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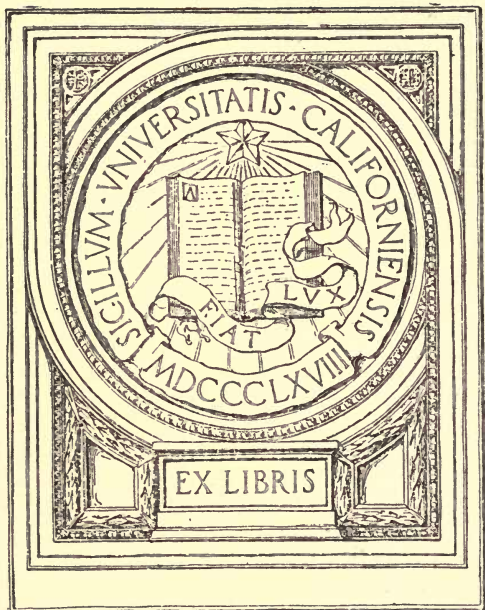


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THE HISTORICAL GEOGRAPHY
OF THE
WEALDEN IRON INDUSTRY

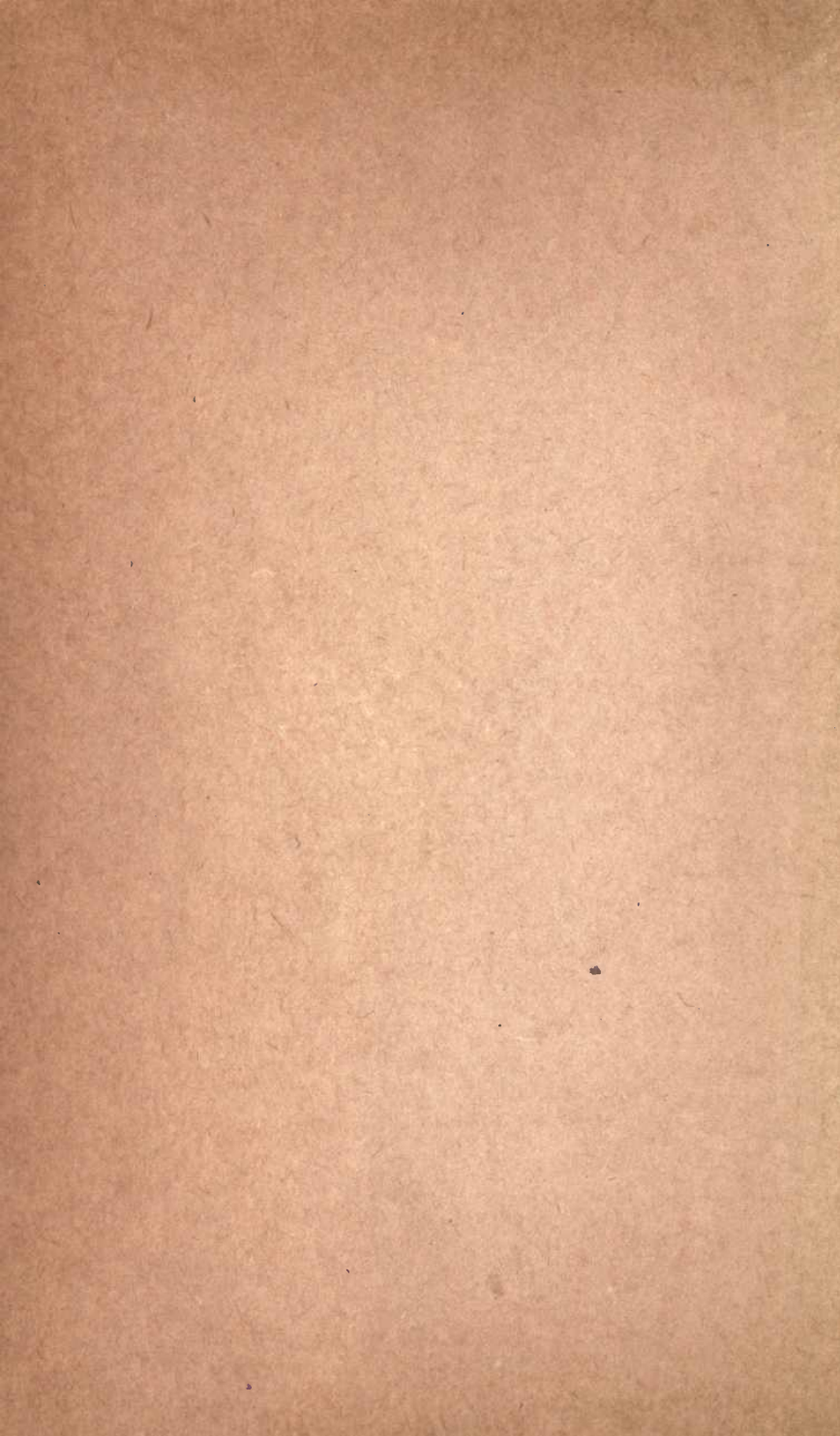
BY
M. C. DELANY.

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THE WEALDEN IRON INDUSTRY.

Historico-Geographical Monographs
Under the Editorship of Professor H. J. Fleury.

THE HISTORICAL GEOGRAPHY
OF THE
WEALDEN IRON INDUSTRY

BY
MARY CECILIA DELANY.

LONDON: BENN BROTHERS, LIMITED
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1921.

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EDITOR'S PREFACE.

The progress of geographical thought has been a marked feature of the last twenty years, and it has become evident that we greatly need more research to bring together facts which will amplify and test our generalizations. The results of the researches are often embodied in papers which are too long to appear as articles in the ordinary scientific journals, and there has been a difficulty in bringing them out in book form.

The Geographical Association is therefore indebted to Messrs. Benn Brothers, Limited, for their co-operation in the present effort to issue research monographs from time to time in a series primarily intended for members of the Association and sister Associations, but, we hope, of interest also to a wider public.

The publications in this series are to be essentially research monographs, giving the results of new and fresh works of geographical nature. But it is strongly felt that too strict an interpretation of the province of geography would be inappropriate. Both education and research are suffering severely at the present time from the over development of specialization. Against this geography offers its steady protest, for it is on the one hand closely linked with the natural sciences, and on the other hand intertwines its hypotheses with those of the anthropologist and the historian.

This Historical Geography of the Wealden Iron Industry was felt to be an appropriate beginning for the series, as it gives the results of a course of steady, quiet research into this interesting phenomenon of the past life of our country, and helps to bring out the bearing of the old industry on the life of the district in subsequent generations. We bespeak for this volume and for the series the sympathetic appreciation of all those who are interested in the progress of geographical thought.

On behalf of the Geographical Association.

H. J. FLEURE, Honorary Secretary,
Professor of Geography and Anthropology,
University College of Wales, Aberystwyth.

September, 1921.



THE HISTORICAL GEOGRAPHY OF THE WEALDEN IRON INDUSTRY.

It is difficult to realise that one of the most peaceful and rural districts in modern England was in the Middle Ages the Black Country, the seat of the largest iron trade in the kingdom. This region, known as the Weald, and extending over portions of Kent, Surrey, and Sussex, is now almost entirely agricultural, but beneath its soil the earth still hides the treasure which once furnished material for an industry far different from the tilling of the ground or the tending of flocks and herds. It is the purpose of this article to trace out the history of the Wealden iron manufacture, and to estimate the chief reasons which led to its total extinction after several centuries of unbroken prosperity.

In commencing such a survey, it will first be necessary to make a brief examination of the geology of the region, in order to discover the source of the iron ore which supplied the industry. The structure of the Weald is relatively simple, consisting of an elevated chalk dome, the upper portion of which has been denuded, exposing the older rocks beneath it, mainly sandstones and clays. These rocks offered a varied resistance to the agents of erosion, resulting in a corresponding variety in the present surface features. The outer chalk layer, being comparatively hard, has only been partly denuded, and now stands out as a

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bold scarp in the North and South Downs which define the Wealden area, extending in a huge oval from Dover into Hampshire and Wiltshire, and thence again eastward along the south coast to Beachy Head. Within the rim of the Downs is a narrow valley, formed of easily denuded gault clay, and following the foot of the chalk scarp from Folkestone to Guildford and Farnham and round through Petersfield and Selbourne to the neighbourhood of Eastbourne. This is succeeded by a second series of escarpments, the lower greensand ridge, extending parallel to the Downs from Sandgate to Woolmer Forest in Hampshire, and back through Petworth and Pulborough to the south coast. Lastly, within the ring of greensand hills come the Wealden rocks, consisting of a belt of low-lying clay, commencing west of Romney Marsh, reaching its greatest width in West Sussex, and curving south towards Pevensey, and in the centre the Hastings beds, forming high ground from Hastings to Horsham.⁽¹⁾ The most important of the Wealden strata from the point of view of the former iron industry are the Hastings beds, the Weald clay, and the lower greensand. The first of these is partly composed of Wadhurst clay, a formation consisting of alternations of clay, shale, and sand-rock, and also containing beds of fossiliferous limestone, calcareous sandstone, and clay-ironstone. The ironstone occurs both in the form of nodules and in tabular masses, rarely exceeding four inches in thickness, and of a light grey colour.⁽²⁾ The Weald clay is also rich in septaria of deep red ironstone, which form layers of two or three feet in thickness near its upper surface.⁽³⁾ As a third source of iron ore, the Folkestone beds of the Lower Greensand contain irregular bands of thin ironstone, known locally as carstone, and especially abundant in Surrey and West Sussex.⁽⁴⁾ Besides possessing these ample supplies of

(1) Stanford—Geological Atlas. 15. M. 28

(2) Topley—Geology of the Weald. 158

(3) G. A. Mantell—Geology of West Sussex. Vol. 1. 38

(4) E. Smith—Reigate Sheet of Ordnance Survey. 6

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raw material to form the foundation of an iron industry, the Weald was also well provided with the means of exploiting its mineral wealth, according to the methods which prevailed previous to the more enlightened period of the last three centuries. Charcoal to supply fuel for the furnaces, and water-power to work the mill-hammers and bellows—these were the two essentials, and perhaps no part of England was so well furnished in both respects as this region nestling in the centre of the Downs. Its river system was formed after the elevation of Wealden dome, but before the chiselling commenced of which the existing relief is the distant outcome, hence the principal streams, Arun, Adur, Ouse, Mole, and Medway, rise in comparatively low ground towards the centre of the Weald, and have deepened their beds in order to cut their way through the Downs to the Thames or the English Channel.⁽⁵⁾ This antecedent drainage, consequent on the original dome, has resulted in the rivers renewing their youth, geologically speaking, so that instead of flowing in broad valleys with a gentle slope to the sea, as they may have done before denudation accomplished its work, they are narrow and swift, and engaged in hollowing out for themselves a permanent channel, through the scarps of the greensand and chalk hills. They were thus, together with their numerous tributaries, eminently suited to forwarding an industry which required water-power. It will be seen later that all the centres of iron manufacture were situated in the upper course of one or other of these small streams. With regard to the second essential for the industry, there was, at any rate in Sussex, no lack of timber to furnish charcoal from the earliest times right up to the eighteenth century. The Wealden forest is even now one of the most considerable in England, in spite of the constant inroads made on it in the past by generations of ironmasters and shipbuilders. Its extent at different periods is so intimately

