were again of great assistance. I am particularly grateful to the volunteers whose efforts in excavation and surveying in the usual unfavourable conditions allowed work to be completed within the limits of time and funds available. Their efforts were amply rewarded, in particular by Mr W.F. Beswick's generous offer to undertake the conservation of the waterwheel fragment.

The Use of Bloomery Slag in Blast Furnaces — David Butler

In the bloomery furnace flux was not normally added to the furnace burden; the latter consisted only of ore and charcoal. However to obtain a bloom of iron it is necessary for the unwanted parts of the ore to be removed in the form of a free running slag. For this purpose iron oxide in the ore acts as a flux, and at the low temperatures prevailing in the bloomery a considerable quantity of the iron oxide content of the ore is required to form a free running slag. The iron oxide so used as a flux is not available for the production of iron and consequently the efficiency of the bloomery process suffers.

In the charcoal blast furnace a higher temperature could be attained compared with a bloomery furnace. If there were no flux addition to the furnace burden, then, as for the bloomery, iron oxide from the ore is used to flux the unwanted part of the ore. However, because of the higher working temperature, a free running slag can be produced in the blast furnace with less iron oxide than required by the bloomery. (The data suggests that the iron oxide content is not much less, but the effect of small quantities of limey material charged as part of the ore may enable the iron oxide content of the slag to be appreciably lowered whilst still remaining free running. Further information on this aspect would be appreciated.)

If instead of using the iron oxide from the ore another source of oxide could be found, a greater yield of iron would result. Such a source is old bloom slag. At the temperatures prevailing in the blast furnace, this slag, containing much iron oxide, can act as a flux and take up some of the impurities in the ore. The iron content of the tapslag is still not available for the production of iron, but it frees some of the iron oxide of the ore from having to act as a flux, and increases the efficiency of the furnace.

With the introduction of limestone as a flux addition to the blast furnace burden, a different set of slag

forming conditions arise. It is no longer necessary for the iron oxide of the ore to be lost in forming a free running slag, as its function is replaced by the limestone. If bloomery slag is also added to the furnace burden, then it would appear that the iron oxide content of this may also be replaced by the calcium oxide from the limestone, whereupon it is available for the production of iron. Thus tapslag could be a valuable iron-producing constituent of the furnace burden. The information on this aspect appears to be meagre and I would welcome further data. Does anyone know if this processwas used in Sussex? It appears to have been a common practice in the Forest of Dean.

Wealden Fortified Camps and the Iron Industry — C. F Tebbutt

Thoughts on the title of this article were prompted by a recent visit by Mr and Mrs E.W. Holden and myself to that most interesting earthwork known as Piper's Copse, near Kirdford, Sussex (SU 978 295). This was first surveyed by G.H. Kenyon in 1935, who carried out a small excavation there with S.E. Winbolt soon afterwards (see Sussex Arch. Collections **77** (1936) pp.245-9; further notes on the site were contributed by Mr Kenyon in S.A.C. **86** (1947) p.xxxix, and **99** (1961) p.248; also in Sussex Notes and Queries May 1969; and by Winbolt in The Times of August 5th 1935.)

The earthwork, situated on low ground in dense coppice woodland, is ovoid in shape with an impressive, single rampart standing up to 8 feet above ground level, and an outside ditch 8 feet deep. It encloses an area of just over one acre. Winbolt found what he described as an iron smelting hearth on the inside of the rampart on the north-west side associated with what is described as La Tène III pottery. He mentions Romano-British and Medieval pottery, found elsewhere in the earthwork.

On our recent visit we found that the rampart had been dug into in a number of places, presumably in pursuit of rabbits or foxes, whose holes occurred all round the bank. At the place marked "Lime Kiln" on the plan we found several large pieces of iron smelting cinder, one at least being part of a "furnace bottom", and at the point marked "Hearth" (on the published plan in Sx.A.C. 77) were several more, all apparently from a bloomery. Winbolt does not mention the finding of any such cinder or slag and our material seems to reinforce his findings.

