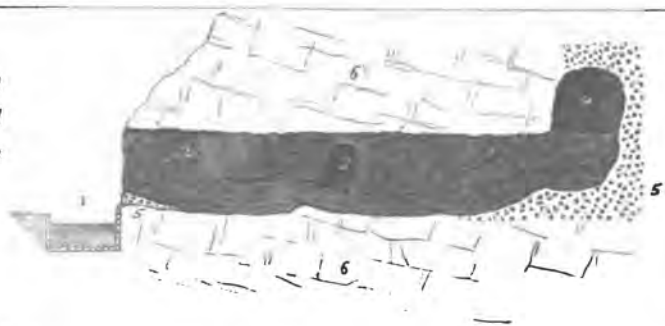


Various Views of a Flint Instrument, of the Spearhead Type, found in Wookey Hole Hyæna Den.—Natural Size.



1. Canal.
2. Vertical Section of Antrum.
3. Upward-tending Passage.
4. Vertical Fissure.
5. Undisturbed Breccia.
6. Dolomitic Conglomerate.



Wookey Hole Wyena Den.

BY W. BOYD DAWKINS, B.A. OXON, F.G.S.,
H. M. GEOLOGICAL SURVEY OF GREAT BRITAIN.

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THERE are, perhaps, no researches of greater interest than those of archæo-geology, by which man is traced backwards in time until the clue is lost amid a group of animals that has been extinct longer than we can compute, and by which he is proved to have existed under circumstances differing most entirely from those now obtaining in the same region, under a different climate, and at a time when the relations of sea and land were altogether different. And this startling result of the combination of geology with archæology, so unexpected, and so completely subversive of our pre-conceived notions, having met with, during the last fifty years, two out of the three inevitable objections which, according to Professor Agassiz, all new and startling facts in science must encounter, first, "that it is not true," and secondly, "that it is contrary to religion," has now happily arrived at the stage in which people say "everyone knew it before." Some of the data contributing to this settlement of the vexed question were contributed by the exploration of the Hyena-den at Wookey Hole, of which a detailed account* has already been published; I will, therefore, altogether omit the details, which are to be found elsewhere, and, after briefly showing its relation to a system of caverns, will dwell at greater length on its more important features, its fauna, and the indisputable traces of man found in it.

II.—The Mendips, like all other limestone districts, are deeply indented by combs and ravines, at the upper end of which is frequently a cavern, and always one or more at their sides. They are but the main trunks through which the drainage of the district passes, and the side-caverns are but the channels of subterranean feeding

* Quarterly Geo. Journ., vol. xviii., part 2, no. 70, p. 115, and do. vol. xix., part 2, no. 74.

rivulets. And, as many of these have altered their course, either on a change of level, or the widening and deepening of other channels, the caverns through which they formerly flowed have become dry. The process, indeed, by which all caverns in limestone districts are formed enables us to realise fully the wonderful circulation of matter prevailing all nature, and the slow, insensible way in which she produces some of the grandest of her works. The rain after absorbing an infinitely small portion of carbonic acid from the air falls upon the limestone, and disappears through the small fissures caused by the drying and upheaval of the rock from the depths of the sea, and by the contortions of its layers consequent upon volcanic action. The carbonic acid as the drops pass onwards forming a chemical union with the insoluble carbonate of the rock, changes it into the soluble bicarbonate of lime. They unite to form a stream which flows along the various fissures, dissolving minute portions of its bed and exchanging carbonic acid, for bicarbonate of lime. And lastly, this its burden is either deposited as stalactite, and stalagmite, if a free current of air be present, or is conveyed out into the open air partly to be precipitated in the form of tufa on the vegetables in the water, or to be absorbed into their living tissues, partly to be carried seawards to supply the respective wants of the inhabitants of the sea. Thus admirably in the harmony of nature are the extinct organisms made subservient to the good of those now existing, and the coral, the encrinite, and the spirifer, disinterred from their tombs, live over again in the green grass of our fields and in the familiar forms of the organisms of our sea coasts. Owing to this beautiful circulation of matter, reducible to a chemical law, are our ravines, or unroofed caverns formed, and our caves enlarged, or, on the free access of air, covered with drapery as of



