IV.—*The Site, Fauna, and Industry of La Cotte de St. Brelade, Jersey.* By
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Read 25th November 1915.

THE communication which I now have the honour to lay before the Society of Antiquaries presupposes a knowledge of the contents of my two papers concerning Jersey antiquities already published in *Archaeologia*.¹ I beg to thank the Society for enabling these successive reports on the excavations of La Cotte de St. Brelade to be printed and illustrated on so generous a scale. I would here take the opportunity of likewise acknowledging my debt to many other helpers: first, to Mr. G. F. B. de Gruchy, Seigneur of Noirmont, and owner of the cave, who has not only made over the whole of the treasure-trove to public institutions, providing funds into the bargain in order as it were to exploit himself, but has throughout been my constant adjutant and co-worker; then to my Oxford friends and pupils who have at considerable cost to themselves taken part in the work for weeks and months together, Captain A. H. Coltart and Mrs. Coltart, Mr. T. B. Kittredge, Mr. B. de Chrustchoff, Miss Bayly, Mr. R. de J. Fleming Struthers, the Rev. E. O. James, Mrs. Jenkinson, Mr. P. H. Brodie;² next, to Jersey residents innumerable, most of them ardent members of the Société Jersiaise, such as, to mention but a few, Mr. E. T. Nicolle, Mr. J. Sinel, the late Dr. A. Dunlop, Mr. H. J. Baal, Mrs. Briard, Mrs. Symons, Mr. G. Le Bas, Mr. A. H. Barreau, Mr. E. F. Guiton, the two last-mentioned gentlemen having as draughtsman and photographer respectively helped largely to make our results intelligible by way of the eye; and, finally, to the many experts who have in various ways assisted in the interpretation of what we brought to light, among them being Sir Hercules Read and Mr. Reginald A. Smith of the British Museum; Dr. A. Smith Woodward and Dr. C. Andrews of the British Museum of Natural History; Dr. A. Keith of the Royal College of Surgeons; and Professor

¹ *Archaeologia*, lxii, 449 f., and lxiii, 203 f.

² Mr. de Chrustchoff and Mr. Fleming Struthers deserve special credit for having, during the whole course of operations in 1914 and 1915 respectively, occupied a small and lone cabin on the site itself where the finds had to be temporarily stored under the care of a guardian.

Photo : E. F. Guillon

Fig. 2. Eastern wall, a fortnight later. Implementiferous bed extends from right hand of figure to top of stick: below, experimental trench driven 5 ft. below floor-level : cf. p. 78

Photo : E. F. Guillon

Fig. 1. Cave-interior, 13 April 1914. To right, near head of figure in foreground, top of shelf overhanging bed along eastern wall

Fig. 1. Ground-plan of cave, showing progress of excavation. H. C. Querée *del.*

Fig. 2. Vertical section of cave along line 10 ft. from eastern wall. H. C. Querée *del.*

W. J. Sollas and Mr. H. Balfour of Oxford. Let me add, in order to save the face of my kind allies and advisers, that I am in the last resort responsible for every statement of fact or opinion that appears here.

Scheme of operations.—When the work of the Société Jersiaise at La Cotte de St. Brelade came to a standstill in 1911, the promise of further advance was by no means encouraging. The palaeolithic floor had been opened up to an extent of about 11 ft. square on the western side of the entrance, the cleared area thenceforward narrowing by degrees with an extreme penetration of 26 ft. The implementiferous bed, rarely more than 3 ft. to 4 ft. thick,¹ proved indeed to be exceedingly rich where 8 ft. to 10 ft. inwards along the side-wall there had come to light the remains of a hearth; but, apparently, it thinned out from this centre in all directions almost to nothing. So much for the prospect at floor-level. Above, barring the rest of the entrance, was a mass of débris 20 ft. to 25 ft. high, the top of which formed a V-shaped depression. This was subject to a cross-fire of falling stones, alike from within the cave, where at the N.E. corner a dome in the roof revealed huge suspended blocks as much as 45 ft. up,² and from the ravine outside, where the loose pile of rock-rubbish covering the back rose steeply to an even greater height. No wonder then that a halt was cried. It is true that, in association with Mr. G. de Gruchy, I sought and found in the following year a buried cave, containing, as it turned out, implements of the same Mousterian pattern, some 40 ft. away on the opposite side of the ravine. But here again operations were destined to end abruptly, under stress of the threat of a stony avalanche from above.³

In 1913, however, at my urgent request, the British Association formed a committee to carry on the exploration of the main cave as far as a grant of £50 would take it. It may be remarked in passing that, had ample funds been available from the start, it would have been good policy to lower into the ravine (whence it could scarcely have been recovered intact) an elaborate 'plant', consisting, among other things, of a stout crane and some iron trucks running on rails, whereby the cave-filling might have been systematically demolished from the top downwards with a minimum of effort as well as of danger. As it was, we had to be content with uncovering a strictly limited space down to floor-level, while pushing back the containing walls of débris just so far as might ensure safety for life and limb. Thus the future must be left to take care of itself, the

¹ Just at one spot, 11 ft. in from the entrance and 7 ft. out from the western wall, a flat rock, standing 5 ft. to 6 ft. above floor-level, was found to be strewn with human refuse. See *Archaeologia*, lxiii, 205.

² As measured from floor-level.

³ See R. R. Marett, *Compte-rendu du Congrès internat. d'anthropologie préhistorique de Genève*, 1912, i, 359; also R. R. Marett and G. F. B. de Gruchy in *Man*, 1912, No. 93; reproduced in *Bulletin de la Soc. Jersiaise*, xxxviii, 326, and in *Records of the Past* (Washington), 1912, 270.

more so because, if the search proved barren on a first trial, there would be all the less reason for proceeding further.

From 1st March then to 28th April 1914 excavation went on, the work being entrusted to the previous contractor, Mr. Ernest Daghorn, a master of his trade. It was calculated that, if the full £50 went to labour, the inevitable extra expenses being borne locally, a clearing 18 ft. broad could be carried right across the foremost section of the cave to the eastern wall, distant, as it then seemed, but 20 ft. to 30 ft. across. It soon became plain, however, that this wall was considerably undercut, so that at floor-level an average breadth of 40 ft. must be reckoned with. Hence the original plan had to be modified, a trench no more than 10 ft. broad being driven parallel with the entrance, its outer limit falling 8 ft. within the cave. This interior line of advance was selected partly because it coincided with the V-shaped depression overhead, and partly because the bed seemed richer here than by the mouth. Up to the half-way point, indeed, this bed was normally no more than 3 ft. to 4 ft. thick; but as it approached the eastern wall, while the bottom remained almost flush with the bench-mark representing the lowest floor-level, the top rapidly rose until against the wall itself it was no less than 10 ft. to 12 ft. high.¹ Partially protected as it was by a shelf that jutted out some 12 ft. from the wall, this easternmost portion of the human deposit seemed at length to offer some chance of stratigraphical analysis. Meanwhile, the total yield was considerable, amounting to more than 10,000 flint fragments and about half that number of pieces of bone. As for the trench, enclosed though it was by precipitous ramparts of débris that perpetually threatened collapse, it held to the end of the year's work, when it had to be filled with sterile rubbish from above in order to seal the workings against casual depredations.

It remains to add that, in order to make sure that the bench-mark taken to represent the lowest floor-level held good everywhere—as indeed it was found to do—the trench was lowered for an extra 5 ft. without striking bottom.² This probing of the depths brought out the same facts as the similar experiment made in 1911 near the western wall. While traces of man were entirely lacking, there occurred, sandwiched between layers of clay, of which the upper one contained calcareous concretions or *Lösspuppen*, a black gritty deposit that in places was 2 ft. thick or more. There is reason to think that this deposit is largely of vegetable origin, but systematic exploration of the pre-Mousterian substratum down to bed-rock is needed before a final interpretation can be essayed.³

¹ The implementiferous bed along the eastern wall was uniformly about 10 ft. thick, and never more, but its base was 2 ft. above floor-level from about 18 ft. from the entrance inwards.

² See pl. XIII, fig. 2, in which this experimental trench is to be seen.

³ See also the detailed account of the work of 1914 in *Report of the Brit. Assoc.*, 1914, 230-4, reproduced, with five plates added, in *Bulletin de la Soc. Jersiaise*, xl, 63-9.

The results obtained in 1914 were so satisfactory that the Committee of the British Association resolved to undertake a fresh campaign of excavation, obtaining another contribution of £50 from that liberal body for the purpose. Moreover, the Government Grant Committee of the Royal Society generously provided a similar sum. A threefold task was now to be faced. First, the attack was to be pushed home along the western wall, though the Société Jersiaise had reported a dearth of finds when once 20 ft. of penetration was exceeded along this line. This section was afterwards known as Working A. Secondly, the strip, 8 ft. thick, that still extended across more than half of the entrance, must be dug out, there being good hope of a rich haul here, at any rate as soon as the eastern wall was approached. This became Working B. Lastly, most formidable business of all, there was the huge mass of débris towering up to 45 ft. in the NE. corner to be pushed back somehow for at least a little way, and, more particularly, so as to free the part nearest to the eastern wall, where the bed of 10 ft. thickness showed every sign of continuing inwards. This was known up to the half-way point as Working C, whence it passed into Working A. According, then, to this threefold scheme, operations were renewed from 1st July to 4th September 1915.

To deal first with Working B, the human deposit throughout the middle part of the cave was found to be even poorer and thinner near the threshold than it had proved to be farther in. On the other hand, it grew rich and thick as it neared the eastern wall, corresponding in all respects with the bedding of the parallel strip to the north. Progress on this side involved much cutting-back of the talus masking the back of the ravine; and, though work outside the cave was merely incidental to work within, clearance enough was made to render it probable that the margin of the implementiferous stratum coincides with the line of the entrance.¹ At any rate, nothing was found beyond this limit, with the exception of some human remains to be mentioned hereafter.

In Working A, 12 ft. of additional penetration revealed a re-entering corner, where, after bending in at right angles for about 3 ft., the western wall slopes inwards at an angle of 45° for at least another 12 ft. The roof here for about a third of the way across is not more than 25 ft. to 30 ft. high, and, apart from a loose slab or two, is evidently quite solid. From this side, then, as from a sort of penthouse, it was found possible to stretch grappling irons across to the overhanging masses of débris in the NE. corner and so to precipitate downfalls that eventually benefited Working C, even if often obliterating it for the time being.

¹ It is just possible, however, that the bed awaits discovery outside the entrance at a lower level than was reached by our excavation, which went no farther down than our conventional floor-level; for 40 ft. away on the other side of the ravine, where Mr. de Gruchy and I found a cave in 1912, Mousterian implements occurred at a point about 8 ft. below the floor-level of the main cave to the north. See *Man* (1912), No. 93, p. 117.

To promote such demolition of the most dangerous part of the cave-filling was perhaps the chief function of Working A, though it was by no means the case that from 20 ft. onwards it was utterly barren of the relics of man. Bone, indeed, was scarce and in poor condition, owing to the prevalence of damp in this corner. Flint implements, on the other hand, were to be found scattered here and there along a sharply rising plane, and I happened myself to discover, together with several other implements, a fine specimen of the Mousterian 'point' that lay near the wall no less than 43 ft. from the entrance and 15 ft. above floor-level.¹

Working C, assisted as has been shown by a flank attack conducted from Working A, eventually resulted in the complete clearance of a 10 ft. strip extending parallel to the entrance from the half-way point to the boundary wall. The distribution of the human deposit here corresponded in most respects with that which occurs throughout this eastern half of the cave. It was thinnest towards the centre; though 18 ft. out from the eastern wall it was already 6 ft. thick. At the wall itself it showed the usual 10 ft. of thickness; the bottom of the bed standing hereabouts some 2 ft. above the lowest floor-level, and the top 12 ft. The presence of a great deal of burnt bone, accompanied by many hammer-stones though but few well-worked flints, indicated the former presence of a hearth along the wall for a space of 20 ft. to 25 ft. from the entrance. Altogether, it was a fairly prolific spot, though by no means so prolific as the adjoining strip excavated in the previous year.

