



NEWSLETTER

Number 28 Autumn 1998

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LETTER FROM THE CHAIRMAN

Dear Fellow Members,

Looking around me at a recent foray I was struck by the fact that, despite having been a member of WIRG for more than twenty years I was still one of, if not the, youngest member present. I mention this not to be ageist, for my seniors (!) were all setting about the work we were doing with a will, but to draw attention to the fact that WIRG is in need of some young blood. Many are the times when undergraduates or post-graduates contact the group in search of information, but what we need particularly are young archaeologists who are eager to cut their teeth with a well-established amateur group and enable WIRG to engage in some of the more intensive archaeological work that it has been unable to contemplate since the days of Fred Tebbutt. I should like to see a return to small excavation projects such as were undertaken at Cow Park or Millbrook, so that we can answer some of the questions which years of fieldwork have posed. So if any of you know of such individuals, please try and persuade them to take an interest in us, or put them in touch with me.

One highlight of the year was the opportunity to be involved in the work of Channel 4's Time Team, when it was filming at Beauport Park. Whether one agrees with this method of archaeology or not, there is no denying its popular appeal, and the invitation to WIRG to assist with smelting iron in a 'replica' furnace proved to be a valuable experience for the experimental bloomery team. It will be interesting also to see what further information they were able to glean from the site at Beauport, which was probably the largest of the Roman iron sites in the Weald, for behind the cameras and the 'personalities' there is real archaeology going on, properly recorded. I, for one, will be riveted to the television when the dig is broadcast some time in the new year, but also eager for the published report.

WIRG is moving with the times, and publishing its own Web site on the Internet. Over the past year I have been able to correspond with people all over the world, have my questions answered, and answer the questions that others send. The Internet is an

invaluable research tool because individuals and organisations have made available a vast amount of information. The Committee felt that WIRG should be there too, providing information and offering a service to anyone interested. So I hope those of you who have access to the Net will take a look at WIRG's site, and if you have any suggestions I shall be pleased to hear them, as indeed your Committee are always keen to learn of items of interest you may come across.

My best wishes for the new year

Jeremy Hodgkinson

ANNUAL GENERAL MEETING

The AGM was held on 25th July at Hurst Green Village Hall. The business was quickly over and then our President, Dr. Bernard Worssam, gave an interesting talk entitled **Aspects of Wealden Geology and Iron Ore**. The usual excellent lunch was served at 12.15. In the afternoon there was a visit to Iridge furnace site, which is particularly interesting because of the great number of pen ponds which made up the watercourse. We are indebted to Mr John Fuller, a fellow geologist and WIRG member for the following report on **The President's Address**:

With a fine display of communicative skill, he steered his audience through the fundamentals of sedimentary geology in a miniature crash-course that combined theory with practical demonstration. One needs," he said, "to understand basic concepts in relation to general problems." Three things in field geology govern the relation of Wealden rocks to the iron ores.

1. The lithology – meaning the physical and mineral constitution of a rock, say a sandstone, which is made of visible quartz grains (oxide of silicon). Clay, on the other hand, equally common in the Weald, is made of alumino—silicate particles that individually are invisible.
2. The stratigraphy – meaning the order and sequence of strata. Layers of sediment lie in succession upon one another. Wealden stratigraphy

is peculiar to this area, hence the local nature of Wealden iron ore.

3. The structure - by which is meant the end-result of bending, folding and dislocating masses of rock. Continental forces of huge magnitude are constantly at work, sometimes benignly, sometimes not.

Amplifying the subject of stratigraphy and stratigraphic names, such as Weald Clay or Ashdown Sand, Bernard mentioned that in England the names in use dated mainly from the work of William Smith, a mineral surveyor who in 1796 discovered that certain strata, in more than one part of the country, could be identified (that is to say, given the same identity) by virtue of observed identities among their enclosed fossil remains.

Smith called Weald Clay the "Oak Tree Clay" from its abundance of oak, or Sussex Weed. Ashdown he called "Forest Ridge"; and in 1819 he wrote that "The ancient Ironworks were chiefly on opposite sides of the Forest Ridge where Marl occurs with Ironstone and thin beds of Limestone."

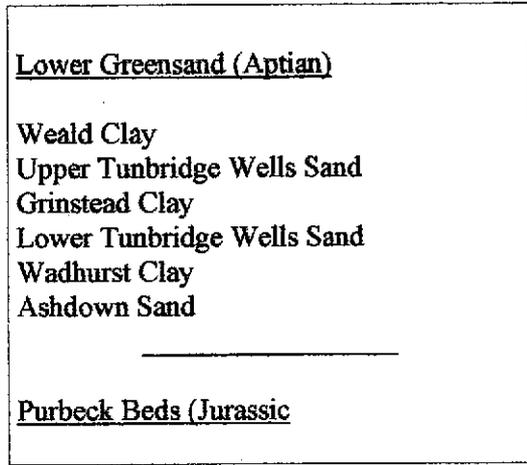
Bernard went on to define minerals, and the differences between minerals and rocks. A mineral is a particular chemical species, such as calcium carbonate. Mineralogists call one form of this substance calcite, which occurs commonly in nature as the sedimentary rock limestone. It often contains shells, with some sand or clay, as in the Bethersden Marble.