alabaster. To this cause, apparently so insignificant, and operating so slowly that its results of the present day cannot be noted, to the action of the infinitesimal atom of carbonic acid in each rain-drop upon the rock with which it came in contact during enormous periods, are owing those grand unroofed caverns, Cheddar Pass, Burrington Combe and others, among which Wookey Hole Ravine by no means takes the lowest rank. It is but the unroofed and ruined portico of the main cavern now at its head, which, in its very name of Wookey Hole Cavern, carries the proof that it was familiar to the Celts. On the south side of the ravine, and at a distance of about 200 yards from the main cave is the Hyena-den, one of several dry caves ranged round the ravine like branches round the trunk of a tree. All doubtless were feeders to the river Axe, which, disappearing at Priddy down a swallow hole, after a subterranean course of at least three miles, passes out of the main cave at Wookey Hole greatly increased in volume, and flows along the bottom of the ravine.

III.—In cutting a channel in the rock to convey the water from this cave to the paper-mills hard by, the mouth of the Hyena-den was intersected some ten years ago, and from that time up to December, 1859, it was undisturbed save by rabbits and badgers. At its discovery it was completely filled with red earth, stones, and organic remains, and presented no external feature to indicate its presence with the exception of a few rabbit and badger holes. The workmen state that as they were quarrying the Dolomitic conglomerate in place of rock they came suddenly upon red earth and stones, and, on the floor of the cave, a layer of bones and teeth about twelve inches in thickness, of which they took no particular notice. One of them, however, wiser than his fellows, sold two cwt. of

upper molars of *Rhinoceros tichorhinus* (as I made out by his description) to a dealer in old bones at Wells. Some also of his comrades preserved a few of the teeth, which have been scattered among private collections or are to be found in the British Museum and that of the Somerset Archaeological and Natural History Society at Taunton. A pot of Romano-British money was also found near the cave, which, being of about the same workmanship, form, and size as a large common flower pot, was broken, as is usually the case, and the silver coins of Allectus and Commodus were divided among the workmen. Some skeletons found at the same time were passed by as unworthy of notice. In the course of this excavation about twelve feet of the original mouth of the cave have been cut away.

IV.—When we began our exploration so completely was the cave filled with débris up to the very roof, that we were compelled to cut our way into it. Of the stones scattered irregularly through the matrix of red earth some were angular, others water-worn; all are derived from the decomposition of the Dolomitic conglomerate in which the cave is hollowed. Near the entrance, and at a depth of five feet from the roof, were three layers of peroxide of manganese, full of bony splinters. Passing obliquely up towards the southern side of the cave, and over a ledge of rock that rises abruptly from the floor, further inwards they became interblended one with another, and at a distance of fifteen feet from the entrance were barely visible. In and between these the animal remains were found in the greatest abundance.

While driving this adit we found an angular piece of flint which had evidently been chipped by human agency, and

a water-worn fragment of a belemnite, which probably had been derived from the neighbouring marlstone series; bones and teeth of *Rhinoceros tichorhinus*, *Cervus Bucklandi*, of other species of deer, of Irish elk, mammoth, hyena, *Ursus spelæus*, wolf, fox and horse rewarded our labours; and at the mouth of the cave, and cemented together by stalagmite, were frogs' remains.

V.—In 1860 we recommenced work and, in addition to the above remains, found satisfactory evidence of the former presence of man in the cave. One white flint spear-head, of rude workmanship; one chert arrow-head; a roughly chipped piece of chert; a round, flattened piece of chert; together with various splinters of flint, which had apparently been knocked off in the manufacture of some implement, rewarded our search. Two rudely fashioned bone arrow-heads were also found which, unfortunately, have since been lost; they resembled in shape an equilateral triangle with the angles at the base bevelled off. All were found in and around the same spot, between the dark bands of manganese in contact with teeth of hyena, at a depth of four feet from the roof and at a distance of twelve feet from the present entrance. That there might be no mistake about the accuracy of the observations I examined every shovelful of débris as it was thrown out by the workmen, while the exact spot where they were excavating was watched by the Rev. Mr. Williamson. The white flint spear-head was picked out by him of the undisturbed matrix; the remainder of the implements were found by me in the earth thrown out from the same place. Thus there can be no doubt as to their exact position and error of observation is rendered very improbable.

