an intelligent man, and even finds time in the midst of his ivory raids to attend to the interests of science. He recently came upon a remarkable tribe on the Congo, to the north of Nyangwé, who do a great deal of work in copper, and whose inlaid work in that metal is of a highly artistic character. He sent several specimens to an English friend at Zanzibar, who has brought them with him to this country. Still more interesting is the discovery by Tippoo, among the same people, of what may be regarded as the first steps towards a currency. Spears are, naturally among the most valuable articles which such a people possess, and, as a matter of fact, the value of everything is reckoned by them in terms of spears. Not only so, but they have actually reached the stage of a conventional currency. Enormous spear-heads of very thin copper are made, some six feet in length, which are passed from hand to hand, just as bank-notes are with us. These spears, for example, in the purchase of ivory, are valued at £200—their intrinsic value being probably not so many pence. We are glad to know that a specimen is likely to be deposited in the British Museum. Readers of Schweinfurth's "Heart of Africa" will remember that among the Niam-Niams hoes are used for a similar purpose, only after a reverse fashion; tiny hoes, what we should call mere toys, are in common use as money.

THE principal article in the new number of *Petermann's Mitteilungen* is a summary of the journey across Africa from Mossamedes to Quillimane, by the Portuguese travellers, MM. Capello and Ivens in 1884-85. The most valuable geographical work accomplished by the travellers was the exploration of the interesting region lying between the Upper Zambesi and Lake Bangweolo. The important north-east tributary of the Zambesi, the Kabompo, was traced to its source in the closest proximity to the sources of the Lualaba, one of the most important contributories to the Congo. From here a zigzag was made eastwards and southwards, across the head-waters of many affluents of the Zambesi, until that river was reached about 16° S. and 29° E. MM. Capello and Ivens took very numerous astronomical and meteorological observations during their journey, as well as observations for terrestrial magnetism. The complete narrative of the journey, with ample supply of maps and scientific appendixes, has just been published in Portuguese. The same number of the *Mitteilungen* contains a large collection of barometric data on the hypsometry of South America, mainly Peru and Bolivia.

PROF. L. BODIO sends to the *Bollettino* of the Italian Geographical Society for December 1886 an important paper on Italian emigration, which he divides into two categories—permanent and temporary. The latter, which is essentially of a periodical character, varies from 80,000 to 100,000 persons yearly, and consists chiefly of stonemasons, bricklayers, navvies, and other day-labourers from the northern provinces of Piedmont, Lombardy, and Venice, who seek casual employment on the public works in Austria, France, Germany, Switzerland, Corsica, and elsewhere. They generally leave their homes in the spring, returning with their earnings towards the close of autumn, and enjoy the reputation of sober, steady, intelligent workmen. The permanent movement, which alone constitutes emigration properly so called, has already risen during the last twenty years from less than 20,000 to about 80,000 annually, and is directed from the same northern provinces, and from Liguria and parts of Naples, almost exclusively to the Argentine States and some other parts of the New World. The emigrants, who sail either directly from Genoa, Naples, and Palermo, or from the French ports of Marseilles, Bordeaux, and Havre, comprise between 60 and 80 per cent. of male adults, the small minority consisting of women and children. They represent nearly all social conditions, the peasant class, however, largely predominating in South America. For the year 1885 the returns show 57,827 to the Argentine Republic; 15,485 to the United States; 12,311 to Brazil; and 1477 to Uruguay. The chief inducements to leave their native land and settle abroad appear to be poverty, the desire to better their fortunes, and the direct encouragement of friends and relatives who have prospered in their new homes across the Atlantic. Very few ever return to reside permanently in the mother country.