The net result of these operations of 1915 was that over 5,000 flint fragments and about as many pieces of bone were collected. Some 1,200 square feet of the palaeolithic floor had now been unearthed and thoroughly examined, this total comprising about 250 excavated in 1910 and 1911, 350 in 1914, and 600 in 1915. For every square foot thus opened up at least a ton of the cave-filling had been removed by sheer manual effort. Nor was this all. The upper part of the wall of débris to the rear had been cut back to a uniform distance of 50 ft. from the entrance, so that a further area of about 600 square feet lay partially cleared down to within 20 ft. to 15 ft. of floor-level. The top of this half-demolished pile was already proving productive, implements and bone occurring in plenty 32 ft. in near the eastern side-wall, and more sparsely 43 ft. in along the re-entering western wall. On 3rd September, however, the roof overhanging this rearmost part of the cave suddenly fell in, completely smothering all our workings under some 500 tons of rock-rubbish. Though nine persons were inside at the time, no one was hurt, thanks to a hurried exit. As soon as the dust cleared, one saw daylight streaming down through a hole some 20 ft. in diameter (fig. 3). Thus the

¹ This was on the morning of 2nd September, and, as there was a dangerous fall of rock here a few minutes afterwards, and the roof finally caved in next day, there was no subsequent opportunity of finding out how far down the implementiferous bed went at this point.

Fig. 3. Interior of cave after the collapse on 3rd September 1915.

hypothesis of an aperture communicating with the northern face of the cliff, whereby the cave had been filled as through a funnel, was signally confirmed.¹ Further falls due to the winter rains have since lengthened the gap, so that it now measures at least 30 ft. from its southern extremity, where the live rock rises vertically for about 140 ft. above floor-level, to its northern end, where a thin partition, the top of which was 60 ft. above floor-level, but is now lower, separates the excavated part of the cave from the open air. Actual quarrying can alone decide whether in the course of pushing through to the northern face of the cliff—a matter of a few feet for half the way down and 50 ft. at floor-level—solid rock or mere débris is to be encountered.² In any case it would not seem likely that in Pleistocene times La Cotte was rather a tunnel than a true cave. The blocks composing the cave-filling are mostly large, and usually seem, if detached, yet to be still lying almost *in situ*. Hence one is tempted to suppose that, under the combined stress of breaching at the top and weathering to the rear, there gradually collapsed a solid enclosure of granite which once protected the back of Mousterian man from boreal draughts. Such a problem, however, can be resolved, if at all, only by complete excavation of the site. In 1916 it is hoped to make a clean sweep both of the wreckage from the roof and of whatever remains of the unexplored cave-filling beneath it.³

*Osteological remains.*⁴ (a) *Man*.—It is disappointing that recent operations have added nothing, or at any rate nothing unambiguous, to the thirteen teeth which testify to the bodily presence in this cave of *Homo Neanderthalensis*.⁵ The thick and sheltered bed along the eastern wall would afford ideal conditions for

¹ I put forward this hypothesis originally in 1910 (see *Archaeologia*, lxii, 453) in opposition to a suggestion made in *Man* (1910), No. 102, p. 185, that, apart from blocks fallen from the roof, the cave-filling was due to a lateral thrust of rock-rubbish from the ravine to the south. In 1914 we sank an experimental shaft on the north side of the cliff forming the back of the cave, and conjecturally identified the top of the supposed funnel with the very spot that has since fallen in.

² After a tentative excavation in January 1916, which resulted in the removal of about 50 tons of débris from the northern face of the cliff, Mr. Daghorn gave it as his opinion that it would not be feasible to clear out the cave from this side.

³ For an account of the operations in 1915, see *Report of the Brit. Assoc.*, 1915, and also the separate and very full account in *Bulletin de la Soc. Jersiaise*, xli, 154 f.

⁴ All bone found in the cave, with the exception of a few duplicate specimens in the possession of the British Museum of Natural History, is at present in the museum of the Société Jersiaise in Jersey.

⁵ In *Archaeologia*, lxii, 456, I ventured to term the owner of the teeth in question *Homo Breladensis*, seeing that Professor Keith in *Journ. Anat. and Physiol.* (1911), xlv, 12 f., discovered in them an extreme form of primitiveness falling somewhere between the ordinary type of the Neanderthal man and the type of *Homo Heidelbergensis*. I had no intention, however, of suggesting that we had here anything more than a new variety of man. Hence, if M. Boule insists (see *L'Anthropologie*, xxii (1911), 675, and xxvi (1915), 36) that such a denomination should be reserved for a specifically distinct kind of man, I am quite willing to withdraw the expression in favour of the term *Homo Neanderthalensis*, which undoubtedly applies in a broad sense to the Jersey specimen.

the preservation of human remains, and one can only hope that such will one day come to light in those inmost recesses that still lie hid. By way of compensation, however, a rather curious discovery has been made of the fragments of a human skull which is probably, but not indubitably, of the modern type. These did not occur, however, inside the cave. At the very outset of operations in 1915 it was necessary to remove a portion of the talus at the back of the ravine in order to effect a means of approach. Here, 6 ft. beyond the entrance of the cave and 18 ft. above floor-level, were found together three pieces of bone. Mr. Daghorn, the contractor, must go bail for the facts, since no archaeologist happened to be present. Dr. A. Keith, to whom the fragments were submitted, reports that the first and largest is part of the left side of the occipital portion of a human skull, showing a sutural border. It is very thin, and is considerably contorted. Dr. Keith attributes it to a child not more than 6 years of age. In his view, it bears both inside and outside all the marks of the modern, as contrasted with the Neanderthal, type of man.¹ The contortion he considers to be the result of a partial cremation. The second fragment is an imperfect malar of somewhat anomalous shape. Dr. Keith thinks that its curvature and its porcelain-like resonance can alike be accounted for on the hypothesis of a partial combustion, and would therefore refer it to the same cremation. The third fragment is too small for certain diagnosis, but appears likewise to be human, and is possibly part of a lower jaw. In the light of such findings it would be unwise to suggest any connexion between these human relics and the institutions, whether funerary or culinary, of the Mousterian cave-dwellers. The remains might well belong to some much later age that practised cremation, and have slipped down into the ravine from the top of the cliff, where, as witness both the ruins of a small battery and the existing cabin, a human 'station' would not have been out of place. If the formidable task of dismantling the back of the ravine were to be taken in hand, further elucidation of the mystery might follow.

(b) *Other animals*.—A striking result of the latest excavations is the great increase in the number of animal species that can now be assigned to Pleistocene Jersey. In 1910 woolly rhinoceros, reindeer, red deer, horse, and ox—five kinds in all—were discovered, while 1911 added sheep or goat. The list of species

¹ Dr. Keith in subsequent conversation seemed inclined to pronounce judgement somewhat less decidedly. After all, the skull of a child, even if it were one of the Neanderthal type, would be thin in any case; and, for the rest, the original character is bound to be somewhat obscured by the effects of cremation. It may be noted that two interments of Palaeolithic age seem to have been made over a hearth while the fire was still burning, namely, at Mentone and Solutr; cf. W. J. Sollas, *Ancient Hunters and their Modern Representatives* (2nd ed., 1915), 383.

now amounts to twenty-eight.¹ The following determinations are due to Dr. C. Andrews, of the British Museum, who was assisted by Miss D. M. A. Bate as regards the birds :

- Mammalia. Ungulata* : (1) *Elephas ?trogontherii* (A primitive form of mammoth).
 (2) *Elephas primigenius* (Mammoth).
 (3) *Rhinoceros tichorhinus* (Woolly rhinoceros).
 (4) *Cervus megaceros* (Great Irish elk).
 (5) *Cervus tarandus* (Reindeer).
 (6) *Cervus elaphus* (Red deer).
 (7) *Cervus ?capreolus* (Roe deer).
 (8) *Cervus sp.* (Another kind of deer).
 (9) *Equus* (Horse).
 (10) *Bos primigenius* (Urus).
 (11) ? (Sheep or goat).
Carnivora : (12) *Hyaena crocuta, var. spelaea* (Cave hyena).
 (13) *Canis ?lupus* (Wolf).
 (14) *Canis vulpes* (Fox).
Rodentia : (15) *Dicrostonyx torquatus* (Arctic or banded lemming).
 (16) *Microtus ratticeps* (Vole).
 (17) *Arvicola sp.* (Water rat).
 (18) *Lepus ?cuniculus* (Rabbit).
Insectivora : (19) *Sorex araneus* (Shrew mouse).
Aves. Anseriformes : (20) *Anser brachyrhynchus* (Pink-footed goose).
 (21) *Bernicla leucopsis* (Barnacle goose).
 (22) *Bernicla brenta* (Brent goose).
Gruiformes : (23) *Gallinula chloropus* (Moorhen).
Charadriiformes : (24) ? (Small wader).
Passeriformes : (25) *Cinclus aquaticus* (Dipper).
Galliformes : (26) *Tetrao sp.* (A grouse, possibly blackcock).
 (27) ? *Lagopus mutus* (Ptarmigan).
Falconiformes : (28) *Falco tinnunculus* (Kestrel).²

¹ In the case of ox, horse, reindeer, and ?rabbit considerable discrepancies occur in the size of teeth and other bones. Thus it may well be that bison coexists with urus, Prjewalski's horse with the 'forest horse', caribou with a smaller reindeer, and Arctic hare with rabbit.

² Of the mammals, No. 14 was found in 1914 only; Nos. 1, 8, 13, 16, 17, 18, 19 in 1915 only. Of the birds, No. 26 was obtained in 1914, the others in 1915. Amongst the mammals, reindeer, horse, ox, and lemming are exceedingly common, the rest being more or less rare. The birds are in each case represented by no more than an odd bone or two. Not much stress, however, can be laid on the argument from relative frequency. A mere remnant has survived of the rich store of bone that must obviously have existed formerly; while, of the fragments that remain, comparatively few are determinable, thanks partly to the disintegrating effects of time, and partly to Mousterian man's systematic search for marrow.

