

Copper river, and other water routes of the Territory, the United States Congress having granted 100,000 dollars for the purpose.

SCIENTIFIC facts are presented to the public freely and attractively in three lectures which have been arranged at the Whitechapel Free Public Library and Museum. On Tuesday Prof. Hobday lectured on "The Horse and Dog and their relations and friends." On Tuesday, May 10, Prof. W. F. R. Weldon, F.R.S., will discourse upon "Butterflies"; and on June 7, Prof. Marshall Ward, F.R.S., will give an address upon "A Piece of Wood." Admission to the lectures is free by ticket, which can be obtained in the Museum and Library.

APPENDIX II. for 1898 of the *Kew Bulletin* is entirely occupied with a list of New Garden Plants of the year 1897, including also the most noteworthy of those which have been re-introduced after having been lost from cultivation. In addition to species and botanical varieties, all hybrids, whether introduced or of garden origin, with botanical names, and described for the first time in 1897, are included.

MESSRS. J. AND A. CHURCHILL announce that they will publish in a few days a new work on "The Blood: how to examine and diagnose its diseases," by Dr. Alfred C. Coles, illustrated with six coloured plates. They will also issue a fifth edition of "A Manual of Dental Anatomy, Human and Comparative," by Mr. Charles S. Tomes, F.R.S., with many new illustrations. The part dealing with comparative odontology has been expanded to meet the requirements of students of biology.

THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Mrs. Grace Currie; a White-tailed Sea Eagle (*Haliaeetus albicilla*) from the Liautung Peninsula, China, presented by Mr. J. W. Carrell; ten Californian Quails (*Callipepla californica*) from California, presented by Captain Thos. Yardley Powles; a Common Viper (*Vipera berus*), British, presented by Mr. R. Tucker; an Egyptian Jerboa (*Dipus aegyptius*), four Egyptian Ichneumons (*Herpestes ichneumon*), six Gulls (*Larus*, sp. inc.), a Common Kestrel (*Tinnunculus alaudarius*) from Egypt, a Leopard (*Felis pardus*) from West Africa, a Reticulated Python (*Python reticulatus*) from Malacca, deposited; a Chimpanzee (*Anthropopithecus troglodytes*, ♂) from West Africa, a Rosy-billed Duck (*Metopiana roseosaca*, ♀) from South America, purchased.

OUR ASTRONOMICAL COLUMN.

THE DOUBLING OF THE CANALS ON MARS.—The origin of the doubling of the canals visible on the surface of the planet Mars has again come to the front, and this time M. Antoniadi has put forward an explanation. His suggestion is that the doubling is only a phenomenon caused probably by the eye of the observer; in fact, it is the result of slight focusing errors when observing these markings. A full account of this curious cause of error is contributed to *Cosmos* (No. 687) by M. Th. Moreux, and M. Antoniadi himself gives a complete summary of his suggestion in the *Bulletin de la Société Astronomique de France* for April. According to the latter, a thin line, when gradually put slightly out of focus, becomes slowly double, the inner parts of which are blurred; in fact, a regular germination is observed. In addition to this, he finds that if several lines be made to cross at a point, all of these do not become double, but only certain of them. Not only do straight markings, but round and elongated spots become alike doubled. At the end of his paper, after remarking on the curious phenomenon of canals, as actually observed, becoming double in the course of a few hours, he says:—

"Ainsi, si Mars est couvert de 'canaux,' la vision imparfaite devra dédoubler ces lignes. Pareille vision indistincte peut provenir, ainsi que nous venons de le voir: 1° d'une minime erreur de mise au point; 2° d'oscillations diplopiques (fatigue)

de l'œil. Voilà ce qui doit fatalement arriver, et ce qui arrive en réalité."

M. Camille Flammarion tells us in the same journal that M. Adolphe de Boe, of Anvers, in the year 1891 suggested, in a letter to him, that this doubling might be the result of secondary images which, under certain conditions, might be formed in the eye. M. Flammarion is, however, no great believer in this idea, as it does not seem to sufficiently explain all the phenomena of doubling, germination, &c., which have been observed on the surface of this interesting planet, although the arguments brought forward reproduce very ingeniously the greater part of the observations. With him we echo the sentiment of wishing to know what M. Schiaparelli has to say on the subject.

COMET PERRINE.—The latest elements and ephemeris of this comet have been calculated by Prof. H. Kreutz, who gives the results in No. 4 *Circular* recently distributed.

