THIRD REPORT OF THE SETTLE CAVE COMMITTEE (VICTORIA CAVE) *

WORK has been carried on almost uninterruptedly throughout the year (except from March 20th to May 20th, when it was stopped for want of funds), at a cost of 175*l.* 12*s.* 7*d.*, Of this, 80*l.* 11*s.* 9*d.* was a balance in hand, 50*l.* the British Association grant, and 45*l.* 0*s.* 10*d.* raised by private subscription.

Great progress has been made in the past year in uncovering the glacial deposits at the entrance of the cave, and showing their relation to the older bone-beds containing the remains of man with the extinct animals. The boulders are seen to cover an area of at least 1,200 square feet.† They are of all sizes, and consist of dark and white Carboniferous Limestone, and the basement bed of that formation, Carboniferous Gritstone, and Silurian Grit. Some have travelled at least two miles, and others greater distances. They are various in size, from mere sand-grains to blocks several tons in weight. An interesting section was displayed, showing the passage of the boulder-beds in one part from a regular till with large scratched stones, through scratched gravel, sand, to laminated clay, and these were so interbedded as to demonstrate that some at least of the laminated clay is of glacial age and origin.

At length, after six years' work, we are able to say that we have reached the floor of the cave at the entrance. Several pinnacles of rock have been found by the removal of the boulders; they run in lines parallel with the joints of the rock above, and give testimony to the cave having been at some time occupied by a stream, similar rock-weathering occurring in other water-caves in Craven. The arched niches on the right of the cave at the entrance lead to the same conclusion.

And now, with the additional evidence of another year's diggings, we may again consider the question, the most interesting perhaps of all the problems before us: Are the glacial deposits which rest upon the older bone-beds, containing the extinct mammals and man, in the position which they occupied at the close of the glacial conditions, or have they subsequently fallen into their present site? We may again urge the reasons given last year (see Second Report), strengthened by enlarged sections and a wider experience, which go to prove the first alternative. To these arguments we may now add the following:—That the extent of the glacial deposits now exposed is so great that it is impossible that they can be a mere chance accumulation of boulders which have been re-deposited in their present position since glacial times. This being the case, it is clear from the position of the boulders beneath all the screes, that they are a portion of the general glacial covering of the valleys and hillsides which was left by the ice-sheet at the time of its disappearance.

These are the main arguments to be derived from the cave itself, but further strong presumptive evidence, that the Pleistocene fauna lived in the North of England before the ice-sheet, exists as follows:—The older fauna once lived in this district, a point which admits of no dispute from its existence in the Victoria Cave, in Kirkdale Cave, Raygill Cave in Lothersdale, and perhaps in other caves. But their bones are now found nowhere in the open country. None of the river-gravels contain them; and just that district which is conspicuous by their absence, is also remarkable for the strongest evidences of great glaciation. Putting these facts together, the probability is very strong that it was glaciation that destroyed their remains in the open country. To suppose that these have been destroyed by other sub-aërial agencies, would be to ignore the fact that in the South of England and other non-glaciated areas, such remains exist both in the caves and river-gravels.

A few bones were found lying upon the boulders beneath the talus. They have been determined where possible by Prof. Busk, but they are only fragmentary and not of much interest; they were probably washed out of the Lower Cave-earth when it was exposed above the edge of the boulders. No fragments of bone were found throughout the 19 feet of talus which lies between the base of the Neolithic layer and the top of the boulders.

Work in Chamber D.—A considerable amount of work has been done in excavating this chamber which leads off from the principal entrance towards the right. It was choked to the roof over the greater part of its extent, with clay and limestone blocks. It is now 110 feet long, 20 feet wide, and 20 feet high at the entrance. Two galleries lead off from it on the right. One, the Birkbeck Gallery, is made easily accessible for a distance of 44 feet, in a N E. direction. Here it becomes very narrow and leads to a narrow chasm 20 feet deep. The other gallery is blocked at the entrance with stalagmite.

