

PLANT-LIFE, PAST AND PRESENT.

THE opening lecture of the second course of 'Saturday lectures,' delivered at the National Museum in Washington, was by Mr. Lester F. Ward, assistant geologist U. S. geological survey, and honorary curator of fossil plants to the museum; the subject being 'Plant-life of the globe, past and present.'

The object of the lecture was to give some account of the progress which has taken place toward the adoption of a truly natural system of botanical classification. After describing and comparing the methods of Linné, of A. L. de Jussieu, of Adrien de Jussieu, and of modern botanists, the lecturer pointed out the objections which may be made to all of these, and then presented the outline of a system which aimed to exclude the objectionable features, and to accord with the results of the latest discoveries in structural botany, and especially with the teachings of paleontology, which he claimed to have been too much ignored by botanists. The proposed system was as follows:—

Cryptogams.	Cellular.			
Vascular.	Filicineae . .		{ Filices.	
			{ Rhizocarpeae.	
	Lepidophytae .		{ Equisetinaeae.	
Phenogams.			{ Lycopodiinaeae.	
			{ Ligulatae.	
Gymnosperms.	{ Cycadaceae.			
	{ Coniferae.			
Angiosperms.	{ Gnetaceae.			
			{ Monocotyledons.	
			{ Apetalae.	
			{ Polypetalae.	
			{ Dicotyledons.	
			{ Gamopetalae.	

type which have been found fossil at each geological horizon, and also the most reliable estimates that could be obtained of the number living at the present time in all parts of the world. It also showed the percentage that each type formed of the total known flora of each epoch. We give below a condensed view of this chart, which is all we have space to present.

Relative to this table, it should be explained, —

1. That the figures given for the living gymnosperms and dicotyledons are, in round numbers, those of Messrs. Bentham and Hooker, as stated for each genus and order in the 'Genera plantarum,' and which are here compiled, perhaps for the first time.

2. That the number of fossil species were collated from a great number of sources; Schimper's 'Traité de paléontologie végétale' being the basis, supplemented by data from all the more recent publications which were accessible, and by some unpublished data. Absolute completeness, however, was not claimed, but only such substantial accuracy as was deemed sufficient for the purposes of the lecture.

3. That under 'tertiary time' are included all the beds from the quaternary to the middle cretaceous; the latter being represented in this country by the Dakota group, and in Europe by the cenomanian. This is done because it is at the last-named horizon that the dicotyledons first appear, and because they appear here in such extraordinary profusion. Marquis Saporta has also made the vegetable tertiary to begin at this point.¹

The facts embodied in this table were further graphically illustrated by two diagrams, prepared by Ensign E. E. Hayden, U.S.N. The first of these showed, by means of accurately plotted curves and

Number of known species of fossil and living plants.

GEOLOGICAL PERIODS.	CRYPTOGAMS.						PHENOGAMS.								Total.
	CELLULAR.	VASCULAR.					GYMNOSPERMS.			ANGIOSPERMS.					
		Ferns.	Rhizocar- peae.	Equis- etinae.	Lycopo- dineae.	Ligulatae.	Cycadaceae.	Coniferae.	Gnetaceae.	Monocotyle- dons.	DICOTYLEDONS.				
											Apetalae.	Polypet- alae.	Gamo- petalae.		
Present time	35,000	3,000	100	30	500	400	75	300	40	25,000	12,000	35,000	40,000	151,445	
Per cent	23.10	2.00	0.05	0.01	0.32	0.25	0.04	0.20	0.02	16.50	8.00	23.10	26.41		
Tertiary time	302	202	7	27	2	5	19	253	3	446	1,285	1,650	499	4,700	
Per cent	6.43	4.30	0.15	0.57	0.04	0.11	0.40	5.38	0.06	9.49	27.34	35.11	10.62		
Secondary time	112	298	1	33	1	-	198	90	-	19	-	-	-	752	
Per cent	14.89	39.63	0.13	4.39	0.13	-	26.33	11.97	-	2.53	-	-	-		
Primary time	Carboniferous	19	664	3	81	298	-	67	54	-	-	-	-	1,186	
	Per cent	1.60	55.99	0.25	6.83	25.13	-	5.65	4.55	-	-	-	-		
	Devonian	29	35	-	4	16	-	5	5	-	-	-	-	94	
	Per cent	30.85	37.23	-	4.26	17.02	-	5.32	5.32	-	-	-	-		
Silurian	19	1	-	2	2	-	1	-	-	-	-	-	-	25	
	Per cent	76.00	4.00	-	8.00	8.00	4.00	-	-	-	-	-	-		

The claims of this scheme as the nearest approach yet made to the system of nature were supported, for the most part, on paleontological grounds. To do this, an elaborate chart was presented, giving the geological history of each of the principal types of vegetation. This was in the form of a tabular exhibit of the number of species belonging to each

colored areas, the development of each type of vegetation through the several ascending strata, the breadth of the areas at any epoch representing the prominence of the several types relatively to the entire flora of that epoch. The other diagram consisted of

¹ Le monde des plantes avant l'apparition de l'homme, p. 160.

a series of independent figures, designed to show the degree of development attained by each type at any epoch relatively to other epochs.

These charts and diagrams were thoroughly discussed; and the lecture closed with a few remarks on the genealogy of plants, illustrated by an arborescent figure showing one of the possible ways in which the present forms of plant-life may have been derived.