(5) Victoria County History of Kent. Vol. 1. 26

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connected with the history of its ironworks that it will not be amiss to discuss its distribution before proceeding to the survey of its staple industry. The Anderida or Forest of Andred in Roman times extended from the coast of Kent over the north of Sussex and through a part of Surrey into Hampshire. Previous to their coming, it must have been practically inaccessible except by means of the river valleys and certain well-worn tracks along the greensand or chalk scarps, where, owing to better drainage, the woodland would be less dense. The best known of these primitive trackways is the narrow lane commonly called the Pilgrim's Way owing to its use in mediæval times by travellers visiting the shrine of St. Thomas of Canterbury. Unlike the later Roman roads its course is determined by physical features. From the neighbourhood of Canterbury to the point near Chevening where it enters Surrey, it follows the south slope of the North Downs. It can still be traced in places, creeping half-way up the hills immediately above the line of cultivation, and underneath the highest crest, for the most part avoiding the towns and villages and the regular roads.⁽⁶⁾ This ancient route, as well as the undoubtedly British coins found in various parts, and the remains of ancient burial grounds as at Mount Caburn, or the piles of Druidical Stones forming Kit's Coty House, give evidence that the Wealden forest was a centre of early habitation, but beyond this fact very little else can be learnt of it at that remote period. With the Roman conquest the opening up of the woodland commenced; roads were cut, dwellings built, and mines worked, though the only records of the progress of the conquerors which have come down to us are furnished by archæological evidence. Among the relics which they have left are their coins, their pottery, the heaps of slag or waste material from their iron mines, and foremost of all, the remains of their magnificent road system. But even the expert engineers of this mighty race

(6) Topley—Geology of the Weald. 254

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must have found the vast Wealden forest an unusually difficult task to negotiate. The Itinerary of Antoninus, a third century document describing the military routes of the Empire, mentions only a single highway in this region, connecting Chichester with London via Winchester, Silchester, and Staines, which points to the fact that there was no direct route through the Weald until a later date, when the Stane Street Causeway was built. This road ran from Chichester across the South Downs, past Pulborough and Slinfold to Dorking, thence through the Mole Gap to Leatherhead, Merton, and London Bridge. There were no towns along it, showing that it was purely of strategical importance as means of conveying troops rapidly from the coast to the capital.⁽⁷⁾ With the exception of this road, the forest was probably little less cleared than before the Roman occupation. The Saxons on their arrival seem to have had no taste for roadmaking under the difficult circumstances which prevailed. They merely adopted the existing Roman roads and British trackways, so that it is not surprising that Sussex was the last part of England to accept Christianity, since communication even with Kent was almost impossible. But the fact that the new settlers had no inducement to wander resulted in a more rapid opening up and clearing of the forest than would otherwise have been the case. It is at this period that some idea is first gained of the size of the Andred's Weald or Andreswald as it came to be called. In the reign of King Alfred, when its timbers furnished our first national fleet, the Saxon Chronicle of A.D. 893 estimates its greatest length from east to west at one hundred and twenty miles, and its greatest width from north to south at thirty miles,⁽⁸⁾ though its outlines are still entirely conjectural, apart from the fact that it was delimited on two sides by the Downs. Its probable extent was as follows: Skirting the chalk hills of Surrey, it went

(7) Victoria County History of Surrey. 269

(8) J. C. Cox—Royal Forests of England. 301

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as far north as Sevenoaks in Kent, and passed by Mereworth and Chart Woods to Hurst near Lynne; then, fringing the Romney Marsh, it entered Sussex from Sandhurst, and Penhurst (wood-end) near Battle was one of its southern boundaries. The chalk downs of Sussex separated it from the sea, and Lyswood, Fairfield, and Clanfield, in Hampshire may represent the western boundary.⁽⁹⁾ Lambarde, one of the earliest historians of the Weald, describes it in his 'Perambulation' as having been "in times past nothing but a desart and waste wilderness, not planted with towns or peopled with men, but stored with herdes of deere and droves of hogges only"⁽¹⁰⁾ This is clearly an exaggeration, for though the forest was reputed by him to have been "of such exceeding bignesse" that it extended over parts of three counties, it was by no means uniform in growth, nor were all parts equally barren. The characteristic tree was and still is the oak, though the density and type of woodland varied with the geology. On the coarse soils of the lower greensand and Hastings sands, the plant growth, mainly consisting of scattered oak and birch trees, and even passing into heathland in the driest and most exposed parts, differed materially from the giant oak-woods with hazel undergrowth which flourished on the damp clays and loams of the valley regions, or the thick groves of alder, willow, and other hydrophytes which shaded the marshy banks of the streams.⁽¹¹⁾ This diversity of vegetation would tend to make settlement a less difficult process in some localities than in others. Thus the open woodland was gradually cleared, while the denser portions served as hunting grounds, at first for all classes, and later for the more powerful Saxon chieftans who usurped sole rights. Besides furnishing opportunity for the nobility to indulge in their favourite pastime, the more open parts of the oak

(9) C. Pearson—Historical Maps of England. 5

(10) W. Lambarde—Perambulation of the Weald. 4

(11) Tansley—Types of British Vegetation. 75-85

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and beech woods (the latter being practically confined to the slopes of the chalk downs) afforded food for the numerous herds of swine which then formed the wealth of the middle classes. In course of time the chief feeding-grounds became known as 'dens' or 'denes,' and the right of pasturage in them was granted by the lord of the woodland in return for the payment of 'pannagium' or pannage, usually a certain proportion of the pigs fed. It is this utilitarian method of estimating the value of the woods according to the number of hogs they were able to maintain which results in an almost complete lack of information as to the extent of the Wealden forest during the whole of the Saxon and Danish dynasties, though grants and endowments of pannage grounds are common throughout the period. Thus Canterbury was endowed by Egbert in 838 with Pagham, Tarring, and South Malling manors, comprising a large tract of woodland on the eastern side of the Weald.⁽¹²⁾ But apart from the scanty knowledge of the history of the forest obtained from contemporary documents, there is the valuable testimony of place-names, which give evidence as to the type and density of settlement, and often the character of the country settled. It is always possible that they may have been obscured or perverted by corruption of the original form, in which case they are apt to be misleading, but this danger is comparatively slight in south-east England owing to its isolation until quite late times. The south coast of Sussex possesses the most remarkable collection of names with purely clan endings in the whole of England, for example Worthing, Tarring, Lancing, and a host of others, situated either between the Downs and the sea or in the Ouse valley and to a less extent up other river gaps, wherever early settlement was likely to be easy. But on crossing the Downs a totally different collection of place-names occurs, the majority of endings, such as 'hurst,' 'den,' 'field,' 'ley,'

(12) Victoria County History of Sussex. Vol. II. 292

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and 'fold,' being mediæval in form and pointing to late and gradual clearings in the forest, as at Midhurst, Tenterden, Heathfield, Chailey, Cowfold. The only settlements which may with certainty be regarded as pre-Norman are those referred to in the various grants of pannage to manors outside the Weald, the chief being Bromley, Chart, Mersham, Brabourne, Aldington, Appledore, and Wittersham on the eastern confines, and Surrenden, Biddenden, Bennenden, Shornden, Herbourne, Broxham, Hemsted, and Tyhurst, actually within the Kentish portion of the forest.⁽¹³⁾ The Sussex settlements at the same period included at least Brightling, Ninfield, Ashburnham, Mountfield, Netherfield, Whatlington, Sedlescombe, and Crowhurst, all of which were owned by Edward the Confessor or his powerful kinsman Earl Godwin.⁽¹⁴⁾ The southern portion of Surrey was still in all probability virgin forest, more or less uninhabited.

With the Norman Conquest comes the first definite attempt to make a systematic survey of the country. Sussex is for the first time divided into the six strips or Rapes of Chichester, Arundel, Bramber, Lewes, Pevensey, and Hastings; Kent also has similar divisions for the purpose of local government, corresponding broadly to the modern Lathes of St. Augustine, Aylesford, Sutton-at-Hone, Shipway, and Scray. Each of these major units comprised a number of Hundreds, composed in their turn of vils or manors. But here again the practice of estimating the quantity of woodland in each manor by the number of hogs it would feed is of little value in elucidating the point in question, as to how far the forest extended. There are five parks mentioned in Domesday within the wealden area, namely Rotherfield, Tortington, Waltham, Walberton, and Wiltingham, and only one forest, that of Dallington, though at least seven are said to have existed in Sussex alone. All forest land was held to

(13) R. Furley—History of the Weald of Kent. Vol. I. 218

(14) Victoria County History of Sussex. Vol. II. 324

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belong to the Conqueror, who parcelled it out among his followers, at the same time enforcing a stringent code of forest laws. At this point it is necessary to differentiate between the terms forest, chase, and park, all of which are frequently mentioned from this period of history onwards. A forest was an extensive tract of wild, woody, uncultivated country, contained within recognised limits, though without pale or fence on the whole, and belonging to the king. A chase was similar to a forest, but was granted by the king to a subject, and a park was any part of a forest enclosed with fence or hedge for the purpose of preserving game or for other reasons. These appellations, however, seem to have been interchangeable.⁽¹⁵⁾ The Sussex Rapes have already been enumerated; they each extended inland from the sea so as to include a portion of coast, down-land, and forest, and those manors in them which are recorded by the Domesday survey as paying the highest pannage rates may usually be assumed to have contained most woodland. The interior of Chichester rape, the most westerly division of the county, was occupied by woodland extending through the manors of Compton, Racton, Harting, Stoughton, and Stanstead, which are mentioned in the survey as furnishing one hundred hogs apiece. If the custom of paying one hog in every ten, the common rate in Ashdown Forest, be assumed to have been universal, the wooded area which could support one thousand pigs must have been extensive; it was later known as Stanstead forest, and adjoined that of Arundel in the next rape, with no definite boundary between. This second forest to which access from the sea was possible by means of the river Arun, included Arundel, Selhurst, Halnaker, Goodwood, East and West Dean, and Walberton, and much of it was held as pasture-land at this time by the Sees of Canterbury and Chichester. Further east, in the north-east of Bramber rape, lay the

(15) J. C. Cox—Royal Forests of England. 2

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forest of St. Leonard's, watered by the tidal river Adur, and covering the manors of Beeding and Steyning, formerly owned by Edward the Confessor. From the number of flint implements discovered around Horsham, it appears that this portion of the Andred's Weald was very early inhabited. This fact and the omission in Domesday of any mention of forest in the region, seem to show that the vegetation was less dense here than further west, a conclusion supported by the nature of the coarse sandstone soil, which would be unfavourable to the retention of sufficient moisture to foster compact tree growth. The whole estate together with the rest of Bramber rape is recorded as the possession of William de Braose, one of the Conqueror's followers.