No bone was used in evidence that either from its condition, or from its place in the débris, appeared to be of recent origin. Indeed, away from the implementiferous bed, bone was hardly discoverable anywhere, and the occurrence of a few fragments high up near the roof—they appeared to belong to ox, sheep or goat, and rabbit—was noted as a wonder. Of course, though the greatest care was taken, it was not possible to prevent falls of rubbish such as might cause an occasional bit of bone, especially if it were one belonging to a small animal, to slip down unnoticed; but this must have happened quite exceptionally, if at all. It may be stated, then, with considerable confidence, that the bones of all the species mentioned in the foregoing list were found in close association with implements of Mousterian pattern. They would therefore seem to be of Pleistocene age. This conclusion is fully borne out by the character of the fauna, not excluding the avifauna. The list of species implies an environment ranging from steppe to tundra.¹

From the standpoint of stratigraphy, there was not much to be gathered

¹ The reindeer and banded lemming, to judge by their present habits, belong on the whole to the tundra, though of course they are migratory. Indeed, the latter is the most characteristic land mammal of the treeless north (cf. W. B. Wright, *The Quaternary Ice Age*, 222). The extinct mammoth and woolly rhinoceros were steppe and tundra forms, with a predilection for distinctly cold weather. *Elephas trogontherii*, though the contemporary of *E. antiquus*, would seem to have had a more Continental and eastern, and therefore a colder, range (cf. W. Soergel, 'Elephas trogontherii Pohl. und Elephas antiquus Falc.' in *Palaeontographica*, lx (Stuttgart, 1913). See especially *ad fin.*). The voles belong rather to the steppes. *Microtus ratticeps*, a large long-skulled mouse with relatively heavy teeth, is still found in Northern Eurasia, but is locally extinct. According to Mr. Hinton, it reached Britain from France during the latter part of the 'middle terrace' stage (G. E. H. Barrett Hamilton and M. A. C. Hinton, *A History of British Mammals*, Part xvi (November, 1914), 469). Various small unidentified species of *Arvicola* occur in the Middle Pleistocene of Grays Thurrock and Ilford, but are not encountered again in Britain until the Ightham horizon, when *A. abbotti* is numerous (*ibid.*, 477). As regards the shrew (identified by means of a single imperfect skull), it is true that *Sorex araneus* proper first appears in Britain only in the latest Pleistocene deposits, but an extinct species, almost of the same size, occurs in the 'middle terrace' brick-earth of Grays, in Essex (*ibid.*, Part viii (September 1911), 80, 86). The known range of *Hyaena spelaea* in Pleistocene times accords perfectly with the theory of a prevailing sub-arctic climate, even if it be true that it is but a variety of *H. crocuta*, now confined to Africa. Of the remaining species of mammals none, in respect either to its habitat or to its place in the time-series, is suspect, with the possible exception of sheep or goat, and rabbit, seeing that their bones likewise occurred high up in the débris, and may consequently be intrusive when found at a lower level. Yet as regards the latter species, at any rate the rabbit is known from Pleistocene deposits both in Britain and on the Continent (*ibid.*, Part x (February 1912), 173), while possibly the present remains are those of the Arctic hare. Of the birds, the two grouse are no longer found in Jersey; the pink-footed goose and the barnacle, though probably visitors, are not definitely recorded; the dipper is rare; and the brent goose, moorhen, and kestrel common. The geese and waders at present breed in the Arctic regions; the ptarmigan is an Arctic or mountain species, while the blackcock has a more temperate though northerly range; the dipper and the kestrel range far north in summer; and the moorhen extends at least as far north as Scandinavia. I owe the information about the birds to my co-worker, Mr. de Gruchy.

from the relative positions of these animal remains. For one reason, the determinable portions were not enough to be taken to represent the unidentified remainder. Again, the bone in good condition was almost invariably found immediately beneath one or other of the largest stones, such as could not have lodged in the human deposit without causing much dislocation. Otherwise, there might have been a better chance of estimating the extent of the climatic changes that took place during the Mousterian occupation, a change that is usually supposed to have been on the whole from warmer to colder conditions, though not perhaps without minor fluctuations. As it is, there are but two sets of facts that have some stratigraphical value. In the first place, whereas the remains of *Elephas primigenius* (associated with some of *Rhinoceros tichorhinus*) occurred at the very top of the implementiferous bed, where near the eastern wall it is 10 ft. thick, those attributed provisionally to *Elephas trogontherii* were found at the very bottom of the bed, though 18 ft. out from this wall where the thickness amounted only to 6 ft.¹ There was thus a difference of 10 ft. in the relative heights at which the two finds were made. It is surely not without significance that the older animal should be found so far below. On the other hand, it may be argued with some assurance that there is nothing belonging to the human occupation of the cave that is posterior to the age of the mammoth; for three teeth of that animal were collected with my own hands on the very surface of the bed at the one spot where superincumbent débris was absent, namely, where a projecting shelf of rock afforded almost complete shelter to whatever accumulations might form beneath. In the second place, it is interesting to observe that the remains of the lemmings and voles occurred in several thick clusters that lay uniformly on or near the top of the human deposit, as notably along the eastern wall. It would look as if the close of the period of

¹ The tooth on which the determination depends is almost entire, thanks to the care with which it was rescued from the bed by my friends Messrs. R. de J. Fleming Struthers and P. H. Brodie, the former of whom afterwards treated it most successfully with gelatine. It is probably the first upper molar. Eleven plates are preserved, the number lost being uncertain. Three wear-surfaces are complete, two partly worn. The width at the wear-surface is 50 mm. The height (at vii) is 156 mm. The enamel is about 2 mm. thick. The length as preserved is 139 mm. Into this length the number of the plates goes about thirteen times. Such a proportion seems too low for *Elephas antiquus*, but, on the other hand, is too high for *E. primigenius*. Hence Dr. Andrews is inclined provisionally to assign the tooth to *E. trogontherii* (Pohlig). The characters of its molars are carefully differentiated by W. Soergel in *Palaeontographica* (1913), lx, 6, 7. He notes that this elephant seems to pass into the primitive form of the mammoth from the second interglacial period onwards. For an illuminating monograph on Pleistocene elephants in general, with references to the literature of the subject, see P. Zuffardi in *Palaeontographica Italica* (1913), xix, 121. I owe these two references to Dr. Andrews and Prof. Sollas respectively. The exact spot at which the tooth was found on 23rd August 1915 was 18 × 23 × 2 (i.e. feet from the entrance, the W. wall, and floor-level respectively, cf. p. 112). The mammoth teeth, on the other hand, were found on 20th April 1914 at 18 × 39 × 12.

Fig. 1. Tooth of *Elephas ? trogontherii*: general view

Photo: E. F. Guillon

Fig. 2. Tooth of *Elephas ? trogontherii*: view showing wear-surfaces

Photo: E. F. Guillon

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human occupation coincided with the formation of one of those 'rodent-beds', of which several Continental sites afford examples.¹

Finally, it ought to be mentioned that a single shell of *Purpura lapillus*, L., in good condition, was found lying in the heart of the implementiferous bed in Working B, as I am able to testify from personal inspection. It is quite possible, however, that it was introduced by some accident after our trench was opened up, being perhaps dropped by a bird. I should, therefore, be reluctant to draw any far-reaching inference from so questionable a datum—as, for

Fig. 4. Fragment of bone showing striations. ($\frac{1}{1}$)
A. H. Barreau del.

Fig. 5. Bone awls (?). ($\frac{3}{8}$)
A. H. Barreau del.

instance, that during the Mousterian occupation the cave was not far from the sea. But it is right to record the fact for whatever it may be worth.

Artefacts. (1) *Bone.*—A discovery of some interest is that of a small piece of bone on which is to be seen a number of cuts such as might be made with a sharp instrument (fig. 4). It came from the upper part of the bed in Working B.

¹ Thus, at Sirgenstein there are two layers of this character—the lower one occurring immediately over the Mousterian, and the upper corresponding to an Early Magdalenian horizon; while the latter consists of *Myodes* (= *Dicrostonyx*) *torquatus* exclusively, the former yields *M. torquatus* in association with *M. obensis*. See R. R. Schmidt, *Die diluviale Vorzeit Deutschlands* (Stuttgart, 1912), 20, 160. Mr. de Gruchy suggests to me that, since the closely-allied lemming of Norway has the habit of emigrating in huge swarms, herein may lie the clue to the peculiar distribution of the remains of its Pleistocene congener. As regards the place where the lemming remains were found, one cluster occurred at $8 \times 39 \times 10$ and another at $22 \times 34 \times 12$, that is, in each case on the very top of the bed, which rose 2 ft. as it went farther in.

Dr. Smith Woodward and Dr. Andrews agree that the cuts are of artificial origin. One is naturally led to compare the similarly marked pieces of bone found in considerable quantity by Dr. H. Martin at the Mousterian station of La Quina.¹ M. Commont offers some enlightening suggestions as to the probable way in which such striations were caused.² A primitive artisan who was engaged, let us say, in trimming a branch with the aid of a flint implement, might naturally pick out a bone from amongst the cave-litter so as to provide a firm rest for what he held in his hand; whereupon a certain number of his attempts to cut or scrape would find their way down to this makeshift carpenter's bench. M. Commont himself discovered two pieces of bone showing signs of having been used as 'anvils' (*enclumes*) at Montières-les-Amiens, the industrial horizon of which he assigns to the very base of the Mousterian.

It is also to be noted that several sharply-pointed pieces of bone were found, such as may well have served as drills (fig. 5). One of these, in an excellent state of preservation, was almost certainly cut and not broken; but whether this was done with the design of shaping an implement, and not merely in the course of extricating the marrow, must remain a matter of speculation. Another specimen, which is somewhat worn, is of a rounded make. This might conceivably be the result of art, but is more probably due to disintegration of the outer parts. Altogether, a convincing example of a bone implement is still to seek from this site.

(2) *Industry in flint.*³—In the rest of this paper the opportunity will be taken of giving a rather detailed account of the industry of this site as illustrated by the finds of the last two years. It must be remembered, of course, that stored in the museum of the Société Jersiaise is a splendid collection of worked flint representing the fruits of our labours in 1910 and 1911. With this earlier material I have dealt elsewhere, though it cannot be said to have yet been studied as systematically as could be wished. During 1914 and 1915, however, when the excavation was under my personal direction, I sought to

¹ See H. Martin, *Recherches sur l'évolution du Moustérien dans le gisement de La Quina (Charente)*, 1907-10, vol. i. *Industrie osseuse*.

² V. Commont, *Les Hommes contemporains du Renne dans la Vallée de la Somme* (Amiens, 1914), 134; and *id.*, *Compte-rendu du Congrès internat. d'anthropologie préhistorique de Genève*, 1912, i. 298.

³ All flint or other stone used by man from this cave, with the exception of a type-series of something over 100 specimens presented with the approval of the Société Jersiaise to the British Museum, is at present in the museum of the Société Jersiaise, where full facilities for studying it are provided. The figured specimens are labelled S.J. or B.M. accordingly. Those in Jersey were drawn by Mr. A. H. Barreau, and I cannot thank him enough for the trouble he has taken. Mr. Reginald A. Smith had the others drawn for me at the British Museum, and likewise was kind enough to furnish me with their descriptions, which I reproduce with a few slight modifications.

establish the foundations of such a systematic study by enforcing the rule that henceforth every piece of flint without exception should be carefully preserved. Thereupon 15,070 fragments of flint and 854 pieces of other stone used by man, the whole collection weighing about a quarter of a ton, were duly stored and sorted. Now since it can be laid down with some certainty that there is no flint in the cave which was not introduced by the hand of man, it at once becomes possible to compile an accurate statistic in regard to the proportion of used to unused flakes, and so to take a measure of the ancient flint-knapper's intelligence as applied to the avoidance of needless waste. It stands to reason that in a flint-producing region similar results could not be expected, since parsimony would there be wholly out of place. But Pleistocene Jersey called for what may almost literally be described as a skin-flint policy; and, as will presently be seen, it speaks well for the wits of Mousterian man that he answered so well to the test thus imposed upon him. Such, then, was the first and more simple of our statistical tasks.

The second task was to divide up the implements of seemingly determinate shape into their natural groups, showing at the same time how each group stood to the rest as regards the number of implements it contained. Now the constitution of any type-series is at best a risky business, and the student of worked flint is faced by a choice between three different principles of classification, with the risk of perpetrating a cross-division if he tries for a compromise. First, there is the genealogical principle. Implements may be distinguished according to the supposed process of their manufacture. Secondly, there is the functional principle. They may be differentiated according to the supposed use to which they were put. Thirdly, there is the morphological principle. They may be classed according to the shapes which they actually display. Of these three principles the last, being the most objective, the most dependent on direct perception as contrasted with the speculative imagination, would seem to be the safest, at any rate for the purposes of a preliminary survey of a rather large mass of material. A purely morphological classification is bound to ignore distinctions of a genealogical and functional import. For instance, distinct processes of manufacture may result in convergent forms which mere morphology is content to treat as identical. Or, again, implements which might be classed variously as a scraper, a knife, and a saw, according to the usage which the edge would seem in each case to have suffered, will perhaps nevertheless so agree in their general pattern as to be referable to the same morphological type. Morphological descriptions, therefore, ought to be supplemented and qualified by considerations both of origin and of function before the last word is said concerning particular implements. In taking stock of the material from this cave, however, it was deemed best to

rely exclusively on morphology to supply a type-series. From such a humble basis of observed fact one may proceed to loftier constructions of the theoretical order, returning again thereto whenever, as so often happens, the theoretical construction threatens to give way and leave one in the air.

