

The Swedish Flint-Mines.

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(LATE OF THE GEOLOGICAL SURVEY OF SWEDEN.)

The prehistoric flint-mines of Sweden were discovered in 1903. They are situated in the southernmost part of that country, a few miles east of the town of Malmö, in three villages, Kvarnby, Sallerup, and Tullstorp. They are sunk in the white chalk, which has been worked here for half a century in ten separate chalk-pits, and has of late been used on a large scale both at home and abroad. It is, however, only in four of these chalk-pits that flint-mines have been found, though traces of flint-miners are to be seen in all the pits except one. The distance between the two most remote pits is about two English miles.

The most remarkable point about the occurrence of this chalk is that it is not *in situ*, as geologists in general supposed it to be till quite recently, but consists only of loose blocks of various sizes brought by the inland ice from the Baltic and deposited between the two moraines—the ground moraine and the upper, usually fairly thin, surface moraine. Owing to the economic value of the chalk, several borings have been made through it, so that the mode of its occurrence is clearly ascertained. Of these blocks three or four are very large, and the largest appears to have a length of about 3000 feet, a breadth of about half that, and a thickness reaching from 10 to 20 feet. On this remarkable occurrence, which can be paralleled also on the German side of the Baltic, I have written more fully in a separate paper, to which I may here refer.†

Originally the flints lay in this chalk, stretched like beads on a string in horizontal layers, but now they have been raised and disturbed by the inland ice, though as a rule less than one might expect. They are often cracked, but by no means always, and, especially in the upper beds, they may be quite uninjured. The flint is dark, often quite black, and has a very regular fracture which adapted it remarkably well to the use for which it was employed in prehistoric times. That it then formed, probably after being worked up to some extent, an important article of commerce may be inferred from the fact that flint implements are now to be

* At the request of Mr. W. G. Clarke, Hon. Secretary of the Prehistoric Society of East Anglia, the Author has drawn up this abstract of his work, "Flintgrufvor och Flintgräfvare i Tullstorpstrakten" (Ymer, 1906, pp. 139-174). To some extent he has also drawn upon another work "Förhistorisk grufvbrytning i Sverige," a lecture printed at Örebro in 1912, and delivered before Bergshandterings Vänner in that town.

† Om skrifkritan i Tullstorpstrakten och de båda moräner, i hvilka den är inbäddad. Sveriges Geol. Undersökning, Serien C., No. 194, Stockholm, 1903. More or less complete abstracts of this article are to be found in Geologisches Zentralblatt, 1903, Geological Magazine and American Geologist for February, 1904, as well as in Bulletin de la Société Belge de Géologie.

found all the way along the eastern coast of Sweden far up to the north, while the flint itself, with the chalk in which it occurs, is restricted to the most southern parts of the country.

THE SHAFTS.

The flint was won by sinking a fairly regular shaft, about 7 ft. in diameter, occasionally somewhat oval, down through the surface covering of drift (usually the surface moraine) which as a rule is only from 1 to 7 ft. thick, and continuing through the chalk till, at a depth of 3 to 10 ft., the uppermost flint layer was reached. Then as much flint was taken out as could be got at by horizontal workings round about the shaft. The loose condition of the chalk, due to shattering by inland ice, usually prevented these workings from becoming more than a small vault round the shaft; and from their resemblance to "baker's ovens" these vaults have received that name from the present quarrymen. On the horizontal floor of one of these vaults there have been found the remains of a carbonised pit-prop, identified as birch by Baron Cl. Kurck.

Sometimes the shafts lie very close together, and two adjacent shafts may actually be in connection up to the upper surface of the chalk. I was able to count sixteen shafts on a rectangular area of chalk, 93 ft. by 17 ft. The loose and shattered condition of the chalk must have rendered timbering the shaft particularly desirable. Evidence of this may perhaps be found in the so-called "stake holes," open holes of the thickness of an arm or less (1 to 3 inches in diameter) which enter the chalk in a vertical or slanting or sometimes horizontal direction. They are always straight, or nearly so, and are said sometimes to go up to the surface of the chalk but never to continue below the floor of the shaft. Such a hole is said to have been followed to a length of 14 ft., and in some of them charcoal has been found.

As soon as the workings were finished, each shaft was filled up again, partly with earth and with the chalk thrown out of it, partly also with fragments of flint which are often an important constituent of the filling. The white chalk in this filling causes the shaft to stand out boldly against the drift covering as it passes through it. The workmen therefore call these shafts "chalk pillars."

It is well known that flint newly taken from the chalk is, probably on account of its moisture, more easily worked than flint which has lain a long time in the air. This seems to have been the reason why the coarser working of the flint brought up from the shaft was carried on close beside it; and thus it is that we find lying there, not only the refuse splinters proper, but also such roughly blocked out cores as were found in the progress of the work to be full of cracks or of holes, or for some other reason difficult or impossible to work, and which therefore were thrown away.