Worth forest in the rape of Lewes lay east of St. Leonard's to which it was probably contiguous. It was another of the possessions of Edward the Confessor, though the only part of it mentioned in Domesday is the manor of Worth, doubtless owing to the wild and remote nature of the remainder. It was connected with the coast by the river Ouse, and perhaps included Worth, Crawley, Ardingly, Slaugham, and Balcombe. Judging from the character of the soil and the present plant growth, birch trees have always formed a predominant feature of this woodland, much of which verges on heath, especially in the north. Ashdown forest in Pevensey rape has ever been the most extensive in Sussex, and at the time of Domesday occupied the manors of Maresfield, Fletching, East Grinstead, Hartfield, Buxted, and Withyham. Like Worth forest it seems to have been mostly open country; pannage accounts certainly show that the oak was not so flourishing here as elsewhere. The geology of the underlying soil affected its history no less than its aspect; for the same sandstone that caused its picturesque and uncultivated beauty also contained in its iron-bearing strata the elements which contributed to its future

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greatness. On the north-east of Ashdown in the same rape, and distinct from it only on account of different ownership, was a forest anciently called Rotherfield Chase, and afterwards Waterdown. Originally the property of King Alfred, it is mentioned as park in Domesday, and was granted by the Conqueror to his half-brother Odo. It was probably a densely wooded region, occupying the whole of Rotherfield, and extending to Tonbridge in the next county on the north, and into Eridge and Frant on the east. Finally Dallington Forest, in Hastings rape, formed the eastermost extension of the Sussex Weald, and occupied the manors of Dallington, Brightling, Burwash, and a part of Mountfield. Its exact limits are not known, but it included Penhurst and Ashburnham woodlands, and was a royal possession. Though heavy timber grew well, there was much open country. It is the only forest mentioned as such in the survey, and later ranked with Ashdown, St. Leonard's, Waterdown and Worth, as a seat of the iron industry.⁽¹⁶⁾ The Kentish portion of the Weald seems to have extended as far east as Blean Wood, near Canterbury, in which case it would include the manors of Calehill, Hothfield, Eastwell, Godmersham, Chilham, Hambledon, and Selling. There is no mention in Domesday of any of the manors of Tunbridge, Cranbrook, Tenterden, Hawkhurst, Penhurst and Cowden, all of which rose in importance at a later date, hence it is reasonable to conclude either that their sites were at this time occupied by virgin forest or that settlement was still in its earliest stages. Furley gives a list of thirty-two vils or manors which then bordered on the Weald,⁽¹⁷⁾ from a consideration of which, its eastern boundary possibly extended from Appledore near Rye as far north as Maidstone and Sevenoaks, after which it turned westward into Surrey, where forest must have occupied the whole of

(16) Victoria County History of Sussex. Vol. II. 291-3

(17) See Appendix A.

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the southern portion of the country, though none of it came under forest law.

The history of the Weald from the time of the Conquest is chiefly one of grants of woodland to religious communities, and complaints of illegal felling of trees, hunting, or imparkation of common pasture land. That there was a certain amount of genuine forest, subject to full forest laws, in the time of Henry III. is proved by the summoning of the foresters in 1223 to make a report preparatory to the visitation of the justices. The Charter of the Forest which this king was compelled to sign on his accession, while it disafforested considerable areas, did not of course affect the natural features of the country, of which a large part still retained its forest character, so that Edward I. was obliged in 1276 to employ fifteen guides on a journey to Chichester. He and his successor frequently hunted in St. Leonard's Forest or the adjoining Knepp Park, which together covered an area of about eight thousand acres. The principal drain on the timber at this time was caused by its demand for building and repairing castles, bridges, and especially ships. Thus Edward II. had sixty oaks cut down in Ashburnham Woods for the repair of Pevensey Castle, and one hundred and sixty-nine for Dover Castle. "The free chase of Ashdown with all the rights and liberties pertaining thereto," was granted by Edward III. to his third son John of Gaunt, hence it appears in contemporary records as Lancaster Great Park.

Up to this time the eastern boundary of the Weald does not seem to have altered much since the Conquest. The gradual clearing of the forest, however, must have been in progress during the whole of the period, for the Court Rolls of the manors included within it contain constant entries of 'new rents' arising from 'new assarts,' that is, from woodland lately cleared of timber and brought under the plough. But it is from the succeeding era of the Middle Ages that most of the forest settlements date, if

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place-names may be taken as any indication. There are over one hundred and fifty ending in 'hurst' alone in east Sussex, and almost every local name for miles around indicates some form of clearing. The 'hursts' and 'charts' were the dense portions of the forest; the 'leys' were the open glades where cattle loved to lie; the 'dens' were the deep wooded valleys, and the 'fields' were little patches of felled or cleared land in the midst of the surrounding forest. From Petersfield and Midhurst by Cuckfield, Wadhurst and Lamberhurst, as far as Hawkhurst and Tenterden, these names stretch in an uninterupted string. Of the total number of names in Surrey, thirty-six per cent. have terminations like wood, holt, hurst, ley, den, or more, and twelve per cent. end in combe, ridge, or hill, so that almost half the county was once uninhabited.⁽¹⁸⁾

Rapid and systematic destruction of the forest dates from the reign of Henry VIII., when the extensive development of the Wealden iron industry began, and legislative action for the protection of the woodland frequently became necessary. In 1543 an Act was passed providing that in felling timber of more than twenty-four years' standing, twelve standard oaks, or as many ash, elm, or beech were to be left to each acre. This was followed in Elizabeth's reign by an "Act for the preservacioun of Tymber in the Wildes of the Counties of Kent, Surrey and Sussex," forbidding the cutting of young trees measuring less than "one foot square at the stubbe." A further enactment of the same reign prohibited the use of timber as a fuel supply for ironworks within twenty-two miles of London or four of the South Downs, though these measures had very little effect. It is to Elizabeth's reign that we owe the first map of Kent and Sussex, showing the distribution of the woodland at that date, 1577. Its cartographer, Thomas Saxton, inserts only thirty parks

(18) J. Taylor—Words and Places. 381

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and three forests, Arundel and Ashdown appearing as parks, though the number in existence was probably twice as great.⁽¹⁹⁾ The parks or enclosed portions of the forest at this time appear to have reached their maximum number. Thus Stanstead Forest contained Harting, Stoughton, Stanstead, and Up Parks, while Goodwood, East Dean, Halnaker, Arundel, and Selhurst helped to form the adjoining Forest of Arundel, which was also bordered by a number of outlying parks, namely Slindon and Aldingbourne on its southern edge and Houghton, Bignor, Petworth, Shillinglee and Farnhurst on the north. On the other side of the Arun was St. Leonard's Forest with its parks of Sedgewick, Chesworth, Beaubush and Shelley, fringed on the south by Knepp, Ashurst, Wiston, Angmering and Findon. The wooded portion of the next rape of Lewes was occupied by Worth Forest in the north, the parks of Slaugham, Bentley, and Cuckfield in the centre, and those of Hurst, Danny, Ditchling and Keymer in the south. Pevensey rape was also a well-wooded region, containing Waterdown Forest, with its parks of Eridge and Rotherfield (extending partly into Kent) in the extreme north-east, the parks of Bolebrook, Buckhurst, Stoneland, Newenden, and Maresfield forming Ashdown Forest in the north and west, and the parks of Frankham, Mayfield, Buxted, Ringmer, Plashet, and Glynde further south, while much of the centre was occupied by Waldron woodland, covering the parishes of Waldron, East Hoathly, Chiddingly, Laughton, and Hellingly. In the sixth rape of Hastings the chief wooded district was around Burwash, Brightling, and Dallington, with Mountfield and Whatlington parks on its southern verge, as well as those of Ashburnham, Battle, Buckholt, Hurstmonceaux and Bexhill with the woodland known as Darum or Darvel in the centre.⁽²⁰⁾ Much of the forest in Kent had been cleared

(19) See Appendix B.

(20) Victoria County History of Sussex. Vol. II. 296-8

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by this date, except in the south-western corner, where the iron industry flourished, though to a less degree than in Sussex. Surrey was only beginning to be opened up owing to the extension northward of the rapidly developing Wealden industry. The necessity for limiting the destruction of timber was urgent, when as many as two hundred cords (one hundred and twenty-five cubic feet each) of oak were authorised to be cut yearly in the royal forest of St. Leonard's alone, while in very few instances were measures taken for restocking the woodland.

By 1616, when Speed's map of Sussex was published, the number of parks had sadly diminished, though this enumeration is generally considered to be inadequate. During the Civil Wars and the Commonwealth, much unnecessary damage was done to royalist property in the forest by parliamentary troops. At the Restoration a survey of the iron mills in St. Leonard's Forest in 1655 states that two hundred and fifty loads of charcoal and thirty cords of wood were "reserved yearely out of ye said forest for ye use and service of ye said forges and mills." A petition made shortly after this by the leading ironfounders for protection of their trade by tariff estimates that the woods of Sussex "by computacioun amount to 200,000 acres." Bugden's map published in 1724 marks thirty-eight parks and five forests. In this century, which witnessed the gradual decline of the iron industry, the Wealden area reverted to agriculture, and tree-planting was encouraged to supply masts for the navy and hop-poles for the Kentish farmers, though it was impossible entirely to repair the damage wrought by the waste of several centuries.