The elements computed from the observations of March 19, 23, 27 and 31, differ slightly from those we have previously given, being:—

$$T = 1898 \text{ March } 17 \text{ } 37558 \text{ Berlin M. T.}$$

$$\begin{aligned} \omega &= 47 \text{ } 34 \text{ } 12 \text{ } 1 \\ \Omega &= 262 \text{ } 33 \text{ } 59 \text{ } 6 \\ i &= 72 \text{ } 27 \text{ } 48 \text{ } 1 \end{aligned} \left. \vphantom{\begin{aligned} \omega \\ \Omega \\ i \end{aligned}} \right\} 1898 \cdot 0$$

$$\log q = 0 \cdot 040842$$

The ephemeris for the ensuing week is as follows:—

1898.	R.A.	Dec.	log r	log Δ	Br.
	h. m. s.				
April 14	23 7 15	+40 47 7	0·0757	0·2233	0·77
15	12 13	41 32·9			
16	17 15	42 16·9			
17	22 20	42 59·7			
18	27 27	43 41·3	0·0851	0·2330	0·71
19	32 37	44 21·6			
20	37 49	45 0·6			
21	43 3	45 38·4			
22 23	48 19	+40 15·0	0·0953	0·2438	0·64

It will be noticed that the brightness of this comet is gradually decreasing, and by the end of the month it will be about half that at the time of discovery.

THE APRIL LYRIDS.—As pointed out in this column on March 31 (p. 519), the April shower of meteors is due on 19-20 of this month. The conditions for viewing these bodies if they should be numerous will be very favourable, as the moon will be absent. As Mr. Denning tells us, the periodical maxima of this stream of Lyrids has a computed time of revolution of 415 years, a brilliant display having occurred on April 20 in the year 1803. The radiant point is $270^\circ + 32^\circ$.

THE MEUDON OBSERVATORY.—Prof. Janssen is evidently bringing together a very strong force at the Astro-Physical Observatory at Meudon. We hear now that, in addition to the other experienced astronomers who are working there, M. Deslandres has been transferred from Paris, and will in future continue his valuable spectroscopic researches at Meudon.

PREHISTORIC RUINS OF HONDURAS AND YUCATAN.

IN 1891 the Directors of the Peabody Museum secured from the Government of Honduras (through the liberality of Mr. C. Bowditch, of Boston) the right to explore the ruins of Copan, and to take away half of the objects found in the excavations, during a period of ten years. The preliminary report of the exploration,¹ now published by the Directors of the Museum, gives the result of the first two years' work, and is accompanied by a plan and many excellent photographic plates.

All those interested in American archaeology must be for ever grateful to the Committee directing the expedition for one instruction given to the explorers; it was to the effect that a wall should be built round the principal group of ruined structures and carved monoliths, so as to save them, if possible, from further destruction. This work has now been most satisfactorily carried out, and the ruins, which were always safe from approach on the river face, are now enclosed on the land side by a substantial stone wall nearly one mile in length.

¹ *Memoirs of the Peabody Museum, &c.* Vol. i. No. 1: "Prehistoric Ruins of Copan, Honduras." "A Preliminary Report of the Explorations by the Museum, 1891-95."

Examination and excavation have thrown no light on the age of the buildings; in fact, the further examination has only complicated the problem, as clearer proofs are forthcoming that the mass of masonry has grown up in the course of ages, old foundations being enlarged and covered in turn by new build-

fully incised figures and hieroglyphs. I have had the good fortune to be able to examine this skull in the Peabody Museum, and can only express an earnest hope that photographs of it, and drawings of the incised ornament, may be included in the further publications which are promised us.

During the second year's work a sad event occurred in the death of Mr. J. G. Owens, the leader of the expedition, who contracted a malignant fever during a journey to the coast, and died soon after his return to the ruins, where he lies buried in the great Plaza surrounded by those strangely carved monoliths in which he had learned to take so keen an interest.

The Exploration Committee of the Peabody Institute has not confined itself to organising expeditions in Honduras only; it has for some years worked with equal success in furthering the examination of ancient ruins in the peninsula of Yucatan. There, under the direction of Mr. Edward H. Thompson, for some time the United States Consul in Merida, a thorough examination has been made of the ruins of Labná; but, unfortunately, the report on that portion of the work has not yet been made public, and the second article in the *Memoirs* of the Museum deals only with the exploration of the Cave of Loltun,¹ which Mr. Thompson undertook in 1888 before setting to work at Labná—from which it is twelve miles distant—and continued in 1890-91.