A magnificent series of bones was found in Chamber D. They were all carefully registered as to their position by Mr. Jackson. The Committee are much indebted to Prof. Busk for his kindness in determining them. He says: "They are a remarkably interesting collection, especially in the Bears, and I think the larger of the two skulls is by far the finest specimen of the kind yet found in this country."

"Out of about 269 specimens including detached teeth,

127	belonged to	Bear	
37	,,	,,	Hyæna
36	,,	,,	Bos
24	,,	,,	Fox
22	,,	,,	Deer { 15 Red Deer, 7 Reindeer
10	,,	,,	Rhinoceros
2	,,	,,	Horse
1	,,	,,	Badger."

To these we may add 1 of Pig, 2 of Elephant, and 1 of Hippopotamus. The Rhinoceros is *hemitœchus*, the Elephant *antiquus*, and the Hippopotamus, a portion of a tusk, is the only specimen of that animal found in the course of six years' digging. The careful registration of the remains has enabled your reporter to construct a section showing the distribution of the different animals throughout the different portions of the deposit. It is too bulky for publication, but the result may be given in words. The bones group themselves along two horizons separated by a greater or less thickness of laminated clay, cave-earth, and stalagmite. The lower extends from the back of the boulder-beds at the cave mouth, is continuous with that which contained the human fibula, and runs continuously as far as Parallel 42. The upper bed commences only at Parallel 15, close against the roof, and continues to Parallel 43. Where the upper bed commences, the two horizons are about twelve feet apart, but they gradually approach other, and at Parallel 35 not only touch, but seem to be somewhat commingled.

From this section we find that the following species are—

Peculiar to the Upper Bed.	Peculiar to the Lower Bed.	Common to both.
Badger.	Hyæna.	Man.
Horse.	Brown Bear?	Fox.
Pig.	*Elephas antiquus*	Grisly Bear.
Reindeer.	*Rhinoceros hemitœchus.*	Red Deer.
Goat or Sheep.	Hippopotamus.	
	Bos primigenius.	

Brown Bear has previously been found in the upper beds in other parts of the cave. The upper bed probably contains remains from the Reindeer period to the present, those of later date being mixed up with older in the mud at the surface. But as distinguished from the lower bed, the chief characteristics of the upper appear to be the presence of the Reindeer, and the absence of Elephant, Rhinoceros, Hippopotamus, and Hyæna.

In the upper bed the only sign of man's presence consists of the spinous process of a vertebra of a bear which has been hacked apparently by some cutting instrument with a tolerably regular edge. It might have been done with a bronze celt or polished flint axe. It is probable that Chamber D was never the resort of man within the historic period. The soft wet mud of the floor, and the lowness of the roof, render it most unlikely that anyone would take to it, except under the direst necessity, or in the pursuit of science.

In the lower bed again evidence of man's presence is but scanty. At the mouth, and close to where the human fibula was found, we have this year met with a piece of rib apparently nicked by human agency. The nicks appear to have been made by some clumsy instrument drawn backwards and forwards. They are in character totally unlike the square-troughed gnawings of rodents, and the furrows heavily ploughed by the teeth of carnivores.

And now, having restricted ourselves to the hard road of

* Abstract. Read at the Bristol meeting of the British Association, August 1875, by R. H. Tiddeman, M.A., F.G.S.

† The full report will contain two photographic plates giving a general view of the cave and a nearer view of the boulders.

fact, we may, perhaps, in conclusion, be permitted to indulge in a short flight of fancy. Let us endeavour to realise how great is the distance in time which separates the savage of Craven from our own day. We have the history of much of it in the Victoria Cave itself, and we may restore some of the missing pages from the surrounding district.