To have the sharp, cutting flint scraps lying round the shaft on ground over which they had to pass each day must have been very unpleasant for the miners, especially if they were barefooted. It

was probably this that induced them to rid themselves of the scraps by throwing them down into the shafts, which had to be filled somehow or other.

Among the flint rubbish there has not been found a single complete implement showing a finished working of the flint. The finishing seems to have been done in another place.

As appears from the preceding, the shafts of the Swedish flint-mines are not very deep. The mining works themselves therefore are not comparable in importance with those carried out in England and Belgium. On the other hand, the shafts are proportionately more numerous.

Flint-mines have also been found in France, Portugal, Italy, and North America. The mining industry was of especial importance in Belgium, as has been more and more recognised of late years. On the other hand, it is remarkable that in Denmark, extraordinarily rich as it is in Neolithic flint implements, no flint-mines have yet been discovered. However, the Danish archæologists remain convinced that flint-mines did exist and will sooner or later be detected.

STAGS-HORN PICKS.

The commonest tool of the flint-miners was the pick of stags-horn, and this is the commonest of all finds in the flint-mines. Their frequent occurrence also in other countries has led Greenwell and others to remark that the stag must have been a very common animal in prehistoric times. Nevertheless, the supply of such picks does not seem to have been sufficient for the great flint-mine industry in Belgium, and consequently picks of flint were used there in great numbers, as sufficiently proved by older finds and those of recent date.

In Sweden, however, flint picks have not yet been found, but there, so far as is known, only stags-horn picks were used. Such were formed in the simplest possible way by sawing off the horn so that only two tines or a tine and a portion of the beam remained. Then, one of the tines was used as a pick point, and the other on the beam as the handle. These tines are therefore, as a rule, much cut and polished at their ends.

There were also used picks of horn from which the tines had been entirely removed, while in their place were inset so-called "teeth" of flint. Horn picks of these two kinds, and other fragments of horn found in the flint-mines and chalk-pits are shown in Plate XXVI.

That accomplished osteologist, Inspector H. Winge, of the Zoological Museum in Copenhagen, was the first to perceive that the stags-horn fragments from the Swedish flint-mines are "Stone Age implements" or handles for such.* Concerning the handle

*Such implements from the flint-mines have been in the Zoological Museum at Lund University since 1866, but it was nearly half-a-century later that their meaning thus became known through the observation of Winge.

shown in Plate XXVIA he has written as follows:—"This is the lower part of a thick horn fashioned into a pick; traces of tool-marks show that the brow and bez tines had been artificially removed and in their place had been bored two holes, in which teeth were certainly stuck; at the lowest end the horn fragment is truncated by grinding; the boss is wholly ground away."

Of the horn fragments shown in Plate XXVIB, *e* and *f* are ordinary horn picks with both tines much worn; *a* is a less usual form, in which the lower tine is somewhat worn; *h* and *i*, the latter being broken off, were possibly used in the same way. They are, however, like the "slagstokke" of the Danes, which were used in quite a different way.* *c* is a handle. *d* and *g* are pieces of horn remaining after the tines have been cut away. Winge describes the latter thus:—"Cut off upper end of a horn with 'prong.' Two tines are cut away. Tool-marks are everywhere fairly clear, in the usual style of the Stone Age. The fragment is not actually a tool but a remnant of horn from which tools have been made." It should, however, be mentioned that *d* and *g* also are somewhat worn. Fragment *l* was probably used as a hammer. When the cut off ends of the horn are hollowed they seem to have served as a fixing for a pounding tool. This is the case with *j*, *o*, both ends of *a*, and the cut off end of the pick-handle in Plate XXVIA.

Horn fragments corresponding to those represented in *e*, *f*, *h*, *i*, and *l* are known from flint-mines on the Continent. These provoke the inquiry: Is this a migrating civilisation which one land gave to another, or did the same need call forth independent discoveries in different places?

A POTTERY LAMP.

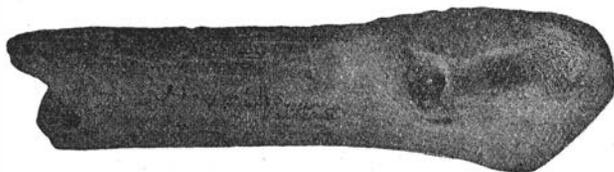
In one of the shafts a remarkable find was made, namely, a lamp of pottery (Plate XXVII.), which lay at a depth of 9 feet in the shaft. The whole shaft, however, was only 13 feet deep. Therefore there was no need of any lamp during the day-time, but it must have been used either before dawn or after sunset. This, so far as it goes, is evidence of the energy with which the flint industry was pursued in this district. The lamp seems too well made to belong to the Stone Age. This then confirms what is gathered from other finds described below, namely, that the flint industry in this district continued after the conclusion of the Stone Age.

THE DWELLING-PLACES.

