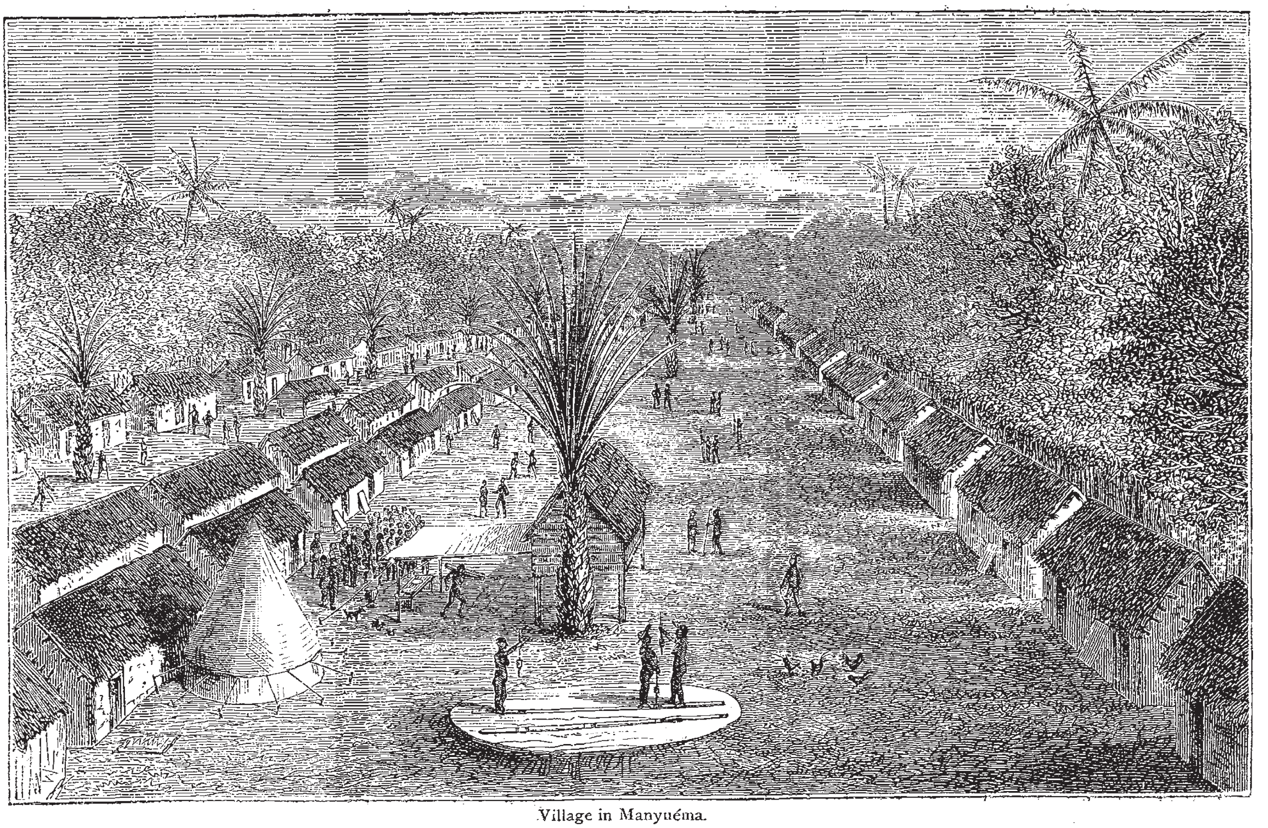
south of Nyangwé, Cameron came to Kilemba, the head-quarters of Kasongo, the chief of the extensive district of Urua, and where is the principal station of the remarkable Arab trader, Jumah Amerikani. This individual has extensive trading connections over Central Africa, is a man of considerable intelligence, and was able to give Cameron much geographical information which he had gathered during his widespread journeys. Cameron was compelled to remain at Kilemba for about eight months, and had it not been for the ever-to-be-remembered kindness of this humane and generous Arab trader, his life must have been intolerable, even if he had been able to preserve it. The treatment of Cameron by this remarkable man is beyond all praise. Cameron found at Kilemba a black slave-hunter from the Portuguese settlements, than whom probably a more barbarous blackguard does not exist. The cruelties practised by this man and the chief Kasongo are almost incredible and painful to read of. The whole country here is being rapidly devastated by these slave-hunters from the west coast, and until their fiendish practices are put a stop to, the country can never be opened up either to exploration or legitimate traffic.