LETTERS TO THE EDITOR.

[Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.]

Intelligence of the crow.

JAPAN is the birds' paradise, as fire-arms cannot be carried except by special permit. Though their punishment of criminals is sometimes extremely cruel, to shoot birds for sport or for scientific purposes would never enter the heads of this kind-hearted people. I noticed, in many parts of the country, that the crow felt a sense of security, meeting man boldly, conscious that he is a benefactor—and acknowledged as such—by killing injurious grubs, even though he collect a few grains of corn in the operation. He scorns to fly at your approach, and fears not a stick pointed at him, which he never takes for a gun. He is as familiar in Japan as he is shy in America and Europe.

Another instance of this bird's intelligence came under my observation as I was walking among the crumbling arches of Caracalla's baths in Rome, in April, 1882. When near the walls, a stone nearly as large as my fist fell at my feet. Fearing a recurrence of what I supposed was an accident of perishing masonry, our party went farther toward the centre of the area. A second and a third fell near us; and, looking up, I saw some crows circling above our heads, one of which dropped a fourth from his claws. It seems that we had been strolling too near their nests in the walls; and they took this method to drive us away,—a very effectual one, as a stone of that size, falling from the height of sixty feet, was an exceedingly dangerous missile, and perhaps only prevented from being fatal by the failure of the bird to make allowance for the impetus given by its own motion. The aim was accurate, and the discharge right overhead; but, as both we and the bird were moving, it fortunately missed its mark.

SAMUEL KNEELAND.

Paleolithic man in Ohio.

In SCIENCE of April 13, p. 271, Professor Wright remarks that "no paleolithic implements have as yet been found [in Ohio], but they may be confidently looked for." It has seemed to me possible, from my own studies of the remains of paleolithic man in the valley of the Delaware River, that traces of his presence may only be found in those river-valleys which lead directly to the Atlantic coast, and that paleolithic man was essentially a coast-ranger, and not a dweller in the interior of the continent. If we associate these early people with the seal and walrus rather than with the reindeer, and consider them essentially hunters of these amphibious mammals rather than of the latter, it is not incredible. I submit that they did not wander so far inland as Ohio, nor even so far as the eastern slope of the Alleghanias; and we need not be surprised if paleolithic implements, concerning which there can be no doubt whatever,—for recent Indians made and used stone implements that are 'paleolithic' in character,—are not found in Ohio, or even in Pennsylvania west of the valley of the Susquehanna River.

Unquestionable evidences of paleolithic man in America have been found in the valleys of the Connecticut, Delaware, and Susquehanna Rivers, and probable traces of the same people in the valleys of the Hudson, Potomac, and James Rivers. This is an extensive range of territory, and one not too limited as the probable area occupied by a primitive people.

If we could accept without qualification the assertion occasionally made, that America's earliest race was pre-glacial, the difficulties that beset the study of paleolithic man would quickly vanish. I am disposed to believe it, upon theoretical grounds, but have met with no satisfactory demonstration that such was the case. In a recent lecture before the Franklin Institute of Philadelphia, Prof. H. Carvill Lewis remarked, "That man existed before the glacial epoch has been inferred from certain facts, but not satisfactorily proven."

Accepting the above conclusion, and coupling it with the assertion made by both Professors Wright and Lewis, that the melting of the great continental glacier occurred so recently as ten thousand years ago, we are compelled to crowd several momentous facts in American archeology into a comparatively brief space of time; and it becomes more probable that the fabricators of the implements found in post-glacial gravels came from some transatlantic continental area, and had not wandered far inland when met by southern tribes, who drove them northward, exterminated or absorbed them.

On the other hand, if the relationship of paleolithic man and the Eskimo is not problematical, and the latter is of American origin, then I submit that man was pre-glacial in America, was driven southward by the extension of the ice-sheet, and probably voluntarily retreated with it to more northern regions; and, if so, then in Ohio true paleolithic implements will surely be found, and evidences of man's pre-glacial age will ultimately be found in the once-glaciated areas of our continent.

CHAS. C. ABBOTT.

The copper-bearing rocks of Lake Superior.

Mr. Selwyn's courteous reply in SCIENCE, No. 8, to my letter in No. 5, calls for only a few remarks from me.

In his admission that I am right in asserting the existence of a great unconformity in the St. Croix region, between the basal sandstones of the Mississippi valley and the copper-bearing rocks, he yields the principal point for which I contend. It seems very unreasonable to me to extend the term 'Cambrian' over this unconformity; but, in the absence of any fossil evidence, I am relatively indifferent on this point. I only insist on the complete distinctness of the copper-bearing strata from the lowest sandstone of the Mississippi valley, and from the horizontal sandstone of the eastern end of the south shore of Lake Superior. Mr. Selwyn evidently does not appreciate that the St. Croix valley unconformity is not merely 'locally very great.' Our conclusions as to this unconformity are not based on any one local unconformable contact, but upon the fact, that, for a distance of over fifty miles in a north-westerly to south-easterly direction, the basal sandstone of the Mississippi valley lies horizontally athwart the courses of the tilted Keweenawan beds, overlying and burying the western termination of these beds, which are here disposed in synclinal form. Nor is the St. Croix Falls locality, described in the third volume of the Geology of Wisconsin, the only place in the St. Croix valley where the unconformity may be actually seen. Besides other places, it may be finely seen on Snake