Richer in articles of human workmanship and therefore in some respects more interesting than the shafts, are the dwelling-places which are found close to the flint-mines, and to which in the southernmost province of Sweden there is nothing else to correspond. Two *large* dwelling-places have been found, namely, one which may

* See A. P. Madsen, S. Müller, etc.: *Affaldsdynger fra Stenalderen i Danmark*, p. 68. Kjöbenhavn, 1900.

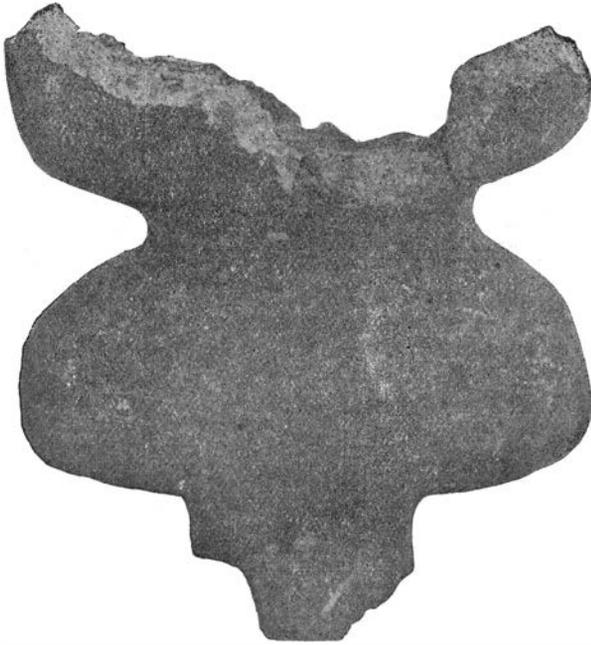
Plate XXVI.



A.—Lower end of stag's antler with two holes in which flint teeth were fastened—probably the handle of a pick. $\frac{1}{3}$.



B.—Antler fragments from seven different chalk pits, the majority used as picks or pick-handles. $\frac{1}{2}$.



b
Lamp of clay (*a*) from the side; (*b*) from above. Natural size.

be regarded as having belonged to a prehistoric village community and therefore has been called Flintby (Flint-village), probably dating from the latter part of the *Neolithic Age*, and a smaller one, which obviously was inhabited during the *Early Iron Age*. Further, there has been found a couple of *smaller* dwelling-places, each probably for a single family, which, at least in part, date from the *Bronze Age*, as well as a fairly large number which are *only from 3 to 4 feet* in diameter. These latter seem only to have been used occasionally. Swedish archæologists are accustomed to call them *hearth hollows*.

The sign of such dwelling-places is the "black earth"—the so-called "culture-layer." A sample of this earth has been analysed and shown to contain only 2 per cent. of organic matter (including the water in chemical combination), or much less than its dark colour gave one to suspect. From this it may be concluded that the colour is mainly derived from the finely powdered charcoal which was thrown out from the ancient fire-places. Small bits of charcoal are also a constant but variable constituent of the "black earth."

The culture-layer contains, besides charcoal, the following objects which seem to have been used by the prehistoric inhabitants and lie strewn around in variable quantities in the layer, namely:—

1. *Fire-cracked stones* from the ancient hearths.
2. *Flint flakes* (Plate XXVIII. *e-e*), as well as *flint rubbish*, but only very rarely a more or less complete *flint implement* (Plate XXVIII. *b* and *c* and Plate XXIX.).
3. Larger or smaller fragments of the *bones of domesticated and wild animals*, the latter very rare; as a rule the remains of meals.
4. *Pottery*. Pieces of broken pots without ornament, and small rounded lumps of burnt clay, which are very numerous.*

Further, in dwelling-places of the *Early Iron Age* there has been found the so-called *harpix* (a kind of resin).

THE FLINT VILLAGE OF THE NEOLITHIC AGE— FLINTBY.

This dwelling-place—the largest of all—is now half destroyed by the quarrymen, but formerly it occupied an area of more than 20,000 square feet. When it is observed that the culture-layer at but a short distance from the edge of the dwelling place has reached a thickness of 5 ft., and further in from the edge may exceed 7 ft., then it is clear that the site must have been inhabited for a fairly long time by quite a large population, probably of flint-miners.

Comparison of this dwelling-place with the one of the Early Iron Age described further on, shows that the culture-layer in Flintby is lighter in colour, and more weathered, as well as remarkably hard

* Dr. Sophus Müller tells me that similar lumps of clay have also been observed in some of the Danish prehistoric dwelling-places.

and well trodden down probably during the constant traffic between the dwelling-place and the workplace, that is to say, the flint-mine.

The culture-layer is covered by ordinary humus about one-and-a-half foot thick, in which splinters of flint are the only objects that betray human activity. But immediately under the humus, in the culture-layer itself, one finds the burnt lumps of clay mentioned above and small clay-balls, the size of which varies between one-sixth of an inch and one inch in diameter. With these are also found small fragments of clay pots. The lumps of clay seem to be most numerous at a depth of a couple of feet. Deeper down come much weathered fragments of bones of ox, sheep, and pig; but these are not nearly so numerous as those from the dwelling-places of the Early Iron Age. Deep down are also found charcoal, flint-rubbish, and fire-cracked stones.

