The moths which issue from these larvæ are captured in great numbers by Sunday ramblers, who resort to the base contrivance of bringing a female moth in a cage. The self-styled "naturalist" sits on a rock, and captures one by one the eager moths which come about him, afterwards pinning out the expanded wings to form grotesque patterns, or selling his specimens to the dealers. Certain wide-spread Diptera are plentiful, and there are a few which pass their larval stages in the quick-running streams which flow down from the moor. The small number of good-sized insects partly explains (or is explained by) the paucity of conspicuous scented or honey-bearing flowers. In this the moor contrasts strongly with the higher Alps. Bees, however, get much honey from the large-flowered heaths and ling; heather-honey is considered better than any other. A little scale-insect (*Orthesia uva*) has been found plentifully on the Sphagnum of the moors, particularly in Cumberland.[1] A big spider (*Epeira diadema*) spreads its snare among the heather, and may now and then be seen to deal in a particularly artful fashion with a wasp or other large insect which may have blundered into the web. The spider cuts the threads away till the struggling insect dangles; cautiously on outstretched leg holds out and attaches a new thread, and then sets the wasp spinning. The silken thread, paid out from the spinneret, soon binds the victim into a helpless mummy.[2] I have never found gossamer so abundant as on the verges of the moor.

In our day the Yorkshire moor harbours no quadrupeds, and the grassy hills none but small quadrupeds. It was not always so. At Raygill, a few miles from us across the moors, a collection of bones was discovered a few years ago in quarrying. A deep fissure in the rock had been choked ages before with stones and clay. This fissure was cut across by the working face of the quarry. Many bones were brought out of it, bones of the ox and roebuck among the rest. But mixed up with these were teeth and bones of quadrupeds now altogether extinct or no longer found in Britain, such as the straight-tusked elephant (*E. antiquus*), the hippopotamus, a southern rhinoceros (*R. leptorhinus*), the cave hyæna, and the European bison. The Irish elk is often dug up in Yorkshire, the reindeer and the true elk now and then. Not very long ago these and other large quadrupeds grazed or hunted a country which can now show no quadruped bigger than a fox.

It is evident that the moors, valleys and plains of Yorkshire have been depopulated in comparatively recent times. The disappearance of so many conspicuous species is commonly attributed to the glacial period, but I think that the action of man has been still more influential. The extinct animals are such as man hunts for profit or for his own safety. Many of them, among others the cave-bear, Machairodus, Irish elk, mammoth, and straight-tusked elephant, are known to have lasted into the human period. That so many of them were last seen in the company of man is some proof that he was concerned in their death.

Central Europe, before man appeared within its borders, or while men were still few, little resembled the Europe which we know. Much of it was covered with woods, morasses or wastes, and inhabited by animals and plants, of which some ranged into the Arctic circle, others to the Mediterranean, Africa and India. The worst lands of all—cold, wet, and wind-swept—had doubtless then, as now, the greatest proportion of Arctic species. But it is likely that the passage from the bleak hills to the more fertile valleys and plains was not then so abrupt as at present. All was alike undrained and unenclosed; and what we know of the distribution of life in Pleistocene Europe shows us that a large proportion of our European animals and plants are not restricted by nature within narrow limits of latitude or climate. Species which are now isolated, at least in Central Europe, occupying moors or other special tracts, and surrounded by a population with which they have little in common, were formerly continuous over vast areas. In the early days of man in Europe many plants, birds, and quadrupeds which are now almost xclusively Arctic may well have ranged over nearly the whole of Europe.

As men gradually rooted themselves in what are now the most populous countries of the world, the fauna and flora underwent sweeping changes. The forests were cleared, and trees of Imported species planted here and there. The land was drained, and fenced, and tilled. During the long attack of man upon wild nature many quadrupeds, a few birds, some insects, and some plants are known to have perished altogether. Others have probably disappeared without notice. Certain large and formidable quadrupeds, though they still survive, are no longer found in Europe, but only in the deserts of the south or the unpeopled northern wastes. Thus the lion, which within the historic period ranged over Greece and Syria, and the grizzly bear, which was once an inhabitant of Yorkshire, have disappeared from every part of Europe. Tillage and fencing have checked the seasonal migrations of the reindeer and the lemming. Useful animals have been imported, chiefly from the south or from Asia. Useful plants have been introduced from ancient centres of civilisation, and common farm-weeds have managed to come in along with them. Many species of both kinds are southern, many eastern, none are Arctic. In our day the cultivated lands of Europe are largely occupied by southern or eastern forms, and the wastes appear by contrast with the imported population more Arctic than they really are. Even the wastes are shrinking visibly. The fens are nearly gone, and we shall soon have only a few scattered moors left to show what sort of vegetation covered a great part of Europe in the days of choked rivers and unfenced land. The moors themselves cannot resist the determined attack of civilised man. Thousands of acres which used to grow heather are now pastures or meadows.