Continuing this crash-course in sedimentology, Bernard showed how the breakdown of minerals that were generated by earth's internal heat, such as those from volcanic debris and granites, were by weathering action - rain, frost, or chemical decay - disaggregated into particles which, transported by water to the sea, formed sedimentary deposits. Granite provided quartz, which became sand grains; and feldspars, which broke down eventually to clays. Sodium minerals contributed to the salt in the sea. Some of the mica forms glistening bedding-planes or shale partings.

The President matched practical example with his theory: he had jars of sediment and water ready to hand. Clean sand shaken with water settled cleanly. Clayey sand, from a source where there might have been decaying feldspars, yielded a clay layer over the sand. This model was applicable to the Wealden area. Often among the Wealden strata, beds of sand were found to be capped by clays; and in the basal parts of the clays, were layers of iron-ore. The ore itself was siderite, iron carbonate, formed as nodules in stagnating mud about a foot or so below reed-swamps. These swamp plants,

chiefly horsetails (Equisitites), inhabited large tracts of the Weald in Kent and Sussex. Horsetails are great survivors.

Overall, the thickness of Wealden strata runs to about 2500 feet, lying between Lower Greensand above and Jurassic strata below. It comprises for descriptive convenience six rather unequal segments:



The time-span of the Wealden was something like 20 to 25 million years, beginning about 136 million years ago. One of the lessons to be learned from the huge span of elapsed time hidden among Wealden rocks is that for lengthy periods little sediment seems to have been reaching its final resting place.

Bernard consolidated his out line of Wealden geology in relation to its iron-ores with illustrations of nodular-siderite seams near the bottom of the Grinstead Clay in Philpots Quarry, West Hoathly; and ancient mine pits revealed by Wadhurst Clay extraction at West Hoathly Brickworks.

This address, comprehending nearly the whole field of Wealden geology, and an understanding of its basic features in relation to the iron-ores and the Wealden industry founded on them, was greeted with enthusiasm by everyone present.

Of course, a summary like this cannot include everything. The point is, as the President said, one must understand basic concepts before trying to understand specific problems.

FRANK GREGORY

1917 - 1998

Frank Gregory's death on the 7th June 1998 severed the Group's last remaining link with Ernest Straker. In the 1930s, when he was still at school, Frank recalled attending a Brighton & Hove Archæological Society walk to the ironworks in St. Leonard's Forest, near

Horsham, led by Straker. Frank was a regular member of the Field Group and an acknowledged expert on mills, and with many Wealden water-powered sites subsequently converted into mills, his contribution to the interpretation of such sites was always very perceptive

THE TONY CLARK MEMORIAL FUND FOR ARCHAEOLOGICAL SCIENCE

Many archaeologists may be aware that Tony Clark, a pioneer in archaeological geophysics and archaeomagnetic dating, died of cancer last year. One particularly endearing feature of Tony was the enthusiasm and encouragement he gave to others, particularly those engaged in fieldwork where financial and technical resources were limited. He was always generous with his advice and technical skills and would help with these whenever he could.

In order that such work can be continued a Memorial Fund is being set up in his name. This will be administered by the Royal Archaeological Institute, and its aim will be to provide some modest support and encouragement towards the application of science in archaeological field projects. Anyone would be eligible to apply for a grant from the fund but priority would be given to small organisations, both professional and amateur, as well as independent archaeologists and students. Grants would support the scientific component of projects, especially those which seek to further the development of field methodologies and the subsequent analysis and interpretation of data. As a reflection of Tony's own work, preference would be given to projects in which archaeological prospecting and/or archaeomagnetic dating is a significant component. Grants might go towards, for instance, the commissioning of survey work, the hiring or buying of relevant equipment, software, travel expenses etc. However, projects which use the applicants' own initiatives in archaeological science would be preferred over those where it is intended only to acquire a commercial service. It is very much hoped that there will be sympathy with such a fund as a positive, appropriate and lasting tribute to Tony Clark, a means of continuing exactly the sort of encouragement and influence for which so many people remember him.

For the initiative to be a success, however, generous financial support will be required. You may respond to this appeal by sending a cheque or postal order (made out to 'The Royal Archaeological Institute') to the Assistant Treasurer, Miss C. Raison, c/o Society of Antiquaries, Burlington House, Piccadilly, London W1V0HS

REVIEWS

Tomorrow's Yesterdays

The third volume of the Proceedings of the Swedish Steel Producer Association's 250th Anniversary conference, which was held in Stockholm in June 1997, is now published.

The 230 page hardback book in English contains the six historical presentations dealing with the history of the Swedish steel industry, its trade and technology transfer.

The historian Prof Marie Nisser of the Royal Institute of Technology, Sweden makes an extensive review of the Swedish steel industry from prehistoric times, through the Vikings and into the Middle Ages with the first blast furnace appearing in 13th Century. Her paper continues with the German influence which moved the industry from peasant owned furnaces run for a few weeks of the year, and the later introduction of Walloon technology which was mainly confined to the rich ores of the Uppland region of Central Sweden. Bulk steelmaking followed with the world's first commercial application of the Bessemer process at Edsken and the introduction of electric steelmaking in the early 20th century, a period between the wars which saw the closure of many of the old blast furnaces, most still based on Walloon technology. The expansion of steelmaking in the 1950s and 60s followed by the crisis of the 70s which saw the closure and merger of many of the works is also dealt with. Finally, the emergence of Sweden as a specialist steel producer brings the story up to date.

