Australia, presented by Mr. R. Hall; two White-fronted Amazons (*Chrysotis leucocephala*) from Cuba, a Prince Albert's Curassow (*Crax alberti*) from Columbia, a Mexican Guan (*Penelope purpurascens*), obtained by purchase; a Herring Gull (*Larus argentatus*), British, presented by the Marchioness of Cholmondeley; a Tuberculated Iguana (*Iguana tuberculata*) from Brazil, presented by Mr. H. E. Blandford; a Chameleon (*Chamæleon vulgaris*), three Lacertine Snakes (*Cœlopeltis lacertina*), and two Horseshoe Snakes (*Zamenis hippocrepis*) from Morocco, presented by Mr. Herbert E. White.

OUR ASTRONOMICAL COLUMN.

COMET 1888 *c* (BROOKS).—Dr. H. Kreutz has more recently computed for this comet more exact elements than those which he had obtained from the observations of August 9, 10, and 11. These later elements are based on observations made at Vienna on August 9, at Hamburg, August 14 and 24, and at Strassburg, August 19; aberration and parallax being corrected for.

T = 1888 July 31·25115, Berlin M.T.

ω = 59° 19′ 25″
Ω = 101 32 50·1 } Mean Eq. 1888·0.
ι = 74 12 13·7

log q = 9·955456

Error of middle places (O − C),

August 14 ... $\Delta\lambda \cos\beta$ = − 3″·5; $\Delta\beta$ = − 3″·2
19 + 3″·3; − 3″·4

Prof. A. Krueger (*Astr. Nach.*, No. 2855) has computed the following ephemeris for Berlin midnight from the foregoing:—

1888.	R.A. h. m. s.	Decl. ° ′	Log r.	Log Δ.	Brightness.
Sept. 21 ...	14 57 40 ...	21 13·7 N. ...	0·1084 ...	0·2310 ...	0·45
23 ...	15 5 34 ...	19 44·1			
25 ...	15 13 7 ...	18 16·4 ...	0·1242 ...	0·2456 ...	0·39
27 ...	15 20 22 ...	16 51·0			
29 ...	15 27 19 ...	15 27·9 N. ...	0·1396 ...	0·2611 ...	0·34

The brightness on August 9 is taken as unity.

On August 11 the comet was observed at the Observatory of Algiers, and the nucleus was estimated as being about equal in brightness to a star of the tenth magnitude; the nebulosity was about 1′ in diameter, and there was a faint tail in the direction of the diurnal movement. Prof. L. Boss, observing the comet at Albany, N.Y., estimated it on August 10 as of mag. 9, and on August 19, in bright moonlight, as mag. 11. The tail on August 10 was estimated as 10′ in length, and was of the same breadth as the head.

DISCOVERY OF A NEW COMET, 1888 *e*.—Mr. E. E. Barnard, formerly of Nashville, Tennessee, now at the Lick Observatory, discovered a new comet on September 3 at 0h. 33m. G.M.T., R.A. 6h. 52m. 16s., Decl. 10° 59′ N. The comet is described as circular, 1′ in diameter, of the eleventh magnitude, with tolerably well-defined nucleus, but with no tail. Dr. Kobold observed it at Strassburg on September 5 at 13h. 44·1m. G.M.T., R.A. 6h. 52m. 1·5s., Decl. 10° 49′ 33″ N.

COMET 1888 *d* (FAYE).—Placing the perihelion passage of this comet as 2·60d. later than given in Dr. Möller's elements, an alteration according well with the observations at Nice, August 9-17, Dr. H. Kreutz has computed (*Astr. Nach.*, No. 2856) the following ephemeris for it for Berlin midnight:—

1888.	R.A. h. m. s.	Decl. ° ′	Log r.	Log Δ.	Brightness.
Sept. 21 ...	6 47 41 ...	15 36 N. ...	0·2472 ...	0·2244 ...	1·33
23 ...	6 51 59 ...	15 16			
25 ...	6 56 12 ...	14 56 ...	0·2489 ...	0·2177 ...	1·36
27 ...	7 0 21 ...	14 35			
29 ..	7 4 24 ...	14 14 N. ...	0·2509 ...	0·2110 ...	1·39

The brightness on August 9 is taken as unity.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1888 SEPTEMBER 23-29.