What we call the Arctic fauna and flora of to-day is apparently only the remnant of an assemblage of species varying in hardiness, which once extended from the Arctic circle almost to the Mediterranean. If climate and soil alone entered into the question, it is likely that the so-called Arctic fauna and flora might still maintain itself in many parts of Central Europe. This Arctic (or ancient European) flora includes many plants which are capable of withstanding extreme physical conditions. Some thrive both on peat and on sand, in bogs and on loose gravel. They may range from sea-level to a height of several thousand feet. They can endure a summer glare which blisters the skin, and also the sharpest cold known upon this planet. Some can subsist on soil which contains no ordinary ingredient of plant-food in appreciable quantity. Such plants survive in particular places, even in Britain, less because of peculiarly appropriate surroundings, or of anything which the microscope reveals, than because they can live where other plants perish. Ling, crowberry, and the rest are like the Eskimo, who dwell in the far north, not because they choose cold and hunger and gloom, but because there only can they escape the competition of more gifted races. The last defences of the old flora are now being broken down; it is slowly giving way to the social grasses, the weeds of commerce, and the broad-leaved herbs of the meadow, pasture, and hedge-row. The scale has been turned, as I think, not so much by climatic or geographical changes, as by the acts of man.

Every lover of the moors would be glad to know that they bid fair to be handed down to our children and our children's children without diminution or impoverishment. The reclaiming of the moors is now checked, though not arrested, and some large tracts are reserved as open spaces. But the impoverishment of the moors goes on apace. The gamekeeper's gun destroys much. Enemies yet more deadly are the collectors who call themselves naturalists, and the dealers who serve them. A botanical exchange club has lately exterminated the yellow Gagea, which used to grow within a mile of my house. Whenever a kingfisher shows itself, young men come from the towns eager tc slay it in the name of science. No knowledge worth having is brought to us by such naturalists as these; their collecting means mere destruction, or at most the compilation of some dismal list. If the selfish love of possessing takes hold of any man, let him gratify it by collecting postage-stamps, and not make hay of our plants and mummies of our animals. The naturalist should aspire to study live nature, and should make it his boast that he leaves as much behind him as he found.

THE MARINE FAUNA IN LAKE TANGANYIKA, AND THE ADVISABILITY OF FURTHER EXPLORATION IN THE GREAT AFRICAN LAKES.

THERE is a story which redounds to the sagacity of a certain Dutch farmer, who, on the sudden appearance of herrings in the ditches on his property, sold it, on account of the indisputable evidence which such fish afforded, of the leaky condition of the dykes. The Dutchman's inference will serve to

[1] Shaw (1806), quoted by R. Blanchard in *Ann. Soc. Ent. Fr.*, tom. lxv. p. 681 (1896).
[2] Blackwall's "Spiders," vol. ii. p 359.

indicate how much surprise the discovery of jelly-fish in Lake Tanganyika, by Dr. Boehm, created in the minds of those who were interested in the past history of the great lakes in Africa, for, in the presence there even of a single organism so typically marine, and so unlike any real fresh-water form as a medusa, there was as good, indeed far better, evidence for the former access of the sea to those regions, than that which was afforded by the herrings in the Dutchman's ditch.

It was partly because I held this view, in regard to the presence of jelly-fish in Tanganyika, more especially because Prof. Lankester pointed out to me that where there were jelly-fish one might reasonably expect to find other marine organisms, similarly cut off, that I went to Tanganyika in 1895. The results of that expedition have fully justified these views, and during the past year, in which the zoological material obtained has gradually been overhauled, it has become more and more apparent that in Tanganyika we have not only a jelly-fish, but the remains of an entire fauna, which can be regarded as nothing but the relic of the former extension of some ancient sea.

Thus besides the jelly-fish there exist on the rocks about the shores, and in the deep water of the lake, numbers of molluscs, which not only in their shell structure, but also in their organisation, show clearly that they belong to those groups which have generally remained marine, and which have never given rise to any of the colonising fresh-water types. Besides these there are at least two forms of prawns, a deep-water crab, and several forms of protozoa, all possessing like marine affinities.

