History of its Fauna." In a previous essay, the author has adduced evidence to show that Celebes should be referred to the Oriental rather than to the Australasian region, the Moluccan Channel, and not the Macassar Strait, forming the division between the two areas. In the present communication, he endorses the opinion that marsupials and monotremes reached Australasia from Asia. According to the author's view, in pre-Tertiary—very likely Cretaceous—times Australia was united by land with Asia. A Euro-Asiatic fauna inhabited this land, from which during the Eocene a southern portion was cut off by partial submergence, this southern portion being the modern Australia and New Guinea, the home of monotremes, marsupials and ancient forms of other groups, such as cassowaries and birds-of-paradise, while widely distributed specialised types are wanting. Northwards extended a coral-sea, in the islands of which dwelt primitive rodents, insectivores and other ancient groups, with perhaps cuscuses. During the Miocene, great changes of level took place in the Archipelago, which attained its present form in the Pleistocene. Celebes was insulated early, Java late. Intermittent land-connections took place, which allowed of periodical immigrations of Asiatic forms from one side and of Australian types from the other. The question is left undecided whether the cuscuses of the Austro-Malay islands are remnants of the primitive Euro-Asiatic fauna or later immigrants from Australia. The suggestion is also made that the Australian and Philippine rodents are relicts of the original pre-Tertiary fauna, although it is admitted that the specialisation of Hydromys is against this. The author fails to see any evidence in favour of a former connection of Australasia with either South America or Antarctica.

THE Rev. George Grenfell, of the Baptist Missionary Society, has constructed a map of the Congo River between Leopoldville and Stanley Falls from running surveys made during 1884–89 in the steamers *Peace* and *Goodwill*. The map is in ten sections, two on a sheet, and the five sheets are published in a convenient case by the Royal Geographical Society. A reprint of Mr. Grenfell's article, "The Upper Congo as a Waterway," which was printed in the *Geographical Journal* for November, 1902, accompanies the map and serves the purpose of explanatory notes.

THE "Englishwoman's Year Book and Directory, 1903," shows in a most convincing manner the ever-increasing part that women are taking in the work of the world. The editor has again obtained able assistance in the preparation of many of the sections, those dealing with science, medicine and education being typical instances. The original work in science done by women workers, a list of colleges where women may study, the names of women holding college appointments, and a list of scientific societies of which women may be members, are some of the subjects included in the science section.

THE issue for 1903 of the well-known annual biographical dictionary, "Who's Who," is considerably larger than previous editions, though all the preliminary tables which have appeared in former years have been removed, except that enumerating the members of the Royal family and the obituary for the year ending September 30, 1902. As usual, prominence is given to the biographies of men who have distinguished themselves in various branches of science, whether pure or applied, and the information is generally trustworthy as well as interesting. The annual is one of the few which can justly be termed indispensable books of reference.

A TRANSLATION, by Prof. J. D. Everett, F.R.S., and Miss Alice Everett, of Dr. H. Hovestadt's "Jena Glass and its Scientific and Industrial Applications," which was reviewed in our issue for December 20, 1900, has been published by Messrs. Macmillan and Co., Ltd., at 15*s.* net. With a view to make the book as clear as possible to English readers, the translators have given the spirit rather than the letter of the original, and they have, in cases where it seemed desirable, added brief explanations, which are always distinguished from the text. Some few matters of subordinate interest have been condensed. The details of an important application of science to industry will, by the aid of this translation, now be accessible to British students and opticians unfamiliar with the German language.

THE permanent seismological commission appointed two years ago by the Imperial Academy of Sciences of St. Petersburg has recently issued its first report, a quarto volume of more than two hundred pages. Most of the papers are written in Russian, and only one of these is accompanied by a summary in French. Several communications deal with the foundation of the International Association of Seismology at Strassburg in 1901; in others, Prof. Lewitski describes experiments with simple seismoscopes and with seismographs the movements of which are registered mechanically. The president of the commission considers the theory of the horizontal pendulum and Mr. B. Galitzin that of other seismographs, the latter erroneously attributing Darwin's bifilar pendulum to Davison. General Pomerantzeff contributes an examination of the seismogram traced at Strassburg on June 24 1901, and concludes that it is extremely difficult to explain the oscillations of horizontal pendulums during earthquakes either by tilts of the ground or by horizontal displacements alone, although they might be produced by a combination of such movements.