Paul Nilles of the Belgium research centre, CRM, describes the Walloon technology of a blast furnace and twin forge, one for refining cast iron and the other for reheating it. He explains how some thousand Walloon workers were welcomed to Sweden in the mid 17C, leaving present day Netherlands to escape persecution for their Calvinistic faith, bringing with them new techniques in ironmaking. To-day, there still remain some 40000 descendants of the Walloons in Sweden, preserving many of their traditional customs and part of the language.

Technology exchange between England and Sweden was the topic of a paper by Raymond Douglas (formerly of British Steel) and Julie MacDonald, Archivist of the Company of Cutlers Hallamshire (Sheffield). This paper traces the development of the blast furnace in England and the introduction of edge steel production by cementation, and later crucible melting. The reputation of Sheffield's steel was largely built on Swedish bar iron which proved particularly suitable for the cementation process due to the presence of manga-

nese. Steel from Osterby bruk was particularly prized for this application. Traffic was not one way, and the introduction of the Lancashire hearth puddling furnace to Sweden in 1831 saw the start of the decline of the Walloon forge, shortly followed by Bessemer steelmaking in 1858 which was more successful than in England due to the low phosphorus content of the Swedish iron.

Andr, Faessel of the French steelmaker, Sacilor, spoke on the Scientific and cultural exchanges between Sweden and France from the Vikings to 'the age of enlightenment' in the 18C. Many scientific and educational exchanges took place at this time of the dawn of modern chemistry.

Friedrich Toussaint (formerly with Thyssen) examined the partnership between Germany and Sweden describing the extensive travel and technology transfer - both ways - between the two countries. The German single hearth forges and earth insulated blast furnaces were far more numerous than the Walloon and were generally used by part time ironmakers who tended the land for most of the year. Ironically, while traditional blast furnaces and forges required low phosphorus iron, the high phosphorus ores discovered in Lapland in the early 20C were much in demand in Germany which had adopted the Basic Thomas process, a modification of the Bessemer converter to using a basic lining. The resulting high phosphorus slag was a valuable source of the element.

The final historical presentation was by Gustaaf van Ditzhuijzen of Hoogovens (Holland) who traced the history of the arrival of Louis de Geer from Liege in 1618 on the invitation of the King of Sweden, to cast guns at Finspang in the south of Sweden. He later moved to the Uppland region of Central Sweden, purchasing a blast furnace and forge at Osterby bruk, and was followed to this region by some 10000 of his countrymen around 1626.

Leaving history, the future of the steel industry is outlined in three papers covering competitiveness, cooperative research and new technologies. The book is extremely well illustrated with most pictures in colour, and the papers are of a high standard.

Iron and Steel _ Today, Yesterday and Tomorrow Vol 3, Price SEK200 is available from Jernkontoret, Box 1721, S-111 87, Stockholm, Sweden. Tel +46 8 611 2089 Fax +46 8 611

A LATE IRON GRAVESLAB

While visiting Essex a few months ago, my wife and I visited Rivenhall church, near Witham, so that I could photograph the handsome iron graveslab of Thomas Western, the gunfounder (WIRG Bulletin 9, 1989).

Dating from 1706, it would have been a product of one of Western's furnaces; probably Ashburnham or Brede. However, the church guidebook drew attention to another iron graveslab, alas not accessible during our short visit, in memory of Western's daughter-in-law, Anne, who later married James Dolliffe, and to her son, James Western. At the bottom of the inscription, so the church guide relates, the plate bears the words, 'CARRON 1778'. So, not satisfied with muscling in on the Weald's gunfounding business, that Scottish firm was snatching the graveslab market as well. JSH

ST. PAUL'S CATHEDRAL RAILINGS

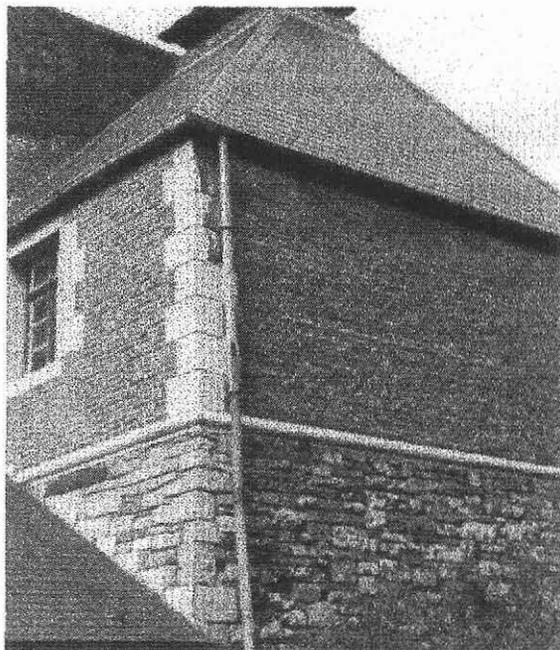
Through the good offices of the Weald and Downland Open Air Museum, to whom they were offered initially, WIRG has acquired a section of the railings which once surrounded St. Paul's churchyard. For many years the section was at Haxted Mill, near Edenbridge, and we were given the railings on condition that we dismantled and removed them. It took Dennis Beene, Brian Herbert and the writer about 1½ hours to release them from the 4-inch-thick block of concrete in which they had been set. They were then driven to Horam where they will be stored (and displayed) for the time being. In an earlier WIRG Newsletter (Autumn 1992) Joe Pettit considered some of the technical aspects of the railings, and it will now be possible to look at their casting, forging and fabrication in more detail. The accounts of the rebuilding of St. Paul's, now in the Guildhall Library, London, record that they amounted to more than 200 tons of iron, and cost over £11,000; a huge sum for those days. One interesting observation is that on the base of a large baluster (one of 149), there is what appears to be a capital letter G, cast into the iron. G, it should be remembered, was the letter used to identify guns cast at Gloucester furnace, Lamberhurst, where tradition has always located the casting of the railings. JSH