At the same time it is most important to remember that Tanganyika contains its full complement of recognised fresh water forms, which are similar to those constituting the entire fauna of lakes such as Nyassa, Mwero, and the like, and that these fresh-water types in Tanganyika differ from those in Lake Mwero and Nyassa only to the same extent that those in Lakes Mwero and Nyassa differ from each other. It is thus obvious, and one of the most important results hitherto obtained, that the fauna of Lake Tanganyika is to be regarded as a double series, one half consisting of forms which are found everywhere in the African fresh waters, the other of what we may call *halolimnic* organisms, which are found living nowhere else in the world, at least so far as is at present known.[1]

In the incomplete state of our knowledge of the Halolimnic fauna, it is undoubtedly the mollusca belonging to this group, which are the most instructive at the present time; for among these organisms there are a considerable number of types which are widely different from each other, and all of which can be compared with living oceanic forms. We have here, therefore, a basis of comparison broad enough to give a clear and trust-worthy conception of their nature and their actual affinities.

In this way it is clearly seen that in several genera of the Halolimnic molluscs, such as *Typhobia*, *Bathanalia*, and others, we have forms which individually do not correspond exactly to any single living oceanic species, but which at the same time, in the curious character of their organisation, do very distinctly foreshadow and combine the anatomical features not of one, but of several living oceanic species which are now quite distinct from one another. The only conclusion, therefore, that can be drawn from this remarkable character of the Halolimnic forms, is that they have been cut off approximately all at the same time from their original marine associates at an extremely ancient date. In fact, that they still retain combined the original characters of the organisms whose progeny in the ocean has become completely differentiated into forms that are now specifically and even generically distinct.

These Halolimnic molluscs stand, therefore, to such oceanic species in the relation of ancestral types.

This inference respecting the great antiquity of the marine fauna in Tanganyika, which we gather from the peculiarities of the organisation of the individual Halolimnic forms, is in exact accord with what we should expect when contemplating the vast physical changes which must have been produced since there was any possibility of Lake Tanganyika communicating freely with the sea. But although from both these sources of evidence we are assured that the Halolimnic fauna is certainly a "hoary relic" of the past, they are neither of them capable of affording any indication of the particular geological period during which the marine contamination of this part of the African interior actually took place.

Quite recently, however, there has come to hand a series of observations which appear to be of the highest interest in this connection, and capable of throwing a considerable amount of light upon the perplexing question of the relative antiquity of the Halolimnic forms. It has been found, after comparing the peculiar shells of many of the Halolimnic molluscs, such as those of the two forms of *Limnotrochus*, the genus *Bathanalia*, *Spekia*, *Paramelania*, and so forth, with the fossilised remains of the molluscs occurring in successive geological periods, that there exists a wonderful similarity between the general facies of the shells belonging to the marine fauna of Lake Tanganyika and those of the old Jurassic seas. This is no merely superficial resemblance between single types, but a substantial conchological identity between so many Halolimnic genera and species and an equal number of forms occurring in the Lias and Inferior Oolitic rocks, that it at once arrests attention, and requires us to consider very carefully, whether we are to regard this similarity of the two series as merely a coincidence, or the expression of some real community of nature and descent.

Without entering too fully into the details of this subject, it may be stated, as the result of a careful comparison of these forms, which will be found fully described in a paper in the *Quart. Journ. Micro. Sci.*, vol. xli. No. 162, June 1898, that the comparison is so striking and so complete in detail, that had the Halolimnic molluscs been known only in some fossiliferous bed, there is not the slightest doubt that even the most fastidious palæontologist, unless he had a particular theory to support, would regard them as unquestionably belonging to Jurassic seas.

Taking, therefore, a retrospective view of the whole matter, it will be seen that the original discovery of jelly-fish in Tanganyika has led us a long way beyond the mere demonstration of the existence of a marine animal in the African interior. It has brought to light the existence of a long series of other marine organisms, which, judged by the nature of their organisation, are unquestionably very old, while, finally, we have obtained evidence which appears to indicate that, at any rate, the molluscs still living in this marine oasis in "terra firma," are relics from Jurassic seas.

Thus the purely scientific interest of the Halolimnic fauna consists mainly in the way in which the different forms composing it afford an insight into the structural peculiarities of a number of types of organisation which were thought to have long since become extinct; but at the same time the presence of this fauna in Tanganyika is destined to throw a world of light on the past history of the continent in which it lives, and it is all the more interesting in this latter sense, because the past history of the African lakes, as read in the light of the Halolimnic group, is not that which many geologists, particularly Sir Roderick Murchison, have supposed it to have been.