One peculiarity of Yucatan is that it is a country without any rivers. The copious rainfall soaks through the porous limestone



FIG. 1.—Foot of the hieroglyphic stairway.

ings. One of the most interesting discoveries made during the explorations is connected with the great hieroglyphic stairway which leads to the summit of one of the largest foundation mounds. The steps of this stairway had become disjointed and displaced, so that it is not easy to determine the exact plan of its construction; and it was probably in order to gain further information on this point that an excavation was commenced near the foot of the steps, which revealed the fact that the hieroglyphic stairway had been superimposed on an earlier stairway, which also had a clear cut inscription on the face of each step. A description of these stairways has been deferred until further exploration leads to a better understanding of their structure; and it is to be hoped that the greatest care has been taken in numbering and recording the position of the stones, so that the continuity of the glyphs in the inscriptions may be retained, as the result of a comparison of the initial dates of the two inscriptions (one of which is in the rarer form of picture writing) will probably prove to be of the greatest value.

No regular burying-place has been found at Copan, but a number of isolated tombs have been explored, in which human bones were discovered in more or less disintegrated condition. The human incisor teeth were found, in many instances, to be ornamented by the inlaying of a little circular bit of jadeite, fitted into a hole drilled into the front of the tooth. These jadeite ornaments are slightly rounded outward, and highly polished. Many interesting pieces of pottery were secured during the excavations, some decorated with painted designs, others (such as the terra-cotta vase in the form of the head of a carnivorous animal, figured on p. 48 of the Report) remarkable for the artistic skill shown in the modelling. The most interesting object of all, however, was not a piece of pottery, but the actual skull of a peccary covered with beauti-

rock, and it is to the pools in the deep caves or "cenotes" that the Indian of to-day looks for his supply of water, as his forefathers did before him. Under such conditions the caves were sure to yield to the explorer many signs of human visitation, but it was of the greatest importance to ascertain whether the

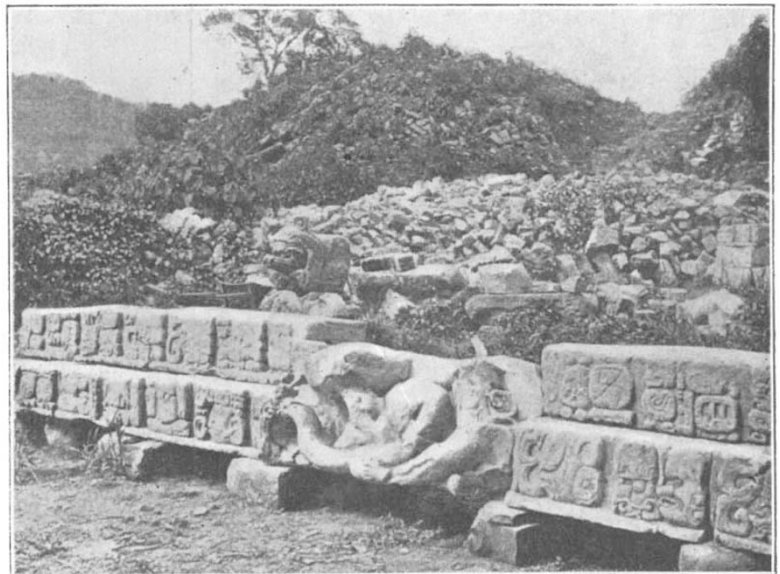


FIG. 2.—Two steps from the hieroglyphic stairway.

evidences of human handiwork should be attributed only to the race inhabiting the land at the time of the Spanish conquest, or

¹ *Memoirs of the Peabody Museum, &c.*, vol. i. No. 2: "Cave of Loltun, Yucatan." "Report of Explorations by the Museum, 1888-89 and 1890-91," by Edward H. Thompson.

whether they could be ascribed to some earlier and more primitive race.

The interest attaching to the result of Mr. Thompson's labours has been somewhat discounted by the publication in 1896 of the admirable treatise on the caves of Yucatan by Mr. Henry Mercer, but to Mr. Thompson must remain the credit of having been first in the field.