There are now at least five known wealden fortified camps, all presumably of pre-Roman origin, all apparently connected with the iron industry, four of them found to have been occupied after the Roman invasion. They are:

HASCOMBE (see Surrey Arch. Collections, **40** (1932) p.89). TQ 005 386. Iron smelting hearth and Romano-British pottery.

PIPER'S COPSE (above). SU 978 295. Iron smelting hearth, bloomery cinder, furnace bottoms, and Romano-British pottery.

DRY HILL (Surrey Arch.Collections, **41** (1933) pp.79-92). TQ 433 417. Iron bloomery slag, but no sign of human occupation.

SAXONBURY (see Sx.A.C. **71** (1930) pp.223-36). TQ 577 329. Here Winbolt found iron slag and Romano-British pottery.

GARDEN HILL (Sx.A.C. **108** (1970) pp.39-49). TQ 444 319. Bloomery cinder and tap slag; Romano-British pottery of the 1st century A.D.

It is only fair to say here that Winbolt himself pointed out, in his article on Piper's Copse, the association of the first four of the sites listed above with the iron industry, and we now have Garden Hill to add. We now know that what used to be called late La Tène pottery, found at all the above camp sites except Dry Hill, went on being used, and presumably also made, for at least 25 years after A.D 43 (see C.F. Tebbutt and H.F. Cleere "A Romano-British Bloomery at Pippingford, Hartfield", publication in progress.)

The problem really concerns the earthworks; some of these, particularly Piper's Copse and Dry Hill, are quite strong defensive works, and should, from our present knowledge of the period, have been constructed in the pre-Roman Iron Age. In spite of this, the only certain occupation period found in them is of early Roman date, relating to people engaged in the iron industry, and, with the one exception, living inside the earthwork. As far as I am aware no wealden earthwork site associated with the iron industry has been exhaustively excavated, and, on those that have had work done on them, no occupation has been found that could be proved to belong to the pre-Roman first half of the First century A.D. Therefore we do not know what the pottery of that period was like, locally, or if it differed from that made after A.D. 43.

All these problems greatly add to the importance of the new excavations started at Garden Hill in 1972. Here in one season we are getting, as a basis, an extensive range of Romano-British pottery of Iron Age type, associated with datable Roman wares and, so far, one coin. Future work there should help to solve some of these problems.

I would like to thank Mr G.H. Kenyon for giving me so much help and information about Piper's Copse.

Pushing Back the Frontier

Straker's southern frontier is north of the scarp of the South Downs and, in the north, he ends far short of the North Downs. But evidence is appearing which will push these boundaries further apart. The Buxted team has a salient in Isfield and an outpost in North Barcombe (TQ 440 178). The London-Lewes Roman Road runs a little to the east and is here slagged. The road is intermittently slagged down to 427 128, in north-west Ringmer. Further west a Minepit Field is recorded at 277 170 (now built over). The ore may have supplied known sites further north. Wivelsfield has a Cinderberry Copse at 350 215(approx), which needs checking. As for the north, slag in Lenham parish and at Smith Farm, Hollingbourne indicates ore almost at the scarp-foot. And if there, why not east and west along the Vale of Holmesdale?

Reports of District Teams

Buxted

1 ORGANISATION

The team now has a more flexible organisation with a series of conveners, each accepting responsibility for a foray or an investigation.

2 TOTAL OF DISCOVERIES TO DATE

BLOOMERIES: 59 of which 4 were dated by pottery sherds (2 Roman, 2 medieval)
WATER-POWERED SITES: 6 of which 3 are blast-furnaces and 3 are hammer-forges
VISITS TO KNOWN SITES: many, of which 2 are perhaps important:
TQ 448 383 Blacklands, Cansiron, Forest Row, Roman industrial site confirmed (Bull. 3)
TQ 507 256 Morphews, Buxted. Roman tile and pottery fragments indicate Roman.
We thus have knowledge of Roman, medieval and early modern sites. One early Roman site has been fully excavated: Pippingford (Bulls. 2/3)

3 DISCOVERIES SINCE LAST BULLETIN

TQ 554 264 “Under Rocks Wood”, West Mayfield, small bloomery, several large lumps of soft cinder in stream and bank
529 219 Cinderfield, Mill View Farm, Buxted. Roman bloomery, large concentration of slag in stream, bank and two fields; black soil, fu lining, and a few sherds of Samian ware.
421 356 Brambletye Manor, bloomery, scatter of tapslag in field, N. side of stream.

