most interesting pictures shown by Dr. Cornish at the Royal Geographical Society and elsewhere, and the descriptive notes which have been prepared for the slides direct attention to the chief points of interest.

We have received from New York the first number of the *Mining Magazine*, an international monthly review of progress in mining and metallurgy. Though new in name, the magazine is really a development of the *Pacific Coast Miner*, a weekly journal of repute. It is edited by specialists, and the illustrations and typography reach the high standard that characterises American magazines. The contents are of varied interest. Mr. J. A. Church gives a sketch of mining, past and future. The geographical distribution of ores within the United States is discussed by Mr. F. L. Ransome. Mr. Carl Henrich gives an admirably illustrated account of the Guanajuato mining district of Mexico; and Mr. Henry S. Fleming discusses the commercial divisions of the competitive coal markets. Lastly, a useful index of current literature is provided.

OUR ASTRONOMICAL COLUMN.

Visibility of the Martian Canals.—In *Bulletin* No. 12 of the Lowell Observatory Mr. Lowell extends and sums up the results recently outlined by him in a communication to the American Academy of Sciences under the title "The Cartouches of the Canals of Mars." During the last opposition he made 372 drawings of the planet's visible surface on 143 nights, and by carefully examining these and eliminating all known extrinsic variations he secured sufficient data to enable him to plot a visibility curve for each canal, between January 19 and July 26, which he believes exhibits only the actual, intrinsic variability of the marking in question. This curve he calls the "cartouche" of that canal.

Analysing the 109 curves thus obtained he finds, except in three cases, a well marked seasonal variation. These curves are not exactly similar, but on arranging them in a steadily progressive order it was seen that the order was one of latitude, the increase of visibility taking place in the north polar canals first and in the equatorial canals last. The reason assigned for the earlier quickening of the polar canals is that all these markings are due to vegetable growth, which requires both warm sunshine and water for its increase, and, as the general surface of Mars is devoid of water, this growth has to await the arrival of the liberated fluid from the polar caps before it can assume its vernal appearance. Naturally, the sun having already passed the summer solstice, those portions of the planet's surface nearer to the water supply will be the first to grow the new vegetation.

Further considerations, dealt with *in extenso* in the *Bulletin*, lead Mr. Lowell to the conclusion that both the anomalies and the generalities he has discovered argue for the artificial origin of the Martian canals.

Total Solar Eclipse of 1905.—An article in the August number of the *Bulletin de la Société astronomique de France* gives a number of details concerning the eclipse of 1905, and maps showing the entire path and the sections of it which traverse Spain and Tunis. A set of diagrams showing the appearance, at various places, of the greatest phase of the eclipse, indicates that for Paris the eclipse commences at 12h. 3·1m. (Paris Civil M.T.), has its greatest phase (0·818) at 13h. 19·1m., and finishes at 14h. 31·7m.

Solar Prominences during 1903.—In No. 6, vol. xxxiii., of the *Memorie della Società degli Spettroscopisti Italiani*, Prof. Mascari summarises the results of the observations of prominences made at Catania during 1903.

Very few prominences were seen during the first months of the year, but they were notably augmented later. In January and February the phenomena presented themselves with equal intensity in each hemisphere, but in the second and third trimestres they prevailed in the northern hemisphere, whilst in the fourth they were more numerous in southern latitudes.

The number of days without prominences during 1903 was 38 per cent. of the total number of days of observation, instead of 67 per cent. as in 1902. The mean latitude of the prominences in 1903 was 42°·1, as compared with 48°·4 in the previous year. The undecennial minimum of prominence activity apparently occurred in October, 1902.

The Lowell Spectrograph.—In No. 1, vol. xx., of the *Astrophysical Journal*, Mr. V. M. Slipher gives a detailed description of the complete spectrographic equipment obtained for the Lowell Observatory from Mr. J. A. Brashear in 1901.

The chief instrument differs but little from the Mills spectrograph (Lick), and its linear and angular dispersion at Hγ, as compared with the other large instruments of its class, may be seen from the following table:—

Spectrograph	Focal length of camera		Dispersion: Linear, tenth-metres per mm.		Dispersion: Angular, for one-tenth metre
	mm.				″
Lowell	Short	386	...	14·5	... 36·8
,, ...	Long	471	...	11·4	... 36·8
Mills (Lick) ...		406	...	12·6	... 40·5
Potsdam III....	1	560	...	10·2	... 36·5
,, ...	2	410	...	13·8	... 36·5
Bruce (Yerkes)	A	449	...	10·7	... 42·8
,,	B	607	...	7·9	... 42·8

Mr. Slipher's communication gives all the details of the instrument's construction and mounting, and is illustrated by several photographs and colour-curves.