While staying here Cameron visited an interesting little lake, Mohrya, studded with houses built on high piles. He also heard of a people who dwell in caves in this region; we believe that Livingstone refers to this in his "Last Journals." Cameron also paid a visit to a Lake Kassali, a short distance south of Kilemba, and which contains many floating islands; but he was not permitted to reach the shores. He has collected much interesting information about the people among whom he was compelled to sojourn, and collected many notes from various sources concerning the geography of the region. But the capricious restrictions under which



Village in Manyuéma.

he was placed compelled him to lead a life of comparative idleness, so that when Kendele, the brutal slave-hunter, whose pleasure he was compelled to await, was ready to march with his ill-gotten human booty, the wearied traveller was heartily glad. This was in June, 1875, and starved and nearly dead with scurvy he reached Benguella in November.

Of the value of Commander Cameron's work we think there can be but one opinion. Every page is interesting, and he has been able to add materially to our knowledge of the hydrography, the geology, the people, and products of the important part of Africa he traversed. The general results he discusses in two concluding chapters, and botanists will be pleased to find in an appendix an enumeration of the plants collected in the region about Lake Tanganyika, drawn up by Mr. Oliver. The flora of the region, Mr. Oliver states, may be taken as belonging to the basin of the Congo.

THE TROPICAL FORESTS OF HAMPSHIRE[1]

III.

We have in the series of beds, the aspect and formation of which I have endeavoured to describe, a total thickness of perhaps somewhere about 1,000 feet. We read in Lyell's "Geology" and other works that river and delta deposits are accumulated with comparatively great rapidity, as in the case of the Rhone delta above Geneva, which has advanced one-and-a-half miles in historical times. Throughout the Bournemouth district we have in the great and sudden deposits of coarse grit evidence of quick deposition. We also find leaves folded over with half an inch of sediment between the folds, and leaves sun-cracked

[1] Continued from p. 261. This concluding article is the substance of a paper read by Mr. J. S. Gardner, F.G.S., at the Geologists' Association, January 5.

and divided with that or more difference in level between the segments, which also shows extreme rapidity of deposition; and although we have proof that we in some cases see the actual soil in which some of the smaller plants grew, still penetrated by their roots, there is no evidence of its having been long occupied, or that it indicates more than a rapid fern growth between recurring floods. We have further, in the fine state of preservation of some of the leaves, which have been doubtless buried before decay set in, and in the breaking up and redeposition of beds, evidence of rapid accumulation; yet we must not hastily conclude that the time required for the formation of these deposits was, even geologically speaking, short. We over and over again see beds, one above another, which have been cut through and carried away after they had become consolidated, that is, after the muds had become so hard that they have resisted the dissolving power of water and been rolled and redeposited as pebbles and boulders.

The same spots may have been again and again silted up and denuded before the beds finally remaining were covered up, the same material has been rearranged by different currents perhaps a great number of times, whilst the constant unconformability of the strata may indicate periods of rest or great lapses of time. All our facts as to the depression of areas tend to show that it is an extremely slow and imperceptible process—slower still when the general depression is intermittent. We have further a totally different kind of evidence, which to my mind is still stronger, of the vast ages that rolled away during the deposition of these beds. This is the significant fact that the entire marine fauna was completely changed. By this I mean that we have in the London clay a fauna that migrated away, a fauna familiar to us and characterised by great nautili and other shells, crustacea, &c., peculiar to it. In the succeeding Bracklesham beds we have another totally distinct fauna, so that the duration of the land period was sufficiently long for the fauna of the London clay sea to be entirely changed before the return of the sea whose fauna we have recorded in the Bracklesham beds. In the Barton beds which overlie the Bournemouth deposits, we have again an extensive fauna, most distinctly characterised and widely separated from that of either of the preceding beds just mentioned.