4 OTHER ACTIVITIES

Visits have been made to Strakers’ sites, i.e. Oldlands blast-furnace, Oldlands Roman bloomery, Pounsley blast-furnace and Little (hammer-) Forge. Such visits generally prompt more questions than they answer. For instance: Oldlands furnace is thought to be the site where Ralph Hogge made the first cast-iron cannon in Britain (1543); moreover it may be where the “ironfounders of Buxted” were founding (casting) in 1490 (Schubert, 161). Thus we have a possible rival to our earliest certain blast-furnace site at Newbridge, Hartfield (1496). Of course, we do not know where the founding or the cannon casting actually took place, nor can we find out by archaeological methods; we have to wait for a document.

5 OUR MAIN OBJECTIVE

Study of the Uckfield River Basin continues; the recent publication of The Institute of Geological Sciences Geology of the Country round Royal Tunbridge Wells (H.M.S.O. 1972) is very timely. It mentions Charles Cattell’s first 13 bloomery discoveries in the Upper Rother Basin (1970); his other twenty were made later. It is unfortunate that our discoveries, going back to 1965, were not published until Spring 1972 (Bulletin 3 1972) or we might have had a mention.

J. P

Crawley

Broadfield, Crawley, TQ 258 353

Earlier short interim reports on this site have appeared in Sussex Archaeological Newsletter 6 (June 1972), Surrey Archaeological Bulletin (April 1972), and the Wealden Iron Research Group Bulletin: the Geology and discovery is covered by B.C. Worssam in The Proceedings of the Geologists' Association **83** part 1 (1972).

This year rescue excavations at Broadfields took place during July and August. Bad weather forced us to abandon our attempt to locate the domestic area, but this enabled us to make a start on a new ironworking complex some 300 yards north of site 1. Although only partially uncovered the area investigated extends over 1,250 sq.feet. The new discoveries consist of five furnaces; three of these have been identified as bloomery shaft furnaces of the Holbeanwood type. Slag and furnace debris had been dumped into a large oval pit, whilst three smaller pits were found to contain a fill of charcoal fragments. The working surface around the furnaces consisted of charcoal, a little tap slag and metal, which had been trodden into the natural clay.

Another feature was a large rectangular area covered successively with layers of red burnt clay and unburnt beaten clay. This is thought to be the floor of a structure, the limits of which have yet to be ascertained. Small finds from this site were, unlike site 1, quite rare. They are mainly sherds of pottery in forms similar to those of the Alice Holt assemblage. This material (thought to date to the 4th Century by discoveries in stratified layers on military sites in the North of Britain) is being revised by Mr Lyne and Miss R. Jefferies.

The past two years' work on Broadfields has resulted in the excavation of approximately 2½ acres of what is thought to be a 20-acre site. Although more is still to be done, we can now make a brief summary of the probable sequence of occupation. Phase A: This consists of an Iron Age occupation which was found at Goffs Park and Southgate West. This has been established by the discovery of small clay crucibles and pottery of the South Eastern 'B' group. At Goffs Park two parallel curving ditches were traced over a short distance. Their fill contained charcoal and tap slag. Aerial photographs show two circular shapes which could prove to be dwellings, however, these were not in the threatened area, and so we have no immediate plans for their excavation. Phase B: There is evidence for an occupation at Southgate West and Broadfield site I and II which has been dated to the late 2nd century by Samian and Castor Ware pottery. Associated with this phase are the Holbeanwood type of bloomery shaft furnace, blacksmith shop, water reservoir and a series of ditches. Phase C: Confined to Broadfields site I and II and dated (provisionally) by Alice Holt pottery to the late 4th Century. Structure associated with this phase seem to be the large bloomery shaft furnace.