At the cave, Roman times are separated from our own by sometimes less than one, but not more than two, feet of talus, the chips which time defaches from the cliffs above. The Neolithic age, which antiquaries know was a considerable time before the Roman occupation, is represented by a layer in some places four or five feet beneath the Roman, in others even running into it. Then comes a thickness of 19 feet of talus without a record of any living thing. Judging by the shallowness of the Roman layer, this must represent an enormous interval of time. And this takes us down to the boulders, the inscribed records of the Glacial Period. They must represent a long series of climatal changes, during which the ice was waxing and waning, advancing and melting back over the mouth of the Victoria Cave. This period saw the Reindeer and the Grisly Bear occasionally in possession. Then we have an unconformity, a break in the continuity of the deposits, the boulders lying on the edges of the older beds. Time again! and that time long enough for changes to take place which allowed the district to cool down from a warmth suitable to the Hippopotamus, and become a fitting pasture-ground for the Reindeer. It was in that warm period that the early Craven savage lived and died.

But these are not all the changes which occurred in the North of England since that time. The age of the great submergence represented by the sea beaches of Moel Tryfaen and Macclesfield, and by the Middle-Sands-and-Gravels of Lancashire, has left no record up at the cave. Your reporter is of opinion that the submergence did not attain in that district a greater depth than six or seven hundred feet, and this would still leave the cave 750 feet above the sea, though it would cut up the land into a group of islands. The fact is sufficient for us, the depth is immaterial.

Upon no fact are geologists better agreed than upon the existence of a wide-spread submergence and emergence of land towards the close of the Glacial Period. No tradition is common to more races and religions than that of a great deluge. Where back in the past is the common point whence these two far-travelled, almost parallel rays of truth had their origin? In the opinion of your reporter the Craven savage who lived before the Great Ice-sheet, and *before the Great Submergence*, may form another of the many strong ties which bind together the sciences of Geology and Anthropology.

*GERMAN SCIENTIFIC AND MEDICAL ASSOCIATION**

THE following communications were made to the various sections. Of many of these papers our space permits us to give little more than the titles and names of authors :—

Section 1. *Astronomy and Mathematics.*—The laws of comets, by M. von Hauenfels.—On the idea of space, by Prof. Hoppe.—On properties of tetragons between hyperbolas, by Prof. Reitlinger.—On the criteria of maxima and minima in definite integrals, by Prof. Zmurko.—On Voigtländer's newest telescopes, by A. Martin.—On the mathematical series called chains, by Dr. Günther.

Section 2. *Physics and Meteorology.*—The new polariscope of Mach, by Dr. Subic.—The glimmer combination of Reusch and their significance for theoretical optics, by Dr. Sohnke.—The relation between the temperature and the inner friction of gases, by Capt. Obermeyer.—Dr. Prestel showed his climatographical atlas of Germany.—On changes of induction-currents through iron nuclei, by A. Ettingshausen.—On the isogonic lines in Transylvania, by G. Schenzl.—On microscopical photography, by A. Martin.—On the increase of the velocity of evaporation through electricity, by Dr. Reitlinger.—On the temperature of steam given off by solutions of salts, by L. Pfaundler.—Method of representing the various constituents of weather in a short and exact manner, by Dr. Prestel.—The conducting powers of several acids for electricity, by Prof. Kohlrausch.—On mirror observations with minute mirrors, by Prof. Boltzmann.

Section 3. *Chemistry.*—On a new colouring matter, phloreïn, by R. Benedict (already published in the *Annalen der Chemie*).—R. Böttger proved that Gore's inflammable antimony contains not only chloride of antimony, but also occluded hydrogen, transforming, as it does, ferricyanide into ferrocyanide of potassium. The same chemist has found glycerine to preserve palladium-hydrogen for three months or longer. The same chemist also showed a new solvent for tri-nitro-cellulose, viz., sodic sulphydrate.—Dr. Schwartz showed the oxidation of ammonia to nitric acid by means of hypermanganate of potassium.—Dr. Meusel proved the transformation of ammonia in water into nitrites to be due to the presence of bacteria, and to be prevented by benzoic, carbolic, or salycilic acids, that kill the bacteria.—A. Mitscherlich showed a new air-thermometer.—A. Butlerow presented observations on the transformation of hydrocarbons CnH_2n into alcohols.—The same chemist has found a phenol $C_{15}H_{24}O$ in the juice of *Cynanchum acutum*.—L. v. Pebal showed new apparatus for disengaging gases, and new thermometers for lecture purposes.—A. Michaelis reported on the continuation of his experiments on aromatic compounds of phosphorus.—H. v. Richter on the action of cyanide of potassium on nitro-compounds, and on the transformation of aromatic amides into bromides.—M. Conrad on dichloro-aceto-acetic ether.—H. Schacherl demonstrated that hydrochloric acid and chlorate of potassium yield hypochlorous acid :—