Economic use of material.—The first thing, then, to be done with the large quantity of flint that awaited analysis was to separate the unused portion from the used, while further subdividing what was used into the merely used, that is, accidentally flaked in the course of employment as a makeshift tool, and the trimmed, that is, deliberately chipped into shape.¹ Now it is not always easy to decide whether the breakages visible along the edge of a given piece of flint are due to its use as a human instrument or to some crushing process—a chance footstep, for instance—to which it may have been subjected. Hence care was taken to submit all doubtful cases to a plurality of opinions. Moreover, it was thought advisable to work over the finds of 1914 and 1915 quite independently and then to compare results. If the criteria were arbitrary, the results would not improbably be disproportionate. The subjoined table, however, would seem to show that, if the sorters erred, there was at least a method in their aberrations:

STATISTIC OF USED AND UNUSED PIECES, 15,070 IN ALL.

	1914.	1915.	Total.
A. Trimmed Pieces.			
Above 40 mm. in length	2,395	1,151	3,546
Below 40 mm. in length	657	265	922
	3,052	1,416	4,468
B. Used Flakes.			
Above 40 mm. in length	932	593	1,525
Below 40 mm. in length	2,611	1,030	3,641
	3,543	1,623	5,166
A and B together	6,595	3,039	9,634
C. Unused Pieces.			
Flakes above 40 mm. in length	508	387	895
Flakes below 40 mm. in length	3,047	1,250	4,297
Cores above 40 mm. in length	148	96	244
	3,703	1,733	5,436

It appears from these figures that hardly more than one piece of flint in three had to be rejected as an absolute 'waster'. Moreover, of these unused remnants only about one in five is of any considerable size, the rest consisting of mere chips less than two inches in length. Have we not, then, in this careful

¹ For this distinction, see R. A. Smith in *Archaeologia*, lxii, 526.

husbanding of his resources an eloquent proof of the intelligence of Mousterian man? Though the savage is proverbially prodigal, this big-brained savage of old could apparently practise strict economy when he happened to be short of raw material. Doubtless we must allow for the possibility, suggested by M. Commont, that, if all the flint or most of it had to be brought from a distance, it was imported, at least partly, in the form of prepared cores, the superfluous portions being left behind at the place of origin.¹ Nevertheless, the nature of the flint-refuse found in the cave, consisting as it does in considerable part of shavings of crust, proves that this was a workshop where implements were fashioned on a large scale, as well as a living-place where the same precious implements were used until, not infrequently, they became altogether unusable.

When the waste products had been eliminated, the next task was to discriminate, in the case of the used flint, between the untrimmed amorphous flakes and such pieces as had been worked up into some sort of a shape. Here it was by no means easy to draw a hard-and-fast line. Whereas rather more than half of these were clearly too irregular in form to rank as anything more than mere *outils de fortune*, the rest seemed to represent every grade from the highly-finished symmetrical instrument to something so coarse in workmanship that to allow it pattern at all was at best a matter of charity. In the end, these more or less trimmed pieces, numbering 4,468 in all, were separated, according to quality, into three groups. Those of the first quality, showing the classic forms of the Mousterian industry at its best, amounted to 155 perfect specimens, though portions of others that, if intact, would have been equally fine were likewise found in fair abundance. Seeing that the total yield of flint fragments was 15,070, the proportion turns out to be about one first-class implement in a hundred oddments, which is exactly the ratio one expects to find in a Mousterian site.² Next in quality came a considerable number of rougher examples, which made good their claim to embody design by falling naturally into types. Of these there were 2,678. Lastly, there were left 713 still rougher flakes, which, though at first given the benefit of the doubt and included among the shaped pieces, could not finally be retained in the type-series, and must therefore be classed at best as implements of third quality. For all practical purposes these 'atypical' specimens might be counted in with the mere *outils de fortune*; but the fact remains that they were judged to show some faint traces of modelling, representing perhaps for the most part the failures which must ever strew the path of art.

¹ Commont, *op. cit.*, 139. The place of origin of the Jersey flint remains an obscure point. On this subject see my remarks in *Archaeologia*, lxii, 458.

² Cf. *Archaeologia*, lxii, 457 n.

I. *Implements of the first quality.*—These masterpieces of the Mousterian industry in its most typical form would seem almost without exception to be adaptations of the Levallois flake. In other words, most of them were probably struck from a prepared core. Something will be said about such cores later. In the meantime it will suffice to call attention to the typical ‘tortoise’-core

Fig. 6. Tortoise-core. S. J. ($\frac{2}{3}$)

(fig. 6), showing on its upper or flatter face the place whence an oval flake has been detached by a blow struck more or less at right angles to the end.¹ This end has been already trimmed square, and the steeply faceted edge of the parent block would furnish a ready-made butt for the derived flake-implement. Such a faceted base, together with a thick and spreading bulb of percussion, is characteristic of the instruments of this highest class. Now, presum-

¹ Cf. R. A. Smith, *Archaeologia*, lxii, 528.

Fig. 7. Ovate flake-
implement. S. J.

Fig. 8. Pointed flake-
implement. S. J.

Fig. 9. Pointed flake-
implement. S. J.

Fig. 10. Pointed flake-
implement. B. M.

Fig. 11. Ovate flake-
implement. S. J.

Fig. 12. Pointed flake-
implement. S. J.

Fig. 13. Pointed flake-
implement. B. M.

Fig. 14. Ovate flake-
implement. B. M.

Fig. 15. Pointed flake-
implement. B. M.

Fig. 16. Ovate flake-
implement. B. M.

Fig. 17. Flake-
implement with
square end. B. M.

Fig. 18. Knife. B. M.

Specimens of implements of first quality. (3)

ably, such a flake would tend in its original form to be oval rather than triangular. The ultimate shape, on the other hand, must depend largely on the use to which it has been put. On a site where flint was plentiful, even a handy and shapely flake might retain its pristine condition; but not so in Jersey, where, as it has already been shown, they made the most of all they had. Hence secondary chipping abounds, proving frequent re-adaptation as a consequence of hard usage.

Hence, perhaps, the predominance of a pointed shape in the case of these select flake-implements. Out of 155 specimens, 70 run up to a point, though only in 5 cases is this at all sharp; whereas 55 have a rounded top, and the remaining 30 are more or less square-topped. It is a fair guess that such a point was altogether non-functional. Using the faceted butt as a handgrip—and it invariably offers an excellent *surface d'accommodation*, being symmetrically rounded in 43 cases, abruptly squared in 32, and in the remaining 80 tapering off bluntly with two or three facets meeting at a very obtuse angle—the owner of the implement would cut or scrape now with one side-edge and now with the other, either changing it from hand to hand or holding it with the same hand face up and face down alternately. A curved edge would suit well enough for a drawing cut, the force of which must be carried through from the butt-end right to the top. Gradually, however, as this edge wore away it would have to be sharpened by means of secondary chipping. The effect of this would be to reduce the sides so that, while the base remained as broad as ever, they would converge at a more and more acute angle until the characteristic triangular or pointed form was reached. The point itself, however, would serve no useful purpose in the case of a cutting or scraping tool. Only when the top is more or less squared can it be supposed to be functional. Thus, on the one hand, an otherwise oval piece can be so flattened in its curve along the top as to furnish what amounts to a third cutting-edge (fig. 16). Or, on the other hand, an otherwise triangular flake may be sharply truncated, possibly in consequence of an accidental breakage, and may so come to furnish a narrow end-scrapers (fig. 17), if indeed the end be sharpened, as is the case with 15 out of the 30 flake-implements of this type. It remains only to add that these well-finished specimens, like the rest of the implements from this cave, run rather small, the average length being no more than about 75 mm. (3 in.).¹ After all, this follows naturally from the size of the cores, which whether trimmed or untrimmed never touch 6 in. in their greatest dimension.

¹ The scale of relative sizes is as follows: 2 specimens of 130-140 mm. in length, 1 of 120-130 mm., 1 of 110-120 mm., 5 of 100-110 mm., 12 of 90-100 mm., 39 of 80-90 mm., 38 of 70-80 mm., 32 of 60-70 mm., 25 of 50-60 mm.

Implement worked on both faces.—In the course of two years' search only one implement of the best quality was found with a worked under face, if the not infrequent cases of a trimmed bulb be excepted. Another half-dozen pieces, apart from the numerous discs, were found to be worked on both faces, but they were mostly somewhat shapeless. The specimen in question (fig. 19), which measures 115 × 56 × 22 mm., occurred just half-way across the cave, 10 ft. from the entrance, at the very bottom of the bed, where it was only about 4 ft. thick. It is heavily trimmed on both faces, and is evidently a choice well-finished implement. It is, therefore, entitled to rank as a *coup de poing*, though

Fig. 19. *Coup de poing* from bottom of bed. S. J. (3)

the tapering sub-oval form is perhaps Mousterian in conception rather than Acheulean. Indeed, one can easily imagine how a Mousterian artist, faced with a somewhat knotty piece of flint such as this is, might for once relax an established rule of operating on a flake with its bulbar face plain. Meanwhile, this single exception serves but to emphasize the fact that such a rule was paramount among the inhabitants of this cave. Judged by this test, which perhaps is not infallible, their industry would seem to be referable to the Middle Mousterian, the earlier stage, supposed to be characterized by a relative frequency of the *coup de poing*, being hardly represented here, though perhaps elsewhere in Jersey.¹

¹ See *Archaeologia*, lxii, 464-6, where I assign the industry of La Cotte de St. Ouen to at least a slightly earlier period than that of La Cotte de St. Brelade. It is true that but one *coup de poing* was found in the former cave, but there are other archaic features, such as the 'cordiform' pattern of the flake-implements and the complete absence of later forms.

- Fig. 6. $125 \times 90 \times 50$. Tortoise-core from which a flake-implement has been struck. The upper face was previously trimmed convex from the edges, and the flakes are truncated by the removal of the finished implement by a blow at the butt. The under face is normally conical, and often retains a patch of crust at the apex, as the only object was to obtain a regular periphery; and the core was on some sites (e.g. Northfleet and Montières) thrown aside as useless after the implement was detached.
- Fig. 7. $73 \times 46 \times 18$. Ovate flake-implement of black flint mottled with grey. Facetted butt. Under face plain and finely worked on both sides. From the top of the bed.
- Fig. 8. $78 \times 42 \times 9$. Pointed flake-implement, very flat and thin, of grey mottled flint, with facetted butt. Under face plain; very finely retouched on both sides up to the point. From the top of the bed.
- Fig. 9. $88 \times 56 \times 19$. Triangular flake-implement of grey mottled flint, patinated white in places and showing iron staining on the underface. Facetted butt; under face plain; well trimmed along both sides up to the point. From the top of the bed.
- Fig. 10. $81 \times 42 \times 12$. Flake patinated in various shades of blue; the butt facetted; under face flat and plain; and both edges carefully worked. Towards the point is a pronounced thickening, the flaking being steeper than usual, and suggestive of Aurignac work. From the top of the bed.
- Fig. 11. $98 \times 51 \times 15$. Ovate flake-implement of grey flint, with facetted butt. Under face plain; secondary chipping mostly along right side. From the top of the bed.
- Fig. 12. $111 \times 61 \times 24$. Pointed flake-implement of grey flint, with facetted butt. Under face flat, the bulb being trimmed with three flakings on the right. Secondary work on both sides up to the point, but heaviest on the right side. From the top of the bed.
- Fig. 13. $92 \times 64 \times 14$. Triangular flake, patinated in shades of grey, with facetted butt and rather steep edge-working; a typical Le Moustier 'point'. The bulb is prominent and the under face plain; the right end of the butt is almost square, the left is rounded.
- Fig. 14. $97 \times 61 \times 23$. Ovate flake-implement, dove-colour, bulb medium, and bulbar face flat and almost plain, straight platform serving as a butt, the convex face flaked all over and fine work on the edges.
- Fig. 15. $103 \times 48 \times 20$. Black gabled flake, translucent at the edges, with longitudinal ridge not central. Under face flat and slightly trimmed, side-edges somewhat carefully worked and the butt rounded. A rough specimen of the 'point' of Le Moustier.
- Fig. 16. $95 \times 70 \times 20$. Complete flake-implement, with secondary work all round the edges and a facetted butt with prominent bulb. Under face quite plain, the other boldly flaked. The type of implement produced on the Northfleet factory-site, being Le Moustier man's version of the St. Acheul ovate. Grey to black; quite sharp.