VI.—On resuming our excavations in April, 1861, we

found that the cave began to narrow, and ultimately to bifurcate, one branch extending vertically upwards while the other, still undisturbed, appeared to extend almost horizontally to the right hand. As we reached the middle constricted passage the teeth became fewer, while the stones were of larger size than any that we had hitherto discovered. The great majority of the gnawed antlers of deer were found at this part, also the posterior half of the skull of a reindeer, the right maxilla of *canis lupus*, and what is more remarkable, a stone with one of its surfaces coated with a deposit, apparently of stalagmite; this, however, was much lighter than stalagmite, and not so good a conductor of heat, and, on analysis, I found that it consisted of phosphate of lime with a little carbonate and a very small portion of peroxide of manganese. Doubtless the surface of the stone, covered with phosphate of lime, formed part of the ancient floor of the cave and hence was coated with excrement, while the lower part, being embedded in the earth on the floor, was not so coated. The stone also itself exhibits tooth-marks, and probably was gnawed by the hyenas, like the necrosed antlers, for amusement: dogs are very fond of exercising their teeth in this way. This discovery proves that violent watery action had but small share, if any, in filling the cave, for in that case the soft album græcum would have been removed from the stone.

The section made in cutting this passage presented irregular layers of peroxide of manganese, full of bony splinters, and, in general, covered with a layer of bones in various stages of decay. These disappeared in the upper portion of the passage. There were masses of prismatic stalactites scattered confusedly through the

matrix. After excavating the vertical branch as far as we dared (for the large stones in it made the task dangerous) we were compelled to leave off, having penetrated altogether only 34 feet from the cave's mouth. In this vertical branch the bones, stones and red earth are cemented together by carbonate of lime, a circumstance which added materially to the difficulty of excavation.

VII.—Encouraged by the results of these our imperfect explorations I, together with Mr. Henry Catt and Mr. James Parker, resolved to empty the cave of its contents. And this we were able to carry out through the courtesy of its owner, Mr. Hodgkinson.

We commenced by clearing out the earth, stones, and organic remains from the large antrum or entrance chamber of the cave, in doing which numerous flint and chert implements were found in two groups, the larger occupying the extreme left of the cave close to the entrance, and extending inwards,—the smaller situated about eight feet from the right hand side of the cave, and about eighteen feet from the present entrance. When we had penetrated as far as the vertical fissure immediately opposite the entrance, being stopped by a vertical wall of rock, we turned to the left, and dug our way into a small horizontal passage, with an average height of four feet, and a width of eight feet which branched off almost at right angles to the large chamber. On penetrating into this from six to eight feet, we came suddenly upon a layer of compacted teeth, and bones of various animals, and of coprolites of hyena irregularly jumbled together, hyena with rhinoceros, and both with Irish elk, wolf, etc. About four inches in thickness, it had an average width of seven, and an extent inwards of fourteen feet, affording, therefore, a square area

of ninety eight feet of organic remains. Its relation to the other members of the same section is as follows:—on the honey-combed and acid-worn conglomerate floor a layer of red earth rested, two feet in thickness and containing few organic remains, but large quantities of stones. Above this came the bone-bed, from three to four inches in thickness with a few stones in its lower part; next a layer of loose dark red earth with, also, a few stones in its lower part which had fallen from the roof, from three to four inches thick, while above this, at an interval of from three to four inches was the roof of the cave. Sixty four jaws and two hundred and forty teeth, exclusive of the numbers that crumbled to pieces at the touch, and of the bones, have been preserved and catalogued from this bone-layer.

On still continuing to advance inwards we found that the passage turned at right angles to the south and at the same time threw a small branch upwards and eastwards. Both contained bone-beds, similar in character to the one above described and presenting the same section, except that in some places the dark red earth was absent and the bones touched the roof. That in the latter, extending from one side of the passage to the other, was perfectly horizontal and gradually thinned out at its upper end owing to the inclination of the passage, until, at a distance of five feet from the bifurcation, it rested on the floor. Fifteen feet in square area it yielded eight jaws and forty six teeth besides a large quantity of bones. The layer of dark earth also thinned out until it rested on the floor, and the empty passage beyond it gradually contracting, at a distance of ten feet from the bifurcation was but little larger than a rabbit hole (nine by nine inches). At this point a stalactite descending formed a vertical

bar right across from floor to roof, as if to forbid further ingress.