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on September 23

Sun rises, 5h. 50m.; souths, 11h. 52m. 6·7s.; sets, 17h. 54m.: right asc. on meridian, 12h. 3·1m.; decl. 0° 20′ S. Sidereal Time at Sunset, 18h. 6m.

Moon (at Last Quarter September 28, 9h.) rises, 19h. 18m.*; souths, 2h. 0m.; sets, 8h. 54m.: right asc. on meridian, 2h. 9·5m.; decl. 7° 44′ S.

Planet.	Rises. h. m.	Souths. h. m.	Sets. h. m.	Right asc. and declination on meridian. h. m.	° ′
Mercury..	7 56 ...	13 10 ...	18 24 ...	13 21·0 ...	9 53 S.
Venus ...	7 42 ...	13 7 ...	18 32 ...	13 18·2 ...	7 30 S.
Mars ...	12 21 ...	16 15 ...	20 9 ...	16 26·9 ...	23 20 S.
Jupiter ...	11 33 ...	15 48 ...	20 3 ...	15 59·3 ...	19 59 S.
Saturn ...	1 34 ...	9 6 ...	16 38 ...	9 16·4 ...	16 40 N.
Uranus...	7 18 ...	12 51 ...	18 24 ...	13 2·0 ...	5 57 S.
Neptune..	20 5*...	3 52 ...	11 39 ...	4 2·0 ...	18 57 N.

* Indicates that the rising is that of the preceding evening.

Occultation of Star by the Moon (visible at Greenwich).

Sept.	Star.	Mag.	Disap. h. m.	Reap. h. m.	Corresponding angles from vertex to right for inverted image. °	°
28 ...	ζ^2 Geminorum...	4 ...	22 20 ...	23 11 ...	55	245

Sept. 23 ... h. 22 ... Mercury at greatest distance from the Sun.

Variable Stars.

Star.	R.A. h. m.	Decl. ° ′		h. m.	
U Cephei	0 52·4 ...	81 16 N. ...	Sept. 26,	4 33	*m*
ζ Geminorum ...	6 57·5 ...	20 44 N. ...	,, 24,	0 0	*M*
			,, 29,	4 0	*m*
T Ursæ Majoris ...	12 31·3 ...	60 6 N. ...	,, 28,		*m*
R Boötis	14 32·3 ...	27 13 N. ...	,, 27,		*m*
δ Libræ	14 55·0 ...	8 4 S. ...	,, 27,	20 24	*m*
U Coronæ	15 13·6 ...	32 3 N. ...	,, 29,	20 31	*m*
U Ophiuchi... ...	17 10·9 ...	1 20 N. ...	,, 25,	20 34	*m*
Z Sagittarii... ...	18 14·8 ...	18 55 S. ...	,, 24,	19 0	*M*
β Lyræ...	18 46·0 ...	33 14 N. ...	,, 24,	2 0	*M*
S Sagittæ	19 50·9 ...	16 20 N. ...	,, 27,	21 0	*m*
X Cygni	20 39·0 ...	35 11 N. ...	,, 29,	5 0	*m*
T Vulpeculæ ...	20 46·7 ...	27 50 N. ...	,, 28,	19 0	*M*
			,, 29,	20 0	*m*
Y Cygni	20 47·6 ...	34 14 N. ...	,, 23,	3 18	*m*
			,, 26,	3 12	*m*
δ Cephei	22 25·0 ...	57 51 N. ...	,, 27,	3 0	*M*

M signifies maximum; *m* minimum.