I have thus briefly outlined the extent and nature of the latest information which has been acquired respecting the zoology of the African lake districts, and the extent to which these observations may change existing preconceptions, and throw old problems into new perspective, will constitute their value from a philosophic point of view. But for the practical ends and advancement of zoology, it will be obvious that the conclusions which have been attained respecting the vast antiquity of the Halolimnic forms, foreshadow the possibilities of almost infinite developments, and that the value of further exploration of these lakes, as a zoological speculation, has become immense.

It is therefore greatly to be regretted that during my recent expedition, under the circumstances in which I found mysel. (without a steamer, and consequently unable to use deep-water dreging apparatus), it was quite impossible to form even an approximate estimate of the range of animals one might expect to encounter in the Tanganyika, and more exasperating than this was the fact that the most interesting Halolimnic forms, the *Typhobias*, *Bathanalias*, and their associates, only appeared just at the limit of my dredging powers, about 1000 to 1200 feet. It was thus only when the dredging capacities of the expedition, so to speak, were giving out, that the more interesting representatives of the Halolimnic fauna were beginning to come in, and there is no doubt that with a steamer and efficient apparatus for great depths, many entirely new forms would be obtained. To show how incomplete our knowledge of the fauna of Lake Tanganyika at present really is, it may be pointed out that although twenty-eight entirely new species of fish were obtained during my expedition, of the four species previously known from this lake I only re-discovered one (see Appendix).

It should, however, be clearly understood that the zoological and geological interest which the possible existence of new

[1] See my papers, *Proc. Roy. Soc.*, vol. lxii., 1898, pp. 452–458; and *Quart. Journ. Micr. Sci.*, vol. xli. pp. 159–180.

Halolimnic forms naturally excites, is not necessarily restricted to the particular basin in which Tanganyika lies; indeed, we have to thank Prof. Süss[1] for collecting the existing observations in such a manner that we are now not only able to separate the lakes into two distinct series, of which the Victoria Nyanza and Tanganyika are types respectively, but to show clearly that the singular Tanganyika valley is geologically related to the similar valleys in which numerous other long and narrow lakes are found to lie. Süss showed that the continued existence of these valleys could be traced north and south in Africa, from the Nyassa region to the Red Sea, and that the narrow gulf in which the Red Sea is itself contained, must be regarded as of the same nature and construction.

Now the fact that there exists a marine fauna in Tanganyika, at the one extremity of the same series of valleys in which the Red Sea lies at the other, would rather lead us to expect that we may encounter the Halolimnic fauna, or something similar to it, in the Albert Edward and Albert Nyanza, which lie along the same depressions in between.

1 "Die Brucke des Ost Afrika."