Some flint objects from the culture-layer are represented in Plate XXIX.* The flint ball or hammer-stone above on the right has already been represented in Plate XXVIII. *d*. Beside it is an ordinary Neolithic end-scraper, 91 mm. (3.6 in.) long, found at a depth of 1.3 metres (4.4 ft.), a fire-striker, and a tranchet. Besides these, more recent diggings have brought to light six other end-scrappers, five flint borers, and one fire-striker.

All these flint implements, the hardness and aged appearance of the culture-layer, and the relative paucity of bones of domestic animals, indicate that the dwelling-place belonged to the Neolithic Age and probably to its later period. The size of the dwelling-place and its immediate proximity to the shafts of numerous flint-mines make it most probable that it was inhabited by the miners, who probably were in the condition of slaves.

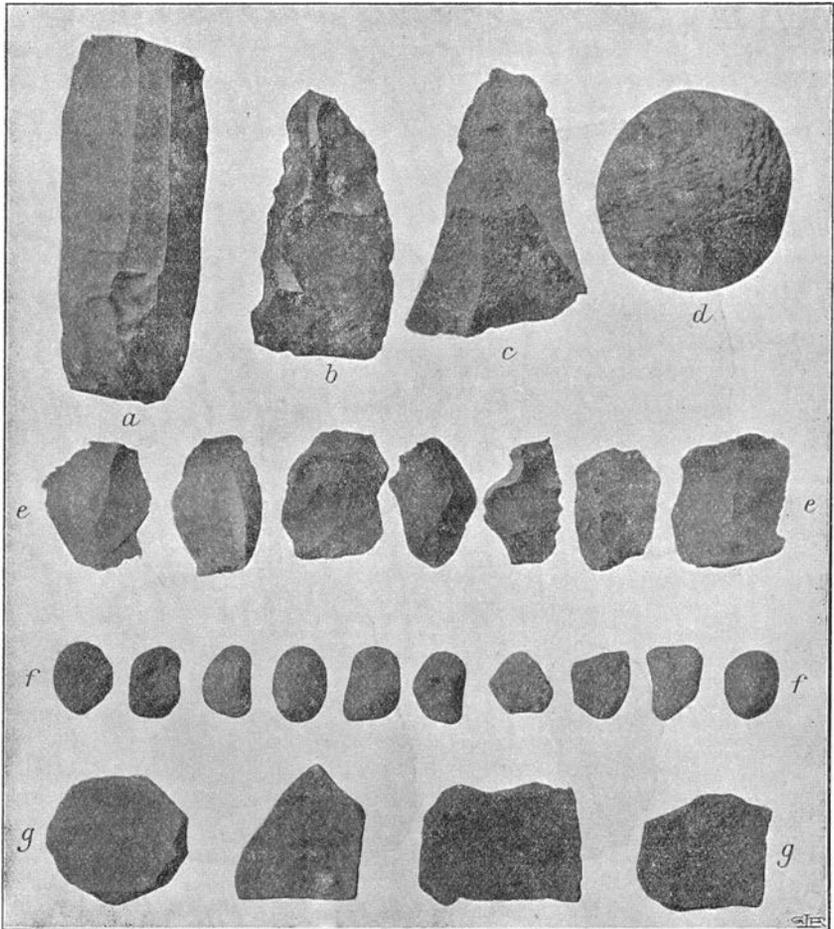
At a distance of only some 10 feet from the large dwelling-place just described, there have been found two smaller ones, probably of single families. One of these may here be briefly described. It was 12½ feet in diameter and had two hearth-hollows about two feet deep, immediately opposite one another on the outer margin. The culture-layer between the hearth-hollows lay beneath the humus, and it was clear that the dwelling-place had from the beginning been excavated a couple of feet below the level of the ground.

In the culture-layer there were found the usual objects: flint flakes and flint rubbish, charcoal, various fire-cracked stones, pieces of clay pots, as well as a beaver tooth. On the inner surface of one of the potsherds was closely attached a carbonised substance which probably represents the remains of meat (? carbonised blood). Since the potsherds resemble those which archæologists refer to the Bronze Age, this dwelling-place has been referred to the same period.

Be the age of the potsherds what it may, it is at any rate certain that the mine district was inhabited, and was probably being worked during the Bronze Age. A young archæologist (now a University Lecturer), Bror Schnittger, who carefully examined one

* "Förhistorisk grufbrytning i Sverige," 1912, *cf.* footnote 1.

Plate XXVIII.