THE Germans are losing no time in making themselves acquainted with the section of New Guinea which they have annexed. The Empress Augusta River, close to the western boundary of the German territory, was recently navigated by Admiral von Schleinitz and Dr. Schrader, in the steamer *Ottilie*, for a distance of 224 miles. It being the dry season, the river was too shallow for further navigation by the steamer. The ship's steam-launch, however, proceeded 112 miles further, to a point situated in 4° 16′ S. and 141° 50′ E.; judging from the quantity of water in the river the voyage could have been continued 50 miles further, but fuel ran short. For over 200 miles from its mouth the river flows through extensive plains; then its course suddenly changes, and it assumes the character of a mountain stream, forcing its way through hills of gneiss, mica-slate, and quartz; but the velocity of its current remains uniform. The settlements on its banks were only found at long intervals.

## *ON THE CONSTITUTION OF THE NITROGENOUS ORGANIC MATTER OF SOILS*

THE organic matter of soils, the residue of the limited oxidation of vegetable and animal matter, has appeared a subject so complex and obscure, and promising the investigator so little of definite result, that it has received but scanty attention. The researches made have been chiefly confined to a study of the non-nitrogenous humic acids, the nitrogenous organic bodies present in soil have been scarcely at all investigated. The agricultural chemist has indeed not unfrequently spoken and written as if such investigation was superfluous, holding that the nitrogenous organic bodies contained in humus were not capable of serving as food for farm crops until they had undergone a further change into ammonia, and finally into nitric acid. A valuable paper, "Sur les principes azotés de la terre végétale," by Berthelot and André, which appeared in the *Comptes rendus* of December 6, has called attention to this neglected subject, and has done much to clear up our ideas respecting the constitution of the nitrogenous organic matter contained in soils. Like many other epoch-making treatises, the paper in question brings forward facts which have, in part, been already established by earlier investigators; but in no earlier investigation, as far as I am aware, have the facts appeared in such a striking aspect, nor have the conclusions which flow from them been clearly set forth.

Berthelot and André conclude that the nitrogenous matter of soils is mainly composed of insoluble amides;[1] these amides are decomposable by the action of acids, alkalies, and to a less extent by water, into ammonia and soluble amides (amido-acids), in the same manner as other bodies of the same class with which the chemist is already quite familiar. The behaviour of soil towards hydrochloric acid furnishes the main facts on which the French chemists base their conclusions. They find that when a soil tolerably rich in nitrogen (0·174 per cent.) is treated with dilute hydrochloric acid, a quantity of ammonia is found in the solution, which is greater as the strength of the acid is increased, as the time of its action is lengthened, and especially as the temperature is raised; two hours' boiling produces, in fact, with various strengths of acid, four, five, and six times as much ammonia as five days' action in the cold. Besides ammonia, there is found in the acid solution a considerable quantity of some nitrogenous organic body, the amount of which rises and falls with the quantity of the ammonia. In cases in which the action of the acid was carried farthest, the nitrogen of the soluble organic body bore to the nitrogen of the ammonia a proportion of about 3 to 1. The extent to which the nitrogenous matter of the soil was attacked by the hydrochloric acid was very considerable; boiling 200 grammes of soil for two hours with 400 cubic centimetres of water, and 100 cubic centimetres of strong hydrochloric acid, resulted in the solution of 31·8 per cent. of the soil nitrogen, and the conversion of 7·1 per cent. of it into ammonia. The nature of the nitrogenous organic matter found in solution in the hydrochloric acid has apparently not been particularly investigated by Berthelot and André, but the whole reaction is so characteristic of the splitting up of an amide that their view of the constitution of this body becomes highly probable.

Investigations earlier than those of Berthelot had shown that hydrochloric acid dissolves nitrogenous matter from the soil. Loges has pointed out that this solution contains a nitrogenous body precipitable by phospho-tungstic acid. The nitrogen and carbon in this precipitate had a relation of about 1 to 6·2. My own experiments show that a nitrogenous body precipitable by phospho-tungstic acid is also extracted from soil by a cold

[1] The presence of amides in soil was long ago inferred by S. W. Johnson ("How Crops Feed," p. 247), from the reactions of soil with which chemists were then acquainted.

solution of potassium carbonate. We may hope that, before long, further light will be thrown on the constitution of these bodies.