- Fig. 17. $100 \times 72 \times 18$. Pale yellow and somewhat cherty flake with square end, and signs of use there and along the side-edges. The bulb is prominent and that face quite plain; but the butt is faceted in the manner familiar from Northfleet and Montières specimens. The square end is no doubt accidental, but a specimen very similar in all respects from the upper gravels at St. Acheul is figured in *Rev. de l'École d'Anth.*, Paris, 1907, 23, fig. 9.
- Fig. 18. $115 \times 45 \times 9$. A broad blade with two longitudinal ribs, and crust along one edge, the other worked like the point. The butt-end with bulb has a faceted platform. Olive-grey patina, the upper end banded.
- Fig. 19. $115 \times 56 \times 22$. *Coup de poing* of elongated, sub-oval shape, of black lustrous flint of a rather 'knotty' composition. Elaborate trimming round the edges and on one face, that on the other face, which is equally convex with the other, being more perfunctory. Found at $10 \times 20 \times 0$, that is, at the very bottom of the bed, which at this point, half-way across the cave and 10 ft. from the entrance, was only 4 ft. thick. This is the only implement of first quality found to be worked on both faces. The form is perhaps Mousterian rather than Acheulean in character.

II. *Implements of the second quality*.—In this category are placed all trimmed flakes showing some typical form other than that of the oval or pointed flake-implement of symmetrical shape and refined workmanship which represents the final triumph of Mousterian skill, being the efficient but economic substitute that drove the *coup de poing* of the earlier periods out of the field once and for all. A certain number of these minor instruments have been shaped and retouched with care, but the majority are somewhat roughly fashioned. For the most part, indeed, they represent forms that must have been suggested by such natural fracture of the flint as took place either when a prepared core was being flaked in the manner already described or else in the course of the previous preparation. It is to be expected, therefore, that under each type will be found examples ranging in the degree of their finish from the perfected to the purely inchoate implement. A purely morphological analysis yields the following series:

A. Long Flakes with two trimmed side-edges:¹

(1) Parallel sides, rounded end	252
(2) Parallel sides, pointed end	143
(3) Subtriangular, rounded end	136
(4) Subtriangular, pointed end	122
(5) Parallel sides, squared end	50

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¹ In categories A to H all implements are above 40 mm. in length.

B. Long Flakes with one trimmed side-edge :		
(1) Straight edge, back (<i>i. e.</i> opposite side) parallel	154	
(2) Convex edge, back straight	114	
(3) Straight edge, back convex	109	
(4) Straight edge, back forming projecting angle	81	
(5) Subtriangular	20	
	—	478
C. 'Square' Flakes : ¹		
(1) Squared top, three trimmed edges	133	
(2) Obtusely rounded top, three trimmed edges	124	
(3) Obtusely pointed top, two trimmed edges	91	
(4) Squared top, top and one side with trimmed edges	48	
(5) One side winged (<i>i. e.</i> projecting outwards from base), three trimmed edges	39	
(6) Both sides winged, three trimmed edges	24	
	—	459
D. Hollowed Flakes :		
(1) Deeply indented	122	
(2) Slightly indented	115	
(3) Slightly indented, with both sides winged	38	
	—	275
E. Curved Flakes :		
(1) With slight curve	48	
(2) With pronounced curve	12	
	—	60
F. Sharpened Flakes	20	20
G. Keeled Pieces :		
(1) Long	113	
(2) Square	51	
	—	164
H. Discoidal Pieces :		
(1) One face trimmed flat, other formed by crust	66	
(2) Both faces trimmed flat	55	
(3) One face trimmed flat, other polygonal	52	
	—	173
I. Dwarf Implements : ²		
(1) Oval and subtriangular flakes (some of the latter curved)	268	
(2) Long flakes (some hollowed)	243	
(3) Square flakes	206	
(4) Sharpened flakes	78	
	—	795

¹ 'Square' means merely that length and breadth are approximately equal. See p. 101.

² Below 40 mm. in length.

Fig. 20. Small pointed flake-implement.

Fig. 21. Small pointed flake-implement.

Fig. 22. Disc: both faces worked flat.

Fig. 23. Core: used as plane?

Fig. 24. Hollowed flake.

Fig. 25. Curved flake.

Fig. 26. 'Square' flake.

Fig. 27. Long flake, with one side trimmed.

Fig. 28. Dwarf implement: sharpened.

Fig. 29. Dwarf implement: long.

Fig. 30. Dwarf implement: long.

Fig. 31. Dwarf implement: long.

Fig. 32. Dwarf implement: square.

Fig. 33. Dwarf implement: square.

Specimens of implements of second quality. B. M. (3)

K. Broken Implements :

(1) Above 40 mm. in length		346
(2) Below 40 mm. in length		127
		— 473
Total (above 40 mm. 2,678, below 40 mm. 922)		3,600

A. *Long two-edged flakes*.—These implements, regarded from the standpoint of pure form, fall into two groups—the oblong and the subtriangular. The former tend to be decidedly elongated, the general ratio between length and breadth being about 5 to 2, though not infrequently exceeding 3 to 1. They may be anything from 115 mm. to 40 mm. long, averaging just 60 mm. The face usually shows a single longitudinal ridge, thus yielding a triangular section. In a few cases this ridge has been partially or even wholly removed by battering, but this feature is so rare that it may be treated as accidental. In the remaining examples a double ridge is usually found. The end of the instrument, whether rounded, pointed, or squared, would seem mostly to be non-functional. Occasional specimens, however, with rounded tops may have served as end-scrapers. There never occurs among those with pointed ends that sharpening by means of diverging blows, directed along the sides from the point, which is characteristic of the later *burin*. Most of these narrow flakes have a sharp cutting-edge, and, in respect of their probable use, might reasonably be classed as blades. It is to be noticed that this type occurred with greater frequency in the upper portions of the thick implementiferous bed along the eastern wall, where there appeared to be the best chance of obtaining stratigraphical evidence.¹ The subtriangular flakes varied in shape from a narrow isosceles to an equilateral form, the general ratio between length and breadth being about 7 to 4. They were anything between 90 mm. and 40 mm. long, with an average of 60 mm. The end, whether pointed or rounded, would not seem to have been functional. From the standpoint of use, the implements of this type are probably to be regarded as double side-scrapers. They are hardly distinguishable, in point of their morphology, from the more pointed examples of the flake-implement; but it may be suspected that, genetically, they differ for the most part, being derived not from the Levallois flake, the standard product of the prepared core, but rather from the by-products of the preparation of such cores. Be this as it may, they are characterized in general by a want of secondary trimming that precludes the possibility of their having started with an oval form gradually reduced by retouching.

B. *Long single-edged flakes*.—The most noteworthy feature of implements of this type—knives, as they might be called in most cases—is that, in addition

¹ See p. 78, and cf. p. 113.

to a trimmed butt, they have a blunt side, or back, opposite to the sharpened edge, thus offering a firm grip for purposes of cutting, scraping, or even chopping. Of the total number of 478, 315 have the edge to the left and 163 to the right when the implement is viewed from above; and, since a right-handed tool would presumably be more popular, one may consequently surmise that such an instrument was normally used with the bulbar face undermost. A straight edge is about three times as common as a convex; but such a result is to be expected from the fracture of the flint when a somewhat elongated flake is given off. The back is probably in most cases due to accident rather than design, being often formed of the natural crust. Where there is a projecting angle on this side one might wonder that it was not trimmed away for the sake of symmetry; but perhaps it was deliberately left in order to afford a grip. Altogether, these long flakes with a back constitute a rough, if distinct, type. They vary in size from 110 mm. to 40 mm., averaging a little under 60 mm.

C. *'Square' flakes*.—The word 'square' in this connexion means simply that the length and breadth of the implement in question are approximately equal. In other words, there occurs frequently a rather stumpy kind of flake of which the transverse lateral dimensions fall on the average between 60 mm. and 55 mm. The type is well marked (fig. 26). The advantage of such a tool, from the standpoint of use, is that the top-edge comes into play, having enough breadth to render it thoroughly serviceable. Two facts, however, namely that there is normally a pair of well-trimmed side-edges, and that the end is almost as often obtusely rounded as squared, show that the top-edge was not the exclusive or even dominant feature of the instrument, but was rather developed in the course of working with a short side-scraper that lent itself to a sweeping movement such as would finally cause the weight of the hand to press downwards from the butt. Sometimes the result would be merely to break down the edge at the upper angles; whereupon a squat subtriangular form with a more or less functionless end would be produced. If, on the other hand, the instrument projects outwards from the butt so as to form a sort of wing at one of the upper angles, or at both, it may be supposed to be to a corresponding extent somewhat unhandy to use; and indeed this form is relatively so infrequent and so rough as probably to fall short of a truly typical development. It should be noted, however, that there is a tendency in such a winged implement for the edge to wear away between the butt and the upper angles, thus giving rise to a sort of hollow scraper. In the next category to be considered, that of hollowed flakes, 38 such specimens are recorded. Here again, however, it may be doubted whether there has been any conscious attempt to realize a type, since the examples are one and all rather crude.

D. *Hollowed flakes*.—A certain proportion of flakes yielding a concave edge

is likely to occur in the ordinary course of breaking up a flint nodule. Again, the wear and tear along a cutting or scraping surface that was originally straight are apt to cause a more or less notched appearance. Thus it is hard to say how many of the flakes classified on purely morphological grounds under this head were intended as hollow tools. On the whole such evidence of design as would be afforded by careful chipping round the indentation itself is decidedly rare, though by no means wanting altogether. On the other hand, it is plain that, whether skill or good fortune was mainly to thank for their production, such hollowed implements would approve themselves as useful, and thus prepare the way for the more conscious and elaborate efforts of a later period.

E. *Curved flakes*.—Under this head are classed sundry implements of a subtriangular form, ranging from 100 mm. to 50 mm. in length, the pointed end of which slopes away to the right or left. Such a form may be treated as a variety of the hollowed tool, inasmuch as there is bound to be a more or less concave edge on the side to which the beak inclines. If, however, the hollowed side shows careful trimming, and is often much worn with use, the other or convex side-edge is by no means neglected, and may even be the more elaborately worked of the two. Meanwhile, this cannot be regarded as an important type, the instruments showing a well-marked beak amounting to no more than a fifth part out of a total of 60. After all, accident will account for the production of a certain proportion of curved flakes by the side of the straight, and it may be that these were trimmed into two-edged instruments indifferently with the rest without much sense of a special value attaching to the curve as such.

F. *Sharpened flakes*.—Very few of the larger flakes show a sharp projection such as might serve as a drill, and in no case is it certain that special means have been adopted to form a spur, as for instance by notching to right and left of the given point. But among the flakes that measure less than 40 mm. in length there are some far more plausible specimens of the intentionally fashioned drill, so that it is just worth while to mark this off as a distinct type.