In the reign of William III. the amount of Sussex woodland had been reduced to about 20,000 acres, of which Ashdown Forest contained 13,000, while by the end of the eighteenth century the largest remaining wooded areas, namely the forests of St. Leonard's and Ashdown,

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contained about 10,000 acres apiece, and the only considerable remnant of the Wealden Forest in Kent was King's Wood in Goudhurst, Cranbrook, and Ticehurst. There was still some fine timber standing in 1771, according to Horsfield, who relates that two oaks sold at £69 and containing about 1140 square feet of wood were carried nine miles to be shipped for the navy at the huge cost of £30. This statement is probably more trustworthy than that of Defoe in 1724, recording the remarkable fact that, owing to the state of the roads and the size of the timber, it sometimes took two or three years for logs to be transported from the interior to the coast en route for Chatham. At the present day the Weald has become popular as a residential area; many of the fine old Elizabethan mansions, like Parham, Wakehurst, and Cowdray, have been restored and reinhabited, and much of the region has been brought under cultivation, with the exception of such parks as Arundel, Sheffield, Goodwood, Eridge or Ashburnham, which form valuable game preserves. Sussex still contains a larger proportion of woodland than any other county. Throughout the history of the clearing of the forest, constant reference is made to the badness of the roads, which after the decay of the Roman system, remained in a deplorable state right up to the eighteenth century. The first highway act was passed by Henry VIII. in 1523, empowering George Gilford or Guldeford, of Cranbrook to alter the position of a road in his neighbourhood for the sake of convenience; this privilege was later extended to any willing landowner, but no attempt was made to improve the state of the roads until the reign of Elizabeth, when legislative action became imperative owing to the heavy charge for road repairing in the industrial regions, particularly the clay areas. In 1581 it was enacted that 'the occupiers of all maner of iron works whatsoever, which shall at anie time hereafter carrie or cause to be carried anie coles, mine, or

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iron to or for anie their ironworks, betweene the twelwe daie of October, and the first daie of May yearlie, shall for every six loads of coal or mine, or for every ton of iron so carried, cause also to be carried yeerelie by the space of one mile through anie highways one usual cartload sindarr, gravell, stone, sand, or chalk, meet for the repairing and amending of the said high waies.' By an oversight in the wording, the act referred to all the roads 'under anie of the hills commonly called the North Downs of Surreye and Kent,' so that the people of Sussex were exempt from repairing their ways until a further act was passed in 1597, which also provided the substitution of a money payment for the carrying of road material. These laws seem to have answered the purpose, for they were reinforced in the Highway Act of Charles I., but the improvement caused by them could only have been local and temporary at best, and in the time of Charles II., most roads were still almost impassable.⁽²⁰⁾ Extracts from the Traveller's Guide, published in this reign, frequently contained the entry: 'this road is inconsiderably frequented, nor commendable for its goodness.' The journey to London occupied two whole days, but the inhabitants of the Weald regarded their bad roads as securities from the evils of London and its people. Communication with the interior was somewhat bettered by the Turnpike Act of William III., 1696, authorising the collection of tolls for repairs on the most used highways, and by the deepening of the Medway in 1740, whereby timber and iron could be shipped direct from Tonbridge to London. Stane Street, was, however, the only good road until 1756, when a turnpike was made from Horsham to London, before which time wheeled traffic had been obliged to make a circuit via Canterbury. Improvement has continued slowly from this date, and though the farm roads still

(20) Sussex Archæological Collections. Vol. XV. 138-144

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leave much to be desired, the main roads through the Weald are now equal to any in England.

Having considered the supply of the three essentials possessed by the Weald for the early working of iron, namely ore, fuel, and water-power, it remains to discuss the industry itself. In this survey the distribution of ironworks at different periods will first be considered, followed by a summary of the methods of smelting and forging employed, and a classification of the iron goods produced. Lastly, an attempt will be made to account for the decline of the industry and its ultimate disappearance.

Iron is the cheapest and most abundant of the heavy metals, the strongest and most magnetic of known substances, and more indispensable than anything except air and water, while the variation in its properties is almost endless. It would therefore be one of the first metals to be employed by a primitive people, so that it is not surprising that some of the British ironworks date from before the dawn of history. According to Tacitus, the early Britons 'enriched their necks and loins with iron as evidence of wealth,' and their coinage is stated by Cæsar to have been either brass or oblong pieces of iron of a certain weight. If the latter are taken to be identical with the iron bars resembling sword blades, which are the most abundant of pre-Roman finds, their distribution points to the Forest of Dean rather than the Weald as the centre of production. On the other hand, the iron wheels and scythes attached to the chariots of the tribes who resisted Cæsar's landing were most probably of local manufacture and several antiquities in iron, including a hammer, spear-heads, a ploughshare, knives and sickles have been found at the old British camp at Mount Caburn, near Lewes, as well as other articles of a similar nature at Battle. With the advent of the Romans, works sprang up all over the Weald, and iron became one of the principal exports of the region, proved by the abundant heaps of iron slag or refuse discovered at

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Maresfield, Westfield, Framfield, Beauport, Chiddingly, and Sedlescombe in Sussex, and at Cowden and Tenterden in Kent, the finds in each case being mingled with fragments of pottery and coins bearing inscriptions of Vespasian, Nero, or Diocletian. The first of these rulers came to the throne in A.D. 69, so that the iron industry must have flourished from the first to the third century, if not longer.⁽²¹⁾

With regard to the period which succeeded the departure of the Romans, there is absolutely no trace of the Wealden ironworks for seven or eight centuries. The furnaces must have been still in blast when the Saxons arrived and they were a warlike race with full knowledge of the value of iron, hence it is not probable that the existing works were allowed to die out altogether. But in the absence of any evidence, historical or archæological, a blank must be left in the record at this epoch. Only one mine is mentioned in the Domesday Book, in the Hundred of East Grinstead, so that the industry still existed, though in a far from flourishing condition. In fact London's supplies of iron were obtained almost exclusively from the Forest of Dean right up to the end of the twelfth century, but the advantage of being considerably nearer to the central market caused the Weald to supplant it from this time onwards. Documentary evidence now become available; thus the Exchequer Rolls of the reign of Henry III. show that in 1253 the Sheriff of Sussex was called upon to provide 30,000 horse-shoes and 60,000 nails, presumably of local manufacture, to furnish the royal army. The Murage Grant made by the same monarch to the town of Lewes, empowering its citizens to levy toll for the repair of their walls on every cart or horse-load of iron passing through the gates may possibly refer to Wealden iron, but as toll was also to be levied on tin and lead, neither of which was of local manufacture, it is equally probable that the iron referred to was imported. The next evidence is more

(21) *Archæologia Cantiana*. Vol. XXI. 313

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definite. In 1275 Master Henry of Lewes, the king's chief smith for the past twenty years, purchased 406 rods 'in the Weald' for £16 17s. 11d., while a year or two later he paid £4 3s. 4d. 'to a certain smith in the Weald for 100 iron rods.' In 1300 the Guild of Ironmongers or Feroners of London lodged a complaint against the smiths of the Weald ('fabri de Waldis'), for making and selling iron rims for cart-wheels too short for use, and several rods of standard length were made and ordered to be set up in the markets. In 1320 Peter de Worldham, Sheriff of Surrey and Sussex, furnished horseshoes and nails for Edward III.'s Scottish expedition. The royal ironworks in St. Leonard's Forest commenced in the preceding reign, and in 1327 were able to send 1,000 horse-shoes from the forge at Roffey near Horsham to the port of Shoreham, the Sheriff being paid £4 3s. 4d. for them, and an extra 5/- for carriage. In 1397 poll-tax returns show that the industry was flourishing at Crawley, where one 'factor ferri' was assessed at 6/- and another at 3/4; the mention of a charcoal burner and six smiths at Lindfield at the same date points to similar conditions in this district. The Kentish works at Ashurst, Cowden, Hawkhurst and Lamberhurst, existed considerably before Tudor times, though the date of their commencement is uncertain.⁽²²⁾

For the fifteenth century there is little contemporary evidence. Iron import from Spain and Sweden still continued, so that not enough of the metal was yet produced for home consumption. Early Wealden produce consisted chiefly of nails, horse-shoes and irons, and firebacks, and occasional cast-iron tomb-slabs; the earliest existing specimen of the last-named occurs in Burwash Church, bearing the inscription "Orate p annema Jhone Collins," and dating from the fourteenth century. A very primitive type of iron ordnance also began to be manufactured at Buxted and other rising towns. All these

(22) Salzmann. English Industries of the Middle Ages. 23-24

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classes of iron goods will be discussed later. The reign of Henry VIII. marks the beginning of the historic period of the Wealden iron industry, which now began to develop so rapidly that it soon embraced the whole of central Sussex and West Kent, extending from Biddenden westward to Petworth, and from Tonbridge as far south as Crowhurst. Hastings sandstone underlies the greater part of this area, though the western portion consists of Weald clay and lower greensand. Kent at no time carried on such a large iron industry as Sussex, since her greater population necessitated the clearing of the forest for food production except in the densest parts. Again, whereas the weald of Sussex was held by lay barons, who felled timber at their pleasure, the Kentish Weald belonged chiefly to the ecclesiastical lords, who prohibited their tenants from felling timber until about the fourteenth century, so that the Kentish iron trade was merely an extension of that of Sussex.