Although at this early stage of the excavations we should not draw definite conclusions, we feel that the evidence thus far shows an Iron Age occupation concentrating on Iron and precious

metal working, which was probably well developed by the time the Romans arrived. During the 2nd Century A.D.there is an adoption of the techniques already established on the Classis Britannica sites, such as Holbeanwood and Bardown. It could be inferred that these new techniques and size of operation represents a military take-over of the site at Broadfields. The sequence briefly described above probably indicates three separate groups moving onto the site to exploit the iron ore at different periods.

In addition to the main excavation we were able to lift the base of a bloomery shaft furnace from the slag dump near site I. This was achieved by reinforcing the structure with a coating of Polyvinyl Acetate Emulsion, and filling the shaft with Polyurethane foam. Then, by undermining its foundations and inserting timbers to form a palette, we were able (with the aid of a crane) to lift the 1½-ton structure. We intended to send the furnace to a laboratory for chemical analysis, but at the request of Mr I.D. Margary and with Mr A.B. Page's permission the furnace was transported to one of the Sussex Archaeological Society's Museums at Lewes — where it is hoped that after restoration work and conservation, it will be put on public display.

New sites

Broadfields Forest 258 344

Observation of a substantial development area was rewarded in September 1972 by the discovery in a service trench of a large pit 32 feet long and 18 feet deep. The fill contained a layer of slag and furnace debris. The section also revealed several mine pits which had cut through on iron-bearing seam. A few feet south of this find, a stream had been dammed to form a pond.

Constable Road, Tilgate 278 348

Quantities of blast furnace slag, charcoal and burnt clay were discovered during the digging of an ornamental pool It would seem that most of this material was redeposited in quite recent times and could easily have originated from the Furnace Green site.

J. G-H.

Slaugham

This first report of the activities of the Slaugham Group is produced merely to allay rumours that we do not exist at all and if we do, we are illiterate. It is not intended to increase anyone's knowledge to any great extent.

The boundaries of the area adopted have been taken as, in the north, the Pease Pottage-Horsham road, the A24 Horsham-Worthing road in the west, the A272 Haywards Heath-West Grinstead road in the south and the London-Brighton railway in the east.

This does not mean to say that we will be inhibited from working beyond these bounds to look at something of ferrous interest.

This "patch" is in a sense classic iron country; the now much-denuded forests of St. Leonards and Tilgate approximate to that of Ashdown to the east. The comparative proximity, in the High Weald, of the mine pits to the furnace sites, and the abrupt fall through narrow ghylls of streams giving a good head of water, often using several feeder ponds, all make it so.

Indeed, it has probably done more than most as an area to keep the memory of the wealden iron industry alive for many in Sussex and beyond, particularly the notable hammerponds on either side of Bucks Head which the Group visited for its May meeting.

The tasks that the Centre has taken on in its area are, in order, the visiting of the already recorded sites (in Straker and elsewhere), checking any known or reported further locations and then, it is hoped, carrying out selective field work. The Centre has mustered an average turn-out of about a dozen members for its meetings, held monthly on the second Saturday of the month, and has already found a number of people with interests as varied as geology, bricks, mosses and snakes. We have enjoyed, at the first meeting and since, the encouragement of Mr Tebbutt and Mrs Meades of the Buxted Group.

The first site which was visited was Blackfold, lying to the east of Nymans at Handcross, where the pond, modified in Victorian times, is still in water and much slag is to be seen below the bay. Next an indoor meeting was held at Warninglid when the 1840 Tithe map of Slaugham, parish was examined and at least one field-name was discovered, confirming a local tradition of iron working. Afterwards an interesting and reputedly very deep pit, possibly a mine pit, was seen at Ghyllhurst. The next meeting was held at Cuckfield where the forge and furnace sites were visited. Some months later we returned to Cuckfield Park to examine several bays upstream from the sites, to test whether these were merely feeder ponds or possibly sites where some traces of working, perhaps seasonal, might remain. The difficulty on this search, as found at Slaugham furnace which was visited in the early autumn, was the thickness of vegetation with impeded progress and probing.

At Slaugham we were able to explore some possible mine pits and the ruins of the Covert mansion that rose from the fortunes of iron and just as swiftly fell into disuse.