Meteor-Showers.

	R.A.	Decl.	
Near α Arietis	30° ...	18° N.	
	105 ...	50 N. ...	Very swift.
,, δ Draconis	290 ...	70 N. ...	Swift.

THE INTERNATIONAL GEOLOGICAL CONGRESS.[1]

I DEEPLY regret that, in consequence of his state of health, Prof. Huxley is unable to be present to-day to bid you welcome to England. But if one voice is here wanting, let me assu e you that the unanimous voice of English geologists unites in the same sentiment, and also thanks you, gentlemen, our foreign colleagues, for having responded in a manner so flattering to the invitation of English geologists to meet this year in London. For in this assembly there are representative geologists from Germany, Austria, Belgium, Denmark, Spain, France, Holland, Hungary, Italy, Norway, Portugal, Roumania, Russia, Sweden, Swizerland, as well as from the United States, Canada, Mexico, the West Indies, the Argentine Republic, and Australasia. From all these countries eminent and illustrious men honour us with their presence, and are here to aid us by their

[1] Inaugural Address delivered by Prof. J. Prestwich, President of the Congress, on September 17, 1888. (Translated from the French.)

knowledge in the discussion of the questions brought before the International Congress. The number of geologists present on this its fourth meeting indicates the continued and deep interest that they take in it.

Among the more permanent officers are the Secretaries of the Congress and of its Committees to whose important and gratuitous services we are so deeply indebted. We have unfortunately to deplore the untimely death of one amongst them—M. Charles Fontannes—and we lose on this occasion the benefit of his long experience and valuable aid.

According to custom, our discussions are, as in the diplomatic world, held in French; but it is to be hoped that the *entente cordiale* will be better maintained than it sometimes is in the other case, where such councils have not always succeeded in avoiding strife. If I may be permitted to speak after an experience of half a century, an *entente* of the most cordial character between us English geologists and our colleagues and friends abroad has been during these long years the normal condition. May these friendly and loyal relations prove a legacy to our science for all time. These friendly meetings were, however, only occasional, so that the opportunities for personal interchange of ideas were few. But more lately, instead of discussing unsettled questions, each nationality apart, the happy idea arose of submitting certain questions, which concern us all, to the arbitration of this General Council. In this manner the different national centres of our science, which have each their local colouring and their special experience, are enabled to combine the results arrived at in a wider and more uniform manner than if each apart worked out its ideas, based necessarily on more restricted observations. Nevertheless, in giving to our science the uniformity of terms and of classification which is so necessary, care must be taken not to draw lines too tight, such as, instead of developing, might retard its progress. It is desirable that these lines should be so elastic as to adjust themselves to the rapid development we have reason to expect in geological science. It is highly necessary that we should agree upon the colours and symbols to be used for the different strata, rocks, and disturbances that the terrestrial crust presents to us, but petrology is still far from being placed on firm foundations, and the synchronism of the beds, even between near countries, is not always easy to determine with exactitude, and still less between distant countries. Let us then try to avoid that error of Congresses—of arrogating an infallibility which is little in accordance with the progress of science.

Let me now say a few words upon what the Congress has already accomplished, and on what remains to be done.

At Bologna, Prof. Capellini gave the history of the Congress so fully that there is no need that I should speak of it unless it be to remind you that the idea of the Congress originated in America at the Exhibition of Philadelphia in 1876, and doubtless this idea, as well as that of the Exhibition itself, was only the expression of a desire that had been very generally felt for some time, to treat certain questions of science and art, not only, so to speak, in a national family reunion, but in a cosmopolitan reunion—to treat the great questions that concern all humanity, as belonging to the whole civilized world, and for the purposes of discussion, to make of the various nationalities a brotherhood, established on their common interests and their common weal.