Iron manufacture did not commence in Surrey until the sixteenth century, chiefly owing to lack of communications; at this period the increasing demand for iron ordnance caused the Sussex industry to develop northward. The first complete record of the distribution of the Wealden ironworks dates from the reign of Elizabeth. In 1573 Ralph Hogge of Buxted, 'the queen's gun-founder and gun-stone maker,' lodged a complaint before the Privy Council, alleging infringement of his patent as sole exporter of ordnance. The following year, in answer to his petition, a commission of inquiry was appointed to draw up a list of the existing centres of iron manufacture and the leading iron masters were summoned to give their bond, under security of £2,000, not to found or export cannon without the royal license.⁽²³⁾ The towns mentioned in the survey are without exception situated in a river valley, where they could obtain a convenient supply of

(23) Sussex Archæological Collections. Vol. III. 241-6

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water-power; while plentiful charcoal and ore were ready at hand. Nearly all the centres of industry mentioned for Kent, as well as a few in Surrey and Sussex, could make use of the Medway and its upper tributaries the Eden, Beult, and Teise. The chief of these are given as follows. In Surrey, Lingfield and Copthorne on the Eden possessed a forge and a furnace; in Sussex, Hartfield and Withyham also had one apiece; East Grinstead had three forges and a furnace on the upper Medway, and Frant four forges on the Teise, which after entering Kent supplied the ponds of Lamberhurst, Goudhurst and Horsmonden. Other Kentish manufacturing towns were Cowden, Ashurst and Tonbridge on the main river, and Cranbrook and Biddenden on a branch. The whole of this district had the advantage of direct outlet northward, an advantage shared by Ifield, Rowfant and Ewood on the upper feeders of the Mole and Cranleigh, Dunfold, Haslemere, Frensham, Shere and Abinger on the headwaters of the Wey. The rest of the Wealden district drains southward into the English Channel, hence the difficulty of communicating with the central market. Starting from the east, the Rother basin was well supplied with ironworks. There were forges and furnaces at Rotherfield. Mayfield, Wadhurst, Etchingham, Robertsbridge, and Salehurst on the main stream, with Dallington, Brightling, and Burwash on a small tributary, and Netherfield on the Brede river, which debouches at the same estuary, while Hawkhurst obtained its water supplies from the Kent Ditch. The rivulets known as Ashten and Ashburn were of considerable importance in 1574, on account of Ashburnham in the latter case, and Battle and Buckholt in the former. On reaching the Cuckmere Valley we come to what was probably the greatest centre of iron manufacture in the whole of the Wealden area. At this time there were four forges and three furnaces in Heathfield alone, as well as four forges and two furnaces at Warbleton, and at least one of each at

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Waldron, East Hoathly, and Chiddingly. West of the Cuckmere lies the Ouse, whose easterly branch supplied the mills at Buxted, Maresfield, Framfield, Uckfield and Fletching; at the same time its western arm was utilised by Ardingly, Slaugham, Horsted Keynes, Freshfield and Horsted. The Adur, passing through West Hoathly and Cuckfield, was comparatively unimportant. Finally, the Arun and its main affluent, the West Rother, boasted only three ironworks, at Kirdford, North Chapel, and Petworth. It will be seen from the above distribution of the iron works in Elizabeth's reign that all the principal centres of manufacture were situated in the east and middle of the Weald, where the Ashdown sand furnished the largest supplies of the necessary ore; on the northern and western outskirts where iron was obtained from the Weald clays as at Ifield, or from the ferruginous strata of the lower greensand as at Petworth, the towns became more scattered, showing the remarkable effect of geographical conditions in determining history.

The extent of the ironworks about a century later may be gauged from consideration of a manuscript, until lately preserved at Horeham, and apparently written in 1664, containing a list of Wealden forges and furnaces from 1653 until that date. By comparing this list with the preceding one, it appears that the zenith of the industry was already passed, though there were a few new works. The paper will be quoted at length, with the name of the place in brackets where identification is necessary. "In the year 1653 did blow these 27 furnaces in Sussex: Waldron, Brede, Robertsbridge, Crowhurst, Barvil (Darvil in Brightling), Streame (Chiddingly), Horsted Keynes, Pallingham (Wisborough Green on Arun), Frith; these ten were continued in repair and found partly stored at ye beginning of 1664. Mayfield, Milplace (East Grinstead), Ewhurst, Northiam, Conster (Beckley), Ashburnham, Beach (Netherfield), Poundsley (Framfield), Tilgate,

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Socknersh (Brightling); these ten were discontinued before 1664 and partly ruined, but repaired and stocked on account of the warr and hopes of encouragement. Bowbeach (Hurstmonceaux), Snape (Frant), Riverhall (Wadhurst), Maynard's Gate (Rotherfield), Warnham, Northparke (Petworth), Beaubush (St. Leonard's Forest), these seven were ruined before 1664, and so remain. In all, 27 in Sussex in 1653, reduced to 11 before 1664. In the year 1653 were 42 forges or iron mills working in Sussex, viz.: Ashburnham, Bugshill (Salehurst), Constance (Warbleton), Hoodshall (?), Ashburnham minor, Cowbeach, Steele (Frant), Riverhall, Howborne (Framfield), Tickridge (Framfield), Kinians (Horsted Keynes?), Freshfield, Holmsted (?), St. Leonards, St. Leonards minor, Poundsley, Rowfant, Bower (?), Coursley (?); these 19 were ruined before 1664, and so remain. Etchingham, Sheffield (Fletching), Buckholt (Bexhill), Rowfant (Worth), Crowhurst, these five are laid aside and not used. Westfield, Robertsbridge, Glazier's (Brightling), Bibleham and Hawksden (Mayfield), Bayham (Lamberhurst), Eridge, Hothly, Streame (Chiddingly), Ardingly, Tynsley (Cuckfield), Birchden (Eridge), Pophole (Frensham in Surrey), Burton (Petworth), Burwash, Maresfield, Buxted; these 18 as yet continue in hopes of encouragement."⁽²⁴⁾ Some of the leading towns given above require further notice. Lamberhurst, situated partly in Kent and partly in Sussex, held a prominent place throughout the history of the industry, and reached its period of greatest prosperity in the reign of Anne, when the great Gloucester furnace was established. Cannon formed the staple article of production, though in its later years the foundry also turned out fire-backs and other cast-iron goods, a fine set of casts with scriptural subjects appearing as late as 1770. Perhaps the most remarkable product of the Lamberhurst works was the set of railings which formerly surrounded St.

(24) Sussex Archæological Collections. Vol. VIII. 16-17.

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Paul's Cathedral, which were of enormous weight and very expensive. The furnace lasted until 1785, when tradition whispers that it was ruined and disgraced owing to persistent illicit export of Ordnance to French privateers and other enemies. Robertsbridge further south had extensive iron and steel works from the time of Henry VIII. The cannon made here were floated down the Rother to Rye by means of 'shuts' or primitive locks, traces of which have been discovered while cleansing the river bed between Rye and Bodiam. Heathfield, in the centre of the Wealden 'Black Country' has left a more extensive record of its industry than perhaps any other town in the region. This record is contained in the recently published manuscript accounts of Sylvan Harmer, whose family were employed in the Heathfield foundry for generations. From him we learn that the Sussex owners of works here in 1574 were: "Sir John Pelham, ij fordgs, i furnace, in Dalington, Hethfield, Waldron, and Brightling; Sir Rychard Baker, ij fordgs, ij furnaces in Hethfield and Warbleton." The iron worked here seems to have been smelted at Waldron and then sent to the two local forges, which were supplied with fuel from "the fallable woods in Hethfield, Hellingly and Waldron." New Furnace, which "formerly in all its departments kept nearly half the parishioners in regular employ" was established by John Fuller of Tanners in 1698. The ponds supplying it extended for over three miles along a branch of the river Cuckmere. The son of this Fuller, true to the family motto of courting prosperity 'carbone et forcipibus,' obtained government contracts for cannon early in the eighteenth century, at a time when most of the Sussex ironworks were on the wane. The furnace accounts continued until 1770, at which time pig-iron, and articles of agricultural or domestic use were the chief products, and seventeen years later the works were finally closed

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down.⁽²⁵⁾ The foundries in St. Leonard's and Worth Forests, the most notable of which were at Ifield, Horsham, Worth, and Rowfant, belonged at all times to the Crown, and prospered until the time of the Civil Wars, when they were pillaged and destroyed by Parliamentary troops in 1643 under the command of Sir William Waller. Buxted on the southern fringe of Ashdown Forest will always have a place in history as the scene of manufacture of the first cannon by Ralph Hogge in 1574. The Hog House on Huggett's Farm where he lived still remains, and iron 'gun-stones' have been turned up in the neighbourhood during ploughing operations, while heaps of glassy slag are common for several miles around. Maresfield further west had a furnace and two forges at the time of the 1574 survey, one forge being built on the site of the Roman works at Oldlands. The two most important works in West Sussex were at Linchmere and Farnhurst, where the iron industry was carried on till 1776 in the former case, and 1790 in the latter. But the most persistent of the Sussex works were those at Ashburnham, extending into the next parish of Penhurst, and obtaining fuel supplies from Dallington Forest. The furnace, which is mentioned in 1574 and was probably established much earlier, lasted till 1811, and the forge continued working until 1825, less than a century ago. None of the Kentish works continued much after 1700, and the industry here was always subordinate to that of Sussex. Iron in Surrey was obtained from three different deposits, namely Hastings sand in the Lingfield area, Weald clay around Ewood, Cranleigh and Dunsfold, and lower green sand in the west at Haslemere, Dunsfold, Chiddingfold, Shere and Abinger, and the later works at Witley and Thursley. Each of these regions represents the northern extension of a corresponding Sussex district, being East Grinstead in the first instance, Worth in the

(25) Lucas—Heathfield Memorials 69, 70, 71

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second, and Linchmere in the third. The most interesting of the Surrey works, as well as the earliest, were at Ewood to the north of Ifield. In 1553 this estate, including the woods of Leigh, Charlwood and Newdigate, was sold by Lord Abergavenny to Christopher Darrell, the ironmaster who owned it at the time of the 1574 record, and who was exempted by special mention from the Act of Elizabeth in 1581, restricting the felling of timber. A survey of Ewood taken shortly before the ownership of Darrell gives a furnace, forge and hammer, a pond of 90 acres, a coal-house, six acres of waste ground for the storing of the coal mine, cinders, and other commodities used in the works, and four cottages occupied by the workmen, as forming part of the estate, which is estimated at the annual value of £40.⁽²⁶⁾ The foundries on Witley and Thursley heaths were the last to be established in Surrey, and also the last to remain. In 1767, a dispute having arisen between the inhabitants of Guildford and Godalming regarding the position of a turnpike on the Portsmouth road, it was stated on the one hand that there was great traffic to and from Witley and Thursley via Milford and Hindehead, while on the other hand it was asserted that not more than one carriage weekly conveyed material to the forge.