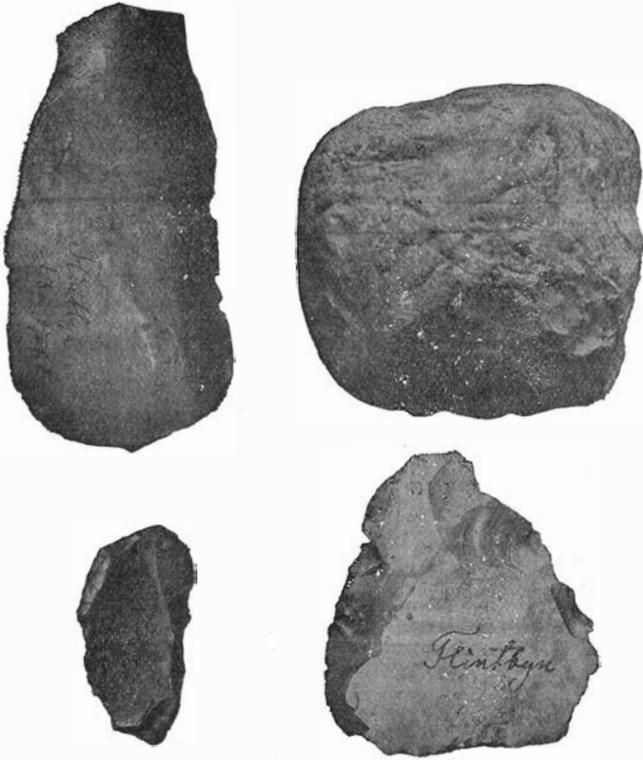
Top Row—(a) Flint core, said to come from a depth of 5 feet. (b) Worked flint from dwelling-place of the Early Iron age. (c) Tranchet, from a shaft. (d) Hammerstone from the "black earth" of Flintby.

Second Row—(e-e) Flint flakes from dwelling-place of the Early Iron age.

Third Row—(f-f) Slingstones (?) from the same dwelling-place.

Fourth Row—(g-g) Sandstone plates from the same dwelling-place. $\frac{1}{3}$.

Plate XXIX.



Implements from Flintby.

Scraper.

Fire-striker.

Hammerstone.

Tranchet. $\frac{2}{3}$.

of these smaller dwelling-places,* situated some way from that described above, but in the neighbourhood of other flint-mines, has established the fact that the *lower* part of the dwelling-place belongs to *the end of the Neolithic Age*, while the *upper* part is formed of a *Bronze Age* deposit with numerous flints.

DWELLING-PLACE OF THE EARLY IRON AGE.

This dwelling-place, though smaller than that of Flintby, is still of considerable size; about 100 feet from east to west. The northern part has been quarried away. The culture-layer, which attains a maximum thickness of about 5 ft., has yielded many objects which show that the inhabitants had reached a higher degree of civilisation than those who lived in the dwelling-places previously described.

A section, taken where the dwelling-place is most complete has the following appearance:—Tippings of the quarrymen 1'5 ft.; black earth (culture layer) 3'7 ft.; alluvial clay with shells, '1 ft.; peat (this is also a culture-layer) '5—'8 ft.; chalk rubbish and chalk. *Flint-flakes* and *flint rubbish* are distributed through the whole of the black earth up to its very surface, abundantly below, but somewhat less abundantly above. This flint rubbish occurs in such quantities that it cannot have been mixed in the culture-layer by mere chance. The flint flakes (Plate XXVIII. e—e) are somewhat stouter than those which belong to the Stone Age.

The *pottery* in the culture-layers consists partly of the clay lumps previously mentioned, partly of potsherds. The former are more rounded, of finer grain, and perhaps somewhat less numerous than those found in the black earth of Flintby. The potsherds have partly a more indefinite grey colour, partly the natural beautiful rust-red of the burnt clay, and partly a pure deep black, clearly produced by painting the surface before firing with lamp-black or some colouring matter that was carbonised in the firing, such as blood, or resin and oil. Sometimes the outer surface is rust-red and the inner black. The pots were quite well fashioned, and *cannot be older than the Early Iron Age*.

The bones of domesticated animals indicate the same date.† Here too it should be mentioned that, in the early seventies, there was found near this dwelling-place a lump of iron of primitive manufacture (an "Osmund-klump") weighing 2'6 kilogrammes (5 lbs.). This lump, which is preserved in the Mineralogical Museum of Lund University is said to have been found "in the chalk," but it can only have got there in connection with the digging for flint.

The abundance of flint-flakes and flint-rubbish in a culture-layer of this later period shows, however, that during the Early Iron Age in southernmost Sweden no inconsiderable use was made

* Bror Schnittger: *Förhistoriska flintgrufvor och kultur-lager*. Gradual-disputation, Stockholm, 1910.

† This is fully confirmed by the objects found in the subsequent excavations of Schnittger, such as a food-strainer of burnt clay.

of flint, though what that use precisely was we cannot say at present.

This result, although it seemed unquestionable to the author, has been doubted by Swedish archæologists. It is therefore with great satisfaction that I find it strengthened by observations made in England. Mr. Stevens, the Assistant Curator of the Salisbury Museum, tells me that he has found evidence showing that flint was still used in England as late as Roman times; it was probably then in occasional use, as for knives, and perhaps scrapers. In the Museum at Salisbury there are flints pierced by Roman iron nails. In 1874, Mr. Boyd Dawkins, in his "Cave Hunting" (p. 126), records an examination of a Roman coffin, which pointed to a similar conclusion: the use of flint in England until Roman times.