Mr. Thompson's report is accompanied by some capital photographs of the rock carvings, taken by Mr. H. N. Sweet and

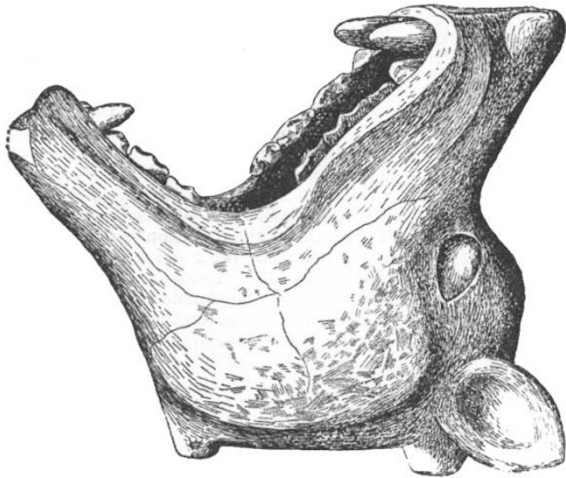


FIG. 3.—Terra-cotta v.r.s. (½ size)

Mr. M. H. Saville, showing them all to be rude and primitive in character, with the single exception of a life-sized human figure with the mutilated remains of a date expressed in the Maya notation above its head, which is just such a figure as one might find on the walls of the ruined temples above ground.

Mr. Thompson's main conclusion is that from the earliest period of the cave's use as a human habitation the people seem to

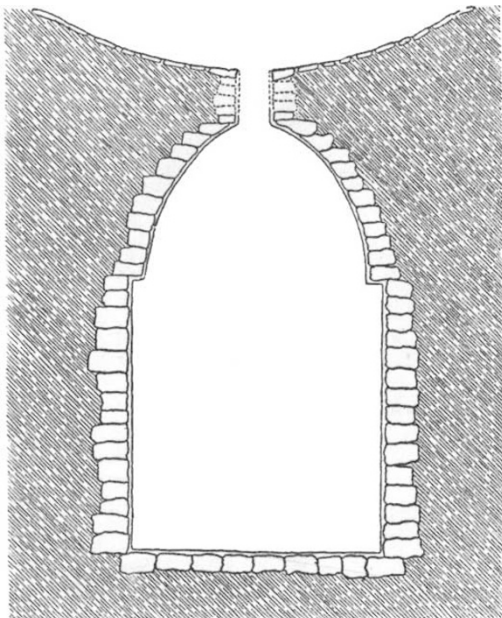


FIG. 4.—Section of a chaltune.

have been of the same manners, religious customs, and household habits as those who built the great structures above ground now in ruins. Mr. Mercer, after pointing out that the caves were not properly dwellings but rather temporary halting-places, has given it as his opinion, (1) that no earlier inhabitant preceded the builders of the ruined cities of Yucatan; (2) that the

people revealed in the caves had reached the country in geologically recent times; (3) that these people, substantially the ancestors of the present Maya Indians, had not developed their culture in Yucatan, but had brought it with them from somewhere else.

In a country where water is so scarce, it is only reasonable to suppose that the inhabitants would have devised some means of storing the precious fluid; and in the existence of numerous "chaltunes" we have almost certain evidence of the means or storage most commonly employed. These chaltunes are "single chambers of a vault-like appearance, built from ten to fifteen feet beneath the surface of the ground, and communicating with the outer world by means of a narrow well-like opening placed near the apex of the vaulted roof." They are somewhat irregular in shape, but the prevailing form is shown in the following section.

Mr. Thompson paid particular attention to the chaltunes amongst the ruins of Labná,¹ a neighbourhood where—if the opinion that they were used for the storage of water be correct—it is likely that they would be found in considerable numbers, as the nearest permanent water supply is found at the Cave of Loltun, twelve miles distant. Mr. Thompson is of opinion that many of the rougher class of chaltunes were formed in the cavities or pockets from which the white earth, called by the natives "zahcab," had been taken. "This earth is of a

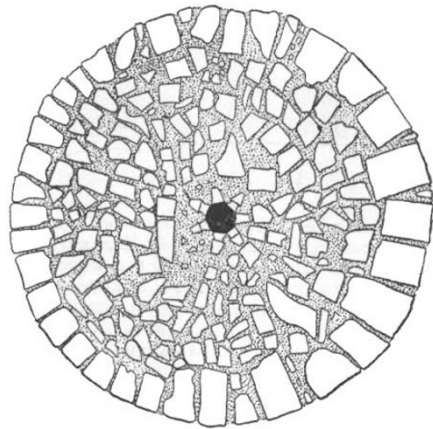


FIG. 5.—The mouth of a chaltune.

peculiar character, and served the ancient builders, as it does those of the present day, as a building material to mix with lime in place of siliceous sand, which is practically unknown in Yucatan." The other chaltunes are well-built chambers, having their walls, roof, and floor of dressed stones, and finished with a coating of fine, hard stucco. In the ruins of Labná, each edifice and each terrace was found to be provided with one or more of these subterranean chambers, the largest of which, however, would not hold more than 10,000 gallons.