A SPECIAL report on the mineral waters of Kansas has been made by Mr. E. H. S. Bailey, with the assistance of Messrs. E. B. Knerr, Crane and McFarland, for the University Geological Survey of Kansas, which is conducted under the authority of the Board of Regents of the University of Kansas. The volume runs to 343 pp. and is divided into two parts; the former provides a discussion of the subject of mineral waters in general, while the latter arranges and classifies those of Kansas and supplies full analyses of a great number of samples of them. Many illustrations and one or two maps add to the value and interest of the report.

OUR ASTRONOMICAL COLUMN.

COMET 1902 *d*.—Herr M. Ebell has calculated the following elements for this comet from observations made on December 3 (Königsberg), December 5 (Hamburg, two observations) and December 7 (Heidelberg):—

T = 1903 April 19·441 Berlin M.T.

$$\left.\begin{array}{rl} \omega = & 51^\circ\ 51'\cdot2 \\ \Omega = & 112\ 54\cdot9 \\ i = & 42\ 10\cdot5 \\ \log q = & 0\cdot17344 \end{array}\right\} 1902$$

The ephemeris which accompanies these elements estimates that the brightness of the comet on December 31 will be 2·4, its brightness on December 2 being taken as unity.

THE ALGOL VARIABLE R.V. (13, 1902) LYRÆ.—In *Circular* No. 66 of the Harvard College Observatory, Prof. Pickering gives the results of an examination of some of the Draper memorial photographs in regard to the new Algol variable, R.V. Lyræ, recently discovered by Mr. Stanley Williams. From a photograph taken July 11d. 18h. 0m., 1893, a correction of +4h. or −2h. to Mr. Williams's ephemeris is obtained, but which of these values is the right one Prof. Pickering has not yet been able to determine.

PROPER MOTION AND PARALLAX OF NOVA PERSEI.—In the *Astronomische Nachrichten* (No. 3834), Herr Asten Bergstrand details the observations he has made in order to determine the proper motion and the parallax of Nova Persei.

Using the astrographic refractors of the Upsala Observatory, Herr Bergstrand has obtained eighteen negatives of the Nova

region, and from ninety-five measurements of these negatives he has obtained the following values for the relative yearly motion of the Nova in regard to the comparison stars here given :—

Comparison Star.	Relative yearly motion of Nova. In R.A.	In Decl.
	″	″
a (B.D. +43°730) ...	+0·06 ...	±0·05
b (B.D. +43°732) ...	−0·07 ...	±0·07
c (B.D. +43°748) ...	0·00 ...	±0·07
d (B.D. +43°751) ...	+0·10 ...	±0·02

Herr Bergstrand has obtained +0″·033 as the final value for the absolute parallax of the Nova.

STAR WITH PROBABLE LARGE PROPER MOTION.—In making observations of Comet 1902 *b*, M. J. Pidoux, of Geneva, has found the position of the star B.D. −1°·3359, relative to the position of the star B.D. −1°·3360, to be $\Delta\alpha = -0s.\cdot03$ and $\Delta\delta = 10' 33''\cdot6$. In the catalogue for 1855, these values are given as −2s.·4 and −12″·1 respectively, thus showing—if the observations of M. Pidoux are confirmed—that the star has a large proper motion (*Astronomische Nachrichten*, No. 3834).

REPORT OF THE GOVERNMENT ASTRONOMER FOR NATAL, 1901.—This report deals with all the meteorological data collected during 1901 at the Government Observatory at Durban and at the thirty subsidiary meteorological stations which are scattered throughout the colony.

The equipment of the observatory has undergone no change during the year.

The table giving the yearly rainfall shows that the amount of rain which fell at Durban during 1901 was considerably above the average, being more than double the quantity recorded during 1900.

TOTAL ECLIPSE OF THE MOON, APRIL 22, 1902.—Several series of observations of this eclipse are recorded in this month's *Bulletin de la Société Astronomique de France*, and an excellent coloured plate, showing the appearance of the moon at various phases of the eclipse as seen by Dr. W. van der Gracht, of Graz (Styria), accompanies the observations made by him.

THE GREAT IRRIGATION DAM AT ASSUAN.

THE country of Egypt consisted principally in its natural state of level, arid plains with a few patches of vegetation on the higher parts. Its agricultural prosperity depends entirely on the irrigation derived from the River Nile. It is many thousands of years ago that the first attempt was made to regulate this river and make it serviceable to mankind. In the time of Menes, the west side of the river was embanked, and the water led by a system of canals and embankments to the land lying between the river and the Libyan mountains. When the river was in flood, openings were cut in the banks and the country converted into a series of lakes, the land being enriched and rendered fertile by the warp brought down in suspension by the turbid water of the river. When the floods subsided, the water drained off and the openings made in the banks were again filled up.