$$2KClO_3 + 4HCl = 2ClO_2 + 2H_2O + Cl_2 + 2KCl.$$

—E. Urban communicated that phosphoric anhydride transforms allylic alcohol, not into allylene, but marsh-gas.—Prof. Butlerow insisted upon the necessity of introducing dynamical views into the constitution-theory of chemical molecules, and explained his intentions by drawing attention to the various decompositions which both cyanic and hydrocyanic acids offer under different circumstances.—I. Iobst sent a communication on a Bolivian bark *Quina cota*, which is free from quinine, but contains 1½ per cent. of a new crystalline body not yet analysed.

Section 4. *Mineralogy and Geology.*—On a Labyrinthodont found near Brünn, by A. Markowsky.—Geology of the Vienna Waterworks, by F. Karrer.—On minerals enclosed in the volcanic conglomerates of the Swabian Alps, by Prof. Nies.—On the Brown-coal Flora of Styria, by C. von Ettingshausen.—On Baer's law respecting the flowing of rivers of a southern direction, by A. Dunker.—On the influence of plants for diminishing the surface of lakes, by Dr. Senft.—On a fossil resin, Hartit, by Dr. Hofman.—On the magnesites of Styria, by Prof. Rumpf.—On the results of deep borings in the North German Plain, by Dr. Huyssser.—On the granites of the mountain-range, Böhmerwald, by Dr. Woldrich.—On earthquakes (trying to demonstrate the action of the moon on subterranean volcanic eruptions), by R. Falb.—On the falling in of abandoned coal-mines in Königshütte (Silesia), by Dr. Serlo.—On eruptive formations in the Fassa-valley and Fleimser-valley, by C. Dölter.—On a discovery lately made near Stuttgart, of eighteen Saurians, partly measuring as much as 0·9 metres in length, by Dr. Karpff.—On corals in Tertiary sediments of Krain, by W. Linhart.

Section 5. *Botany.*—C. von Ettingshausen communicated phyto-palæontological studies in their bearing on the transformation of species; also a paper on the transformation of *Castanea atavia* into *Castanea vesca*.—Dr. Eidam described the development of the sexual organs of Hymenomycetes.—On hign pressure in the cells of plants, by Dr. Pfeffer.—On morphology of cryptogamea, by Dr. Prantl.—On the flora of Australia and of the Cape, by C. v. Ettinghausen.—On the sexual life of plants, by E. Strasburger.—On the vegetation of Mount Etna, by G. Strobl.—On Theophrastus as a botanist, by O. Kirchner.—On a monstrous organ in *Marchantia polymorpha*, by Prof. Leitgeb.—On acclimatising *Rheum Ribes* in Vienna, by Prof. Fenzl.—Morphology of mosses (Lebermoose) and application of phenol and essential oil of cloves for botanical preparations, by H. Leitgeb.

Section 6. *Zoology and Comparative Anatomy.*—On the zoological station at Trieste, and on a sponge, *Sycandra raphanus Haeckel*, by F. E. Schulze.—On the genus Myzostomum, by L. Graff.—On the penis of Scolytides and the chewing apparatus of the same genus, by Prof. Lindemann.—On *Ptychoptera contaminata*, by C. Grobben.—On the circulation of molluscs, by Prof. Kollmann.—On the curves described by the legs of insects, by V. Graber.—On noctilucous Dipteræ at the Aral lake-district, by W. Aleuitzin.—On the ear of Heteropodes, by Prof. Claus.—On *Podocoryne carnea*, by C. Grobben.—The typical forms of the skulls of cattle, by Dr. Wilckens.—On the differentiation in certain species of beetles (*Carabus monilis*, *arrogans*, and

* Continued from p. 34.