A New Band Spectrum of Nitrogen.—Whilst photographing the spectrum of the afterglow from metallic spark discharges in an atmosphere of nitrogen, Mr. Percival Lewis, of the University of California, has discovered what is presumably a new band spectrum of nitrogen. He found that the afterglow occurred only in chemically prepared, dried and purified nitrogen, and then only when a strong condenser discharge was employed.

The spectrum is discontinuous, consisting of lines and bands, some of the latter belonging to Deslandre's third group, whilst others were of unknown origin. No afterglow occurred in the metallic vapours unless there was an afterglow in the gas. New bands occur in most of the spectra obtained at λλ 2750, 2890, 3035, and 3200, whilst others, at approximate wave-lengths 3380, 3575, 3805, 4130, and 4540, only occur in some of the photographs. Of the latter bands several may be due to NO, but none of them are found in the spectrum of NO_2 (*Astrophysical Journal*, No. 1, vol. xx.).

THE PERSEID METEORIC SHOWER OF 1904.

This shower has not furnished a rich display this year; in fact, the number of meteors visible appears to have been decidedly below the average. Yet there was no moonlight to offer any impediment, and the nights were very clear just at the important time.

On August 9 there were a few Perseids, but the meteors recorded from all sources little exceeded the average number observable on an ordinary night in August, and I wrote down in my notebook that I had never seen so few meteors on August 9 in any previous year.

On August 10 there was an increase in the number visible but I made no lengthy observations.

On August 11, between 10h. 30m. and 13h. 30m., Perseids were falling at the rate of about 25 per hour for one observer, and the radiant was at 46°+58° from 37 paths. This horary rate is for an observer who registered a few of the tracks, and whose attention, therefore, was not given continuously to the sky. Mr. McHarg at Lisburn, Ireland, says that from 10h. to 11h. local time the Perseids averaged 30 to the hour. Mr. J. Webb, of Bristol, counted 21 between 9h. 50m. and 10h. 50m.; Mr. W. E. Besley, of London, saw 66 meteors in 3 hours between 10h. 30m. and 13h. 30m., and others must have been missed while records were being made. He saw meteors as bright as Jupiter or Venus at 10h. 30m., 11h. 14m., 11h. 20m., and 13h. 7m. Mr. McHarg noted a brilliant green fireball > ♀ at 10h. 20m. G.M.T. falling in Libra a little west of α and directed from ε Boötis, so it was probably a Perseid.

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On August 12 the Perseids were again in evidence, but not very abundantly. At Bristol between 10h. and 12h. 30m. there were about 17 or 20 per hour, but the watch was not quite continuous. The radiant was very sharply defined at 47°+58° from about 20 paths.

On August 13 the sky was less favourable; there was a good deal of haze, and the stars were blurred and faint; only a few Perseids were seen in these adverse circumstances.

Though the shower generally was not a plentiful one, it is likely to prove interesting in some of its results, for a number of its meteors appear to have been observed at more than one station, and their real paths can be computed.

Three features in reference to the shower of 1904 appear to the writer to deserve special mention :—

(1) The sharply defined point of radiation on August 11 and 12.

(2) The comparatively meagre character of the display.

(3) The fact that nearly all the Perseids appeared on the right (western side) of the radiant. This was very marked, and the writer has been struck with the same peculiarity in preceding years. There were many Perseids in Andromeda, Pegasus, Cassiopeia, Cepheus, and Cygnus, but few in Camelopardus, Auriga, the Lynx, and Ursa Major.

W. F. DENNING.

THE THIRD INTERNATIONAL CONGRESS OF MATHEMATICIANS.

THERE are few towns better suited for a scientific gathering than Heidelberg, and few scientific gatherings have passed off so successfully as the third International Mathematical Congress which met there from August 8 to 13. The number of mathematicians attending the congress was 330, giving with holders of ladies' tickets a total membership of nearly 400. The German Government, the Grand Duke of Baden, the municipal and university authorities of Heidelberg, the Deutsche Mathematiker Vereinigung, and an influential executive committee all joined in giving the congress a hearty welcome, and the local arrangements were perfect.

The formal proceedings opened on Tuesday, August 9, under the presidency of Prof. H. Weber, of Strasburg. The year 1904 being the centenary of the birth of Jacobi, the occasion was selected for the delivery of an address by Prof. Leo Königsberger on Jacobi's life and works. A large volume by Prof. Königsberger dealing with the same subject was published by Messrs. Teubner in connection with the present commemorations.

Another feature of the congress was the presentation, by Prof. Klein, of the first copy of vol. i. of the "Encyklopädie der matematischen Wissenschaften," which volume has just been completed. Considerable progress was also reported in the preparation of the French edition of the "Encyklopädie."