This acquisition has prompted discussion about the techniques and the circumstances of their production. Your committee thinks that this might make an interesting research project. Money from the Tebbutt Fund could be made available to help with any expenses that might be incurred. DMM

THE DOMESDAY SURVEY

Mr M J Leppard of East Grinstead has brought to WIRG's attention, a detailed study of the Domesday survey around Forest Row, Sussex. An article written by Mr P D Wood is published in the East Grinstead Society's Bulletin, Nos 58 & 59, and these are available for £1.25 each (postage included) from :- Mr M J Leppard, 20 St. George's Court, East Grinstead, Sussex, RH19 1QP.

NEWS FROM ELSEWHERE
A 17C Blast Furnace in Liege
 By Tim Smith



The reconstructed 17th century blast furnace in Liege (bellows located in extension on left - note vent on top of roof)

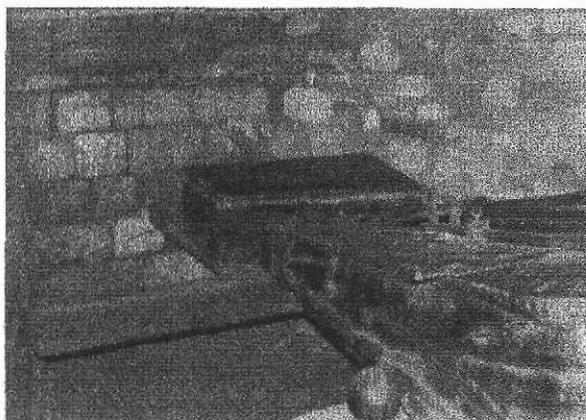
The Principality of Liege, in the east of Belgium, was located in the heart of the Walloon district, a region which as late as the 1920s still preserved its own French dialect (Walloon meaning 'foreigners' - generally French speakers). Iron production in the 16th C stretched from Liege in the east, south westward through Huy to Namur, and southward through Durbuy to Luxembourg.

Housed in a former wrought iron works in Liege is the Museum of Metallurgy and Industry (Maison de la Metallurgy et de l'Industrie de Liege). Within this museum is a reconstructed original blast furnace dating from 17th century along with a refining forge (finery) and helve hammers.

The charcoal fired furnace, which worked into the late 19th century in the nearby village of Gonrioux, between Sambre and Meuse, represents the evolution of furnace design from the truncated pyramid tower standing 6-8m high of the 15 century to the 'high furnace' (haut fourneau) of the 17 century. The square section furnace is constructed outside the main museum building to its full height - estimated at about 15m - and is roofed and capped with a vent - unlike Swedish furnaces which had a movable section of roof.

On one side of the furnace an extension houses a pair of bellows once driven by a water wheel located out-

side the building. Cams act directly on the top plates of the bellows to push them down, a counterbalanced lever then acting to return the upper bellow plate to the top position. The two sets of cams act out of phase to provide alternate bellows movement, the air stream being further equalised by passing through a wind box before entering the tuyere. The tuyere itself is offset to the right of the centre of the arch and inclined upwards. There was no preheating of the air.

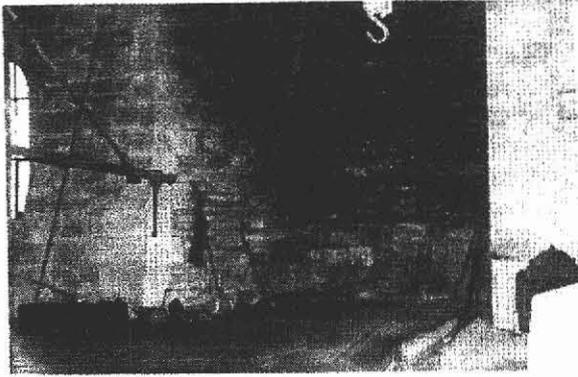


Bellows, windbox and tuyere showing its off centre position in the arch

Charging took place via a charging bridge which the visitor can cross and look down the throat of the furnace into the oval shaped shaft. The throat is rectangular and surrounded by a 1m high wall with four pillars to support the roof.

There was no 'crude' tipping of wheelbarrow loads of charge into this furnace, instead there is evidence of the care taken in blending the charge. Different sizes of roasted ore, limestone and charcoal are carefully laid out in trays for transfer to wicker baskets in weighed quantities before charging into the furnace - no doubt on the command of the smelter below since a small bell hangs in the charging gallery with a line leading to the casting floor below. In the eaves above the charging gallery floor are stored faggots of wood and twigs, presumably kindling to light the furnace at the start of a campaign.