G. *Keeled pieces*.—The vast majority of the flakes that have been worked up into implements having the upper face flattish, it seemed better to relegate to a separate category those which rise into some sort of a keel. In such a case the tool might be grasped and guided from above rather than along the blunted surface of base or side, and it would thus be possible to use any part of the periphery for scraping or planing. A sharp-edged butt is not infrequent, and may even be said to be typical of this class. The keel usually takes the form of a ridge, though a domed shape is also found. Well-finished and symmetrical specimens are rare, and it may be doubted whether a genuine type has yet been evolved. On the other hand, in view of later developments, this group of rough tentative instruments is not without a certain interest.

H. *Discoidal pieces*.—The so-called Mousterian disc has always been a puzzle to the archaeologists. As a matter of fact, the type is by no means confined to the Middle Palaeolithic. The fine series collected by Mr. H. Balfour, which is on view at the Pitt-Rivers Museum in Oxford, shows the same form extending from the Chellean down to the Neolithic period in Europe, while it can likewise be matched from Somaliland, the Zambesi, India, North America, and other distant regions. Unfortunately, no primitive people of modern times is known to use an implement altogether similar; so that the function, or functions, of such a type must remain a matter of conjecture. The Mousterian disc has been sometimes regarded as a sling-stone.¹ Apart from the aid of any device for propelling, such as a thong or a split stick, a flattish sharp-edged pebble flung with a rotatory motion would make a formidable projectile. Again, it is possible, though rather unlikely, that some of these disc-shaped implements may have served as cutting or scraping tools. Finally, there is the view that they are prepared nuclei, analogous to the tortoise-core as regards their origin. Thus M. Commont figures certain Mousterian discs which he asserts roundly to be small cores and not throwing-stones at all.² He notes that his specimens are more or less conical on what he distinguishes as the upper face, and supposes that flakes were struck from the under face so as to produce implements in the ordinary way. There would, perhaps, be no great difficulty in applying this theory to two-thirds of the Jersey specimens, namely, those which have but one face trimmed flat, while the other tends to be conical, or at any rate bulging, either being polygonal in a rough-hewn way or consisting of the natural crust (fig. 34). But when both sides are trimmed more or less flat it is not so easy to regard it simply as a case of a prepared core (fig. 22). In particular, it is hard to see how the smaller examples, measuring, let us say, between 40 mm. and 50 mm., could have yielded a flake worth the trouble of detaching. Thus it must suffice for the present purpose to group these discoidal pieces together without dogmatizing in respect to their origin or function. It should be noted, however, that, if M. Commont's explanation covers all or some of them, the class of cores which is dealt with subsequently³ must be to a corresponding extent augmented.

Fig. 34. Discoid core. B. M. (3)

¹ Compare W. J. Sollas, *Ancient Hunters and their Modern Representatives* (2nd edit., 1915), 167.

² Commont, *op. cit.*, 173.

³ See p. 106.

I. *Dwarf implements*.—This expression may be used in a quite untechnical way to describe all implements that are below 40 mm. in length. No mysterious virtue attaches to this precise figure; but it happens to be true of this particular industry that, whereas from about 2 in. (50 mm.) upwards the flake that is fashioned into an instrument tends to be a stoutish piece capable of undergoing any amount of secondary trimming, there occurs as soon as one gets down near $1\frac{1}{2}$ in. another type of implement formed out of a very thin flake that will not stand, and indeed does not need, much working up to get an edge. In the case of these minute pieces, symmetry of outline is the best guide to intentional design, and the share in the result attributable to happy accident is often hard to determine. There are at least two reasons, however, why one should be chary of altogether rejecting their claim to rank as genuine implements. In the first place, there is good reason to think that, flint being scarce and correspondingly valuable, the economically-minded cave-dweller would make the most even of the lesser products of his workshop. Thus out of a total number of 8,860 flakes not exceeding 40 mm. in length which were available, as against 6,210 flakes and cores of a larger size, 4,563, that is, about half, show signs of use, while only 922,² or hardly more than one in every ten, appear to have been worked up into implements. Given the need to exploit his material to the utmost, there is no disproportionate interest manifested in the trimming up of so moderate a quantity of these minor flakes. In the second place, the shapes with which these dwarf implements are endowed are strictly parallel to those displayed by the larger pieces. Thus we have the oval and subtriangular types corresponding in form to those characteristic of the Mousterian flake-implement in its most typical form; next, the long flake, whether a blade with two sharp side-edges, or a knife with one side-edge and a blunted back, which is so common among the larger flakes; and, lastly, the 'square' type with length and breadth approximately equal such as occurs frequently in the other series. Only in one respect does the small flake show an individuality of its own: it almost exclusively provides a sharpened point such as might serve suitably as a drill (fig. 28). In any case, whatever be thought as to the extent to which these scraps of flint have been deliberately fashioned according to a preconceived scheme of types, there can be little doubt that, found as they were in every part of the implementiferous bed, and occasionally in actual contact with pieces of bone, they belonged to the stock-in-trade of the Mousterian household.

¹ The average length and breadth of the four classes are as follows: 268 oval and subtriangular flakes, 31×22 mm.; 243 long flakes, 36×21 mm.; 206 square flakes, 33×32 mm.; 78 sharpened flakes, 35×15 mm.

² The broken implements of dwarf size are included in this number.

A dozen or so of these small flakes show a single or even double notch near the base, and it was thought possible by some who found them that they were used as the points of a small missile weapon, whether arrow or javelin.¹ A survey of this dwarf series as a whole makes it very unlikely that this was so. The notched pieces are so few in number, the notches are so slight and accidental in appearance, and the end of the implement as a rule so little suited for piercing, that the view seems hardly worth maintaining even as a working hypothesis.

K. *Broken implements*.—It was thought worth while to set apart the fragments, at any rate the more substantial and trustworthy fragments, of what

Fig. 35. Flake-implement of first quality, with chip replaced. B. M. (3)

seemed to have been well-shaped implements, in the hope that the missing bits might subsequently be found. As it turned out, it was possible to piece together in this way about a dozen implements of the best quality (fig. 35). The constituent portions occurred more or less widely apart, in one case as much as 12 ft. from each other, always occupying, however, the same stratigraphical position as measured from floor-level. Rarely, if ever, is there any reason to think that the fracture may be modern, more especially seeing that the edges are usually stained with manganese deposit. On the other hand, it is not likely that falls of rock or pressure of the cave-filling—agencies which have apparently done little

¹ Figs. 30 and 31 are average examples. Six of these notched pieces are figured in *Bulletin de la Soc. Jers.*, xl, 68, plate v.

or no damage to the bone embedded in the human deposit—could not merely have snapped these implements in twain but likewise have scattered the fragments over a wide area of the floor. It may be concluded, then, that these breakages were incidental to the production and use of such fragile tools, and one may imagine the broken pieces being pitched away right and left by the user.

III. *Implements of the third quality.*—Concerning these ‘atypical’ pieces, there is little to add to what has already been said.¹ In most cases the specimen that found its way into this category was one so roughly shaped, if intentionally shaped at all, that it served merely to bridge the typological gap between the implements proper and the merely used flakes. Here and there, however, occurs an example of better workmanship, which nevertheless cannot be brought into relation with the general type-series. It will suffice to cite two instances. The first is that of a long bit of black flint with a high ridge from which the sides fall sharply away, this ridge curving downwards to a point which is slightly depressed below the level of the rest of the flat under face. It is, in short, the ‘rostracarinate’ form of which so much has lately been heard.² The second is that of a heavy lump of the same black flint trimmed from both faces to a convex edge. Such a tool would make an excellent chopper. Both these pieces were found in the lowest part of the implementiferous bed.

Unshaped material and cores.—Statistics have been given as regards the ratio of used to unused flakes,³ and, apart from the bearing of these facts on the question of economy in the use of the available flint, there is perhaps not much to be gathered from a contemplation of the workshop refuse. In the hope of being able to reconstitute an original nodule, attempts were made to piece the scattered fragments together; but, though in one case as many as four flakes, one of them a well-shaped implement, could be referred to the same core, the nodule was never restored as a whole. The general impression, however, which is left by a survey of the material taken in the mass is that the Mousterian flint-knapper was singularly successful in striking off a long flake with a spreading bulb; though perhaps his cleverness in this respect becomes more marked as one passes to the higher portions of the bed.

The study of the cores affords a good idea of the material at the disposal of the cave-men. The largest nodule is only 140 mm. long and 100 mm. broad, and we find correspondingly that 140 mm. represents the maximum length among the used flakes and 134 mm. among the flake-implements. It is plain that frequent use had to be made of water-worn flint pebbles such as would not yield implements of the better class. A typical pebble of the kind measures

¹ See p. 91.

² This piece is figured in *Bulletin de la Soc. Jers.*, xl, 68, plate v.

³ See p. 90.

82 mm. by 52 mm. (fig. 36). No pebble was quite whole. Some of them, however, are but slightly chipped, and ought, perhaps, to be classed as hammers or pounders rather than as inchoate cores. With the exception of one very perfect specimen of the tortoise-core, and of the discoidal pieces already discussed,¹ the prepared core is not much in evidence. Attention may be called to some thirty examples that are trimmed impartially on all sides so that something like a regular cube results. Such masses would make excellent projectiles, or, wrapped in skin, might serve as 'bolas'. On the other hand, one may see here an attempt to fashion a kind of core-scraper; and there are occasional signs of chipping along the edges that would favour such a view.

There is little to add to what was said in a former paper² about the nature of the flint material as such. Black and whitish-grey flint passing into a grey chert are the chief varieties found, the former being somewhat rarer, and likewise on the whole providing implements of better quality. Banded flint occurs only in a few flakes. A scraper, now in the British Museum, and a beautiful 'point', unfortunately imperfect,³ are of red jasperite, both occurring in the upper part of the bed.

Fig. 36. Beach pebble used as core. B.M. ($\frac{2}{3}$)

Fig. 20. $56 \times 35 \times 8$. Black-grey flake, very like fig. 21, with small faceted butt, and careful edge-working all round; a 'point' of Le Moustier type.

Fig. 21. $56 \times 35 \times 11$. Spotted dark-grey flake retaining bulb at butt, and the edges carefully worked all round, the under face being quite plain; a variety of the 'point' of Le Moustier.

These and the following small flakes (figs. 28-33) may be compared with examples of Le Moustier date from La Chapelle-aux-Saints and Les Rebières figured in *L'Anthropologie*, 1913, pp. 621 and 639 respectively.

Fig. 22. $41 \times 38 \times 12$. Greyish-white disc, flaked all over, both faces almost flat, with zigzag edges and slight secondary work. A small specimen of a type common in Late Drift times.

Fig. 23. $32 \times 31 \times 30$. Core-like specimen about the shape of a large walnut, irregularly flaked, but with a flattened face and undercutting at one end, due to sharpening for use as a plane. From this point of view it resembles the carinated plane (*grattoir caréné*) of Aurignac times. Yellowish-grey with patch of crust at the back end. It may be compared with a specimen found in the soil at Barnfield pit, Swanscombe, Kent (*Archaeologia*, lxiv, 192, fig. 17).

Fig. 24. $69 \times 26 \times 8$. Spotted black-grey flake with alternate edge-work on the two faces, and three notches (*encoches*), one deeper than the others; the point is also trimmed alternately.

¹ See p. 103.

² See *Archaeologia*, lxii, 458.

³ Figured, but not very satisfactorily, in *Bulletin de la Soc. Jers.*, xl, 68, plate v. It was found on 20th April 1914, at $18 \times 30 \times 9$.