Prof. Gutzmer, of Jena, presented a history of the Deutsche Mathematiker Vereinigung, founded in 1890, as well as the July part of the *Jahresbericht* of the society, containing papers on the teaching of mathematics.

Passing on to a review of the work done in the sectional and general meetings, the most noticeable feature revealed by the general spirit in which many of the papers were written was the growing tendency in the mathematical world to devote greater attention to the practical and experimental aspects of mathematics, especially in connection with mathematical teaching. From such signs as this it appears not unlikely that we are on the eve of a renaissance period in the history of mathematics. A large collection of models, mathematical instruments, apparatus, and books was exhibited in the large hall of the museum. Prof. Runge, of Hanover, exhibited and described Leibnitz's calculating machine. A number of experiments on fluid motion past various boundaries were shown by Prof. Prandtl, of the same town. These differed from Prof. Hele-Shaw's experiments with thin films in that a vessel of some depth (say an inch or two) was used, and water or liquid of small viscosity employed; in this case a series of vortices were seen to be thrown off in succession from a cylindrical or other obstacle, and the various stages of formation of each vortex were clearly demonstrated by photographs as well as experimentally.

Prof. Greenhill's discourse on the theory of the top, considered historically, also contained an attempt to give graphical representations of the motion of the top, and was illustrated by experiments with bicycle wheels and other equally simple apparatus.

Coming to matters of more purely educational interest, Prof. Klein, in his address to the applied mathematics section, gave an amusing account of the methods in vogue in certain German middle schools for obviating the use of the calculus, a state of affairs reminding one of the old Cambridge "three days." Prof. Loria, of Genoa, stated that the attempt to abolish Euclid in Italy had failed owing to the badness of the text-books brought out to meet the new conditions, that a Government prize had been in consequence offered for a good manual on geometry, and that the books of Veronese, Enriques, Amaldi, Paolis and others were the result.

Prof. Gutzmer urged that elasticity and thermodynamics should form part of the training of every professor of applied mathematics. Resolutions were passed by the congress urging the Government to provide models and projection-lanterns for use in teaching mathematics in the German schools and technical colleges. A further resolution related to the teaching of geometrical drawing in schools.

In connection with the historical section, a resolution was passed relating to the publication of Euler's works by the Carnegie Institution. Prof. Schlesinger announced the appearance of the first volume of the works of L. Fuchs, and a bibliography of Wronski's works was presented by Prof. S. Dickstein.

Of papers in applied mathematics, the most remarkable was Prof. Sommerfeld's investigation on the motion of electrons; the remaining papers dealt *inter alia* with the problem of three bodies (Profs. Delaunay and Levi-Civita), equations of wave motion (Profs. Volterra and Hadamard), attractions (Prof. Genese), and geodesy (Prof. Börsch and others).

In pure mathematics the most striking papers were those by Prof. Hilbert on integral equations and on the foundations of arithmetic, and Prof. König's proof that the continuum cannot be equivalent to any well ordered group. Prof. Painlevé, of Paris, gave an admirable discourse on the integration of differential equations; Prof. Segre, of Turin, on the geometry of to-day; and Prof. Wirtinger, of Vienna, on Riemann's lectures on hypergeometric series. We also note papers by Prof. Schlesinger on Riemann's problem, by Prof. Borel on approximations of continuous functions, and many others too numerous to mention. Prof. E. Study showed that the paradoxical result $2=4$ could be obtained from considerations of intersections of quadric surfaces.

The congress was international in every sense, the membership including representatives of Germany, France, Great Britain, Italy, Switzerland, Austria, Sweden, Denmark, Spain, Russia, Japan, the United States, Greece, and other countries. Only seven of the members present were from Great Britain.

For the meeting place of the next congress in 1908, Rome has been selected, and the congress will take place at a somewhat earlier time of the year (probably about Easter). In this connection a prize is offered for the best thesis on the theory of algebraic gauche curves. It has been decided to hold the next following congress in England.

Not the least important feature of the congress was the large amount of local interest shown in the organisation of social entertainments. On Wednesday, August 10, a dinner was given to all the members in the new Town Hall of Heidelberg. On the Thursday we were received and entertained at Schwetzingen by the Hereditary Grand Duke of Baden. The next evening we sailed down the Neckar in illuminated barges, and on reaching Heidelberg the castle was illuminated by red fire, the proceedings ending with fireworks, including a set-piece of the Pythagorean Theorem (Euc. i., 47). The last evening we were entertained at a concert at the castle, followed by another illumination and a Kommers, for which a special song-book had been published that included a number of amusing mathematical songs written for the occasion. To make this insight into German student life more real, two delegates were elected by the students of German universities to officiate in the uniform of their corps, and with their swords.

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