Besides the objects already alluded to, the black earth has yielded the following finds:—The above-mentioned rounded pebbles (sling-stones), Plate XXVIII. *f—f*; sandstone plates, Plate XXVIII. *g—g*; and three small pieces of *harpix*. The last-mentioned burns with a sooty smoke and is usually regarded as a mixture of birch resin and wax.*

The section previously given (p. 247), shows that underneath the black earth comes '1 foot of alluvial clay with shells. In this have been found eighteen different species of molluscs.† It is quite free from objects of human workmanship, although such are found not only in the underlying black earth, but also in the underlying peat. The shell-clay therefore indicates a slight break between the formation of these two culture-layers.

Beneath the shell-clay comes a little peat layer, which may exceptionally reach a thickness of '8 foot, but is usually only '5 foot, and occasionally only '1 foot thick. The peat is impure, gravelly, and much trampled. It contains much flint rubbish, which, however, resembles neither that of the Stone Age nor that found in the overlying black earth, but consists of exceedingly small flakes. There are also found in this peat fragments of charcoal, with bones of domesticated animals, namely, pig, sheep, and ox. No others have yet been observed. According to Winge, the pig was large but the sheep small. The ox-bones are gnawed by dogs.

* Compare C. E. Herbst: Om de over en Kjaerne af braendt Leer stöbte Bronze-Öxer. Aarbøger for nordisk Oldkyndighed og Historie, 1866, p. 130. Chr. Hostmann: Der Urnenfriedhof bei Darzau, p. 119. Braunschweig, 1874. Heintzel: Urnenharz aus dem Urnenfelde von Borstel bei Stendal. Zeitschr. f. Ethnologie. XIII. (1881), p. 241.

† (The mollusca noted in the shell-clay and identified by A. C. Johansen. They have been compared by us with those from Grime's Graves and here rearranged. They were—*Polita radiatula* (Ald.); *Punctum pygmaeum* (Drap.); *Vallonia pulchella* (Müll.); *Cochlicopa lubrica* (Müll.); *Pupilla muscorum* (Linn.); *Vertigo antivertigo* (Drap.); *Vertigo pygmaea* (Drap.); *Vertigo angustior* (Jeff.); *Carychium minimum* (Müll.); *Succinea elegans* (Risso); *Aplexa hypnorum* (Linn.); *Limnæa pereger* (Müll.); *Limnæa palustris* (Müll.); *Limnæa truncatula* (Müll.); *Planorbis lævis* (Ald.); *Planorbis spirorbis* (Linn.); *Valvata cristata* (Müll.); *Pisidium*, sp. Nine of these species are aquatic and indicate very different conditions from those at Grime's Graves.—A.S.K. and B.B.W.).

Remains of bones are much rarer in the peat than in the black earth.

Among the finds in the peat should particularly be mentioned pieces of linden bast. These have only been found at the bottom of the deposit, and are, as a rule, small and short, sometimes sharply cut across. They are probably remnants from the manufacture of bast cord, which presumably was much used since it served to fasten the domesticated animals. The bast is brownish yellow, but this perhaps is only due to colouring matter in the peat. Professors F. W. C. Areschoug and B. Jönsson have both examined this substance and were the first to make known its true nature. The latter writes:—"Microscopic examination has shown that the golden yellow or brown yellow coloured streaks are composed of bast fibres and newly formed wood tissues. Maceration and chemical treatment proved the presence of cell elements coming from the linden (lime-tree). Particularly characteristic are the portions of vessels provided with both spirals and pits, which must undoubtedly be regarded as belonging to the linden. I consider therefore that the organic streaks may be interpreted as remains of linden bast, with accompanying portions of the newly formed wood tissues."

The basin in the peat was certainly made by man, probably in order to have a water-supply for himself and his animals.

THE HEARTH-HOLLOWS.

Naturally hollows for hearths are also found in the more permanent dwelling-places, but of the more temporary resting-places they are often the only relics. It is only the latter hearth-hollows that are here in question.

They are found in abundance round mine-shafts, but cannot be considered as exclusively pertaining to the mining districts. They are bowl-or funnel-shaped, about three feet wide above, and narrower below, with a depth of from two to three feet, and much resemble one another in size and shape.

In one of them, which was investigated by J. E. Strandmark, the culture earth contained numerous large stones partly fire-cracked, remains of charcoal, flint-rubbish, among which were some fine thin flint-flakes, potsherds, and bones of ox (a small race), sheep, and pig. Remains of the last-mentioned species comprise the shoulder blade of a smaller race (domesticated) and the lower jaw of a larger (wild boar?). The appearance of the potsherds suggests the Iron Age as their date.

DOMESTICATED ANIMALS DURING THE EARLY IRON AGE.