Many of the chaltunes had become hopelessly ruined, and many were filled up with earth and rubbish; but some of them had been purposely sealed up by the ancient inhabitants, and these presented a new and interesting field for investigation. Human bones and various objects of human workmanship were found among the deposits at the bottom of the chambers; and Mr. Thompson is led to the conclusion that many of these singular structures, after having been first used as reservoirs, were finally used as depositories for human remains, probably secondary burials, in connection with some special rite, after which the entrance of the chaltune was closed and cemented.

ALFRED P. MAUDSLAY.

P.S.—While the foregoing was in the printer's hands, an article on Copan has been brought to my notice, published in the *Century Magazine* for January, in which Mr. Gordon states that he has finished his work on the hieroglyphic stairway. It proves to have been a single flight of steps, and not one stairway built over another. The illustration given on p. 569 shows the foot of the stairway as it was at first disclosed

¹ *Memoirs of the Peabody Museum*, vol. 1. No. 3: "The Chaltunes of Labná, Yucatan." "Report of Explorations by the Museum 1888-89 and 1890-91," by Edward H. Thompson.

by Mr. Owens's excavation. The disjointed stones of the upper part of the stairway (some of which have already been cleared away) had slid down bodily from above and, until the excavation was made, had completely hidden the lower part of the stairway.

It is to be hoped that the next part of the *Memoirs of the Peabody Institute* will give the details of this interesting work, and a more accurate (if less ambitious) drawing than that of the "restored" stairway published in the *Century Magazine*. If it has been possible to preserve the continuity of the inscription on the steps, Mr. Gordon's labours will have added to our store one of the longest and most valuable inscriptions yet found in Central America.

Surely it is through an unintentional error that the drawing of the Jaguar stairway, on page 409 of the *Century*, is ascribed to Henry Sandham. A. P. M.

RECENT PAPERS ON GLACIATION.

AT the Toronto meeting of the British Association the numerous papers bearing on the glaciation of the North American continent were of exceptional interest to the British student of glacial geology, inasmuch as they brought prominently to mind the methods adopted by the Canadian and American glacialists, which differ in many respects from those to which we have become accustomed on this side of the Atlantic.

In no branch of earth-lore is the influence of his environment more strongly impressed upon the worker than in stratigraphical geology, and the effect of the simple topographical forms and of the enormous extent over which the glacial deposits are distributed in North America, has been to give a broader grasp and bolder tone to the general run of its glacial literature. This was admirably illustrated by the work brought forward at the meeting. In the British Islands, from the abundance of natural and artificial sections as well as from the complexity and narrow limits of the topography, the lithological composition of the drift deposits is usually made the pivot of the studies, while in America it is rather the arrangement of the drift in regard to the general physical features which is held to be of paramount import.

The following comments on the papers read at Toronto have been written from the standpoint of a British glacialist anxious to find wherein he might profit by the adoption at home of the Transatlantic methods.

To realise the extent of the field in North America it must be remembered that the total area of the Dominion of Canada, about 3,616,000 square miles or not much less than the whole of Europe, can show, in one form or another, traces of the Great Ice Age in every part, and that the same glaciated area further extends over a region about one-fifth as large to the southward of the Canadian border. It is not surprising, then, that the study of glacial phenomena should have attracted so many able workers in Canada and the United States.

The exploratory work of Russell, Wright and others upon the existing glaciers of Alaska, and of Chamberlin, Peary, Barton and others upon the edge of the ice-sheet in Greenland has been more readily assimilated by American than by British glacialists, and its influence is perceptible throughout their researches. It is true that the Danish explorers had already made known to us the leading facts relating to the latter region, but their studies were not perhaps made so directly from the standpoint of the glacial geologist as those of the above-mentioned observers, nor were their results so accessible to the English-speaking geologists. But since Russell, by his investigation of the Malaspina Glacier, with its forested moraine-covered margin sheltering a varied fauna and flora, has shown how widely different are the conditions of Piedmont ice and Alpine glaciers, and since Chamberlin, in describing the mode of occurrence of the detrital matter in the basal layers of Greenland ice-tongues, has thrown so much new light on the whole question of drift-deposition, the British glacialist would do well to recognise, with his colleagues across the Atlantic, that the glaciers of the Alps do not afford the best introduction to the study of glacial geology. It is clear that the Alpine conditions are, in many respects, very different from those under which the ice-sheets of the Glacial period did their work.