THE PARIS CONGRESS.—At the first Congress, which met in Paris in 1878, the primary questions of nomenclature and of classification were sketched out, as well as the unification of geological works with regard to colours and figures, so that in all countries their signification should be the same. A proposal, which was at first well received, was to make use of the solar spectrum, and to adopt the three primary colours—red, blue, and yellow—for the three divisions of the first rank of Primary, Secondary, and Tertiary rocks; that the subdivisions of the second order should be distinguished by shades of these colours, and those of the third order by hatchings of these same colours. But subsequently this scale was found to be too restricted, and at Bologna and Berlin several modifications and complementary colours were introluced, although always retaining to a certain degree the original idea. As a corollary it has been suggested that the labels of fossils should, as has already been done in several Museums, be of the same colour as that used for the strata from which they come, and that thus one would at a glance see the horizon and age of the fossil.

As to the question of unification of nomenclature for the great divisions of the earth's crust, it was felt that it is in the first place essential that there should be perfect agreement about the terms in use, and therefore that a dictionary of geology comprising the etymology or the origin of each geological name, its synonym in other languages, a definition in French, and a demonstrative figure after the manner of technological dictionaries, would be of very great use. The publication of such a work, which ought to be in at least six languages, was strongly supported. Finally, the consideration of the foregoing questions was referred to the International Commissions to report upon to the meeting of the Bologna Congress.

With regard to the classification of the strata, memoirs were received upon the Pre-Cambrian rocks, and on the nomenclature of the Palæozoic strata of North America; on the limits of the Carboniferous and Permian in various parts of Europe and in America; on the relations of the zones of extinct Vertebrates in North America and in Europe; these two last memoirs being accompanied by valuable lists of Invertebrates, plants, and reptiles of different countries. These memoirs raised very important stratigraphical and palæontological questions with regard to the wide distribution of families and of genera. Each of the faunas of the primary divisions of geological periods has been in part recognized as occurring at the same time in the two continents—in Europe and in North America: and Prof. Cope has been led to inquire whether the organic types proceed from a special centre from which they have spread; or whether the same types of generic structure have appeared independently at different points of the surface of the globe; and if so, whether they are contemporary or of varying periods. These synchronous appearances form a subject full of mystery, from whatsoever side they may be viewed. The geological record is at present too incomplete for the problem to be solved. In each country there are gaps that can only be filled by aid of continued observations in the other parts of the world. One of the most useful functions of the Congress is to encourage these.

The classification of Quaternary deposits was also discussed in relation to the remarkable history of the caves of Central France; the glacial deposits and dunes of Holland; the Tertiary beds of Portugal, which are limited to the Miocene and Pliocene; the Tertiary eruptive rocks of Hungary, viewed as to whether there is not a certain relation between the mineralogical constitution and the relative age of the various trachytic types.

The Congress was also occupied with some high physical questions, such as those of the deformations and fractures of the earth's crust; the strike and dip of faults and of chains of mountains; the origin of volcanoes, and the probable causes of great earthquakes; the structure of the Alps, and the folds of the Chalk.

Less in connection with the fundamental objects of the Congress, but having nevertheless an interest of their own, were the memoirs on the feldspars, on the alteration of the superficial deposits, on the use of the polarizing microscope, on the conductivity of heat in rocks, and other special subjects.

THE BOLOGNA CONGRESS.—In the handsome volume of the Proceedings of the Session at Bologna, will be found the Report of the International Jury appointed to judge the competing memoirs on the unification of colours and geological signs, towards which the King of Italy generously gave 5000 francs to be awarded to the best memoir considered practically applicable. Six memoirs were received, of which the three selected for the award are published with coloured illustrations which leave nothing to be desired. The authors of these papers were of opinion that although the solar spectrum offers a very advantageous fixed base, the scale of colours is insufficient, and that it would be necessary to introduce complementary colours, or those having relation to the primary colours. The divisions, in short, of the sedimentary strata are so numerous that it will be necessary, not only to employ those colours, but also several shades of the same, or different hatchings, in reserving rose colour for the crystalline Archæan schists. For the eruptive rocks, they all agreed to use dark and bright tints of red, green, and purple, the intensity of which will render them to be readily distinguishable from the primary colours of the sedimentary rocks and from the clear colour of the schists. It was attempted to distinguish the acid and basic rocks, both with respect to their petrological composition and their age, by the use of different tints of the same colours in coloured dots, or by hatchings of various patterns, and with the letters of the Greek alphabet. Thus it is proposed to show by signs the principal varieties of granitic, porphyritic, trachytic, andesitic, and basaltic rocks, &c.; but the varieties