That in the former passage which had a gentle dip to the south of 6°, extending from side to side, averaged six feet in width and fourteen in length and therefore afforded a square area of eighty four feet. Besides an enormous quantity of bones, forty seven jaws and one hundred and twenty teeth, it yielded the only rolled flint found in the cave which exhibited no traces of man's handiwork. As we approached the further end of the bone-layer indications of a fine sand began to appear on the floor, and the red earth became of a paler hue and more and more clayey. These changes became more and more marked, until, at the very edge of the bone-bed, a section showed about one foot six inches of pale grey clay, reaching up to the roof, containing a few large bones and many large stones, both angular and water-worn, based upon four inches of fine sand mixed with pieces of mountain limestone chert, and a quantity of peroxide of manganese. This rested upon the water-worn and acid-worn floor. In the grey clay a beautifully polished piece of chert was found which appears to owe its polish to friction upon some soft substance. Dr. Buckland would ascribe it to the friction of hyenas' feet or skin and term it a rubbing-stone.

On penetrating a few feet further we found that the passage suddenly became vertical and was completely filled with grey clay and large stones, without any trace of organic remains. At the point where we ceased it took the form of a vault, six feet high and four feet wide with a small opening about one foot square in its top, which doubtless communicates with the surface above.

VIII.—The floor of the cave, in the main horizontal or but slightly inclined, exhibited traces of a twofold action. The pebbles of the conglomerate in which it is hollowed exhibit striæ or grooves with the same general course as the passages, and clearly pointing back to a time when a current of water sufficiently strong to move large stones in its course flowed through the cave, when it was the channel of a feeder to the river Axe. They are, moreover, nearly worn down to the level of the much softer calcareo-magnesian cement in which they are embedded. They are also in some cases acid-worn, and show a delicate fretwork of calc spar on their worn surfaces, similar to that on the stones composing the débris of "subaerial" denudation on the summit of Mendip. Of the four upper trending passages, two which slant obliquely upwards contain both stalactites and stalagmites and have their upper parts empty, two which are vertical are totally devoid of stalactites and stalagmites and of organic remains, and agree in the large size of the stones and the pale grey colour of the clay with which every cranny of them is filled. The two latter were doubtless at some former period swallow holes and were in immediate connection with the surface of the ground above.

The roof of the cave conforms roughly to the dip of the strata, as also does the floor, but not to so great an extent.

IX.—Let us now pass on to consider the method by which the various contents of the cave were introduced.

The red earth, the matrix in which the organic remains and stones were embedded, highly calcareous and containing magnesia and peroxide of iron, is identical with the cement which binds together the pebbles of limestone

in the dolomitic conglomerate, and doubtless was derived from its decay. And as this proceeded the pebbles, either angular or water-worn, as the case may be, dropped out. But while the stones in all probability were thus derived from the roof and walls of the cave, and in part also the red earth, as in all the caves of Mendip, the identity of the latter and the grey clays, and the fine sand of the cave with the deposits of a stream flowing through the Wookey Hole Cavern, shows most decidedly that a considerable portion of it was introduced by water. The layers of peroxide of manganese also point to the same cause.

X.—The organic remains found, as we have already seen, in the greatest abundance in the three bone-layers, were in all stages of decay, those which were longest uncovered by the red earth being the most decayed, and those of the most compact nature, such as the metacarpals and metatarsals of the herbivores being the best preserved. Some have lost but little of their gelatine. All those that were perfect were solid bones, or with but a small and insignificant medullary cavity, while all the hollow bones that contained marrow were more or less broken; the majority were reduced to splinters, others had lost but one of their extremities. The majority belonged to the rhinoceros, and out of the five hundred I have catalogued two hundred and thirty eight belong to that animal. The coprolites of *Hyæna spelæa* were very abundant.