In many cases it is recognised that variations in fauna are dependent upon the depth of the sea, but such cannot be the case in this instance since we get species belonging to the same genera, so closely resembling each other, that we cannot but infer that they lived under similar conditions. And when we come to see, as we do, that this applies to all the groups, the inference drawn from one individual group accumulates to an evidence which presents itself as at any rate approaching certainty. The well known case of the difference in the fauna of the Red Sea and the Mediterranean, which are separated by so narrow a strip of land, has been often referred to as a possible explanation of how different fossil faunas occurring close together may have existed contemporaneously, and do not imply any lapse of time during which changes of climate occurred; but although in many cases it is impossible when a purely hypothetical theory is brought forward to bring an argument to disprove it, yet in this case there is no evidence whatever in its favour, and what little evidence there is bearing on the question, is directly opposed to it; therefore the other seems the more reasonable explanation. The great changes in the flora which I shall mention to you, although principally due perhaps to the great change of level of which we have other indications, may also indicate long lapse of time, long enough as I have said for the marine fauna of Bracklesham to develop, to disappear, and to give place to that of Barton.

These deposits, which have been neglected by geologists, are of extreme importance as being one of the few records we have of land surface. The rocks in which organic remains are found are aqueous rocks, principally marine; the remains of aquatic animals are more numerous than are those of terrestrial animals, and are, for the same reason, far more numerous than those of plants. Such facts as these give great interest to series of land remains of so complete a nature. We can form an idea of how incomplete our terrestrial records are when we consider that whilst upwards of 4,400 plants are growing in Great Britain, about 700 only are known fossil, whilst 513 testaceous mollusca now inhabit Great Britain, and 4,590 were known fossil as far back as 1862.

The Bournemouth flora seems to consist principally of trees or hard-wooded shrubs, comparatively few remains of the herbaceous vegetation being preserved.

Parasitic fungi are abundant. Ferns, extremely rare in the lower part of the series, become abundant, as far as the remains go, almost to the exclusion of other vegetation, towards the close of the middle period. The prevailing group seems that of Acrostichum, of which several species are present. We can also determine, with almost certainty, the presence of Angiopteris, Anemia, Nephrodium, Gleichenia, Lygodium, and there are, besides these, several undetermined forms.

Of Conifers we have Cupressus and Taxodium, determined by De la Harpe, with the addition of Dacridium and indications of Pinus; Cycads have disappeared.

Of Monocotyledons we have indications of reeds and rushes; Pandanus is represented by its fruit, Nipadites; palms are very abundant, especially in the lowermost beds of Corfe, the middle beds of Studland, and the upper middle beds of Bournemouth. Massolongho has determined Chamoecyparites, in addition to which many fan and feather palms exist, belonging to Flabellaria, Sabal, Phœnicites, and a genus new to the Eocene, Iriartea. A gigantic aroid is also very abundant, and the Smilaceæ occur in all the fossiliferous beds throughout, and are represented by five or six species.

The Dicotyledons are, however, most abundant, and it is probable that a vast number of species will be determined from these beds. De la Harpe's list included in 1856:—

Apetalæ.—Populus, Ulmus, Laurus, Quercus, and Artocarpidium, to which Massolongho added Daphnogene. To these we may now add Carpinus, Fagus, Castanea, Salix, Platanus, Ficus, Celtis, numerous Proteaceæ, Cinnamomum.

Polypetalæ.—Elæodendron, Rhamnus, Prunus, Juglans, Cluytia, have been already noticed by De la Harpe. We will add, *fide* Massolongho, Ceratopetalum, and as new to the Bournemouth flora, Acer, Dodonæa, Celastrus, Eucalyptus, and a number of Leguminosæ.

Monopetalæ.—De la Harpe has determined Diospyros; to this may perhaps be added Porana.