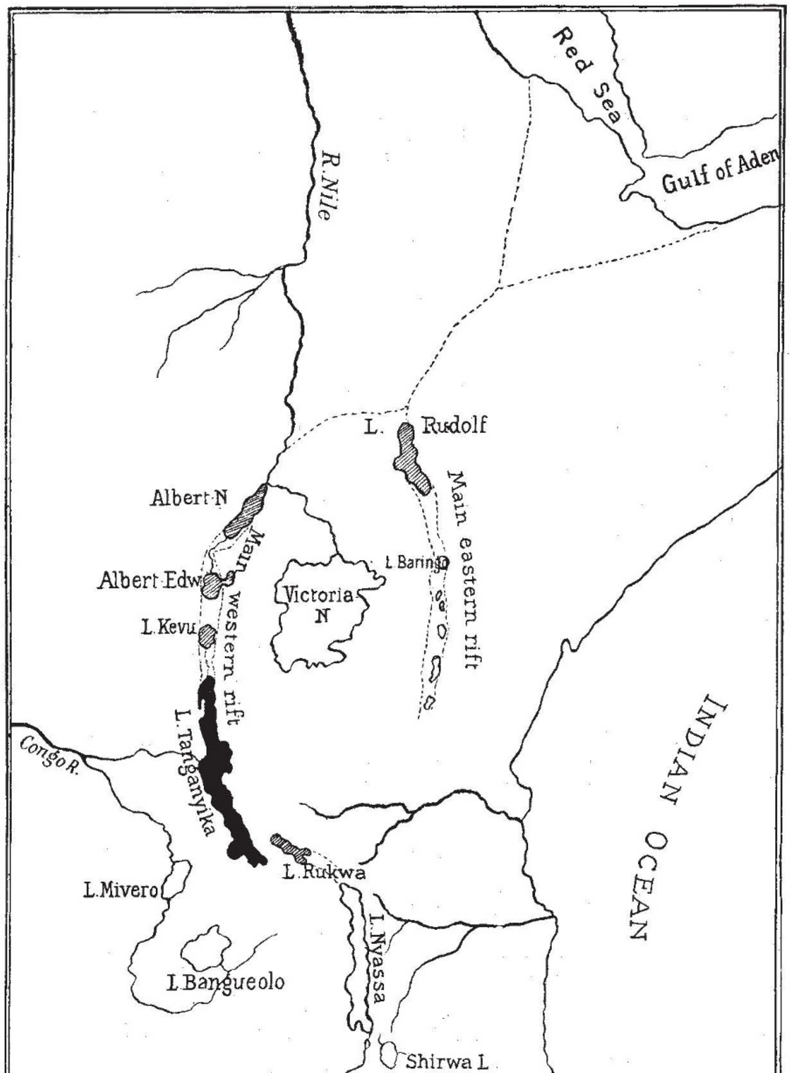

FIG. 1.—Sketch map of the Great Lake region of Africa, showing the relation of the principal lakes to the Chains of Rift valleys; and the distribution of the normal fresh-water and Halolimnic fauna in these lakes. The lakes partially shaded are those which have not yet been zoologically explored, and in which the Halolimnic fauna may be found. The one Lake Tanganyika, in which the Halolimnic fauna is now definitely known to coexist with the ordinary freshwater stock, is represented quite black; while those lakes, such as Nyassa, in which there are certainly no marine forms, are left entirely white.

The facts of distribution which have actually been obtained are, however, merely these. I showed that the Halolimnic fauna does not exist in Lake Nyassa, nor in any of the subsidiary lakes which occur within the British Central African Protectorate. It is, further, certain that this fauna does not exist in Mwero or Bangweolo, the two lakes which form the western boundary of North Charterland.

In the accompanying map, these lakes are therefore represented blank. It may, however, be yet found in Rukwa, east of Tanganyika (which is consequently shaded), and it is still more likely to occur in Lake Kivu, the Albert Edward, and the Albert Nyanzas, all of which lie actually in the same valley as Tanganyika, immediately to the north, and concerning the fauna of which practically nothing is known.

Passing to the more westerly series of faults, it is certain from the collections of shells brought back by Dr. Gregory from the small lakes Naivasha, Elineteita and Baringo, that the Halolimnic fauna is not present in these districts, while the collections of Messrs. Donaldson Smith and Cavendish, from Lake Rudolf in the north, seem to tell the same story.[1] It would appear therefore, that unless some marine extension formerly existed, which was quite independent of the Rift valleys, up some such depression as that of the Rufigi and Ulanga rivers, in which case the remains thereof will be exceedingly difficult to find, both the living and dead representatives of the Halolimnic group, may be expected in the great depression north of Tanganyika, *i.e.* in the three lakes which I have named. Mr Scott-Elliot, who descended into the northerly extension of the Tanganyika valley, between Ruanda and Mwezi's country, speaks of old lake-bottoms occcurring there above the present level of Tanganyika, as sandy plains, with banks of drifted shells! An immense amount of interest, therefore, attaches to the exploration of these lake-bearing districts immediately to the north of Tanganyika.

Referring to the map, I would therefore direct special attention to the fact that Lake Kivu is about four days' march from the extreme north of Tanganyika, along the same valley and up the lake's effluent, which flows back into the Tanganyika basin. From Kivu it is certainly not more than five days' journey to the Albert Edward, which is on the other side of the north and south watershed, and overflows into the Nile. The effluent appears, so far as I can ascertain, to be navigable for boats; and if this be so, the Albert Nyanza could be reached without trouble in five or six days; in any case, and allowing ample time for zoological work in these lakes, the whole series could be explored, in something less than two months from the time of leaving the north of Tanganyika, and all that it would be necessary to take in order to do as much as, and a good deal more than I have already done in the case of Tanganyika, would be a few suitable dredges and a couple of collapsible boats.

There is, however, another direction in which evidence bearing upon these subjects can be sought. At the present time the geology of this part of the African interior is almost entirely a

1 I have, however, shaded Rudolf, as very little is known about the fauna it ontains.

blank; but it has been rendered evident from my expedition, as well as by those of Joseph Thomson, and Burton and Speke, that there exist all over these regions west of the Victoria Nyanza immense areas of sedimentary deposits, which extend without interruption to the north of Lake Nyassa, and here they have been proved to be fossiliferous, and it is a fact (which is on no account to be ignored) that the remains of ganoid fishes, discovered there by Henry Drummond, are not regarded by Prof. Troquhair, who described them, as being at all necessarily fresh-water forms. With the same caution, Prof. Rupert Jones, who described the Lamellibranchs occurring in these beds, intentionally placed them among those estuarine forms which might be regarded either as salt water or fresh. Still more important is the existence of what appears to be an oligocene sea-urchin, which certainly came from some portion of this region, and probably from the same fossiliferous beds.