XI.—The sum total of one thousand and sixteen teeth and one hundred and fifty five fragmentary jaws, of which I will now speak, passing over a detailed account of the bones, were pretty evenly distributed in the cave as the subjoined table shows.

	Antrum		Passage from Antrum to Bifurcation		Smaller branch to the east		Branch at right angles to south		Total	
	Jaws	Teeth	Jaws	Teeth	Jaws	Teeth	Jaws	Teeth	Jaws	Teeth
CARNIVORA.										
<i>Hyena spelæa</i>	26	229	46	67	8	7	41	39	131	342
<i>Felis spelæa</i>		5		2			2			9
<i>Felis</i>							1			1
<i>Ursus spelæus</i>	1	13				3	8		1	26
<i>Ursus</i>	1								1	2
<i>Ursus arctos</i>		1								1
<i>Lupus</i>	1	3	3						4	3
<i>Vulpes</i>	3	2							3	2
PROBOSCIDA.										
<i>Elephas primigenius</i>		13		4				13		30
PERISSODACTYLA.										
<i>Rhinoceros tichorhinus</i>	3	88	4	63		10		29	7	190
<i>R. hemitachus (Falc.)</i>		1								1
<i>Equus</i>		215	4	95		24		28	4	362
ARTIODACTYLA.										
<i>Bos primigenius</i>		14		1		1				16
<i>Bos</i>		1								1
<i>Megaceros Hibernicus</i>	2	18	7	4		1	3		12	23
<i>Cervus</i>		7								7
* <i>C. tarandus</i>	2								2	
† <i>C. elaphus</i>										
<i>Strongylo ceros spelæus</i> }										
Total	39	610	64	240	8	46	44	120	155	1016

* Under the head of *Cervus tarandus* (the reindeer) I have classed the species, termed by Professor Owen (Brit. Foss. Mam., pp. 485, 486) *Cervus Bucklandi* and *C. Guettardi*. He bases the species upon the position of the brow antler and the size of the beam, both of which vary according to the age of the animal. A skull of reindeer in the Taunton Museum bearing an antler of *C. Guettardi*, shows the futility of basing species upon such shallow foundations. And in the recent reindeer there is no part more variable than the brow antler; sometimes it is altogether absent, at others is connate with a second, and, as far as I have examined, is never symmetrical, even in the same individual. *C. Guettardi* is a young, *C. Bucklandi* an old reindeer.

† *Strongylo ceros spelæus*, Owen (Tom. cit. p. 472), is likewise a species founded upon size of antlers, and size alone, and until there is more evidence of the difference between it and *C. elaphus* there are no doubt specimens that it is not an old variety of the latter existing and well known.

The preponderance of remains from the antrum is owing to its being so much larger than the passages in dimensions, coupled with the fact that a few remains picked up out of the earth obtained from the passages are reckoned among those from the former. The horse, rhinoceros and hyena are the three which far exceed the rest in number, and out of one hundred and fifty six jaws one hundred and thirty one belong to the latter animal. Its jaws show the dentition in every stage, from the youngest to the oldest, with bone-crushers worn or broken away. In the latter the alveolar edge of the jaw shows traces of inflammation, caused by the laceration of the gum by splinters of bone while the animal was feeding.

Two jaws of the Irish elk exhibit great peculiarities. In one, the first premolar (P.m. 2) has come up the wrong side foremost and with the outer side innermost, which is an anomaly I have never before met with nor heard of. The outer side of the second exhibits traces of inflammation of the periosteum and consequent abnormal increase of thickness of the outer wall of jaw, owing, possibly, to a blow received in the rutting season. Space will not permit me to quote any other of the numerous instances of morbid anatomy from the cave.

The prevalence of horse teeth and the scarcity of those of *Bos primigenius*, compared with the scarcity of the former and the abundance of the latter in the Kirkdale cave, shows that at the time that great herds of oxen roamed over Yorkshire the plains of Somerset supported equally great numbers of horses.

The small milk molar of *R. hemitachus* is remarkable as proving the contemporaneity of that species with *R. tichorhinus* and *E. primigenius* and is the second instance yet met with in England of its being associated with the traces

of man. It may, perhaps, refer the date of the cave back to the earlier division of the newer Pliocene.