are so numerous that one hardly knows where to draw the limits; according to one plan, the use of seventy-six signs and hatchings would be required. You will be able to judge of the various methods proposed by the fine plates which illustrate the Reports. The sections given of some of the mountains of Switzerland, and others which serve as specimens, have an excellent effect. Conventional signs are also made use of to indicate the strike and dip of the strata, faults, fossiliferous localities, sources of cold, thermal, and mineral springs, travertines, quarries, mines, &c. A geological map will thus be a veritable hieroglyphic chapter, with a universal signification.

As a result of the discussions at Bologna, and with a view to a practical application, it was decided to publish a geological map of Europe on the scale of 1/1,500,000, in which the scale of colours used would be that definitely adopted by the Congress. This map, of which the execution is well advanced, is under the direction of a Committee at Berlin.

With respect to the unification of geological terms, Reports were received from nine National Committees, viz. from Austria, Belgium, Spain, Portugal, France, Great Britain, Hungary, Italy, Russia, and Switzerland. Besides these, eleven have been received from individual members. It can be well imagined that with so many opinions they were not all in agreement, but with the good will shown by everyone, although there were differences on points of detail, they were almost unanimous on the essential points, and a preliminary general agreement was arrived at for the stratigraphical terms, such as system, group, series, stage; and for chronological terms, such as era, epoch, age, &c., leaving to future Congresses the consideration of certain subordinate points. This subject reminds me, gentlemen, of a difficult question which has yet to be faced. If your resolutions are carried by the votes of all the members of Congress, the result must be affected by the varying number of the nationalities in the changing places of meeting. For example, at Bologna there were 149 Italian members and 19 English; at Berlin there were 163 Germans and 11 English; here, on the contrary, we are . . . English and . . . foreign geologists. Therefore, if all vote, the opinion of the seat of the Congress may too much preponderate unless you find means of placing some limits upon it.

Thanks to the loyalty of the Bologna Council, the greater number of the resolutions were carried unanimously, a few only were referred to various Committees for future consideration.

With respect to the stratigraphical divisions it was resolved:—(1) That the term "group" should be applied to each of the great divisions of Primary, Secondary, and Tertiary rocks. (2) That the subdivisions of these groups should be named "systems." You have thus a Primary or Palæozoic group, and the Silurian system, the Jurassic system. (3) As to the divisions of first order of the systems, the term "series" was applied (the Oolitic series); to those of the second order, the term "stage" (the Bajocian stage); and to those of the third order the word "zone" (the zone of *Ammonites humphresianus*). The unity of the stratified masses is the stratum or bed. With regard to a word much in use in England, and dating from the primary period of geology—the word "formation," the majority of the Congress decided not to employ it in the sense of *terrain* in French, as we do, but only in the sense of origin or mode of formation, and so on. It is necessary, therefore, to seek some word to replace with us the familiar terms of "Chalk formation," "London Clay," &c.

For the chronological divisions corresponding with the stratigraphical, it was proposed that (1) "era" should correspond with "group," as the Primary era, the Secondary era; (2) "period" with "system," as the Silurian period, the Cretaceous period; (3) "epoch" with "series," as the Lower Oolitic epoch, the Lower Cretaceous epoch; "age" with "bed," as the Portlandian age, the Bathonian age, &c.