As regards the cause of the Great Ice Age, we heard at the Toronto meeting two interesting communications. That of Prof.

T. C. Chamberlin, outlined in a former number of *NATURE* (September 16), was avowedly altogether speculative, and belonged to the domain of earth-physics rather than to geology in the ordinary sense. The other was that in which Dr. J. W. Spencer ably advocated his well-known views on the continental elevation of the Glacial epoch.

Dr. Spencer described a large number of drowned valleys, often extending from the mouths of the great modern rivers across the submarine plateaus at various depths, reaching to even 12,000 feet or more, and recognisable as far northward as Labrador. He stated that upon tracing northward the deposits occupying the great valleys, he found that glacial accumulations occur in New Jersey between the Lafayette formation, which is the latest horizon dissected by the great valleys, provisionally regarded as of late Pliocene age, and the Columbia formation, which is mid-Pleistocene. From all these considerations he concluded that the eastern portion of North America stood more than two miles above the sea during the earlier Pleistocene epoch.

On other evidence he judged that the Mexican plateau was mostly depressed to near sea level during the times of the high elevation of the eastern portion of the continent; and that, with the subsidence of the eastern region, the western side of the continent was elevated from 6000 to 10,000 feet or more. The separation of the Atlantic and Pacific Oceans he regards as only of recent date. These changes of levels and the dependent variations of currents, &c., seem, in his opinion, to be sufficient cause for the Glacial period.

As Dr. Spencer pointed out, his views are practically those which have been advocated by Lyell and many others. But while a pre-glacial elevation of the North American continent is generally acknowledged by geologists, the extent of this elevation is not usually admitted to have been even approximately as large as Dr. Spencer would claim, and the difficulties in accounting for the widespread glaciation of the Northern Hemisphere by the effects of elevation alone are so great that the defenders of this hypothesis are at present few.

There is a somewhat remarkable blank in the evidence to hand in North America as to the conditions immediately antecedent to the Glacial Period, nothing equivalent to the Forest Bed Series and associated pre-glacial deposits, of which we possess such excellent sections on our Norfolk coast, having yet been discovered. For this reason the paper of Mr. R. Chalmers, of the Geological Survey of Canada, on the pre-glacial decay of rocks in Eastern Canada, was of especial interest. Mr. Chalmers showed that in the region he described, beds of decomposed rock, of variable thickness and more or less modified, occur wherever the surface of the rocks has not been abraded by Pleistocene ice, though boulder clay may often be found overlying them.

He gave the following general section of these beds in descending order:—(1) Transported and stratified water-worn gravel with beds of fine sand and clay. (2) Coarse stratified gravels, usually yellow and oxidised, the materials wholly local. (3) Sedentary rotted rock, passing into solid rock beneath.

There seems at present to be no evidence as to the precise age of these beds in Eastern Canada; but Mr. Chalmers pointed out that somewhat similar deposits occurring at the western base of the Green Mountains in Vermont, have yielded vegetable remains by which Lequereux, many years ago, referred them to the Miocene. He concludes that the general aspect of the dry land in Eastern Canada previous to the Glacial period must have been nearly similar to that of the region south of the glaciated zone in North America.

The occurrence of similar local rubble in sheltered situations beneath the drift has often been noted in the British Islands, and the ease with which such loose-lying material would become incorporated into the basal layers of an advancing ice-sheet has been frequently discussed. On both sides of the Atlantic it seems more probable that the greater bulk of the glacial deposits was derived from this source, rather than from the direct erosive action of the ice upon the solid rocks.

With regard to the initial stages of the glaciation, while the European glacialist looks to the highest ground in the northern part of his continent and its islands—to the mountains of Scandinavia, of Scotland, England, Wales and Ireland, and of Switzerland—as the great gathering grounds, it is generally recognised that in North America, with the exception of the Cordilleran mass in the extreme west, the glaciation commenced and spread from the comparatively low ground in the north of the continent and moved southward against the slope of the land, the mountains near its south-eastern margin being