In the meantime we had been to St.Leonards forge and furnace where the largest areas of slag so far seen were found. There seems to be some attraction for badgers to these sites. We also made an unproductive investigation of a ghyll near Shelley Plain, at Broadfield, and to Gosden furnace ponds at Lower Beeding.

The final reportable meeting was in November when a brisk day saw a promising examination of the Ardingly hammer at Fullingmill, on the line of the London-Portslade Roman road, part of which was inspected with Mr Potter and members of the Pitt-Rivers Society of nearby Ardingly College, with whom we are hoping to co-operate in field work on the Fulling mill site, which may be flooded by the proposed Shellbrook reservoir.

D. A.

East Grinstead

Our section of has been inactive over the summer season in terms of foraying, but has organised what is believed to be the first “open” Wealden Iron exhibition in East Grinstead. This was carried out at the invitation of the East Grinstead Society, who were organising a one week exhibition of local history in the town, and it was only natural that they should want the local iron industry to play a significant part. The

significance was really only appreciated when all of the local iron sites were plotted on the 2½in maps, TQ33, 34, 43, 44.

The tally was:- 28 Bloomeries (undated); 5 Bloomeries (Roman); 14 Furnaces; 11 Forges; This averages out to 0.375 sites per square mile, and even then vast tracts were virtually empty over the 155-square-mile area. However, by considering an area equal to one map (38.5 square miles), there was a maximum density of 0.94 or nearly one site per square mile.

The usual display of slags was also shown, unfortunately in a rather arbitrary sequence due to the incorrect shape of showcase. It had been hoped to show the important difference between bloomeries and blast furnaces, which was the first put unambiguously in Strakers' book.

Anybody reading elsewhere, before and after Straker, should study with care. Even in 1972, the "History of West Sussex" monthly magazine states "Pigs were taken from Broadfields Roman bloomery to London". Where will it end?

A coloured flex was run from each slag sample to the actual site where it was found, marked on the map. Also on view were photographs, including a panoramic view of the bloomeries at Upper Stonehurst, showing the "ore line" as predicted by the geology. (W.I.R.G. report No 4, p.28).

The term "ore line" is used to pinpoint the geological junction of the Wadhurst Clay with the Ashdown Beds. It is at this point, or perhaps a short distance above in the Wadhurst Clay, where any remaining clay ironstone (iron ore) outcrops. It is interesting to note that the geological maps show the outcrop of ironstone in the Wadhurst Clay, but in many places they are only indicating where the ironstone has been mined.

The main attraction of the exhibit was a working model of a wealden forge made by Mr J.C. Smith of Burwash Weald. This demonstrated the (electrically driven) water-wheel operating a tilt-hammer (Straker, pp.84, 87), and a pair of counter-balanced bellows to provide a draught for the hearth. The model was realistic down to the racket made by the hammer hitting the anvil, and even after silencing, it could still be heard throughout the exhibition.

A coin-operated switch was designed to set the forge operating, and during the week £7.41 was collected, £2.50 of which was given to Mr Smith, £2.50 to the East Grinstead Society, and the remainder kept for the local section of W.I.R.G. This coin mechanism may be borrowed for short periods by contacting the author. Profound thanks must be given to Mr and Mrs Gibb of Tidebrook, Wadhurst, for transporting the model forge to and from Burwash Weald. During the exhibition it became clear how much passing interest there is in the subject, and how many people did not know the wealden iron industry. Even so, out of the 2000 attendance there have been only two further enquiries for W.I.R.G. membership.

This does not include the interest shown by Mr Woodrow of Haxted Mill near Edenbridge, Surrey, (TQ 418 455), who has kindly offered room in his watermill museum for a permanent wealden Iron exhibition. The point of common interest between Haxted Mill and wealden iron is of course water wheels, but this does not preclude the bloomery period from being covered. So it seems that this may be the long awaited chance for a display of iron industry material. There is also the possibility of the display being shown in the East Grinstead library early next year, before going to Haxted Mill.