This system remained in existence until after the English occupation, when regulating sluices took the place of the more primitive method of cutting and making good the banks. A great depression on the Libyan side of the river was also, in the time of the Pharaohs, converted into a vast regulating basin known as Lake Mæris which was reckoned one of the wonders of the world. Afterwards the right side of the river was also embanked, and the channel enlarged and regulated.

To Joseph of scripture fame belongs the merit of having made one of the principal canals used for irrigating the land, and after the lapse of 4000 years the Bahr Usuf, or Joseph's waterway, is still doing useful work.

For records of further works of importance, it is necessary to skip over a very long period to the time of Mehemet Ali, about the year 1833, who, under the advice of French engineers, caused to be constructed the great barrage above Cairo across the Rosetta and Damietta branches of the Nile, and, by thus holding up the water when plentiful, a very large area of land is irrigated and rendered highly fertile during the dry period. When the difficulty and cost of obtaining the stone necessary for this great work was pointed out to the Egyptian ruler, it is said he at once gave orders for the destruction of so many of the pyramids as would provide the necessary material, and these monuments were only preserved by the engineers assuring the Khedive that the cost of this would be greater than transporting the stone from other places. Until the English occupation, this barrage was more or less a failure, as, owing to defective foundations, the water could not be held up sufficiently high to make the irrigation effective as it otherwise would be. When the English Irrigation Department obtained control over the works, this defect was with great skill and difficulty remedied.

It has long been recognised by the English irrigation engineers that the present system of irrigation very imperfectly makes use of the fertile properties of the Nile floods. The most perfectly irrigated lands command a rent equal to 5*l.* an acre; imperfectly irrigated land is not worth more than 1*l.* an acre, while one-third of Egypt, or about two million acres, is yet undeveloped. It is estimated that the rental value of Egypt may be increased six millions a year by an effective system of irrigation. The great bulk of the land is dealt with by the original plan of basin irrigation, where the water is carried on to the land during the Nile floods and after remaining there for about six weeks is drained off. The more effective and profitable plan is where perennial irrigation is carried on, that is, where water can be supplied, not only in times of flood, but in summer and dry seasons. To effect this it becomes necessary to store up the water in floods in impounding reservoirs and let it out as required in the dry season.

The great dam at Assuan, which was opened with much ceremony in the presence of the Duke and Duchess of Connaught and the Khedive at the beginning of December, has been constructed for this purpose. This dam, erected across the Nile, will hold up the water for a distance of 147 miles.

For several years, the staff of the English Irrigation Department was engaged in surveying the country in order to arrive at the best site for the intended reservoir, and finally it was decided that the first cataract at Assuan offered the most eligible conditions for this purpose. A scheme designed by Mr. Wilcocks, the chief of the Engineering Department, was approved. This scheme was opposed because the Temple of Philæ would be submerged, and ultimately, in deference to the objections of archæologists and the foreign members of the International Commission who had to be consulted, a compromise was arrived at and the height of the dam was reduced, allowing the temple to stand out above the level of the water. The dam has, however, been so designed that at any future time the additional height can be added to it so as to take full advantage of the natural reservoir capacity. When this is done, ten millions of rental will be added to the resources of the country at a cost of about a quarter of a million a money.

The great dam is a Cyclopæan work. It is a mile and a quarter long, constructed of solid granite and cement, and is founded on the natural bed of granite over which the river runs. The height is 82 feet, and when full it will have a head of 65 feet of water against it. The base is 80 feet and the top 24 feet wide. It is pierced by 140 lower openings 23½ feet high by 6 feet wide, and 40 upper openings. These openings are provided by doors so hung and balanced that they can be lifted and lowered with very little labour. Through these openings, the Nile water will flow in floods and the scour will carry with it the sediment that may have settled when the water is still. As the flood waters decrease, the doors will be closed and the water impounded and only allowed to escape in such quantities as will be required for irrigation during the summer months. For the navigation, a canal a mile long has been cut through the rocks with a width of 50 feet, and a lock constructed having a descent of 69 feet in four drops.

For the further regulation of the water, another dam has been constructed across the Nile 330 miles lower down, above the entrance to the Ibrahimeh Canal at Assiout, to control the irrigation below this point. Here also a lock has been made of sufficient size to allow the largest steamers using the Nile to pass through.

When this scheme of irrigation was ripe for commencement, a question arose as to how the large sum of money required for its execution were to be raised. The International Commission charged with the finances of Egypt refused to allow a charge to be made on the public debt, and without this per-