At the dwelling-place of the Early Iron Age have been found the bones of domestic animals in great number, and the quarrymen say that they have carried away very many cubic feet. They are the

remains of the meals of the former inhabitants. The hollow bones are cloven or at least cracked to extract the marrow. The bone fragments are most numerous near the bottom of the culture-layer. Nearer the surface of the ground they are altogether mouldered away. The dwelling-place gives the impression that the inhabitants were quite well-to-do; perhaps the profits from the flint-mines contributed to this.

The bones belong to sheep, ox, pig, horse, and dog, but only the first three of these were at all numerous.* There has also been found a single human bone (a piece of humerus), as well as half the lower jaw of a water vole (*Arvicola amphibius*, Linn.), but this last may have got into the layer at a later date.

In considering the racial peculiarities shown by the domestic animals the author has had the advantage of consulting Inspector H. Winge and Professor E. Lönnberg, both men of great experience in mammalian osteology. The following account is therefore based mainly on their conclusions.

"The *sheep* bones belong to a small race" (Lönnberg).

"All the remains of *cattle* indicate a small and stunted race" (Lönnberg).

How stunted this race was appears from the little horn-core figured (Plate XXXA) which shows on both sides the deep cut by which the horny covering was separated from the core.

"*Pig*.—Fragment of lower jaw,[†] with both posterior premolars (p 3, p 4) and both anterior molars (m 1, m 2). The length of these teeth is p 3=13'5, p 4=14'5, m 1=16'5, and m 2=22'5 mm. These measurements precisely correspond with those in the sow of a wild pig, and therefore indicate that the jaw-fragment in question belonged to such an animal or perhaps to a tame sow which had not degenerated from its wild ancestry. In confirmation of this, it may be mentioned that the length of the corresponding teeth in an "acorn pig" from Scania, with a shoulder-height of about 80 cm. (31'5 in.), that is to say a large and strong animal, is: p 3=12, p 4=13, m 1=14, and m 2=19 mm.

"The united length of m 1 and m 2 in the jaw-fragment in question is 39 mm. In comparison with this it may be mentioned that according to Rutimeyer the corresponding teeth in a male 'Torfschwein' measure together 37 mm. and in a female 34 to 37 mm., but according to Studer, in a male 'Torfschwein,' 33 mm.

* The mammalian bones hitherto investigated have not been sufficiently numerous to enable one to calculate their relative numbers with certainty. Such a calculation has, however, been made with reference to Björkö (Birka), which was the capital of Sweden during the Viking period, and was at the height of its prosperity from about 800 to 1000 A.D., but is now completely desolate. The culture-layer is about 5 feet thick and stretches over about 16 English acres. It took about 200 years to form, and in it there have been found the remains of domestic animals, which may be arranged in the following order according to their numbers: the commonest is the ox, then come pig, sheep, goat, dog, horse, and lastly cat. H. Stolpe: Naturhistoriska och arkeologiska undersökningar på Björkö i Mälaren. Öfversigt af Kongl. Vetenskaps-Akademiens Förhandl. 1872, No. 1, p. 90.

† This lower jaw as well as one of the shoulder-blades comes from the above-described hearth-hollow of the Iron Age.

The pig from which this jaw-fragment came must therefore have been larger than a 'Torfschwein,' and this fact renders it most probable that we have to do with a fragment of a wild pig.

"Of pigs there also occur two fragments of the shoulder blade. Both of these belonged to a very small animal. This is inferred from the fact that the column scapula in the largest example does not measure more than 25 mm. (1 in.) across at the narrowest place, while the Scanian pig with which comparison is made above has a breadth of 33 mm. at the corresponding place" (Lönnberg).

The fragment of shoulder-blade described by Lönnberg has also a purely archæological interest. It was used as a spoon for food. On this, as on another smaller shoulder-blade, it is very clearly seen how the handle, that is to say the tract just about the neck of the shoulder-blade, is remarkably worn, just as far as the fingers reached when the spoon was used. Winge was the first to draw attention to this use of the pig's shoulder-blade and to show that "spoons of this peculiar character were in very general use in the earlier part of the Neolithic Age."* How long afterwards this use of shoulder-blade spoons continued is for the present not known.

The *horse* bones have been subjected by Winge and myself to comparison with the corresponding bones in a horse skeleton from one of the well known peat-bog finds, namely, in Nydams mosse, which dates from the end of the fourth century A.D. The correspondence was as complete as possible. The race is a small one.†

Lönnberg, who came to the same conclusions, based them upon the following measurements: "The bones are more slender than the corresponding ones of the skeleton of a modern Swedish horse, with a height over the withers of only 145 cm. (14'2 hands). The front part of the lower jaw of a horse (stallion), with well-developed canines, has at the narrowest part of the symphysis a cross diameter of only 30 mm., and in the above-mentioned Swedish horse the same measurement is 35 mm. A fragment of a hind cannon bone does not measure more than 27 mm. in cross diameter, but in the skeleton referred to the same measurement is 33 mm. In the same way the distance from the outer side of the outer trochlear ridge to the inner side of the inner ridge of an astragalus is about 38 mm., but in the modern horse under comparison about 41 mm."