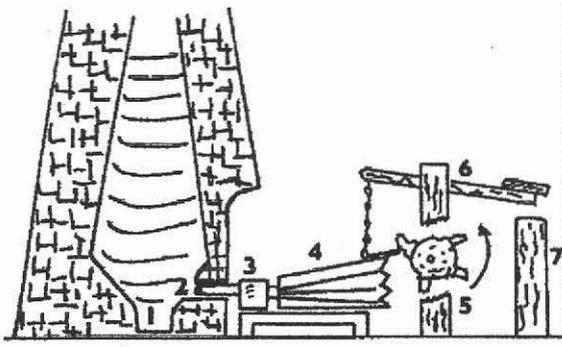
The casting arch is in an adjacent wall to the blowing arch and is slightly wider. In the fore-hearth is a large wedge shaped stone (la dame) over which the slag was apparently scooped, following which the iron was tapped through a lower hole to the side of the dam, plugged with clay until ready for use. The iron was run into a mould in the sand floor to produce a single large pig some 4m long and weighing about 600kg, or could be directed by a runner to cast objects such as fire backs, fire dogs and cannon balls. In the 17th century furnaces were producing about 2t of iron a day, this increasing to 7-8t by the early 19th century.



The Casting Arch

One interesting detail in the construction of the casting arch is the single alcoves in each of the arch pillars some 2.5m above ground level. This feature has been observed in other furnaces, but its use can only be speculated upon. The alcoves seem too high to hold a lantern for light, and anyway face away from the casting arch where light would be needed. If they were to hold support beams, they seem unnecessarily elaborate, and certainly non functional in the present configuration of the furnace. Did they possibly hold some religious relic to assist the ironmaster in his craft? There is indeed a statue in the charging gallery.

Another interesting point is the colour of the slag. When broken open, it is a pastel green in colour, most unlike the dark brown and black Wealden slags, and more akin to the blue slags found in Sweden.

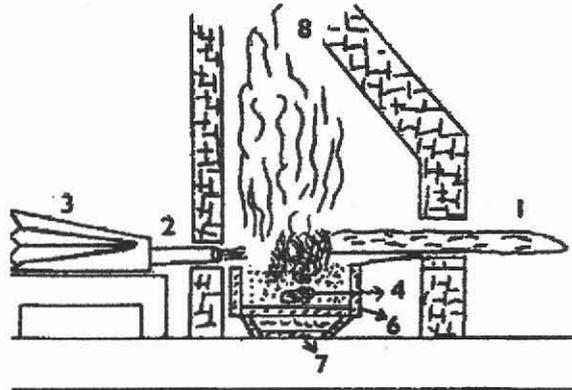


Section of blast furnace (courtesy MMIL)

1 hearth; **2** tuyere; **3** wind box; **4** bellows; **5** axel and cams; **6** counterweight beam; **7** counterweight stop

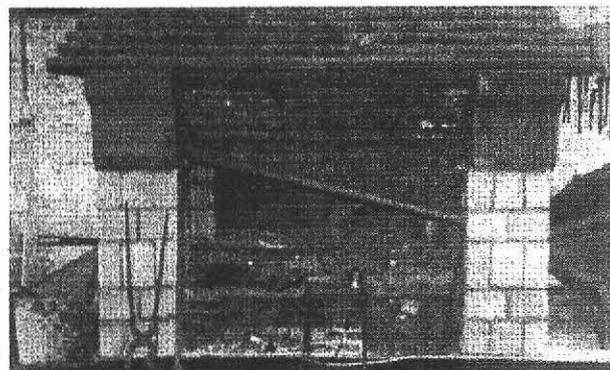
Two almost identical forges are exhibited in the museum. The 'finery' forge consists of a cast iron box about 1.5m square raised 0.5m above the floor so as to accommodate a water circulation system beneath the hearth to cool the box. In the back wall, there is an opening through which the long Walloon pig was fed to enable its end to be melted off bit by bit, forming a pasty mass (a loop) of decarburised iron in the forge bottom. Air was supplied to a tuyere in the bricked side wall by a pair of water powered bellows. This air burnt the charcoal to supply the heat and provided the

oxygen to decarburise the iron. The front of the hearth was half bricked, diagonally from the top, to partially shield the smith, while the side of the hearth opposite the bellows was left open. A chimney caps the hearth to remove flue gases. This hearth is more compact than that at Osterby bruk in Sweden, which is the only remaining example of a Walloon forge in situ. (see WIRG Newsletter No 26 Winter 1997). In particular, the opening for entry of the pigs is much smaller in the Liege forge, (approx 0.5x0.5m) and a greater area of the walls is bricked, indicating better thermal efficiency.



Section of finery hearth (courtesy MMIL)

When ready, the 'loop' of decarburised iron would be taken from the finery and hammered to consolidate it and drive out much of the slag trapped during refining. A water powered helve hammer was used for this, an example of such a hammer being exhibited as a static display. The hammer preserved is a belly helve from Bomerey dating from 17th C. Its strike rate was 30 blows a minute, and the hammer and shaft together weigh over one tonne. This force was further enhanced by the use of a timber beam 'spring' against which the helve was pushed as the cams raised it.



The finery forge (note hole in back wall to feed pig through)

As the iron cooled, it needed to be reheated. Rather than returning it to the finery which was in use refining the next piece of iron from the pig, the iron was

reheated in the 'Chafery', a smaller forge operating at a lower temperature. In the Liege region, where charcoal was scarce but coal was present, there is evidence that coal was sometimes used as the fuel for the chafery. The Museum exhibits a second forge, but sadly not a chafery. It is another finery with a back wall opening for feeding in pigs.