On the subject of colours and signs, the final decision was remitted to the Committee of the Geological Map; and with regard to the rules to be followed in the nomenclature of species, it was resolved that the name attached to each genus and to each species should be that by which they have been earliest known, on the condition that the characters of the genus and species have been published and clearly defined. The priority not to date beyond Linnæus, twelfth edition, 1766.

There were only four special and local memoirs presented to the Congress at Bologna, and these were in support of collections and documents exhibited.

THE BERLIN CONGRESS.—The official Proceedings of this session having only been issued during the last few days, were not available when this address was prepared. I have therefore had recourse for information to the independent notices of Messrs. Renevier, Klebs, Choffat, Frazer, Blanford, and Dewalque. At Berlin, special attention was given to the construction of the geological map, of which the Committee, profiting by the liberty given to it by the Bologna Congress, revised the colours for the sedimentary series in the following manner:—

1.	Recent deposits (Alluvium, &c.)	Very pale cream colour.
2.	Quaternary (Diluvium)	Naples yellow.
3.	Tertiary	Various shades of yellow.
4.	Cretaceous	Green tints and hatchings.
5.	Jurassic	Blue tints.
6.	Triassic	Violet tints and dots.
7.	Permian and Carboniferous ...	Gray tints and hatchings.
8.	Devonian	Brown tints.
9.	Silurian	Grayish-green tints.
10.	Archæan	Rose tints.

And for the ten divisions of eruptive rocks, various brilliant and dark red tints and points.

In the use of monograms to accentuate the tints, it was decided to employ Latin initials for the sedimentary deposits, and Greek initials for the eruptive rocks.

It is on this plan that the large and grand geological map of Europe in course of execution at Berlin is to be coloured, and of which the publication will realize one of the principal practical objects of the Congress—the unification of the colours employed in geology.

As to stratigraphical unification, the Congress adopted, for the most part, the resolutions passed at Bologna. But the French and Portuguese Committees proposed to substitute the term "series" for "group" in the first and third great divisions of sedimentary strata; thus, instead of Primary group, Secondary group, &c., it will be Primary series, Secondary series, &c. The word "group" will then take the place of divisions of systems, such as Oolitic group instead of series. This replacement will perhaps recommend itself to many of us.

Further, the Committees were not unanimous on the proposition to substitute, for the various existing terminations of systems, homophone terminations in *ic*. Instead of speaking of the Eocene, Cretaceous, Carboniferous, Silurian, &c., system, it was proposed to use the terms Eocenic, Cretacic, Carbonic, Siluric, &c., system. Is it essential thus to change the ancient ensigns of our science? Etymology is lost, and signification destroyed. It is well to have these terminations for things positive, such as the crystalline and eruptive rocks—for example, granitic rocks, porphyritic rocks, basaltic rocks—for here it indicates their characters; but can we subject, or is it needful to subject, several series of deposits that have no character in common to the same rigid rule, from the circumstance that they all come under the same ideal classificatory name? This question will be discussed, and it is for you, gentlemen, to judge what solution may be the most advisable.

Among other subjects, gentlemen, that you will have to consider, is that of the classification of the Cambrian and Silurian strata. According as these two great systems have been taken in descending or ascending order, the boundary between the two has been placed lower or higher, because the discordances between the series are rare, and the palæontological chain between the two systems is but little interrupted. In England, Sedgwick, who commenced from below, found himself stopped by no discordance until he reached the Mayhill Sandstone, whereas Murchison, who commenced from above, saw no reason to stop until Palæozoic life failed him; he hesitated, therefore, where to place his base line. In the same way, in those countries where they followed Murchison, whose classification was better known, the stratigraphical barriers were, according to the partisans of the one, passed over; whilst, according to the partisans of the other, there was an absence of palæontological proofs. In this country—their native stratigraphical country—the Cambrian and Silurian occupy comparatively a small area; and it is only since the death of their founders that the palæontological proofs have been increased to an extent sufficient to bring out clearly their distinctive characters. These two systems are found elsewhere (especially in America, where it is a question whether they should be associated with a Taconic system), either better developed, or with special characters which may help to

determine more precisely their mutual relations. It is here, again, gentlemen, that the knowledge that you bring from many parts of the world may aid us in throwing light on this difficult subject.