- Fig. 25. $80 \times 46 \times 15$. Grey flake with lozenge butt and median ridge curving to left near the point. The convex side-edge is carefully worked, but not blunted or battered to form a rest for the finger as in the Abri Audi and Châtelperron points, which it otherwise resembles. It is very similar to one of Le Moustier date from La Bouffia Bonneval (La Chapelle-aux-Saints) figured in *L'Anthropologie*, 1913, 615, fig. 3, no. 4.
- Fig. 26. $57 \times 53 \times 13$. Yellowish-grey flake with facettèd butt and the edges square, the top and right-hand side showing signs of use, if not of trimming. One of a large number of 'squares' found in the cave, and almost identical with a solitary specimen from Grime's Graves, Weeting, Norfolk, illustrated in *Report on Excavations* there in 1914, p. 199, fig. 76.
- Fig. 27. $78 \times 25 \times 9$. Yellow-grey flake with one side thick but untrimmed; the other (convex) side is finely worked, and may be compared with a heavier specimen (fig. 18).
- Fig. 28. $33 \times 14 \times 6$. Creamy-white flake, perhaps a borer, the edge trimmed only along the right side; section of point triangular.
- Fig. 29. $34 \times 24 \times 8$. Broken flake, banded and translucent, yellowish, with crust along one side; the butt is facettèd, and retains the bulb.
- Fig. 30. $33 \times 18 \times 7$. Yellowish translucent flake with rib not central, top end worked, jagged and notched on left-hand side, and small butt facettèd.
- Fig. 31. $32 \times 26 \times 6$. Smoky-black blade with central ridge, signs of use along both side-edges, the notch below being accidental; facettèd butt with bulb.
- Fig. 32. $30 \times 27 \times 8$. Translucent yellowish flake, squared in the style of fig. 26, the upper edge serrated, and the others used on alternate faces; facettèd butt with bulb.
- Fig. 33. $33 \times 27 \times 6$. Opaque black flake, roughly oblong, with slight signs of use all round, and facettèd butt with bulb.
- Fig. 34. $78 \times 72 \times 34$. Irregular disc, grey to black with manganese deposit, resembling a small 'tortoise-core' in the Northfleet style. The under face is convex, a low cone with apex not central, and is flaked all over from the circumference, one small patch of white crust remaining. The flatter face has had a small flake-implement detached, truncating the flaking from the edges. The detached flake had a prominent bulb, and measured about 2 in. by 1.5 in., the diameter of the core being 3 in. Though smaller than most of the Northfleet series, this is by no means the smallest of the type.
- Fig. 35. $128 \times 85 \times 23$. Grey flake-implement with facettèd butt, the latter apparently finished after detaching from the core, which was presumably of the 'tortoise' type. The under face is quite plain; the bulb prominent, but partly trimmed away; fine secondary work on the edges. Good example of the Northfleet type of implement. A good deal of manganese marking, and flake now replaced at side, which was not found in close proximity.
- Fig. 36. $82 \times 52 \times 28$. A beach-pebble used as a core for small flakes, which have been detached from both sides of one face: the toughness of the material accounts for the lack of success in flaking.

(3) *Industry in stone other than flint.*—If flint was scarce in prehistoric Jersey, there was an unlimited supply of the local stone, whether in the form of granite or in that of the greenstone, or diabase, long dykes of which intrude into the rocks of the present coast to the south of Jersey.¹ Nevertheless, such inferior material occupied a quite subordinate place in the economy of the cave-men's life, as the following facts attest:

STATISTIC OF USED STONE OTHER THAN FLINT.

A. Granite series :

Hammers and pounders, with signs of use	237
Similar pieces, without signs of use	127
Rubbers	48
Roughly-trimmed scrapers (doubtful)	48
	— 460

B. Greenstone series :

Hammers and pounders, with signs of use	172
Similar pieces, without signs of use	147
Roughly-trimmed scrapers	75
	— 394

Total (433 pieces in 1914, 421 in 1915)	854
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It will be noted that, whereas the excavations of 1915, though covering a larger area than those of 1914, brought to light only about half as much in the way of flint, they yielded the other kinds of stone in approximately the same quantity. The reason is that 20 ft. to 25 ft. in along the eastern wall, where in 1915 an abundance of burnt bone was found, arguing the former presence of a hearth, there also occurred, associated in the closest manner with the bone, a large number of round pebbles of granite or greenstone such as may well have served to break up the bones, or, again, may have been used as boiling-stones for cooking purposes. Apart from this special conglomeration, the other material showed a distribution parallel to that of the flint. It consisted of rounded water-worn pebbles and sharp-edged flakes.

To deal first with the pebbles, these were clearly introduced by the hand of man, inasmuch as the sterile portions of the cave-filling proved to be wholly lacking in them. They were mostly of rather moderate size, as the following figures will show : Only 13, including a flattish water-worn stone that would serve well as an anvil,² were 120–160 mm. in length ; 163 were 80–120 mm. ;

¹ A petrologist would doubtless distinguish several varieties of stone in what is here classed as greenstone. One rough scraper, for instance, seems to consist of a hard sandstone such as is found at Alderney. Diorite, too, is not uncommon.

² This was found at 22 × 36 × 8, i.e. near the eastern hearth.

461 were 40-80 mm.; and the remaining 94, including some two dozen minute white pebbles to be considered presently, fell below 40 mm. That many of these pebbles had been turned to account for hammering and pounding was manifest from the battered condition of the surface, while not a few had been broken across either in the course of use, or possibly with intention so as to obtain a sort of flat-faced mallet. Of the rest it is not certain that they may not have been used in many cases for hammering purposes also, as stone so hard would not necessarily display traces of such employment. On the other hand, some show all the signs of having been subjected to great heat, and may well have been brought into play, after the fashion followed by modern savages, in order to boil water or to broil a steak. Finally, one group of pebbles is of great interest as exhibiting patches of polished surface that prove them to have served as rubbers or mullers. The finding of a stone with a rubbed patch on it in 1910 was duly noted by me in a former paper,¹ but the present discovery of quite a large class of these objects allows one to say that grinding operations of some sort, possibly such as were of help in the preparation of roots or grain for food, constituted a staple occupation in these remote times. These rubbed surfaces, which often involve a considerable flattening to the detriment of the natural contour of the pebble, are easily distinguished from the effects of water action as seen on the rest of the stone. Moreover, the cave-man would seem to have selected for his triturating tool a granite pebble of somewhat coarse grain with a rough exterior rather like that of a nutmeg-grater, so that the wear-surfaces are all the more noticeable by way of contrast. The green-stone pebbles, on the other hand, being of fine texture and naturally smooth, have not been put to this use, or at any rate reveal no former function of the kind. A few granite pebbles have slight hollows in them, apparently produced by blows; but whether these were meant to serve a purpose, or are merely the by-product of rough usage, one can but guess. Finally, in connexion with the subject of the pebbles, it is perhaps worth while to take note of the fact that some two dozen very minute pebbles, mostly of white quartz, occurred in the implementiferous bed and nowhere else in the cave. The chances are that they were brought there by the hand of man, but with what object it is hard to say.²

As regards the sharp-edged fragments of stone other than flint that have been provisionally classed as rude scrapers, a sharp distinction must be drawn

¹ See *Archaeologia*, lxii, 465. The stone in question, being both large and flat, was clearly one on which the rubbing was done, corresponding therefore to the quern of a later age rather than to a muller.

² A nest of similar small pebbles was found associated with an interment in the dolmen at Les Monts Grantez, Jersey (see *Bulletin de la Soc. Jers.*, xxxviii, 322), and such a discovery is not without its archaeological parallels in prehistoric Egypt and elsewhere. But it would be rash to found on such a fact a theory that the Mousterian pebbles had a ceremonial value.

between the granite and the greenstone specimens. The former may be pseudomorphs. On the one hand, they recall in outline various types among the rougher flint-implements; they would doubtless be handy enough as scrapers so long as the edge lasted; and they occur side by side with the flint and bone of the implementiferous bed. On the other hand, the cave-filling is largely composed of more or less splintered granite, and it has proved possible to extract a certain number of hardly less plausible examples of these same forms from levels where flint and bone were absent. In these circumstances the granite-scraper, convincing though it seems at the moment of discovery, must be regarded as of doubtful authenticity. The greenstone fragments, however, though they tend to be rather amorphous, have undoubtedly been chipped to a rough edge. In one case it looked as if, helped by the natural cleavage planes of the stone, the cave-man had managed to subject a block of this material to the same flaking process that answered so well where flint was concerned; for it was found possible to fit together three substantial fragments, any of which might have been worked up into a rude scraper. As, however, the pieces in question were found within a yard of each other, and in no case showed marks of chipping along the edge, it is questionable whether the threefold splitting of the block, neat as it is, was not a result of mere earth pressure. It remains to take note of the curious fact that several of the greenstone fragments appear to show a ground, not a chipped, edge. It does not follow, however, that they were ground to an edge with conscious design. Since the granite rubbers prove certain grinding operations to have taken place for unknown, but presumably culinary, purposes, it might well be that an odd bit of greenstone was occasionally used in the same way. At the same time it must be admitted that, whereas chipping produces a poor edge in this material, grinding will achieve the same end far more efficiently. It may be, then, that Pleistocene man made a discovery which he had not the wit to follow up. Not until Neolithic man appears in Jersey is the copious local supply of stone suitable for such grinding turned to good account, while well-worked flint becomes correspondingly rare.

Stratigraphy.—The greatest care was taken to refer each discovery of importance to its exact place in the cave. This was done by dividing the excavated portion into cubic feet, a system which the local conditions made it easy to carry out. If a square of 40 ft. be taken, one side will be found to coincide with the line of the entrance, and the two sides at right angles thereto to coincide hardly less exactly with the side-walls; while the back-line roughly represents the extreme limit of penetration so far as the complete excavation of the implementiferous bed was carried out.¹ On the other hand, floor-level was taken from a bench-mark which was found to hold good so nearly for the whole area

¹ See datum lines given in the plans facing p. 77.

cleared that the base of the human deposit was nowhere found below it or more than 2 ft. above it.¹ Thus there was never any practical difficulty in taking either the horizontal or the vertical measurements from the conventional lines of demarcation; so that, for instance, the formula 20 (feet from the entrance) $\times$ 40 (feet from the western wall) $\times$ 2 (feet from floor-level), which marks the outer and lower limit of the eastern hearth, could be applied almost at a glance by any one familiar with the cave and its principal landmarks.

Nevertheless, though it was thus made possible to compare the relative positions of the various finds, little seemed to result from the comparison so long as the western half of the bed was being considered. Here the deposit was mostly less than 4 ft. thick, and from the lie of the superincumbent *débris* one got the impression that heavy falls from the north-east corner had to some extent flattened out and displaced the floor-litter along the western wall of the cave. Thus a later implement might well come to rest side by side with an earlier at or near the bottom of the bed.

Prospects improved, however, as soon as the eastern wall was neared. Here the implementiferous deposits were uniformly some 10 ft. thick. Even so, since the implements lay at all angles, it was hard to know how far displacement and rearrangement had taken place. But at last an important clue to the stratigraphical situation was obtained (fig. 37). About 4 ft. to 6 ft. away from this wall, 12 ft. to 18 ft. in from the entrance, and about half-way up the deposit, namely 6 ft. above floor-level, there was noticed towards the end of operations in 1914 a layer, 6 in. to 12 in. thick, composed of whitish gritty, not to say sandy, soil quite destitute of bone or flint.² Here and there a large stone had broken through it, but on the whole it provided a clear line of demarcation between the upper and lower portions of the bed wherever the white band could be traced, namely, over an area of about 12 sq. ft. It was decided to keep carefully apart all the implements from the two levels thus marked off from each other throughout the area in question, so as to be able to obtain a wholesale impression of whatever contrast their several styles of workmanship might present.

The excavations of the next year confirmed the existence of such a dividing line. On 24th July 1915 it became necessary to remove a huge block, weighing some 8 tons, which had hitherto formed a salient between Workings A and C, and had served to prop up the whole of the rearward mass of *débris*. It came

¹ Exception ought perhaps to be made in the case of the rearward parts of Working A, where along the western wall the bottom of the bed was not easily traced (the finds being somewhat rare and scattered), and may have been in places as much as 4 ft. above floor-level. Cf. *Archaeologia*, lxiii, 205.