The distribution of Wealden ironworks can only be approximately settled, for traces of cinder and hammer-ponds occur in places not definitely mentioned in history. The next point is to describe the various processes of manufacture, and the classes of goods produced. The latter were of three kinds, including bar or wrought-iron, ordnance and shot, and cast-iron articles such as firebacks, and each kind involved a different process of smelting and fashioning. During the earliest phase of the industry, which lasted from prehistoric times till about the fourteenth century, wrought iron alone was produced. This type is

(26) Victoria County History of Surrey. Vol. II. 269

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distinguished from cast-iron by its difference of carbon-content, for iron is never obtained in a perfectly pure state, but unites to a greater or less extent with the carbon contained in the fuel which smelts it. Wrought iron has a very small carbon-content, about .3% in the case of charcoal-hearth iron; cast-iron contains as much as from 2.2 to 5% of carbon, while steel occupies a position midway between the two. The properties of iron vary with the amount of carbon it contains. Thus wrought-iron is malleable, steel becomes brittle on sudden cooling, and cast-iron is very brittle whether cooled slowly or rapidly. The wrought-iron produced by the early Wealden furnaces involved direct extraction of the metal from the ore, and was possible to a certain extent even by the most primitive methods. In Roman times a hearth of wood or charcoal was set on a wind swept hill or in some other position where a natural draught would be ensured, and alternate layers of ore and charcoal were heaped upon it, the whole being covered with clay to keep in the heat. The resultant conical structures have been found at Beaufort and Maresfield, and their crudity and wastefulness are proved by the fact that in later years it often paid to work the slag or cinders left by the Romans rather than to dig a fresh mine. When ore was to be extracted, it was obtained by sinking bell-pits, of about six feet in diameter at the top, and widening gradually towards the base. They were usually shallow, being rarely more than twenty feet deep. The ore, which is often referred to as myne or mine, is very abundant, and local names were used for the various beds of ironstone, which differed in colour, weight and goodness. An eighteenth century treatise describes some of them as follows: "The first stratum of mine is called Bottom. This is a coarse, indifferent sort of mine, but it is useful to work with the richer mines, because it is a sort of lime-stone, which fluxes other metal and keeps it alive in the furnaces. The second stratum is Bull, a hard hot mine abounding in

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iron, which is hard to melt out of it. The third stratum next the Bull is Three-foot Pitty, also a fairly course ore." The treatise ends here without referring to the more valuable ores, which are elsewhere named Foxes, Riggitt, Brushes, and Caballa balls. In good mining each pit would be carried down to the lowest layer of mine, but sometimes only the richer and more accessible layers of mine were taken, and a fresh pit was then started.⁽²⁷⁾ The ore having been duly dug was subjected to a preliminary calcination, alternate layers of charcoal and ore being laid in a small kiln and burnt sufficiently to enable the iron to be easily broken, but not to cause it to loop or run into a hard mass. It was next beaten into small pieces with a sledge-hammer, and the finer but more intractable mine was mixed with coarser ore or cinder, after which the mixture was placed in the furnace to be smelted. This building was in the early centuries similar to a blacksmith's forge, with a cup-shaped hearth or crucible at the base, in which the imperfectly molten iron could accumulate.⁽²⁸⁾ The artificial blast which soon replaced the natural draught at first employed, was supplied by bellows, worked by hand, or rather by foot, until the fourteenth century, after which water-power was substituted, and a blast was obtained by the downward suction of air in a falling column of water. The lump of malleable iron produced in the furnace was then taken to the smithy to be worked, where it was fashioned into shape by hammering. In this process also, water-power was introduced before 1496, at which date there was a great 'water-hamor' in the royal works at Ashdown Forest. The hammers used weighed from 1200 to 1500 or even 2500 lbs. and were worked by a rough cog-wheel driven by a stream of water. By about the fifteenth century this simple but wasteful process of manufacture was replaced by another, at once more

(27) Sussex Archæological Collections. Vol. II. 206

(28) Topley—Geology of the Weald. 341

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complex and more economical. In order to save fuel and labour, the height of the forges was gradually increased, while the water-power now used to work the bellows supplied a pressure strong enough to force the blast up through a longer column of ore and fuel, and the length and intimacy of contact between them caused the former to become carburised or cast-iron, after which it could be reconverted into malleable wrought-iron by reheating if required. The mine was still calcined first as before, and was then carried to the blast furnace, which was built of brick about 24 feet square and 30 feet high, and shaped like a truncated cone. Within, the cavity was egg-shaped, measuring 8 to 10 feet, and was lined with sandstone. "Behind the furnace were two huge pairs of bellows, whose nozzles met at a small hole near the base. These were compressed together by certain buttons, placed on the axis of a large wheel which was turned by water. As soon as these buttons were slid off, the bellows were raised again by the counterpoise of weights, whereby they were made to play alternately, the one giving its blast all the time the other was rising."⁽²⁹⁾ Before the mouth of the furnace was a bed of sandstone, into which the cast-iron could be drawn off in moulds, the resultant mass being termed a "sow" if over 1000 lbs. and a "pig" if under that weight, possibly owing to the practice of making one large oblong depression in the sand in the direct line of the flow, and several lesser ones at right angles to it. When a furnace has once been lit, it was kept burning sometimes for as long as 40 weeks, the period of its blowing being reckoned in 'foundays' of six days each; during one founday, on an average 8 tons of iron could be made at the expense of 24 loads of charcoal (11 quarters each), and 24 loads of mine (18 bushels each), though the sows varied in size according to the capacity of the furnace, which was much greater at the end of a blowing than at the beginning, owing to the

(29) C. Dawson—Sussex Ironworks and Pottery, 8, 9, 10

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fire eating away the sandstone hearth. The cinder-like scum in the furnace would rise to the top of the molten metal, and could be drawn off from time to time, forming the slag-heaps which are so characteristic of parts of the Weald. When a sow was cast, it was taken to the forge, ironmill, or hammer, which was a building containing two open hearths, the finery and the chafery, a great hammer of 7 or 8 hundred weight, fixed on a forked shaft, and raised and lowered by a revolving waterwheel. At the finery the mass of iron was first reheated, and a piece or loop of about $\frac{3}{4}$ cwt. was melted off. This was beaten with the hammer very gently to force out the dross and cinders, and then brought to a "bloom" or "four-square mass about two feet long. This done, they bring it to an 'ancony,' or bar about three feet long, of the shape they intend the whole bar to be; at the chafery they only draw out the two ends suitable to what was drawn out at the finery in the middle, and so finish the bar."⁽³⁰⁾ Most of Sussex iron other than ordnance was made in bars, of suitable length and thickness to be easily fashioned into tyres, ploughshares, and other articles of common use. Two ponds at least were necessary at an iron foundry, one to supply the blast for the furnace, and the other to work the hammer at the forge, and these ponds were easily obtained by damming up the rivers and streams with which the Weald abounds. They are abundant all over the region, being still called Hammer Pond, Furnace Pond, or Forge Pond, and are sometimes used to work flourmills, as at Ifield, while in other cases they have been drained and planted as osier beds as at Heathfield. The casting of ordnance was an important branch of the Wealden industry. Cannon were used by Edward III. at Crecy and during the Scotch wars, though it is not certain that they were of British manufacture. The earliest cannon made in the Weald were probably similar in type to the

(30) J. M. Swank—Iron in all Ages, 86-8 (quoted from Ray's account 1674)

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iron pieces found at Eridge Green and in the castle moat at Bodiam, both of which had cast-iron chambers made in the form of a tube composed of long iron bars arranged like the staves of a barrel, and bound together by bands of wrought iron. They were breech loaders, consisting of two parts, the barrel and the chamber; the latter in which the charge of gun-powder was placed, being usually detachable. The projectiles employed for the larger guns before the sixteenth century were round stone balls such as had been used for mangonels and catapults from Roman times, and these were supplied chiefly from quarries at Maidstone. They measured 14, 16 and 18 inches in diameter, and could be cast for the distance of about a mile though the discharge almost buried the cannon in the ground.⁽³¹⁾

Iron gun-stones were first used towards the end of the 15th century, for in 1497 Simon Ballard cast large quantities of iron shot at Newbridge in Ashdown Forest, being paid at the rate of 16d. per cwt., and Peter Robard in the same year cast 'pellettes' at Hartfield at 6d. per day. Cannon were first cast hollow, and put together in strips. The turning point in the history of ordnance was in 1543, when Ralph Hogge of Buxted and his assistant Peter Baude discovered a method of casting cannon whole and then boring them. Wooden models were used, on which cannon were smoothly turned at a lathe, the drill being stationary, and the gun revolving with the boring-wheel, to the axis of which it was fixed.⁽³²⁾ The water-power used for the bellows and hammer turned the boring-wheel also. The 'iron devils' mentioned in the Heathfield accounts in connexion with gun founding were small portable grates containing a charcoal fire for drying the inner surface of the mould. The forerunner of the modern bomb dates from this period. We read in Stow's Chronicle that "one

(31) L. F. Salzmänn—Industries of the Middle Ages. 26, 27

(32) P. Lucas—Memorials of Heathfield. 65

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Peter Baude and another alien called Peter van Cullen conferring together, devised and caused to be made certain mortar pieces, for the use whereof they caused to be made certain hollow shot of cast-iron, to be stuffed with firework or wildfire, whereof the bigger sort for the same had screws of iron to receive a match to carry fire kindled, that the firework might be set on fire for to break in pieces the same hollow shot, whereof the smallest piece hitting any man would kill or spoil him."⁽³³⁾ The ordnance trade expanded greatly during Elizabeth's reign, when Admiral Seymour established profitable works at Worth, and the constant restrictive measures seem to have had very little effect in checking illicit export, which was largest from Rye, Pevensey and Lewes. In 1576, 1579 and 1588 all the Wealden furnaces were ordered to be stopped until the Queen's further pleasure. Later on, in the reign of Charles I., an office of Surveyor of Ironworks was created by Letters Patent, with full powers to visit works, examine accounts, and even search premises, but the office was abolished after three years. After the destruction of the Royalist works during the Commonwealth, export from Hastings and other ports showed a marked decrease, though there was a short spell of renewed prosperity during Charles II.'s Dutch wars. But on the whole very little ordnance was cast after the reign of Charles I. except at Heathfield, Grayetye in West Hoathly, and Lamberhurst which had government monopolies until 1770.

The third class of produce from the Weald consisted of cast-iron articles, of which the earliest extant specimen is the tomb slab in Burwash Church already referred to, dated from the fourteenth century. The fact that brick and stone were easily corroded by fire would make a fireback of iron an early necessity, and some of those still existing also date from the fourteenth century. They were moulded from boards, cut to the required outline and thickness, and

(33) J. M. Swank—Iron in all Ages. 47

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pressed into a bed of sand, the molten iron being poured into the shallow cavity without any top to the mould. The readiest decoration was to be obtained by pressing into the smooth surface of the sand any ornament at hand or specially prepared for the purpose. The grouping of impressions was left to illiterate workmen, often with very crude results. Their stock ornaments were fleur-de-lys, rosettes, crowns and odd pieces of carving, which were pressed into the sand without any attempt at arrangement. The slabs were edged with twist devised from cable stiffened with pitch or glue, and this edging is characteristic of all early work of the type in question. The existing specimens of all periods may be grouped into four classes, namely those moulded from separate movable types, those with armorial bearings cast from a single piece mould, those bearing biblical, allegorical or kindred subjects, and replicas of Dutch seventeenth and eighteenth century designs. Some of the earliest firebacks bearing armorial crests were cast at Heathfield, Wadhurst, Waldron, Mayfield, and Warbleton. By degrees the founders added their initials and the date, and moveable stamps were practically discarded after 1640. Grave-slabs were made with stereotyped words, as on those at Crowhurst and Wadhurst. Figures were sometimes stamped on the firebacks at a later date, that of Charles I. on horseback being cast at Lamberhurst. Many of the local nobility owned foundries, where they had their family arms stamped on the goods. Among these were the Bakers of Battle, the Barhams of Wadhurst and Frant, and numerous others. One of the most interesting specimens is that representing Richard Leonard of Brede Furnace, with his dog, tradesmark, implements, and a delineation of his works; the date is 1636. Biblical and Dutch models were largely imported, and one was used at Ashburnham until 1811. Besides fire-backs, andirons or firedogs were manufactured, all of them consisting of a rectangular pilaster, with moulded cup and base, seated on two

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straddled legs, forming a depressed arch, sometimes cusped, the junction being concealed by a shield. None are of earlier date than the reign of Henry VIII. Their period can sometimes be identified by the head-dress worn by the human head by which they are surmounted. Among miscellaneous articles made in the Weald, the chief were the copings of Rochester Bridge, founded at Mayfield in the sixteenth century, and the railings for old St. Paul's, produced at Lamberhurst in the eighteenth.⁽³⁴⁾

But the staple produce was always pig-iron, as it is in the the Black Country of Stafford to-day.