XII.—To one of the most difficult questions of the day—"How were the remains introduced?" one of three answers must be made. First, that at some remote period, when the drainage of the district was far different to what it is now, a current of water was the introducing agent, as it undoubtedly was in the Liège caverns.* That the remains happening to be near a swallow hole became engulfed, and finally rested in these positions in which they were discovered. Secondly, that the remains are those of creatures which fell through swallow holes, as in the case of the Wirksworth cave, and in the same manner as sheep frequently fall into open crevices in the Mendips at the present day. Thirdly, that the cave was for some period the abode of some beast of prey, such as the fox, wolf, bear or hyena.

As the absence of traces of watery action upon the organic remains themselves, and of its sorting action in their arrangement, coupled with the fact that in some instances the most minute points and processes are perfectly preserved, which would undoubtedly have been ground to powder had a current once set the stones in the cave in motion, invalidates the first; so does the presence of large quantities of remains of the carnivores, the absence of perfect bones of the herbivores, and the com-

* Vid. "Recherches sur les Ossements Fossiles decouvertes dans les Cavernes de la Province de Liege." 1833. All the caves described by Dr. Schmerling in the above admirable work belong to that class which owes its contents to the passage of water from a higher to a lower level, and which consists of a vault or a chain of vaults, of which the furthest from the entrance is the lowest. Dr. Buckland also (*Reliquiæ Diluvianæ*, p. 57, and p. 69) affords us examples of this class at Hutton and in the Plymouth caves.

† Buckland *Rel. Diluv.* p. 61, pl. 20.

paratively equal distribution of the remains in the passages and in the large antrum render the second altogether untenable. On the other hand, the large percentage of teeth, jaws and coprolites of the hyena, the fragmentary condition of all the remains, the enormous number of splinters of bone, and the teeth marks upon them all point to the third and last hypothesis as that only which satisfies the requirements of the case, while they are totally at variance with the two former. They show, indeed, that the hyenas were the occupiers of the cave and dragged in the remains of the other creatures for food, as at Kirkdale.*

XIII.—It is clear, however, that the organic remains now are not in the exact position in which the hyenas left them. Some of them touched the roof, and the maximum distance of the bone-layers from it was not more than eight inches, a space manifestly too small for a hyena one-third larger than the existing one (*H. crocuta*) to devour the head of a rhinoceros or elephant. We must, therefore, ascribe their position and their re-arrangement to the only adequate cause, to water. But the presence of the three bone-layers in the narrow passages instead of in the large open antrum proves that while they have been in the cave no current has passed through the passages in which they lie, for in that case they would have been swept out into the antrum on the diffusion of the current over the wider area, and they would not have been found in places where it exerted its greatest force. Were the outlet of

* Tom. cit. pp. 1-19. In Macmillan's Mag., No. 35 (Sept. 1862), is a very extraordinary paper "On the Hand of Man in the Kirkdale Cave," by John Taylor, Esq. He argues that Druids and not hyenas conveyed the organic remains into it, and, having assumed that there was a brisk foreign trade in those days, concludes that the cave is but the storehouse of a vast quantity of imported physio. The plans and sections drawn to scale are, nevertheless, well worthy of examination.

the ravine through which the Axe now flows blocked up or insufficient for the drainage during an unusually wet season, all these otherwise conflicting phenomena are satisfactorily explained. The water, being pounded back, would gradually rise until it reached and flowed into the mouth of the cave, and there meeting with the remains, which are lighter than the sediment and the stones, it may have elevated them, and permanently, on account of the red earthy sediment, which is always present in the freshets of Mendip. And this process, often repeated at various intervals, may have elevated some of the remains, on the surface at the time, even up to the roof. The presence of the lower jaws of the same hyena in one layer of matted bones, teeth and coprolites, and of teeth of the same elephant, belonging respectively to the right and left sides of the lower jaw, and other examples of the same kind in a second, may, perhaps, indicate that the bone-layers were elevated *en masse*. In fine, as it is certain that hyenas introduced the remains, so will no other hypothesis satisfy the phenomena than that the water which every winter elevates the peat of the neighbouring moor above its summer level raised the organic remains to the position in which we found them, and permanently, on account of the sediment which it contained.