² The sand was very hard, having almost the consistency of sandstone. The late Dr. A. Dunlop, an expert geologist, examined it on the spot, and, having detected in it signs of fine stratification, was of opinion that it had been deposited by an intermittent agency, possibly wind.

clean away without causing for the moment any downfalls of rubbish, and a beautiful section of the cave-filling was thereupon exposed. The same line of whitish soil, hereabouts 1 ft. thick, was seen to run right across the cave for

Fig. 37. Synthetic section of implementiferous bed (representing bed near eastern wall about 20 ft. from entrance).

some 20 ft., beginning 17 ft. from the western wall. It was 8 ft. above floor-level at the centre of the cave, and sloped slightly downwards until it was some 2 ft. lower near the eastern wall. It now became plain that below this level the cave-filling everywhere consisted of a compact breccia—so compact, in fact,

that the indurated clay resisted the pick almost as if it were stone. For some 2 ft. above floor-level the breccia was of a black colour, which turned out to be due, not to ashes as one at first supposed, but to manganese staining. Above this the breccia was brownish with but occasional black stains.¹ So much for the stratum or strata below the white band. Above it the débris was comparatively loose, open interstices being visible here and there between the stones, though they rested generally in a magma of yellow clay. The white band showed a wavy line as if it had been pounded by falls from above, but was rarely broken right through by intrusive blocks. The general impression left on the mind was that there had existed a fairly level floor of occupation which lay open to the air for a long period. During this time the disused cave had become thickly strewn with dust and blown sand, while the human deposit below became densely consolidated, perhaps by the agency of water. Later on, a new floor of occupation was established amid débris that was apparently beginning to descend already, since the implements and bone-fragments of the upper layer occur amongst the stones and do not find their way into the white band itself.

Given this stratigraphical clue, however, the resulting conclusions may seem somewhat disappointing. The masses of material from the lower and upper beds were arranged side by side, and carefully studied with an eye to the differentiation of an earlier and a later style. But the prevailing impression produced by the survey was that the workmanship was throughout the same as regards all its leading ideas. As for the differences, they amounted to two. First, the work from the lower bed was decidedly rougher and coarser. Though the oval and pointed types of flake-implement occurred, they were poor in quality; so much so that the choicest museum-pieces came almost invariably from the very top of the upper bed. Secondly, while the typical implement from the lower bed is thick and stumpy, the work of the upper bed is characterized by a general tendency to elongation; the narrow thin blades come mostly from this stratum; the flake-implement itself is more tapering in outline. Altogether, the workmanship, while adhering in the main to the original patterns, renders them in a less ponderous and more graceful way. There is an evolution, but it is an intensive evolution. It is the same industry, but perfected.²

¹ The same succession of a black topped by a brown stratum was noticed in 1914 (see *Bulletin de la Soc. Jers.*, xl (1915), 66), and, since the bottom of the brown layer seemed almost sterile, the finds of the two levels were segregated in the hope that a succession of forms might be detected; but little difference, if any, in the workmanship was to be noticed.

² The contrast will be realized if the two groups of implements drawn by Mr. Barreau are compared. The five lumpish pieces occurred within the same cubic foot at the very bottom of the bed, here about 6 ft. thick, namely, at $20 \times 22 \times 2$, not far from the place where the tooth of *Elephas? trogontherii* was found, namely, $23 \times 22 \times 2$. The five more elegant and finished specimens likewise occurred together within the same cubic foot at $3 \times 37 \times 10$, namely, at the top of the bed, at this point 10 ft. thick.

Fig. 38. Pointed flake-
implement.

Fig. 39. Pointed flake-
implement.

Fig. 40. Long flake, serv-
ing as end-scraper.

Fig. 41. Pointed flake-
implement.

Fig. 42. Ovate flake-
implement.

Fig. 43. Hollowed flake.

Fig. 44. Hollowed flake.

Fig. 45. Rough flake, used.

Fig. 46. Rough flake, used.

Fig. 47. Rough flake, used.

Five implements (figs. 38-42) from upper, and five (figs. 43-47) from lower, bed ; each set occurring together within one cubic foot. S. J. (3)

- Fig. 38. $80 \times 50 \times 18$. Pointed flake-implement of lustrous black flint, with faceted butt which is symmetrically rounded. The under face is plain. Both edges are carefully worked up to the point. This implement and the four next figured were found together within the same cubic foot at $3 \times 37 \times 10$, namely, at the very top of the bed along the eastern wall near the entrance. Thus on stratigraphical grounds they may be assigned to the latest phase of this industry.
- Fig. 39. $68 \times 38 \times 14$. Roughly-pointed flake of lustrous black flint mottled with grey; straight platform serving as a butt. Under face plain; sides well worked up to the point. From the top of the bed at $3 \times 37 \times 10$.
- Fig. 40. $133 \times 43 \times 17$. Elongated flake of black lustrous flint, a squared platform providing the narrow butt. Bulbar face plain. Fine trimming along both sides, and carried with rather steepish flaking round the end so as to endow the instrument with the character of an end-scraper. From the top of the bed at $3 \times 37 \times 10$. This instrument is without near parallel among the finds in this cave. It somewhat resembles one found by us in the Paviland Cave, figured by Professor Sollas in *Journal R. Anthropol. Inst.*, xliii (1913), 345, fig. 10, no. 63, and ascribed by him to the Middle Aurignacian.
- Fig. 41. $92 \times 45 \times 14$. Pointed flake-implement of black lustrous flint, with faceted butt. Under face flat, the bulb being slightly trimmed. Fine secondary work on both sides up to the point. From the top of the bed at $3 \times 37 \times 10$.
- Fig. 42. $108 \times 68 \times 15$. Ovate flake-implement of grey flint, with narrow faceted butt. Under face plain; slightly worked along left edge and more elaborately on the right side. From the top of the bed at $3 \times 37 \times 10$.
- Fig. 43. $121 \times 58 \times 24$. Rough flake of black chert, with squared butt. Signs of use on the right side, especially within the hollow. From the bottom of the bed at $20 \times 22 \times 2$.
- Fig. 44. $103 \times 74 \times 23$. Rough flake of black chert, with squared butt. Under face plain. Well used at the sides, and hollowed on the right. This piece and the four following were found together in the same cubic foot at $20 \times 22 \times 2$, namely, at the bottom of the bed, and close to the tooth of *Elephas? trogontherii*. They serve to illustrate the very coarse character of the industry prevailing at this level.
- Fig. 45. $123 \times 77 \times 22$. Rough flake of grey flint from the surface of the nodule, with signs of use on the right side. From the bottom of the bed at $20 \times 22 \times 2$.
- Fig. 46. $106 \times 78 \times 18$. Rough flake of greenstone, with rounded butt, and signs of use on both sides. From the bottom of the bed at $20 \times 22 \times 2$.
- Fig. 47. $110 \times 89 \times 37$. Rough flake of grey flint, with heavy natural butt. Signs of use on the right side. From the bottom of the bed at $20 \times 22 \times 2$.
- Fig. 48. $67 \times 45 \times 16$. Pointed flake of brown-black chert, with butt rounded roughly. Under face plain. Signs of use and slight trimming along the sides. The special interest attaching to this rather coarse specimen of a Mousterian 'point' is due to the fact that it was found in immediate association with the tooth of *Elephas? trogontherii* at $18 \times 23 \times 2$, namely, at the very bottom of the bed, which at this point extended upward from 2 ft. to 8 ft. above the lowest floor-level.

Apart from the evidence afforded by the white belt as a boundary line, the aids to stratigraphy on which reliance can be placed are slight. Patina, however, which for the most part is but barely visible on the flint from this cave, is perhaps able to throw a sidelight on the length of time covered by the Mousterian occupation. Some half-dozen flakes, one of them a first-rate example of the pointed flake-implement,¹ show a double patination. In other words, they have been blocked out in a characteristic Mousterian way, and a thick white patina has been acquired by every part of the flake, including the chipped edges; then more or less elaborate rechipping has taken place which has cut through the white patina and exposed the darker substance of the flint underneath, which in its turn has become slightly dulled by a fresh patination. Now this white patina is uncommonly like that which adorns the flint flakes picked up on the surface of the high lands round the coast of Jersey, and usually ascribed to the Neolithic period. If, therefore, this analogy were to hold—though, unfortunately, the conditions under which patination takes place remain too obscure for chronological inferences to be drawn therefrom with any certainty—one might conjecture that at least 5,000 years had occurred between the first and the second handling of these flakes by men of the same culture.² As, one and all, the examples of double patination were found in the higher portions of the deposit, there is at least a presumption that the artists of the upper bed followed Mousterian precedents that went back over many generations.

Fig. 48. 'Point' found with *Elephas ? trogontherii*. S. J. (3)

Two other facts bear on the stratigraphical question. The first, namely the discovery of an implement worked on both sides near the base of the deposit, does not perhaps take us very far. Even if the instrument in question be classed as a *coup de poing*, it would be rash to conclude on the strength of a single instance that one has got back to the Lower Mousterian, which is supposed to be characterized by the presence of this type.³ The second fact is the finding of a tooth of *Elephas trogontherii*, or some other form of early elephant, at the bottom of the bed, whereas *Elephas primigenius* in association with *Rhinoceros tichorhinus* occurs at the very top.⁴ It certainly looks here as if there was proof of a considerable lapse of time—one, in fact, that amounts to a whole zoological period. Meanwhile, a rough but none the less perfectly

¹ This piece is figured in *Bulletin de la Soc. Jers.*, xl, 68, plate v.

² This conjecture was put forward in our report for 1914 printed in *Bulletin de la Soc. Jers.*, xl (1915), 67. I was glad to hear a suggestion to just the same effect made quite independently by Sir Arthur Evans, President of the Society of Antiquaries, when commenting on a specimen submitted by me to the Society on the occasion of reading the present paper.

³ See p. 95.

⁴ See p. 86.

typical specimen of a Mousterian 'point' occurred with other worked flakes in the immediate neighbourhood of the tooth ascribed to *Elephas trogontherii* (fig. 48). It is hard to resist the inference that these Mousterians of the breccia or lower bed belonged to an epoch far anterior to that of the men of the upper bed.

Fully aware, then, as I am of the uncertainty attaching to considerations based on so imperfect a stratigraphical record, I am inclined to assign the industry of La Cotte de St. Brelade to two periods, probably separated by a chronological hiatus corresponding to the sterile white layer already mentioned. The industry of the first period I assign to the Middle Mousterian. From all I have seen and read of the classical series attributed to this horizon, the work of the breccia-level of this Jersey cave has its natural place here. It is, in fact, the typical industry of Le Moustier itself. The work of the upper bed, on the other hand, I assign to the Upper Mousterian. It is not Aurignacian at all, in my opinion, but nevertheless foreshadows the Aurignacian industry in a number of ways.¹ There are particular implements, though in no sense typical ones, that closely resemble Aurignacian forms as regards their outline; but the trimming is Mousterian, not Aurignacian, in its technique, the perpendicular 'retouch' of the later epoch being almost wholly absent.² If these opinions stand the test of further examination—and I trust that many of those competent to criticize will be led to study for themselves the copious material stored in the museum of the Société Jersiaise—La Cotte de St. Brelade is entitled to rank as a pure Mousterian site, as rich and representative in its way as almost any in Europe.

¹ I had the good fortune, when assisting Professor Sollas to excavate the Paviland Cave (see W. J. Sollas in *Journal of the Royal Anthropological Institute*, xliii, 325 f.), to handle Aurignacian implements in the mass; and, for comparative purposes, the composite impression thus gained tends to be more helpful than the study of endless books or museum cases where the selected instance predominates.

² I was able to pick out in all a dozen pieces showing a slight tendency towards perpendicular chipping, most of them being thick flakes that could not well be made to yield an edge in any other way. Fig. 10 affords a fair example of such chipping. Figs. 23, 24, and 40 may also be cited as in other respects approximating to Aurignacian types.