We are thus already in possession of information which indicates the extension of fairly modern seas, far into the African interior. The ascertained existence of marine organisms in Tanganyika is certainly, therefore, in no way opposed to such geological observations as actually exist, but only as new facts usually are, to the perpetuation of crude theoretical anticipations. Our inability to account for their appearance in Lake Tanganyika, is due simply to a complete want of information respecting the geological character of the country which surrounds the lake; but it will have been rendered obvious, that sufficient information on these points can easily be obtained by a properly equipped expedition, which should travel up Tanganyika from the south, and reach, as it could do, the Albert Edward and Albert Nyanzas, by passing up the continuation of the Tanganyika valleys to the north. Now that there are steamers running both on Nyassa and Tanganyika, the deep-water dredging and sounding of both these lakes could be accomplished without much difficulty, and there is no reason, that I can see, why a geologist accompanying such an expedition should not make something of the materials of which the surrounding country is composed. At all events an amount of information would be accumulated, which would mark an epoch in our acquaintance with the zoology and geology of the African interior. What I conceive, however, to be of the first importance is this, that such an exploration is well within the limits of practicability, for the work, entailed under the different heads which I have just discussed, could be carried out by a party properly organised and properly led, well within two years from the time that it set out.

J. E. S. MOORE.

Appendix.

In order to exemplify the productive character of properly conducted zoological exploration in these regions, I have appended, under separate headings, a list of those Halolimnic molluscs, the empty shells of which were known before the present expedition was undertaken, and of the forms which have now been obtained with the animals preserved in a fit state for zoological work. In the same way I have added similar lists of the species of fish previously known to inhabit Tanganyika, and the numerous and almost entirely new forms which have now been brought back. In the older list of molluscs the conchological classification of their empty shells has been retained, in order that it may be seen how completely the acquisition of the animals has changed our views.

I.

LIST OF EMPTY SHELLS PREVIOUSLY KNOWN.

Fam. *Melaniidæ*.	Genus *Spekia* (Bourginnat).
Genus *Typhobia* (Smith).	*S. zonata* (S. P. Woodw.).
T. Horei (Smith).	Genus *Tanganyicia* (Cross).
Genus *Paramelania* (Smith).	*T. rufofilosa* (S. P. Woodw.).
P. Damoni (Smith).	Genus *Limnotrochus* (Smith).
M. nassa (S. P. Woodw.).	*L. Thomsoni* (Smith).
Fam. *Hydrobidæ*.	*L. Kirkii* (Smith).
Genus *Syrnolopsis* (Smith).	
S. Lacustris (Smith).	

LIST OF ENTIRE MOLLUSCS OBTAINED DURING THE EXPEDITION OF 1895 AND 1896.

Fam. *Typhobidæ* (Moore).	Fam. *? Planaxidæ*.	Fam. *Purpurinidæ*.
Genus *Typhobia* (Smith).	Genus *Tanganyicia* (Cross).	Genus *Paramelania* (Smith).
T. Horei (Smith).	*T. rufofilosa* (S. P. Woodw.).	*P. Damoni* (Smith).
Genus *Bathanalia* (Moore).	Fam. *Xenophoridæ*.	*P. crassigranulata* (Smith).
B. Howesei (Moore).	Genus *Chytra* (Moore).	Genus *Nassopsis* (Smith).
Genus *Limnotrochus* (Smith).	*C. Kirkii* (Smith).	*N. nassa* (S. P. Woodw.)
L. Thomsoni (Smith).		

Genus *Bythoceras* (Moore).	
B. iridescens (Moore).	
Fam. *Naticidæ*.	
Genus *Spekia* (Bourginnat).	
S. zonata (S. P. Woodward).	

II.

LIST OF FISHES KNOWN PREVIOUSLY.

Acanthopterygii.	*T. Burtoni* (Gthr.)
Fam. *Coichlidæ*.	Genus *Mastacembelus*.
Genus *Tilapia* (Gthr.).	*M. Tanganyicea* (Gthr.)
T. Tanganyicea (Gthr.).	*M. Ophictium* (Gthr.).

LIST OF FISHES OBTAINED DURING THE EXPEDITION.