XIV.—As we have now accounted for the presence of the organic remains, the stones, and the red earth, let us pass on to consider the traces of man found in the cave. All the implements were found in the antrum, and were lying in three groups, of which the larger one occupies the extreme left of the cave. In this fragments of calcined bones were found, among which one, from its coarse texture and its thickness, strongly resembles the numerous fragments of rhinoceros bone, and, at all events,

belongs either to that animal or the elephant. The exact locality of one bone ash, imbedded in the earthy matrix, between the lower canine and the coprolite of a hyena, and all three cemented to a mass of Dolomitic conglomerate, is uncertain; it came, however, from one of the passages. In one group, situated about the middle of the antrum, two bone arrow-heads were found, in shape equilaterally triangular with the angles of the base bevelled off. These have, unfortunately, been lost, together with a chert arrow-head from the same spot. Layers of peroxide of manganese passed over two out of the three groups of implements. The flint implements have been more or less decomposed and have altogether lost their conchoidal fracture, while those of chert are unaltered. All the spear-heads were of flint, all the sling-stones of chert from the greensand; for flakes and other sharp-edged implements both materials were used indifferently. The three types most abundant were the sling-stone, flake, and spear-head, and a fourth, which, I think, has not yet been recognised, in form is roughly pyramidal, with a smooth, flat base with a cutting edge all round. Of these we found but two examples, both consisting of chert. They are similar in form to some hundreds of flint which were found in a so-called "British village" at Stanlake, near Oxford, and to others I discovered in an ancient burial ground at Yarnton.* The rest of the splinters are irregular in form and some possibly are chips made in the manufacture of implements. On comparing them with those of Amiens and Abbeville I find that, though the typical forms are preserved, the workmanship is much inferior. This, possibly, may

* My friend Mr. Christy, since this was written has given me a cast of a new type of implement found by M. Lartet in the cave of Aurignac, which is similar in form to the Wookey Hole specimens.

indicate a higher antiquity, and certainly shows that the savages of Wookey Hole were of a lower order than those of the valley of the Somme.

XV.—But what date can we assign to these traces of man? Are they of the same date as the remains of creatures which have been extinct long before the dawn of history? Or have they been introduced at a period subsequent to that of the filling up of the cave? To these questions, indeed, but one answer can be given. The absence of traces of disturbance posterior to the filling up of the cave, coupled with the presence of layers of peroxide of manganese, indicative of old floors over two out of the three groups of implements, proves that they were not introduced posterior to the filling up of the cave, while the very fact that they are grouped together renders the hypothesis of their having been introduced or disturbed by water, which disturbed and elevated the three bone-layers and the remains, at the surface at the time, altogether untenable; and we are driven to the conclusion that man was a contemporary with the extinct fauna of Somerset—with the elephants (*E. primigenius*), the two species of rhinoceros (*R. tichorhinus* and *hemiteachus*) and their congeners. But the presence of the remains of hyena underneath one group of implements, and of calcined bone, either of rhinoceros or elephant, tends to show that the cave was a hyena-den before the implements composing that group were placed there, while the layers of peroxide of manganese, mixed with comminuted bone, above two of the groups, and a large quantity of organic remains found at a higher level shows that the hyenas returned again to their old haunt, from whence they had been driven. Thus there are three distinct periods of occupation. First, that of the hyenas, who dragged in and devoured their prey in

the cave. Secondly, that of the savages who kindled the fires which calcined some of the bone lying on the surface at the time, and who left behind them both implements and the splinters knocked off in their manufacture. Thirdly, the re-occupation of the cave by the hyenas. The time when the last contents were introduced is altogether unknown, but the absence of bones of rabbit, hare, birds and bats, abundant in all caves still open in the neighbourhood, may, perhaps, show that the cave was closed before the fauna of the period had yielded to that now holding the same district.