The museum

For those who like unsanitised exhibits, this is the place to go. There is not an inch of fibre glass reproduction anywhere. The exhibits still have the smell of hot metal about them and there is a liberal scattering of slag, charcoal and ore about the place, as well as a host of cast iron artifacts including a small cannon, cannon balls, a host of firebacks, fire dogs, and religious statues in cast iron.

But, take a powerful torch. It might have been because the museum had only reopened from its winter closure the week before, but none of the spotlights which should have illuminated the exhibits in the furnace gallery were working.

In addition to the furnace, forge and hammer, there is a 19th century mill for rolling strip, of interesting construction in that the upper roll rests on the lower, rather than each roll having its own bearing in the mill housing. Thus the roll 'gap' is always closed. There is also an extensive selection of tools used in ironmaking.

Information about the exhibits is scarce (and in French only) but there is a useful duplicated booklet in French about the furnace and forge called 'La Metallurgie Ancienne', stocks of which are carefully hidden in a cupboard behind the curator's desk. There are no postcards or guides on site, but I did later find a small selection of postcards of the iron gallery in the Museum of Walloon Life, also in Liege.

The iron gallery is only one of several in the museum, mainly exhibiting industrial machinery, but there are also some interesting computer exhibits for those who remember punch cards and 18" 'floppy' discs.

Opening hours

The museum is open from 16 March-31 October; Mon - Fri 9am to 5pm (without the usual 2 hour French lunch closure); and on Saturdays and Sundays from 2pm to 6pm.

The entry fee is just BF100 (£1-66), and guided tours for parties can be booked for BF1200 and can be conducted in English. For bookings, ring +32 4 342 65 63. By arrangement, the museum will open in the winter for guided tours.

The museum has a web site with limited information (the opening times were out of date when I looked) and offers five pictures including one of the finery forge. The URL is

http://www.reality.be/atlas/liege/musee/met/home_met.htm

This also provides useful links to other museums in Belgium. The postal address for MMIL is: Boulevard Poincare 17 a 4020, Liege, Belgium. Tel & Fax +32 (4) 342 6563.

There are plenty of other museums to visit in the town, arts, science and rural life, as well as the cathedral and the citadel (a climb of 357 steps for the view as a hospital has been built in the citadel). You could drive, but first practice in Hampton Court maze.

Finding the site

The Maison de la Metallurgie et de l'Industrie de Liege (MMIL) is situated on Boulevard Poincar, in the southern end of the town. If walking, cross to the east bank of the river Meuse by the Albert Bridge, (signed Palais des Congres) continue straight on over a second bridge across a diversion of the river, then right and take the left fork and the museum is 100m on the left. If driving, you will have to follow the one way system and look for the signs to MMIL.

The distance from Calais to Liege is 200 miles, mainly on the E42. Take the exit for Liege after the airport and follow the signs for Avroy, and then Center. Turn right just after the start of Park d'Avroy (on left) and following signs for Palais des Congres (or Holiday Inn) and this will lead to the Albert Bridge.

You could do the trip in a long drive, or take the Eurostar to Brussels (under 3 hours now) and then by train to Liege (1 hour) but it would be better to stay overnight to enjoy more of the city. Hotels start at about €23 for a single room and €30 for a double, or the Holiday Inn does special off season weekend rates for €51. Contact the Belgium Tourist Board at 29 Prices Street, London W1R 7RG on 0891 88 77 99 (calls at 45p-50p/min)

THE BLOOMERY SMELTING EXPERIMENTS

At last: success! Nearly 3 lbs of iron were made on the 26th September on Ashdown Forest. Elsewhere in this Newsletter, you can read about the Time Team who also made iron in their bloomery furnace at Beauport Park in June. Although our smelting techniques have been very similar in the past, one difference stands out; namely the preheating of the furnace with charcoal, such that the temperature 1 foot from the top reaches about 800 deg C, before the ore is added. Another minor difference was the use of slightly smaller charcoal;

0.75". This we have managed using a roller technique, rather than just hammering the charcoal and producing excessive dust.

The Time Team used one of WIRGs bellows (which received only slight damage) to get an adequate temperature. However, WIRG has decided to use an electric blower (for the first time) operating from two, 12 volt accumulators, thus allowing time for other tasks: mending the fence etc.

So, with an early furnace pre-heat with wood at 07:00 hrs.

Charcoal added at 09:30 hrs.

First ore at 11:00 hrs.

Stopping blowing at 15:45 hrs.

Removing the bloom at 16:00.

It was quite a long, but very successful, day to produce nearly 3 lbs of iron.

All from 20 lbs of roasted ore + 40 lbs of charcoal + 20 lbs of pre-heat charcoal.

It was quoted by the Time Team that "anybody can make iron using a vacuum cleaner" (operating backwards). We have disproved this theory with our past use of a gasometer-type air reservoir. Nevertheless, we intending to simulate just one pair of bellows with our new electric blower, by switching it ON & OFF in a regular fashion.

It is hoped that Mr Billings, of Forest Row, can continue to supply WIRG with charcoal at a very reasonable price because the new smelting process requires more charcoal, and now that iron is being produced, smithing will require even more charcoal. To keep the cost to a reasonable level we have plans to make some of our own charcoal on site. This will be in a pit, as demonstrated so successfully by Roger Adams with his bloomery furnace experiments.