B. K. H.

Questions, Answers and Comments

Question

We find so-called "bell-pits" and open-cast pits of a size varying from a small pond to huge linear excavations up to 200 yards long (e.g.at Mine-pit Wood, North Clays, Hartfield). Is a chronology of pits possible, and were such vast quantities of clay removed, apparently away from the excavations?

Reply

Large open elongate pits in the Wadhurst Clay are not uncommon. Dr E. R. Shephard-Thorn reports the existence of one in basal Wadhurst Clay at Bayham Abbey, near Lamberhurst (TQ 651 367). It is quite possible that while the clay ironstone was used for ore, the clay that it occurs in was removed for use as marl. "Marling" was carried on in the Weald until the late 19th century. The term seems to have been used for any clay, not necessarily calcareous, that was spread on the land with the object of improving soil fertility. A detailed account of historical references to the practice is given by W.P.D. Stebbing, in "Sub-soils in farming: the farmer and his mentors before William Smith", Proceedings of the Geologists' Association, Vol 52, 1941, pp.257-272. One popular agricultural writer of the 17th century, Gervase Markham, defined marl as a "certain rich, stiff and tough clay, of a gluey substance, and not fat or Oyly, as some suppose…". This description would fit typical Wadhurst Clay very well. It is possible that such clay was mostly spread on, and would have benefited, light sandy soils on the Tunbridge Wells Sand and Ashdown Beds outcrops. W. Topley, in The Geology of the Weald, 1875, pp.387-8 wrote that marl "is rarely dug at the present day, and then is only laid on light land, where it may be of service; but the general opinion now is that it is worthless, and many farmers say that their land has been spoilt by its use". Topley also recorded that in former times marl had been applied indiscriminately to light and heavy soils.

Question

We have found bloomeries at TQ 445 313, 456 317, 4475 3010, 486 292, 512 288, 566 213, 593 197, 576 218. We presume them to have used ore from nearby; that is from the Ashdown Beds. Are there any iron ore horizons in the Ashdown Beds?

Reply

Clay ironstone occurs locally in the Ashdown Beds, but few occurrences been recorded. Mr R.W. Gallois (in the recent Geological Survey Memoir, Geology of the country around Royal Tunbridge Wells by C.R. Bristow and R.A. Baxley, 1972, p.51) noted a bed of it 1ft 3in thick in some shallow pits (TQ 3980 3304) about 1½ miles W.N.W. of Wych Cross. The pits were presumably worked for ironstone. In the same Memoir (p.53) Dr Bristow notes that a seam of lenticular clay up to 25 ft thick crops out (448 286) at Nutley, only a mile or so south of some of the bloomery sites now found. This was originally thought to be Wadhurst Clay, and probably includes some ironstone, for there are numerous minepits

on the outcrop (4482 2856). He comments that Marlpitts Farm (4500 2904) and Marlpits (4506 2888) were formerly known as Minepits Farm and Sweet Minepits respectively.
Comment (J.P.)
1" Geological Map 303 — Tunbridge Wells — shows the clay at Nutley as noted: we hope to investigate the area for bloomeries; though the "Hogge Buxted organisation" drew ore for its water-powered furnaces from wide distances in the 16th century. "Minepits" is a field name at least as old as the Parliamentary Survey c.1650, but that is not early enough.

Comments on recent publications:

J.H. Money, "Medieval Iron Workings at Minepit Wood, Rotherfield Sussex", Medieval Archaeology xv (1971). (C.F.T.)

The Minepit Wood site was first recorded by Straker who named it from the neighbouring farm called Orznash (Wealden Iron (1931), pp.27 and 257) and he himself led Mr Money to the site in 1937 and exhorted him to excavate it. This he did from 1965-1967. The site actually contains remains of two periods, Iron Age and Roman, and 14th and 15th centuries, thus showing, in a remarkable way, the similar environmental needs of bloomery iron workers separated by over 1000 years, It is with the later period that this article deals, and it should be read by all those interested in the history of the iron industry.