Acanthopterygii.	Genus *P. microlepis*, sp. n.
Fam. *Serranidæ*.	Fam. *Mastacembelidæ*.
Genus *Lates*.	Genus *Mastacembelus*.
L. microlepis, sp. n.	*M. Moorei*, sp. n.
Genus *Lamprologus*, nov. gen.	*Physostomi.*
L. fasciatus, sp. n.	Fam. *Siluridæ*.
L. compressus, sp. n.	Genus *Clarias* (L.).
L. Moorei, sp. n.	*C. angularis* (L.).
L. modestus, sp. n.	*C. biocephalus*, sp. n.
L. elongatus, sp. n.	Genus *Anoplopterus* (Gthr.).
L. fuscifer, sp. n.	*A. platychir* (Gthr.).
Genus *Telmatochromis*, nov. gen.	Genus *Anchinaspis* (Cuv.).
T. vitatus, sp. n.	*A. biscutata* (Cuv.).
T. temporalis, sp. n.	Genus *Synodontis*.
Genus *Julidochromis*, nov. gen.	*S. multipunctatus*, sp. n.
J. ornatus, sp. n.	Genus *Malapterurus*.
Genus *Paratilapia*, nov. gen.	*M. electricus*.
P. pfifferi, sp. n.	Fam. *Characinidæ*.
P. macrops, sp. n.	Genus *Alestes*.
P. ventralis, sp. n.	*A. macrolepidotus* (C. and V.).
P. fuscifer, sp. n.	*A. macrophtralmus* (Gthr.).
P. lep'osoma, sp. n.	Genus *Hydrocyon* (C.).
Genus *Bathybates*, nov. gen.	*H. forskalii*.
B. ferox, sp. n.	Fam. *Cyprinidæ*.
Genus *Eretmodus*, nov. gen.	Genus *Labio*.
E. cyanosticus, sp. n.	*L. ?*
Genus *Tilapia*.	Fam. *Cyprinodontidæ*.
T. labiata, sp. n.	Genus *Haplochilus*.
Genus *Tropheus*, nov. gen.	*H. tanganicanus*, sp. n.
T. Moorei, sp. n.	Fam. *Polypteridæ*.
Genus *Petrochromis*, nov. gen.	Genus *Polypterus*.
P. polyodon, sp. n.	*P. Bichir ?*
Genus *Perissodus*.	

From the above list of fishes, which has been courteously supplied to me by Mr. Boulenger, and which are themselves now in the British Museum, it will be seen that there has been added from this single locality an extraordinary number of entirely new types. In fact, almost the entire fish population of Tanganyika, so far as at present known, is composed of forms which are quite peculiar to the lake. When, therefore, we remember that all these fishes were obtained without deep or even rough water nets and trawls, and that I was only able, as it were, to scratch round some 150 miles of the shallow coast line of a lake over 350 miles in length, and of unknown depth, it will be evident to all, how much must remain there in the way of fishes which have not yet been obtained. But what is true of Tanganyika in this respect, is almost equally true of Lake Nyassa, for no deep-water work of any kind has hitherto been accomplished there, nor is the depth of this lake known. It has been shown to extend to 300 fathoms, but no bottom was obtained; and it consequently follows that wherever the deep floor of Nyassa really is, it is far below the level of the sea.

Thus although it is obvious that we know next to nothing of the zoological contents of Nyassa and Tanganyika, our comparative ignorance of the fauna of these two great lakes is as nothing compared to the absolute want of information appertaining to the aquatic zoology of Lake Rukwa, or of the great Nyanzas north of Tanganyika, the interesting relations of some of which to the Tanganyika valleys I have already pointed out. I hope, therefore, it will become apparent how huge a field for further zoological investigation the energy and enterprise of the great African companies, and the administration of the African Protectorate has opened up to us, as a sort of unconscious gift to science, wherein the problems raised originally by Boehm's jelly-fish may be followed up, not in imagination only, but with the pleasant certainty of tangible results. J. E. S. M.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

DR. LUCIANI, Professor in Human Physiology in the University of Rome, whose work on the functions of the cerebellum is well known throughout the scientific world, has (says the *British Medical Journal*) been elected Rector of the Rome University for the academic year 1898-99. Dr. Corona, Professor of Experimental Physiology and President of the Faculty of Medicine of the Parma University, has been elected Rector of this University.