We hope to have one more smelt before Christmas, when we can get some more charcoal.

Brain Herbert

Observations on the smelt at Beauport Park, Sunday 21st June 1998

WIRG had been asked to give assistance to Jake Keene an iron smelter, and Reg Miles a blacksmith, to conduct an experimental smelt for TIME TEAM in conjunction with their dig at Beauport Park.

The furnace was built on a slope. It was beehive shaped, about 400 mm inside diameter at the bottom, tapering to 240 mm diameter at the top. The walls were about 130mm thick and had been built up using clay from a local pit. The clay had a proportion of shale in it and been well puddled. Small pieces of twig (willow?)

had been worked in as reinforcing material. The whole furnace was about 1220 mm high at the front, from the slag tapping arch and about 920 mm at the rear. There were three holes for bellows one to the rear and one on either side. These holes were set at a height that was near to the ground at the rear, and all at roughly the same height. There were holes for thermocouples, one at smelting height and one higher. There was also an observation hole to the left of the tapping arch 30 mm dia. The tapping arch was 200 mm wide and 260 mm high. It was stated that the bloom would be extracted from this opening. Material for the plug to block the arch was builders sand and 10% clay.

Ore. WIRG had been asked to provide some roasted ore but this was not used. Jake said that if there was time for a second smelt he would use it. He had roasted ore from the local pit which had yielded the clay for the furnace. The roasting had been done on an open site with layers of logs and ore, the ore had not exploded and was relatively easy to break down to size. It was sieved to remove dust and leave pieces of ore about 17mm to 19 mm. Fine dust was discarded and small pieces 10 mm kept aside for later use.

Charcoal was also broken down to 20 mm to 25 mm with dust being discarded. Jake explained that if charcoal was larger than this, it did not tumble down through the furnace. Larger pieces formed bridges.

A Forging hearth was built of clay on the ground about 5 metres from the furnace. It measured 640 mm long and 430 mm wide with a depth of 150 mm. A bellows hole came through the side at halfway.

The smelt. The furnace had been warm from the day before and was alight and burning logs when WIRG arrived at 09:00 hrs. This furnace warming continued while all the materials were prepared. At 12:00 the furnace was loaded with coarse charcoal and the bellows put to work to get the temperature up to smelting heat, this took some time because 'all the world' wanted to have a go and two pairs of bellows were demonstration 'bag' type. Jake would not begin to add ore until the temperature was up. From experience he knew that when the thermo-couple registered 900c the centre of the heat would be at smelting temperature 1200c. Ore and charcoal were fed equally by weight and by the handful, small amounts at a time. At one point blowing was stopped to check whether there was slag, and the temperature quickly dropped and took some little time and effort to get the temperature up again. Occasionally the furnace was poked from the top when a bridge had formed; this was always done with wooden sticks, no metal being allowed as this caused temperature loss. Once, the tuyere hole had to be rodded. The observation hole was often unplugged and looked into as Jake took more note of the colour of the heat to tell him

what the temperature might be.

Eventually the tapping arch plug was removed and with the bellows still working gently, the slag puddle was poked, and two slag runs were achieved. The tapping arch was filled with wet sand as quickly as possible after each opening and the bellows had been kept going to stop cold air entering and cooling the furnace down.

Due to the demands of filming etc. the smelt took about four hours which, Jake said, would normally take about 2.5 hours. Throughout the day the cracks and damage to the furnace were repaired by painting on wet clay.

A wooden anvil and large wooden mallets had been made ready halfway between the furnace and the forge.

When the moment came to retrieve the bloom, sticks were used to rake out as much slag as possible together with unburnt charcoal. The molten bloom separated into three pieces. One large piece was gripped by Jake with two sticks; it was quite pliable and was held on the wooden anvil by the sticks, while blacksmith Reg "pushed" it into shape with a large wooden mallet. The bloom was re-heated several times, still using the wooden sticks, anvil, and mallet. The bloom, now nearly iron with most of the slag removed was heated up to "welding" temperature, handled with blacksmith's tongs and worked on a small iron anvil by Reg with an iron hammer. "Welding" temperature was decided by the eruption of sparks from the forge like the sparks we see from fireworks sparklers.

The piece of iron, 75 mm x 50 mm x 25 mm, was filed until shiny to show up in the fading sunlight for the benefit of the cameras.

Those members of the WIRG smelting group that were able to attend made themselves useful in preparing the ore and charcoal, blowing the furnace and helping to repair it. We were pleased to help and learned much from Jake Keene's experience which is being applied to our own experiments.

Tony Meades

FORAY REPORTS

Foray to Ashdown Forest

A recurring problem with the search for early iron-working sites on Ashdown Forest is the dense bracken cover, so when fire earlier in the year exposed the surface of the ground near Marl pits, at the head of the Misbourne valley, Margaret Tebbutt and Dot Meades were able to confirm the existence of an area of bloomery slag which covered as much as

400m². The Field Group decided to make its first foray of the new season to the site, and on a fine day in October, with the summer's regrowth of bracken and small trees helpfully cut back by the forest rangers, two trenches were dug across the slag heap.

The slag was dense and heavy, and showed plenty of evidence that, however, many furnaces had been used, their workers were able to tap the slag from them, and that they were using a considerable quantity of ore in each smelt. Some of the tap slag masses were at least 10cm thick. Having all the appearance of slag from the Roman period, it was with a real sense of disappointment that the trenches were refilled, no pottery dating evidence having been found.