The action of alkalies on soil is quite in accordance with the assumption of the amide nature of its nitrogenous compounds. Boussingault long ago showed that the agricultural operation of liming a soil caused the production of ammonia. It has recently been shown by Baumann, and others, that a solution of soda, even in the cold, develops a notable amount of ammonia in soil, while at a high temperature the action becomes very considerable.

Nor are facts wanting which seem to exhibit the actual synthesis of amides from ammonia and humic acids. Knop long ago observed that when peat was treated with ammonia the ammonia disappeared, and could no longer be detected. Joulie found, in his experiments on the changes which take place in farmyard manure, that when finely divided straw, horse-dung, and ammoniacal urine of known composition were mixed, and allowed to ferment, a great disappearance of ammonia took place, accompanied by a gain of 35 to 63 per cent. in the organic nitrogen. The ammonia had in this case clearly united with some of the organic compounds present.

The view of the constitution of the nitrogenous matter of the soil which has been now brought forward will, we think, prove fruitful: it throws much light on the chemical changes within the soil; it has also possibly important bearings on plant-nutrition. That the acid sap contained in roots is capable of rendering soluble, and thus effecting the assimilation of various mineral matters with which they come in contact, is admitted to be a fact by physiologists. May it not equally follow that the insoluble amides of the soil are also attacked by the acid root-sap? We know not yet the properties of the soluble amides which result from the action of acids on the insoluble amides of the soil; but if they are diffusible through a membrane, they must enter the plant, and it is certainly very probable that they would then be found capable of taking part in plant-nutrition. A reaction of the kind we have supposed between the root and the soil would probably take place to a very different extent with different plants, much depending on the character of the root-sap. When the subject has been more fully investigated, it may perhaps be found that we have in this action of the roots an explanation of those obscure cases of plant-nutrition which at present puzzle the agricultural chemist. R. WARINGTON

## UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—The following is the speech delivered by the Public Orator, Dr. Sandys, in presenting for the honorary degree of Doctor of Science, Prof. Alexander Agassiz, Curator of the Museum of Zoology, Harvard College, Massachusetts:—

Cum Collegio Harvardiano antiquitus consociati, nuper vetera amicitiae iura auspiciis optimis renovavimus; litteris datis acceptisque trans maria lata dextras iunximus; legatis denique insignibus missis, ludis illis saecularibus, etiam absentes, velut praesentes interfuimus. Hodie vero e Collegii illius professoribus unum revera praesentem videmus, virum et suo et patris et Collegii sui nomine nobis dilectum. Donec Alpium inter culmina ingentes illae glaciei moles desuper paullatim descendunt, tam diu patris illius nomen superstes vivet, qui, in Republica non magna natus, Rempublicam maximam gloriae suae fecit participem, expertus scilicet vetera illa verba quam vera essent:—

"Omne solum forti patria est, ut piscibus aequor,
Ut volucri vacuo quicquid in orbe patet."

Filii vero famam patre tanto non indignam, quibus potissimum verbis exsequi potero? Utinam tu mihi hodie adesses:—

O testudinis aureae
Dulcem quae strepitum, Pieri, temperas;
O mutis quoque piscibus
Donatura cycni, si libeat, sonum.

Atqui Musa illa vocata non audit; rogata tacet; virumque praeconio altiore dignum sermone pedestri laudandum relinquit. Ergo, utcunque possumus, virum libenter laudamus, qui, cum ingenii sui ope aeris thesaurum ingentem invenisset, Academiam suam divitiarum suarum amplitudine ornavit, iudice me (insusurrare mihi videtur Horatius) iudice me, "non sordidus auctor naturae verique." Quid autem de vivario illo dicam, aequoris Atlantici prope marginem ulteriorem condito, ubi maris immensi miracula minutissima ab hoc viro accuratissime examinantur, ubi oceani ipsius e penetralibus profundis rerum naturae veritas ipsa audacter extorquetur? Satis erit hodie de veritate illa dicere quod olim de Romanorum virtute dictum est:—

"Merses profundo; pulchrior evenit."