Among the other questions which preceding Congresses have not decided, are :—

(1) The relation between the Carboniferous and the Permian.

(2) Between the Rhætic and the Jurassic.

(3) Between the Tertiary and the Quaternary.

When there is no interruption in the continuity of the strata, and no discordant stratification, the systems pass one into another without apparent break, like the colours of the solar spectrum; but, as you all know, if one link is wanting, the chain is broken, and the line of separation of the disunited beds becomes sharply defined. If, for example, the Caradoc should be absent in the Cambrian-Silurian, or the Pliocene should be wanting in the Tertiary, there would be between these systems a break which would give the necessary relief to the superimposed strata. The primary colours of the spectrum are not less distinctive because they pass one into the other with intermediate shades; nor does it follow that, because there are passage-beds, the systems form one whole. There must be, somewhere, passage-beds between them, as there are between the colours.

Apart from these international questions, the Berlin Congress was occupied with several special memoirs, but we are yet without particulars, and besides, whatever may be their interest, they concern us less for the moment than international questions. Among others of the latter, a great palæontological project has been mooted, and the Congress has appointed a Commission of distinguished palæontologists to co-operate towards its realization. A work is proposed, on the plan of the "Enumerator et Nomenclator" of Brown, and of the "Prodrome" of Alcide d'Orbigny; but such is the progress that palæontology has made, that at present, for the enumeration of all the known fossils, of animals as well as plants, a publication of some fifteen large volumes would be required. A work of this kind will make a handsome pendant to the large polyglot dictionary of geological terms, projected at Bologna.

Such, gentlemen, are some of the questions and subjects that you have to consider. You have to revise and to settle, when possible, questions already discussed, and also to discuss new problems. Among the latter there is especially the fundamental question of the crystalline schists—a subject remarkable for the great progress that it has made during the last few years, and the entirely new aspect that it is assuming; for it is evident at present that it is not only a chemical question of metamorphism by heat, but that it is a subject which entails questions of weight, pressure, and motion, which necessitate a wide co-operation, and the combined efforts of the physicist, the chemist, the petrologist, and the stratigraphist.

Although the greater number of the subjects considered by the Congress are eminently practical and positive, they also include theoretical questions of the highest interest. The classification of the strata and their synchronism over great areas, which you have to determine, rest both upon stratigraphy and upon palæontology. In order to adjust their precise relation, you have to note the identities as well as the differences of fossil species, and to know if the order of the beds in distant countries follows a synchronous order or is only homotaxial. In the one case, we can hardly expect to find similar species; in the other, the identity of species may be taken as a proof to the contrary, unless it may be supposed, as Edward Forbes thought, that species have had more than one centre of origin.

To solve these problems you have to trace the dawn of life, the appearance, the duration, and the disappearance of species, and the source from which they come. Are we to believe in the evolution of species, or are we to regard them as shoots of short duration, and the genera or families as the branches or permanent trunks? If I have ventured to touch upon these problems of fact and theory, it is not to express an opinion, but merely to point out how vast the field is, and how many fellow-labourers and how long is the time required to make all the necessary studies.

It must not be thought that when the fundamental questions of fact are determined the work of the Congress approaches completion. General agreement on these international questions will only smooth the way, and one can foresee in the cosmopolitan problems of theory already considered, and in many others that cannot fail to arise, what will occupy in a long and useful future all the efforts of this International Congress.