XVI.—Let us now attempt to realise the strange inhabitants of our county during the later Pliocene bone-cave period. The relations between land and water are changed—a level plain extends westward into the Bristol Channel, and, possibly, far away into the Atlantic. Forests* of beech, and yew, and thickets of hazel occupy the drier ground; the willow, the fir tree, and the alder fringe the swamps; here and there upon the mountain patches of greensward peep from among the trees, while bare grey masses of limestone on the mountain side are brought out into strong relief by the surrounding woods. Some of the lowlands, also, are treeless, and form prairies, miniatures of those of North America. Thus far we are, to a certain degree, at home, the trees and even the mosses, and, probably, also, the wild flowers are the same; even the main features of the landscape are identical. The Quantocks, and the Mendips, and the Blackdowns are still overlooking the

* The oak had not as yet supplanted the beech in the north of Europe. Its first appearance is in the peat bogs of Denmark, associated with bronze implements. Professor Max Müller has shown the bearing of language upon this question in his late series of lectures at the Royal Institution.

level plain at their feet. Thus far, but no farther. In the forests lurk the lion and the bear, ready to spring on the rhinoceros, and the deer, and the gigantic ox as they pass to their watering-places, wolves hunt down the reindeer, the hyenas, issuing at the approach of night from their dens, drag back again mammoth or rhinoceros from the woodlands, or red deer, Irish elk and reindeer, but more frequently horses, from the plain, and hesitate not to attack lion or bear, even in their prime. In the woodlands the mammoth, shielded by a woolly covering from the inclemency of this northern climate, browses off the young shoots of our present trees, horses wander over the open plain. In the foreground stands man, fire-using, and acquainted with the use of the bow, but far worse armed with his puny weapons of flint, and chert, and bone, than his contemporaries with their sharp claws and strong teeth. And the very fact that he held his ground against them shows that cunning and craft more than compensated for the deficiency of his armament. He was, indeed, in a worse situation than the bushmen of Port Natal, for they have to contend against less formidable wild beasts. Yet even here we find that the relation between herbivore and carnivore remains constant, though the terms vary. As the deer and mammoth were larger than in existing nature so was the destructive capacity and the size of those animals which preyed upon them—the lion, wolf, bear, and hyæna—proportionably increased.

XVII.—Next comes a blank, a period about the duration of which no estimate can be formed, but that it was enormous there can be little doubt, for in it the cave lion, bear, and hyæna, the rhinoceros, and the elephant became extinct. That it was a period of submergence is shown by the submarine forest overlying the *Elephas primigenius*

clay on the north coast off St. Audries. Next came an upheaval (which I believe to be going on now) during which the shingle and the sand, containing recent marine shells, in places far inland, as, for example, at Westonzoyland, Middlezoy, and Burtle, were first formed, and afterwards the alternation of fine alluvial clay and peat, in the latter of which canoes, celts, and other traces of man are found. The pottery and human teeth found by Dr. Buckland in the great cave unassociated with the remains of animals in all probability is of the same date. And lastly, the discovery of the coins of Allectus "*Comes Littoris Saxonici*" along with the skeletons near the hyena-den brings us down to the fourth or fifth century.

XVIII.—In this brief survey we are in the position of one who from a mountain-top looks down upon a mist-covered landscape below and sees peak after peak insulated in the great sea of mist. But yet he knows that they are parts of one and the same tract hidden from his view and waits until the sun roll away the covering and disclose the unity of the landscape. We must wait patiently, attributing those sharp boundary lines between the extinction of one set of animals and the appearance of another, the apparent isolation of the earliest of our race, and even the great chasms between classes and genera to our imperfect knowledge, in the full belief that the mists now concealing the history of the past will be dissipated and the exquisite unity and harmony of nature be shadowed forth to us by strict and laborious scientific enquiry. We must fully realize the fact that, at the present time, we know as little of our earliest ancestors as of the first trilobite, and that our only means of fixing their place in the geological series are those which are applied to all extinct forms—an appeal, first to the associated forms,

and, secondly, to the succeeding ones. The concurrent testimony of both these—that a race of men co-existed with animals extinct for ages in Europe, and whose representatives are now found only in tropical Asia and Africa; that it was succeeded by other races of a higher grade and possessed of better tools—by the folk of the stone, bronze, and iron ages—points back to an antiquity so great that it is idle to speculate upon the number of years necessary to fill up the chasm which separates the flint-folk from ourselves.