The excavation recovered the remains of a stone-built roasting furnace, and a stone and clay smelting furnace, the latter built inside a timber-framed building set on low stone ground walls and partly roofed. The roasting furnace could be paralleled with those depicted in Agricole's woodcut of 1556, a copy of which is included in the text. Also a lively suggested reconstruction of the site in operation has been drawn by S.E. Rigold. Signs of a slightly older period were also found, mainly destroyed by its successor. The periods were fixed by the pottery found and by carbon 14 dating. As appendices H.F. Cleere reports on "The Iron Making Material", and S.E. Rigold on "The Pottery" and "The Timber Framed Buildings".

This article is not only the record of an important piece of research but is a model of how such a report should be presented. While it contains all the necessary technical detail for the metallurgist this does not make it difficult to read and understand for the layman. The text is clear and succinct, the drawings self-explanatory, and there are two excellent photographs. We look forward to the complementary report describing the prehistoric site, which we understand is ready for publication.

Readers not members of the Medieval Society, but members of Sussex Arch. Soc. can read the article in their library at Barbican House, Lewes. The Hon. Sec. of W.I.R.G. has offprints (30p + post).

"Iron Ore Workings near Horsham, Sussex, and the Sedimentology of Wealden Clay Ironstone", by B.C. Worssam, Proceedings of the Geologists' Association, Vol.83 (1972). (P.J.O.)

In the course of Geological Survey work in the western Weald, Mr Worssam became aware that certain areas of rough ground (mostly copsewood) were caused by mining operations of an early period. The paper referred to is the second (see also Proc. Geol. Assoc., 1964, **75**, 529) dealing specifically with these mining activities and relating the workings to geological features. Indeed, to quote the Author, "Were it not for old workings, the wide extent of clay ironstone in the present area, and in the Weald Clay of the western Weald, would probably not have been suspected".

Apart from noting a source of iron ore that, previously, had been largely overlooked, the paper serves the equally useful purpose of drawing attention to an aspect of the iron industry that has been, virtually, neglected by archaeologists, namely, early prospecting and mining techniques.

The exposure at Warnham Brickworks (N.G.R. 172 340) clearly shows that the pits were dug with straight sides, as would be necessary in the unstable conditions encountered in the Weald strata, and in contrast to the "bell" pits that are popularly thought to have been employed. Mr Worssam contrasts the large depressions (6m diam.) found around Colgate with those (2-3m) between Broadfield Forest and Silver Hill. His observations underline our ignorance. Does the greater subsidence in the former instant arise from deeper working with a comparable shaft diameter or does it represent an excavation larger in both dimensions? What dictated the chosen dimensions? Again, it is very difficult to locate open-cast, iron-ore workings in the Horsham district where the better-known Horsham stone, overlying the principal ore worked, has also been quarried. The discovery of a large excavation, to the west of Bush Copse, with minepits in the floor, as well as others at the original ground level to the north, requires a geo-archaeological investigation since it could represent either an older stone quarry or an open-cast working of the underlying clay ironstone, that has been subsequently re-exploited.

The Author assumes, in another place, that sharp boundaries to the patches of worked ground in the direction of the strike, i.e.the boundaries of gaps in the belt of workings, result from definite plots of land having been worked, and the close spacing of the pits confirms the existence of an organised mining industry. The first assumption can only be reliable where the lode can be confidently asserted to be continuous and where it is known that the mineral rights were leased out. Where, under such circumstances, the land boundaries would be closely observed and the lessee concerned to win the maximum amount of ore, close pitting may be expected without the operation, necessarily, being "organised". The finer points of estate management in the 16th and 17th centuries may not be all that important here but where the landowner exercises close control, as at Beaulieu, Hants., or realises the profit by indirect means, as at Petworth, the social and economic factors of this choice have a bearing on the iron industry.