Throughout the history of the industry, the prices naturally varied with the labour supply, the demand for iron goods, the cost of carriage, and the quality of the iron produced. From the survey of iron mills in Ashdown Forest in 1539, it appears that "to melt the sows in ij forges or fynories, there must be iiij persons, and at the forges to melt the blooms there must be ii persons. So are there at every forge ij persons, whereof the one holdeth the work at the hamor and the second keepeth the work hot. One man cannot keep the hamor because the work must be kept in such heat that they may not shift hands." At Tudeley Forge, Tonbridge in 1333, the workmen were paid in kind, receiving every seventh bloom which was roughly equivalent to 6d. a bloom, but by 1353 this system was dropped, and they were paid from 7½d. to 9½d. a bloom. There is also mention at the first of these dates of a customary payment to the 'Forbloweris' of 2¼d. a bloom, and in the second account 'rewards' were paid to the master-blower and three other blowers; no other workmen are mentioned by name, and as the whole process of making blooms is here referred to as 'blowing,' the staff of these early works evidently consisted of 4 men. The Sussex iron mills at Sheffield in 1549 employed one

(34) J. S. Gardner—Iron-casting in the Weald Archæologia. Vol. LVI. 153-164

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hammerman and his assistant, two fyners and their two servants, a founder, and a filler whose duty it was to keep the furnace charged. The founder was paid 8/-, and the filler 6/- for each founday, and the hammer-man and fyners received between them $13\frac{1}{4}$ per ton, about three tons being produced each founday. Each forge also employed a number of charcoal burners and miners. The amount of wood consumed was enormous. At Sheffield in 1547—9, 6300 cords of wood were coled for the furnace, and 6750 for the forge; at Worth for the same years the amounts were respectively nearly 5900 and 2750 cords, the cord being 25 cubic feet; this represents an expenditure of about 2,175,000 cubic feet of timber for these two works alone in less than two years.⁽³⁵⁾ The payments made to wood-cutters at this time, as stated in a contemporary account book called Westalle's Book of Pannyngrydge, dated 1546, was 3d. per cord, while charcoal-burners were paid at 22d. per load, and miners at 7d. per load. The 'Inventory of Goods belonging to the Lord Admiral Seymour in 1594 gives a little information on the management of the ironworks: "At Sheffield there was a furnace for casting raw iron only, with 23 workmen, at which 14 men were employed for draught, with 2 wain-men, and a hammer-mill, the iron of which has been sold for £8 12s. 0d. a ton. In the forest of Worth there was a double furnace to cast ordnance and shot, as well as raw iron, and a forge also, at which 33 workmen were employed."⁽³⁶⁾ All the workmen were paid by task-work, but over each forge was a manager to superintend the work and workmen, and weigh the iron, with a yearly salary of £4 and a livery, or 10/- and meat and drink. In 1607 Norden states that there were in Sussex alone 140 forges, using 2, 3 or 4 loads of charcoal apiece daily. The acts of 1558, 1581 and 1585 regulating the felling of timber

(35) Salzmann—English Industries of the Middle Ages. 31, 32

(36) Topley—Geology of the Weald. 430-431

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had very little effect, and a century later each furnace was consuming over five tons of charcoal per week. With regard to the price of raw and manufactured material during the fourteenth century, when the value of £1 was 12 times that at present, iron in the mass was £9 a ton, while in 1539 the cost had diminished to £5 or £7 per ton, with an extra 9/- for every ton carried to London or elsewhere. The prices rose rapidly in the next century which was a period of great prosperity. Shot was sold at 11/- per cwt. in 1654, and cast iron at 15/- per cwt. in 1658.⁽³⁷⁾ A list of average prices is appended at the end.⁽³⁸⁾

The Heathfield and Waldron accounts give some idea of the class of goods bought and sold and the prices paid in the seventeenth century. The Waldron forge accounts begin in 1628, and are concerned for the first few years with the purchase of raw materials and charcoal. The following list gives some typical entries of these early purchases :—

“ Mine bought of Richard Sanders of Heathfield			
It. pd to him for 33 loades of veines		£	s. d.
(rich ore), for ye mine and drawing		7	0 3
of it at 4/3 ye load, ye summ of			
It. pd to him for 70 loads of bottom			
mine (poor ore), drawing of it at			
4/- ye load, ye summ of		14	0 0
It. pd to John Wumble for carrying ye			
said loades of mine to ye furnace at			
15d. ye loades, ye summ of		6	8 9 ⁽³⁹⁾

The accounts of the Heathfield cannon foundry begin in 1703, the wages sheets being slightly different from

(37) Thorold Rogers—History of Agriculture & Prices in England. Vol. I.

(38) See Appendix C.

(39) Lucas—Memorials of Heathfield. 72

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those employed in modern factories. Some typical entries are as follows :—

“ Jesse Piper is Cr February 25th, 1739.

By 91 loads of coals from Mr. Offey's	£	s.	d.
Wood att 3 shillings	13	13	0
By bringing 3 patterns for guns and 7 devils	1	4	0

John Harmer is Cr June 28th, 1740

By 35 Foundays and 1 day att 7/6 per Founday	13	3	9
Pd to him and Kempe for weighing 24 tons gun heads	8	0	"

The government contract for ordnance caused huge numbers of cannon to be turned out, as the next account shows :—

“ The Acct of guns to be made for the King in 1739—1740.

9 pder of 7f½	50	there was made	53	completed	
4 " " 6f	70	" " "	117	"	
9 " " 7f	44	" " "	47	"	
4 " " 6f	30	" " "		"	(40)

During the last years of the industry, pig iron and forge tackle were the chief output here as elsewhere in the Weald, where the only modern relics of what was once the staple trade are the firebacks and andirons in some of the old farmhouses, the grave-slabs at Wadhurst and other Churches, the ancient guns preserved at Woolwich, and the numerous local names referred to the iron manufacture, for example Gun Green at Eridge, Tongwood near East Grinstead, Abinger Hammer in Surrey, Furnace and Forge Ponds near Goudhurst, and Boring House Farm at Buxted.

The reasons for the rapid decline of the industry were two-fold. The first was the rapid exhaustion of the timber supplies, which were by no means endless even in the Wealden forest, especially as no measures were taken for

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replacing and renewing the felled trees. That the decline was rapid and complete in the eighteenth century is shown by the table here quoted, giving the number of charcoal furnaces in Sussex and the total output for three consecutive periods :—

1740	Furnaces in	England	59	Tons of iron made in	England	17350
	"	Sussex	10	"	"	1400
1788	"	England	24	"	"	13100
	"	Sussex	2	"	"	300
1796	"	England	104	"	"	108793
	"	Sussex	1	"	"	175 (41)

But the dwindling of timber supplies was by no means solely responsible for the decline of the Wealden industry. It certainly paved the way for decay of prosperity, but the final downfall was caused by the discovery of the use of coal for smelting. In 1620, Dudley, a native of Staffordshire, made use of pit-coal for this purpose, but he was violently opposed, and his secret died with him. However, in 1738 Abraham Darby discovered how to employ coke in iron furnaces, and the cheapness and convenience of this method as compared with the charcoal-smelting process caused it rapidly to supplant the earlier way. The Weald was in the unfortunate position of being unable to adapt itself to this change in industrial methods, owing to complete absence of coal supplies, so that this lack was the direct cause of its reversion to its earlier agricultural state. The coal which has sometimes been held to exist in the Weald is now known to be of the fibrous lignite type, rich in natural gas, but impracticable for smelting purposes. It was apparently tested by some of the ironmasters, as is shown by the article sent by Sylvan Harmer to the Brighton Guardian in 1830.⁽⁴²⁾ "The land around Heathfield is replete with copious signs of coal mines, and about twenty years ago on the western side of the parish, at the bottom of Geer's Wood in Waldron belonging to John Fuller, Esq., was discovered strata of coal 10½ inches thick, in consequence of which Mr. Fuller

(41) Sussex Archæological Collections. Vol. II. 217

(42) Lucas—Memorials of Heathfield. 92-5

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invoked certain mineralogists from Derbyshire to explore the same, who gave very favourable reports, although no effort therein was resorted to." If coal supplies could be obtained from the Weald, it would have to be not from these lignite beds, but from mines sunk down to the Palæozoic rocks below the Wealden strata. Various attempts have been made to sink such shafts, the earliest known being from 1804—9 at Bexhill, which was abandoned after the expenditure of £80,000. Between 1872 and 1876 boring was carried on at Netherfield near Battle, in hopes of reaching the Palæozoic rocks which at Ostend, Harwich and Calais had been found at a depth of 1000 feet. Some slight hope was entertained of the discovery of coal measures, but the boring was continued to 1905 feet, when only Oxford clay was reached, after which it was abandoned.⁽⁴³⁾ Since that date a small coalfield has been discovered at Dover, and the annual output of the Shakespeare Cliff collieries is 3,000,000 tons a year, but this would be obviously insufficient for the recommencement of the iron industry, which if renewed would have to obtain its coal supplies outside the Wealden area. An experiment using imported coal was carried out at Felbridge Water in S.E. Surrey, in the early nineteenth century, but the expense proved too heavy.⁽⁴⁴⁾ The question to be decided in the case of a future industry would be whether coal should be brought in to work the iron supplies, or whether the iron should be carried elsewhere to be manufactured. In either case, the expense incurred would leave a small margin of profit, and the competition with the industrial areas of the north and west would be too severe to be sustained for long. All things considered, it seems scarcely probable that the peace of the Weald will again be disturbed by the rise of an Iron Age, the last phase of which is almost buried in the forgotten past.