THE following list of this year's successful candidates for Royal Exhibitions, National Scholarships, and Free Studentships (Science), has been issued by the Department of Science and Art:—Royal Exhibitions—George S. Taylor, Devonport; Leslie H. Hounsfield, London; William McG. Wallace, Crewe; William W. Firth, Oldham; Henry J. Round, Cheltenham; Sidney A. Main, Brighton; James Davidson, Newcastle-on-Tyne. National Scholarships for Mechanics—Aidan N. Henderson, Edinburgh; John E. Jagger, Manchester; William Alexander, Glasgow; Victor G. Alexander, Portsmouth; Ernest A. Forward, London; George E. Parker, Denholme, Bradford; Percy W. Kelsey, Brighton; Frank H. Phillips, Crewe; Joel J. Lee, Portsmouth. Free Studentships for Mechanics—George Walker, Bradford; Marshall H. Straw, Sneinton, Nottingham. National Scholarships for Physics and Chemistry—George M. Norman, Brighton; William S. Tucker, Kidderminster; John Satterly, Ashburton; Robert J. Bartlett, London; Joe Stephenson, Linthwaite, Huddersfield; Lewis L. Fermor, London; Robert Gillespie (junr.), Glasgow; Frederick C. Clarke, Plymouth; Thomas Stenhouse, Rochdale. Free Studentships for Physics and Chemistry—Arthur E. Garland, London; Stanley C. Dunn, London; Harold V. Capsey, Wellington, Salop; Isidore Tom, London. National Scholarships for Biology—Stanhope E. Baynes-Smith, Sheffield; Stafford E. Chandler, London; Arthur Pickles, Burnley; William E. Clarke, London.

THE Scottish Education Department has issued a circular containing a series of proposals for the recognition of a distinct class of higher grade science schools by the Department. For the further encouragement of instruction in science and art in combination with a sound scheme of general education, a grant will be made on the following conditions to the managers of schools which provide a satisfactory course of instruction extending over not less than three years to pupils who have obtained a merit certificate or otherwise satisfy the Department of their capacity to profit by such advanced instruction: (1) The Department must be satisfied that the school possesses a proper equipment for instruction in science and art, namely, sufficient laboratory accommodation, with the necessary apparatus for instruction in science, suitable drawing tables or desks, and an adequate provision of examples for instruction in art, and, as a rule, a workshop or room specially adapted and equipped for instruction in the use of tools. (2) A course of instruction extending over at least three years must be submitted to and approved by the Department, and this course shall make provision for the following:—Experimental science—Not less than four hours a week, of which at least two hours must be spent by each pupil in practical work. Drawing.—At least two hours a week. The course in its earlier stages should embrace instruction in freehand drawing, model drawing from common objects as well as from geometrical models, and drawing to scale of plan elevation and section. Mathematics.—At least four hours a week. (*a*) Geometry and mensuration—practical and theoretical. (*b*) Higher arithmetic and algebra. History and English literature.—The first two years in the latter subject should be devoted to cultivating a taste for good literature by the reading of interesting works of good style and elevation of sentiment. Geography.—A revisal of previous knowledge; the reading of maps (*e.g.* of contour lines) and their construction; elementary exercises in surveying and mapping; a thorough regional survey, by means of excursions, of the physical geography, flora, fauna, and historical antiquities of the district in which the school is situated; a study of commercial geography, based largely upon the shipping and trade news of the daily papers. Manual instruction.—At least three hours. Girls—needlework and dressmaking, cookery. Boys—woodwork, ironwork, clay modelling. In the latter subjects, and in dressmaking for the girls, the pupils will be expected to make a practical application of the drawing taught in the school, and the knowledge acquired in the science lessons can, to some extent, be turned to account for the explanation of the processes in cookery. The Department must be satisfied that the teachers have a competent knowledge of the subjects which they are to teach, and, in the case of science, that they have had experience in treating the subject experimentally. As a rule not more than forty pupils in a class may be instructed by one teacher at one time, nor more than twenty-five in practical work.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, August 16.—M. Wolf in the chair.—The Perpetual Secretary announced to the Academy the death of M. Pomel, Correspondant in the Mineralogy Section.—On continuous groups of movements in three dimensions of any variety whatever, by M. G. Ricci.—On the differential invariants of a system of $m + 1$ points with respect to projective transformations, by M. E. O. Lovett.—On the representation of varieties of three dimensions, by M. Émile Cotton.—On commutators, by M. P. Janet.—Atmospheric carbon dioxide, by MM. Albert Levy and H. Henriet. After complete removal of carbon dioxide by baryta water, by the prolonged contact of air with caustic potash, fresh quantities of the gas are formed by the slow oxidation of some organic matter existing in the air. Under certain atmospheric conditions, the amount thus formed may amount to nearly as much as the carbonic acid originally present

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