The most refractory problem raised by Mr Worssam's paper, concerns the overall pattern of the Wealden Iron Industry. He notes that the areas of the sphaerosideritic ironstone provide no evidence of pitting although it is of reasonable quality. The suggestion is that the beds are discontinuous and therefore difficult to prove. The intensively worked siltstone is of no better quality but has the advantage of being continuous. Of the iron-working sites in the region, two bloomeries, Cindery Seventeen and Broadfield, are located on the outcrops of the former beds, and one, Southgate West, lies in the vicinity of the latter ironstone; the remaining two bloomeries, Stumbleholm and, particularly, Roffey, lie at some distance from either source. One blast furnace, Tilgate, is situated near an outcrop of the sphaerosideritic ironstone and the other, Bewbush, is on the line of the heavily exploited clay ironstone associated with the Horsham Stone. The conclusion is, that since the bloomeries required no water power and could be set up in the mining area, the pitting was for the benefit of blast furnaces. There is no reason to dispute this but it is salutary to consider the reverse of the coin. Thus, two bloomeries are located on the sphaerosideritic outcrops hence they were, by inference, using this ore; two are located in the proximity of pitted ground hence, by the same argument, they were using clay ironstone from the pits or from outcrop workings of the same material that are no longer discernable. Finally, Roffey is so far from either source of ironstone that it is an exception to the rule — if it is a rule (see the writer's report on Coombeswell). It may well be possible to resolve the enigma by analysis for trace metals present in the ores and the slags.

In contrast to the western Weald area dealt with in his earlier paper (v.s.), the Author concludes that one factor deciding against resumption of the industry in the Horsham-Crawley area after the Civil War, was the fact, derived from his calculations, that much of the ore had been worked out, although he notes that more ground, along the various ironstone outcrops, was left untouched than in the western Weald. "Worked out" is possibly too strong an expression, "reduced availability", which would include the economic aspect, may be closer to the true situation. In the western Weald, the industry led a precarious existence — furnaces changed hands frequently and, sometimes, lay derelict for extended periods. In both areas, where the quality of the ore was not high, the industry was probably as sensitive to economic changes as to the chances of war.

Your attention is also drawn to: H.F.Cleere, "The Classification of Early Iron-smelting Furnaces" Antiquaries Journal **52** (1972) pp.8-23.

Council for British Archaeology, Responsibility and Safeguards in Archaeological Excavation (1972) 15p from C.B.A., 8 St.Andrews Place, N.W.1. Comments on both will be published in the next issue.

Secretary's Notes

In my first ANNUAL REPORT adopted at our July AGM I noted under "PROSPECT" our future needs.

a) **forayers:** local teams of field-investigators to visit known sites and find unrecorded sites. This latter can be quite exciting whether the finds are accidental or forecast by geology or indicated in documents or field names. Since 1965 over 100 'new' sites have been identified.

b) **beachcombers:** these are people who follow the forayers and scratch and probe hoping to gauge the extent of the material remains and to find pottery sherds or charcoal which may lead to dating. C14 dating is almost completely impossible owing to cost so pottery is very important.

c) **excavators:** no one needs me to tell them what excavating is. We haven't enough excavators, either directors or others.

d) **document-combers:** apart from our knowing so little about the general history of the Weald and so having no conceptual framework into which we can fit our findings, we know very little about the history of wealden iron. We have many isolated facts or groups of facts, but patterns, as in so much local history, are lacking. Any one document which turns up is liable to be tantalisingly vague and to indicate how much is unsolved. The East Sussex Record Office has recently catalogued a document of c.1560; it was known to the author, Samuel Evershed, of "Sussex Iron Works", printed in Sussex Archaeological Collections vol.**9** (1867) and was printed in The Uckfield Visitor's Guide (1868). Straker knew nothing of it and now it has turned up. But it is at once definite and vague.

e) "the ol' bwoys": a source of information at once reliable and unreliable is local tradition and knowledge. We all know of the 'old hammer pond' perched impossibly on top of a hill with no outflow of water but we must not despise any clue. Plough men know when their share hits a "foreign" obstruction in the clay. They tell us of 'ironstone': this may be ferruginous Cyrenae limestone, or clay-ironstone. My father told me of a shaw in which he worked in the 1890s where, if you dropped your handbill, it clinked against slag. Straker found 40 years later the same evidence and deduced a bloomery (p.390). The ol' bwoys must know of many other sites and soon they'll be all dead.

So shall we. But we have a job first.

> "But at my back I always hear
> Time's winged chariot hurrying near;
> And yonder all before us lie
> Deserts of vast eternity."

I know Andrew Marvell addressed this 'To his Coy Mistress'. I thus address WIRG.