JSH

SPECIAL THANKS to.....

REG HOUGHTON who often spends weekends putting on a WIRG exhibition for various organizations who invite us to bring a display to their functions. The latest, and very successful, was the Wood Fair at Bentley Wildfowl at the end of September.

JEREMY HODGKINSON who has recently produced an interesting new leaflet to publicise WIRG.

BRIAN HERBERT who does much towards the organization of forays and smelting.

CHRIS AND SHEILA BROOMFIELD for their efforts in producing a WIRG web page for the internet.

All of this work is in addition to their normal work for the committee.

FORTHCOMING EVENTS

Surrey Industrial History Group. Saturday 28th November 1998:

A one-day meeting at Cobham on Alexander Raby, a late 18th century ironmaster. The programme will be as follows:

10.00-10.30 Assemble. Coffee and biscuits provided

10.30-11.10 "The Raby background; the Midlands, London and the Weald" (Jeremy Hodgkinson, Chairman, WIRG)

11.10-11.50 "Ironmaking in Surrey" (John Potter, formerly Principal of Farnborough College of Technology)

11.50-12.20 "Alexander Raby at Cobham" (David Taylor, President Surrey Industrial History Group)

12.20-12.40 "Introduction to Downside Mill, Cobham" (Alan Crocker, President Surrey Industrial History Group)

12.40-13.30 Lunch. Please bring a packed lunch - tea and coffee provided. Alternatively, there are plenty of local pubs etc but it would be helpful to keep together.

SIHG One-day meeting, continued

13.30-15.15 Visit to Downside Mill, Cobham, by kind permission of Dominic Combe.

15.15-15.45 Refreshments. Tea, coffee and biscuits provided

15.45-16.15 "Alexander Raby at Coxes Lock Mill, Addlestone" (David Barker, Chairman Addlestone Local History Society)

16.15-16.45 "Alexander Raby at Llanelli" (Lyn John, Industrial Historian of Llanelli)

16.45-17.00 Discussion and Conclusions

Day School

The University of Sussex Centre for Continuing Education have organised a day school on the Wealden Iron Industry on **Saturday 5 June 1999**, at Hastings Museum. The tutor will be Caspar Johnson, and full details may be obtained by ringing 01273 678926

University of Sussex Cert. in Practical Archaeology 1998-1999 will run various courses at centres in Sussex and abroad, which include Hastings, Crowborough, Burgess Hill, Horsham and Crawley. Details from Yvonne Barnes, Centre for Continuing Education, EDB, University of Sussex, Falmer, Brighton, BN1 9RG. Tel 01273 678537.

WIRG Winter meeting, **Saturday 23rd January 1999** will take place at Rotherfield Village Hall. Our speaker will be Mr Charles Trollope on The Design and Evolution of English Cast Iron.

WIRG AGM, **Saturday 31st July 1999**, venue to be announced later.

FORAY PROGRAMME 1998/99

Oct 14 Trenching bloomery on Ashdown Forest (Dot Meades, Margaret Tebbutt)

Nov 14 Fieldwalking, Lavertye, Forest Row. (Brian Herbert)

Dec 12 Trenching bloomery in Tilsmore Wood, Heathfield (B Herbert)

Jan 9 Fieldwalking, Bletchingley, Surrey (B Herbert)

Feb 13 Fieldwalking Study Area, Heathfield (B Herbert)

Mar 13 Fieldwalking near Waldron (Ashley Brown)

Apr 10 Trenching bloomery at Mayfield (Jeremy Hodgkinson)

Further details from Hugh Sawyer, 01892 652679

SUBSCRIPTIONS

A reminder from our Treasurer that subscriptions are due on the 1st June. A direct debit would be much appreciated. As you know, our sub is very low and prompt payment helps to keep it so.

THOUGHTS ABOUT THE ASHDOWN FORAY

The Wirgers of WIRG are a busy lot
To date a bloomery they search for pot.

Wanting to know whose slag it was
That lay about that Ashdown copse,
They strode downhill with tools in bag
Picked a spot on which to start
And dug and delved with very good heart.

The rain it rained and the sun it shone
And the breeze it blew but they still dug on

Of course they knew a shard would be
Under the roots of a cut-down tree.
We'll just prize it out before lunch, they said
And grubbed and groaned and snipped and chipped
Till it came away with a great heave – and there
Was yet more slag lying cold and bare!

They ate their lunch in the Autumn sun
Chatting the while – but the work wasn't done.
Just one piece of pot and they might have told
If 'twas Saxon or Roman or just how old
That bloomery slag was that laid just there
In Ashdown's soil, so cold and bare.

What slag it was and how much of it
Filling the prescribed 2 x 1 WIRG pit
But the lot of a Wirger can be hard
Of datable pot there was nary a shard.

WIRG'S INTERNET ADDRESS is as follows:

[Http://ds.dial.pipex.com/town/parade/np03/wirg-hp.htm](http://ds.dial.pipex.com/town/parade/np03/wirg-hp.htm)

THE EDITOR THANKS everyone who has contributed towards this Newsletter and will be pleased to receive letters or other items that might be of interest to our members. Material can be on floppy disk, typed or legibly written and you will note from the heading that there is also an Email address for short contributions.

Happy WIRGING in the New Year! DMM