ON THE CONSTITUTION AND STRUCTURE OF THE CRYSTALLINE SCHISTS OF THE WESTERN ALPS.[1]

TEN years have elapsed since Prof. Lory first formulated his views on the crystalline schists of the Western Alps, at the Congrès International de Géologie held in Paris in 1878. These he subsequently developed at the Réunion de la Société Géologique de France at Grenoble in 1881. Since then further work in the field has strikingly confirmed these views, and Prof. Lory has taken advantage of the opportunity given by the invitation of the Organizing Committee of the Geological Congress to summarize briefly the more important facts, derived from the study of the Western Alps, that have a direct bearing on the general question of the crystalline schists.

The crystalline schists appear in the Alps in *massifs* of greater or less extent, protruding through the sedimentary formations. These *massifs* are distributed in two principal zones, arched in agreement with the general curvature of the Alps. These the author proposes to designate *the first Alpine zone*, or *Mont-Blanc zone*, and *the fourth Alpine zone*, or *Monte-Rosa zone*. The intermediate zones (*second* and *third Alpine zones*) are of less importance, the outcrops being rare and of small extent. As they resemble *the fourth zone* in their principal characters, they are treated in its connection.

(1) The *fourth Alpine zone*, or *zone of Monte-Rosa*, is by far the largest. In it the crystalline schists are exposed over the greater part of the Italian slopes, and skirt the plain from Cuneo to Lake Maggiore. Their stratification is often nearly horizontal, and always conformable with the sedimentary formations (Trias or Jura) resting upon them.

It is subsequent to the deposition of these Secondary rocks and, very probably, even much later—in Tertiary times—that this part of the Alps has been fashioned into mountains by the lateral pressure resulting from the gradual subsidence of the vast regions represented by the plains of Italy and the basin of the Adriatic. The result of these important dynamic processes was the formation of a complex of great folds, which are often much complicated by faulting.

The succession of the different groups of crystalline schists in this zone is conformable to the order indicated, long since, by Cordier. It is necessary to point out, however, that this upper group—that of the *talcites* (talc-schists)—contains talc only as an accessory constituent; the unctuous (talcoid) aspect being due, in reality, to the presence of certain indistinctly cleavable and fibrous varieties of mica, especially sericite. These schists may be termed sericite-schists or, abbreviated, serischists. In the purer varieties they are of a nacreous white or clear gray colour; but by the addition of chlorite they assume greenish tints and pass into chloritic and quartzose schists—the chloritoschists which attain so great a development in the whole of the Western Alps. Alternating frequently with these rocks are hornblendic schists, of which the development is very variable. In certain parts of the Italian Alps, however, especially between Ivrea and Domo d'Ossola, they become predominant.

This upper division of the crystalline schists is characterized by a more or less pronounced green tint, due to the presence of chlorite or hornblende, which recalls the name *pietre verdi*, given to these and other schists by Gastaldi and several other Italian geologists.

Below the chloritic and hornblendic schists occurs a large series of mica-schists, with which are intercalated, in conformable bedding, cipolin-limestones (*calcaires cipolins*), granular dolomites, and pure saccharoidal limestones, alternating with mica-schists and evidently forming part of the same formation.

The mica-schists become charged with felspar and pass thus into gneiss, with which they alternate. Black and white micas are associated in these rocks. In proportion as the series is descended, orthoclase becomes more abundant, and the gneisses predominate with a foliation which decreases until they pass into granitoid gneiss, in which the foliation disappears, but the broader features of stratification remain visible. This is well shown in the section of the Simplon *massif*, where the gorges of the Diveria are hollowed out, to a depth of 700 metres, in the horizontal beds of the granitoid gneiss known as the gneiss of Antigorio.

[1] "Sur la Constitution et la Structure des Massifs de Schistes Cristallins des Alpes Occidentales," par M. le Professeur Ch. Lory. "Etudes sur les Schistes Cristallins." London, 1888. (Abstracted from the French by Dr. F. H. Hatch.)