(43) Topley—Geology of the Weald. 433

(44) Victoria County History of Surrey. Vol. II. 295

MAPS



■ Towns with forge and furnace in 1574, still existing in 1653

- " " " " both ruined " "
- " " " " still existing " "
- " " " " but ruined " "
- ▲ " " " " still existing " "
- △ " " " " but ruined " "
- + " " " " mentioned at other dates for their ironworks.
- X " " " " containing traces of early or recent ironworks.

MAP III. DISTRIBUTION OF WEALDEN IRONWORKS IN 1653

Scale 1 : 633,600

APPENDICES

APPENDIX A.

*Furley—List of Manors bordering on the Weald at time
of Domesday.*

Aldington	Great Chart	Orlestone	Sundridge
Appledore	Little Chart	Palster	Sutton Valance
Bilsington	Chart Sutton	East Peckham	East Sutton
Bonnington	Lympne	West Peckham	Tenton
Bewley	Maidstone	Pevington	Warehorne
Boughton Malherbe	Mereworth	Pluckley	Westerham
Boughton Monchelsea	Mersham	Ruckinge	Wrotham
Brasted	Nettlestead	Roting	Ulcombe Yalding

Parishes bordering on the Weald before the 14th Century.

Aldington	Chart Sutton	Lympne	Ruckinge
Appledore	Chevening	Maidstone	Sevenoaks
Bilsington	Egerton	Mereworth	Sundridge
Bonnington	Hothfield	Mersham	Sutton Valance
Boughton Malherbe	Hunton	Nettlestead	East Sutton
Boughton Monchelsea	Hurst	Orlestone	Ulcombe
Brasted	Kennardington	East Peckham	Wateringbury
Great Chart	Kingsnorth	West Peckham	Westerham
Little Chart	Linton	Pluckley	Wrotham Yalding

(Furley—History of the Weald. Vol. I. 219—225).

APPENDIX B.

*Wealden Parks and Forests marked on maps of Saxton,
Speed and Bugden.*

I. *Saxton's Map, 1577* (SUSSEX).

(a) *Chichester Rape* (b) *Arundel Rape* (c) *Bramber Rape*

Stanstead Forest	Petworth Park	St. Leonard's Forest
Harting Park	Burton „	Shipley Park
Lavant „	Shillinglee „	Shermanbury Park
Oving „	Burton „	Albourne „
Ambersham „	Arundel „	Ifield „
Cowdray „	Rokeshill „	
Halnaker „	Sutton „	

(d) *Lewes Rape* (e) *Pevensey Rape* (f) *Hastings Rape*

Cuckfield Park	Waterdown Forest	Battle Park
Slaugham „	Ashdown Park	Ashburnham Park
Hurst „	Sheffield „	
Ditchling „	Buckhurst „	
Woodmancote „	Eridge „	
Worth „	Mayfield „	
	East Hoathly „	
	Hellingly „	
	Hurstmonceaux Park	

Total :—3 Forests, 32 Parks.

II. *Speed's Map, 1616* (SUSSEX).

(a) *Chichester Rape* (b) *Arundel Rape* (c) *Bramber Rape*

Fernhurst	Park	Shillinglee	Park	St. Leonard's Forest
Lurgurshall	,,	Michelham	,,	Beaubush Park
River	,,	Petworth	,,	Shelley ,,
Cowdray	,,	Meadhowe	,,	Knepp ,,
Selhurst	,,	Burton	,,	Shermanbury ,,
Elstead	,,	Downton	,,	Henfield ,,
Harting	,,	Arundel	,,	Wiston ,,
Stanstead	,,	Badworth	,,	Albourne ,,
Funtingdon	,,	Warningcamp	,,	Slinfold ,,
Downley	,,			
Goodwood	,,			
Halnaker	,,			
East Dean	,,			
Aldingbourne	,,			

(d) *Lewes Rape* (e) *Pevensy Rape* (f) *Hastings Rape*

Worth	Forest	Ashdown	Forest	Dallington Forest
'Tilgate	,,	Waterdown	,,	Hurstmonceaux Park
Crabbett	Park	Stoneland	Park	Ashburnham ,,
Slaugham	,,	Eridge	,,	Crowhurst ,,
Cuckfield	,,	Buckhurst	,,	Battle ,,
Danny	,,	Newnham	,,	Broomham ,,
Hurst	,,	Maresfield	,,	
		Little Horsted	,,	
		Plashet	,,	
		Broyle	,,	
		Ringmer	,,	
		Firle	,,	
		Hellingly	,,	

Total :—6 Forests, 52 Parks.

III. *Bugden's Map, 1724* (SUSSEX).

(a) *Chichester Rape* (b) *Arundel Rape* (c) *Bramber Rape*

Stanstead	Forest	Arundel	Park	St. Leonard's	Forest
Standstead	Park	Slindon	,,	Wiston	Park
Goodwood	,,	Shillinglee	,,	Warminghurst	,,
Halnaker	,,	Bignor	,,	Den	,,
Selhurst	,,	Burton	,,	Sedgewick	,,
Aldingbourne	,,	Cowdray	,,		
Up	,,	Petworth	,,		
Ladyholt	,,	Parham	,,		
		Angmering	,,		

(d) *Lewes Rape* (e) *Pevensey Rape* (f) *Hastings Rape*

Tillgate	Forest	Ashdown	Forest	Dallington	Forest
Slaugham	Park	Waterdown	,,	Ashburnham	Park
Wakehurst	,,	Sheffield	Park	Ratton	,,
Broadhurst	,,	Stoneland	,,	Broomham	,,
		Broyle	,,	Hurstmonceaux	,,
		Plashet	,,		
		Moat	,,		
		Ringmer	,,		
		Buxted	,,		
		Eridge	,,		
		Heathfield	,,		
		Halland	,,		

Total :—6 Forests, 37 Parks.

(W.S. Ellis—Parks and Forests of England 2. 3.)

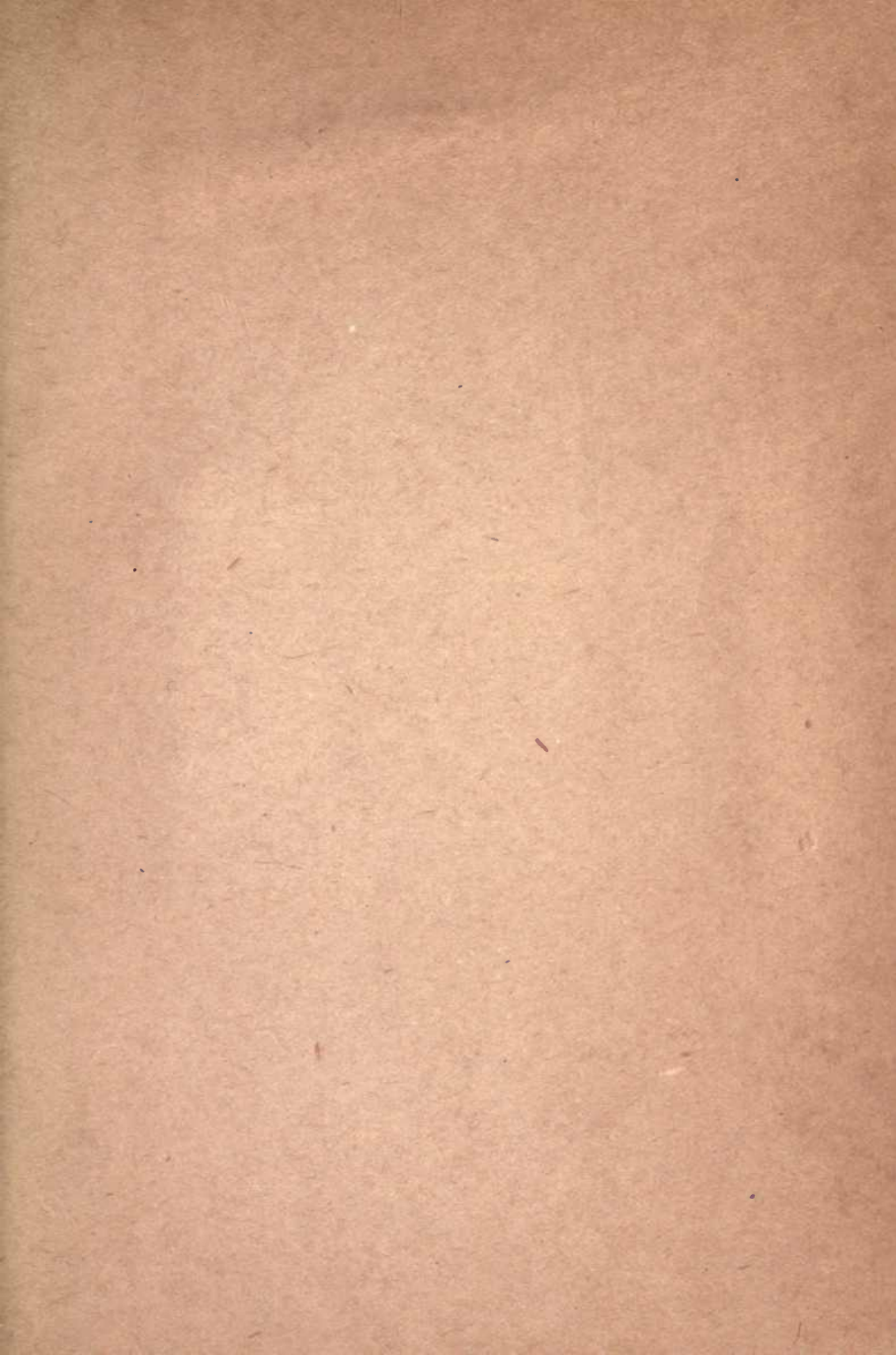
APPENDIX C.

*Price of wrought iron per cwt. from the 13th to the end
of the 17th Century.*

<i>Period.</i>	<i>Average.</i>	<i>Highest Price.</i>	<i>Lowest Price.</i>
1261—1350	4/1	(1391) 18/-	(1282) 3/1½
1351—1400	9/5¼		
1401—1540	15/7½	(1555) 74/8	(1412) 11/8
1541—1582	26/2¾		
1583—1700	36/4	(1637) 65/-	(1588) 18/8

(Thorold Rogers—History of Agriculture and Prices.

Vol. I—VIII.)



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