Cactus and Stenocarpus have been previously mentioned, and have never previously been found fossil.

In addition to these we have probably represented almost every genus described from continental Eocene floras, but it is premature, for the reasons already stated, to go further into this question at present. The forms I have mentioned will, however, give you a general idea of the composition of the flora.

It will have been gathered from the anniversary addresses of our president, Mr. Carruthers, that the remains of plants are, if possible, of more interest and importance than those of marine animals, as whilst we have already some idea of the succession and development of animal life, especially of the more purely marine orders of crustacea, mollusca, echinodermata, &c., we know very little of the history and development of plant life. Mr. Carruthers laid stress on the somewhat sudden occurrence of dicotyledons as being unfavourable to the hypothesis of evolution in descent. I concur with him fully that it is difficult to realise that the absence of dicotyledons can be due to any cause but their absence from the then existing vegetation, yet there are certain causes tending to make their preservation difficult, which may perhaps be taken into account.

Some kinds of coniferous plants resist decay, when immersed in water, more completely than do almost any dicotyledons, and this resistance may, owing to their resinous nature, be very greatly increased when the immersion is in sea-water. This supposition is borne out by a fact I have noticed, that in some Eocene beds, such as the marine beds at Bournemouth, the Bembridge marls, the Bracklesham beds, coniferous remains preponderate, whilst from the two latter places I have never seen remains of dicotyledons at all, although there is evidence in these cases that dicotyledons were abundant on all surrounding land areas. This may partly account for their complete absence in marine cretaceous rocks in England, where, as in the gault, &c., foliage, fruit, resinous gums in the form of amber, remains of coniferæ, are preserved. The foreign cretaceous rocks, in which an abundance of dicotyledons is met with, are principally of fresh-water origin.

It should be borne in mind that our Chalk period contains a deep sea fauna, and we have no record in England as to what were the prevailing contemporaneous shallow water forms of life in other regions. I have great doubts, however, as to the correct position of many of the foreign so-called cretaceous beds. Those of America, from which most of the list of dicotyledons of this period is derived, appear to me, from the character of their fauna, to be either Lower Eocene, or at most filling in the gap between our chalk and London clay. Most of the shells have a marvellously Eocene-like aspect, and I take it that the presence of an ammonite, and some few other forms of shells, which in England do not range above the Chalk, should not be taken as conclusive evidence of the antiquity of the bed, as although migrated from our seas, they may very well have lived on in other regions. It is inconsistent to assume that no ammonite lived on in any part of the world to a more recent period than that of our Chalk; the finding of pleurotomaria and other supposed extinct cretaceous shells in Australian waters, should not be forgotten. The same doubts apply to many of the European leaf deposits; many of these are isolated patches, and their age has been inferred rather from the character of the leaves than from their stratigraphical position. The age of many of the so-called Miocene leaf-beds is admitted now to be extremely doubtful.

What little evidence we may expect to find in these beds seems to me likely to be in favour of the theory of evolution by descent, although until the flora has been worked out, it is premature to offer an opinion. By far the greater number of the plants belong to the lowest division of the dicotyledons, the *apetalæ*, a minority are *polypetalous*, whilst none can, as far as I know, with certainty be assigned to the highest (according to Haeckel) group, the *monopetalæ*.

Prof. Ettingshausen has traced the gradual development of some of the Miocene forms into existing species, notably that of *Castanea atava* to *Castanea vesca*; when he was here last summer and saw my collection, he especially picked out the castanea from Bournemouth as carrying the history of this genus a step further back, and linking it with the oak—as it possesses an oak-like character of venation. I would merely add that many botanists who have studied fossil plants, as Unger, Schimper, and others, are profoundly impressed with the amount of botanical evidence that has already been brought forward in support of the theory of evolution.