Duco ad vos marinae praesertim zoologiae indagatorem indefessum, ALEXANDRUM AGASSIZ.

## SCIENTIFIC SERIALS

THE *Quarterly Journal of Microscopical Science*, January.—The anatomy of the Madreporian coral Fungia, by G. C. Bourne (plates xxiii. to xxv.). During a visit to Diego Garcia (an atoll lying in 7° 13′ S. lat., 72° 23′ E. long.) which extended from the middle of September 1885 to the middle of January 1886, the author was able to collect and preserve a large number of specimens of *Fungia dentata*. These Fungiæ were very abundant within the lagoon, where at low spring tides they could be collected by scores from depths of from three to ten feet: a prolonged search failed to secure any specimens under two inches in diameter, or an example of the nurse-stock. It is suggested that the time of the year was the cause of this; the depth of the water in which the search had to be made was also unfortunate for such investigations. The name "mesogloea," suggested by Prof. Lankester, is used to denote the supporting lamina of Cœlenterata: the only seeming objection to the name is that it is the name of a well-known genus of Algæ.—On some points in the development of *Petromyzon fluviatilis*, by Arthur E. Shipley (plates xxvi. to xxix.). The material was obtained by fertilising the eggs of the ripe female Lampern, hatching the larvæ out, and rearing them in confinement. The summary is too long for abstracting, but it may be mentioned that the early development of the skeleton is described up to the stage where Prof. Parker commenced his researches.—The ammoniacal decomposition of urine, by Dr. W. R. Smith (plate xxx.). Records a series of observations proving that the ammoniacal decomposition of urine is brought about by the presence of a Micrococcus which differs from that described by Prof. W. Leube, inasmuch as it liquefies gelatine. Though about twenty different organisms were isolated from one sample of healthy urine, only this one acted so.—Notes on Echinoderm morphology, No. 10; on the supposed presence of symbiotic Algæ in *Antedon rosacea*, by P. Herbert Carpenter (plate xxx.). Discusses the views of Vogt and Yung as to the Sacculi of Antedon being symbiotic Algæ, and considers these views as certainly not proven; an opinion which Perrier seems by intuition to have already ascribed to him.—The function of nettle-cells, by Dr. R. von Lendenfeld (plate xxx.). The plasmotic contractile coat of the cnidoblast is incited to action by the cnidocil: the animal can control this action.—Some new methods of using the aniline dyes for staining Bacteria, by E. H. Hankin. Illustrations of the structure and life-history of *Phytophthora infestans*, by Prof. H. Marshall Ward (plates xxxi. and xxxii.).—On the formation and liberation of the zoospores in the Saprolegnieæ, by Dr. Marcus M. Hartog.

THE *Journal of Botany* for January is chiefly occupied by a biographical notice of the late Dr. H. F. Hance, of Whampoa.—In the number for February, Dr. Richard Spruce describes and figures a Hepatica from Killarney new to science, to which he gives the name *Lejeunea Holtii*; Mr. Alfred Fryer continues his notes on the genus *Potamogeton*; and Mr. J G. Baker commences a synopsis of the six genera *Sodiroa*, *Caraguata*, *Schlumbergeria*, *Guzmannia*, *Catopsis*, and *Tillandsia*, which make up the tribe Tillandsieæ of the natural order Bromeliaceæ.

*Bulletin de l'Académie Royale de Belgique*, December 1886.—Determination of the parallax relative to the larger member of the double star Σ 1516 of Struve, by L. de Ball. From previous observations the chief star of this group appeared to have a proper movement in a straight line independently of its companion, with which it had no physical connection. By means of a Cointe refractor the author has followed the relative displacements of the two stars, and has determined a periodicity, the effect of the relative parallax, which he finds to be

$$0''\cdot091 \pm 0''\cdot013,$$

and the distances

$$0''\cdot112 \pm 0''\cdot010.$$

From these elements he determines an absolute parallax $0''\cdot104$, with a mean error $0''\cdot008$, corresponding to a distance which