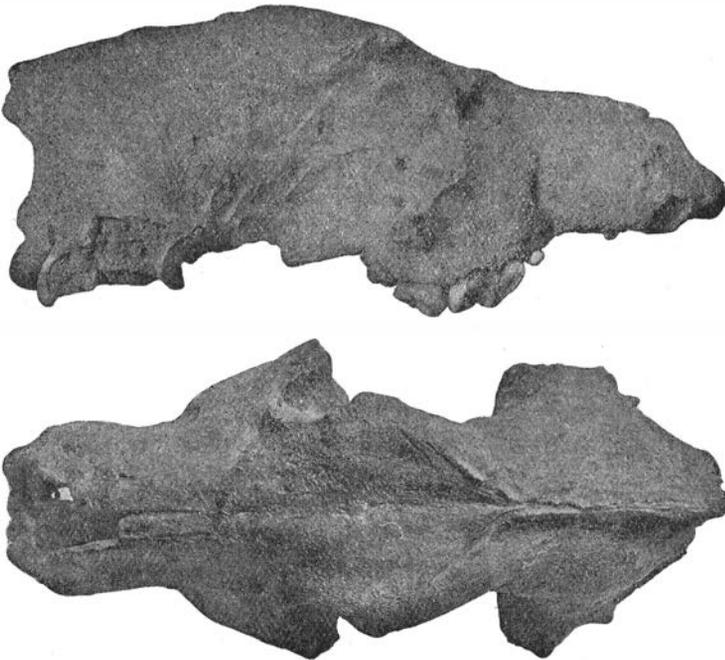
That the *dog* was not rare may be inferred from the fact that the mammalian bones in general as well as the above-mentioned human arm-bone are gnawed by dogs. Among the collected bone

* A. P. Madsen, S. Müller, etc. : *Affaldsdynger fra Stenalderen i Danmark*, p. 155. Kjöbenhavn, 1900

† In Denmark the following conclusions have been reached with reference to the general development of the races of domesticated animals. The *horse*, which was first introduced during the Bronze Age or at the earliest at the close of the Neolithic Age, was small, not only during the Bronze and Early Iron Ages but also down to the Middle Ages. The *dog* was smaller in the Neolithic Age than later, whereas the *ox* and the *pig* had a contrary development, and from the Neolithic Age, when they were first introduced, became gradually smaller down to the Middle Ages. Compare V. Nordmann : *Danmarks Pattedyr i Fortiden*, p. 96 et seq. Kjöbenhavn, 1905.



A.—Horn-core of a stunted race of Oxen, seen from two sides. From the "black earth" in the dwelling-place of the Early Iron Age. $\frac{1}{2}$.



B.—Skull of a Dog, from the side and from above. From near the bottom of the "black earth" in the Early Iron Age dwelling-place. $\frac{1}{2}$.

remains, the dog is represented by a particularly fine and quite complete skull, which is of great interest owing to its strongly marked characteristic shape. During its life-time the animal received a strong cut or blow slantwise across the nose, but this healed and led to no deformation of the cranium. (Plate XXXB.)

“The dog is of a large powerful race, much larger than that which is usual in our Stone Age. On the other hand, it agrees well with our large race from the Iron Age. The length of the skull is about 190 mm. (7.5 in.). The length of the upper canine, 22 mm., and of the upper front premolar $14\frac{1}{3}$ mm.” (Winge.)

“The most peculiar feature in the general appearance of this skull is the short nose and the profile-contour sloping straight down from the forehead without showing any strong concavity such as is seen in the wolf, still less like that in many of our tame races of dogs. This straight profile and the shortness of the nose conferred on this cranium somewhat the aspect of a *Cuon* (compare Plate XXXB). The remarkably broad and flat forehead is also extremely characteristic, as well as a departure from the usual dog type. This arises from the fact, among others, that the cranium has an interorbital breadth in front quite as large as has a cranium of the Greenland dog, with a basi-cranial length more than 2 cm. (8 in.) greater.” (Lönnerberg.)

The dwelling-places herein described are only a portion of those which have been found in the neighbourhood of the old flint-mines. Many are already completely destroyed, and since, as a rule, they only become known as they are uncovered by the quarrymen, it may be taken for granted that there are many still entirely unknown. A similar dwelling-place has recently been found in a more easterly tract of Sweden's southernmost province, near a homestead called Ulricelund, and it seems probable that this dwelling-place was also connected with flint-mines. Chalk occurs in the neighbourhood at no great depth.

The Swedish flint-mines that have here been described appear to have been worked, with or without a break, from the later portion of the Neolithic Age down to the Early Iron Age. Did such a mining activity extend further back in any other country, whether in Europe or elsewhere? In other words, during which archæological period did it first begin? The question is of great interest, and it may perhaps be possible to answer it with more or less completeness from examination of the material that has already been obtained.