OUR ASTRONOMICAL COLUMN

RED STAR IN CETUS.—No. 4 of Sir John Herschel's list of red stars at p. 448 of his Cape Observations is placed by him in R.A. 1h. 19m. 8·7s., N.P.D. 123° 26′ 1″ for 1830, with the remark "most beautiful orange red. Two observations," and he estimated it 6m. Dunlop in his catalogue of 253 double and triple stars in vol. iii. of the *Memoirs of the Royal Astronomical Society*, gives the position of a highly-coloured object thus: for 1827, R.A. 1h. 19m. 43s., N.P.D. 123° 31′, and calls it "a very singular star of the seventh magnitude, of an uncommon red purple colour, very dusky, and ill-defined;" he made three observations upon it, and notes that it had a small star preceding and another following it. We may presume that these stars are identical, with an error of position on the part of one or other observer, most probably on Dunlop's, whose catalogue contains a number of errors; and it may also be supposed that this is the star spectroscopically examined by Secchi, which he calls No. 11 of Schellerup's catalogue of red stars, but places in 35° 17′ S. declination (A.N. 1737), perhaps through a misprint. In this state of uncertainty as to the star's true place, meridional observation appears very desirable. So far we believe it is not to be found in any catalogue, founded on such observations; it does not occur in the zones published in the Washington volumes 1869-71, a most valuable series, nor in those of Prof. Ragona in the *Giornale Astronomico e Meteorologico del R. Osservatorio di Palermo*, vols. i. and ii., neither is it found in the southern catalogues of the Cape, Madras, or Melbourne Observatories. Sir John Herschel's place reduced to 1877·0 is R.A. 1h. 21m. 19·0s., N.P.D. 123° 11′ 16″. Secchi says of the star he examined, "couleur rose; spectre à zones discontinues."

VARIABLE STARS.—There is considerable probability that Lalande 12863-5 should be added to the list of variable stars. His estimates of magnitude are $6\frac{1}{2}$ and $8\frac{1}{2}$; it is 6 on Harding's Atlas and in Argelander, 6·7 in Heis, 7·3 in the *Durchmusterung*, but does not occur in Piazzi, Bessel, or Santini. Piazzi has a star of the ninth magnitude about $1\frac{1}{4}$° distant (VI. 190), which, oddly enough, he places in the Lynx. The position of Lalande's star for the beginning of 1877 is in R.A. 6h. 35m. 23s., N.P.D. 83° 32·3′.

Will some one of our southern readers record the actual magnitude of μ Doradus? At present we have the following estimates indicating a long period of variation. La Caille 5m. about 1751, Brisbane 6m. about 1825, Jacob 9·5m. in 1850 and 9·2m. in 1855; while Moesta states that between February, 1860, and January, 1861, he had always found it $8\frac{1}{2}$m. or 9m. The law of variation may be similar to that of 34 Cygni, P Cygni of Schönfeld, the so-called Nova of 1600.

A FIFTH COMET IN 1851.—In a small tract entitled "Ragguagli Popolari sulle Comete Periodiche," by Prof. Ragona, published at Palermo, in 1855, there is reference to a comet stated to have been discovered at Rome by Prof. Calandrelli, director of the Pontifical Observatory, in the morning twilight on November 30, 1851, which both the discoverer and the writer of the tract considered to be the short-period comet of Brorsen, due in perihelion in the autumn of that year. By comparison with B.A.C. 4798, the following position resulted:—

1851, November 29, at 17h. 32m., M.T. at Rome.

Right Ascension, 14h. 21m. 38s. Declination, + 1° 47′ 2″.

This position Prof. Ragona compares with the elements of Brorsen's comet according to Dr. van Galen, and found the differences between calculation and observation + 35′ 27″ in R.A., and + 11′ 1″ in declination. But notwithstanding this approximation, it is certain it was not the periodical comet of Brorsen that was observed by Calandrelli, Dr. van Galen's prediction having been vitiated by a serious error of calculation, so that, instead of arriving at perihelion on November 10, the date assigned by him in *Ast. Nach.*, No. 782, the comet passed that point in its orbit about September 25, and consequently on November 30 was far removed from the position of the body observed by Calandrelli, which was therefore a new comet.