charged, and that a ruinous situation has only been saved by a recourse to self-fertilisation, which is undergoing evolution along cleistogamic lines.

THE U.S. Department of Agriculture, Division of Botany, Washington, has just issued as one of the series of "Contributions from the U.S. National Herbarium," "Notes on the Plants used by the Klamath Indians of Oregon," by F. V. Coville. The author, while engaged in a botanical survey of the plains of south-eastern Oregon in the summer of 1896, spent three days at Fort Klamath and the Klamath Indian Agency, from whence he was enabled to secure information as to the principal plants used by the Klamath Indians. The notes are now issued with a view to their use by others in securing fuller and more varied data about the aboriginal uses of plants by this tribe. The author hopes, when the necessary material has been collected, to prepare a comprehensive paper on the subject. The present list includes a few plants which give suggestions of usefulness in the arts and industries of others besides the Indians, among which may be mentioned the yellow pine-lichen, which produces a beautiful canary-yellow dye; the Rocky mountain flax, which furnishes a strong, fine fibre; and several of the tuberous-rooted perennials of the parsley family, which make palatable and nutritious foods.

WE have upon our table the following new editions:—"Elemente der Geologie," by Dr. Hermann Credner (Leipzig: Wilhelm Engelmann.) This is an eighth revised edition of a work which first appeared twenty-five years ago. It is a bulky volume of eight hundred pages, illustrated by more than six hundred woodcuts. As a handbook of general geology the work has found considerable favour in Germany.—"Physikalisches Praktikum," by Eilhard Wiedemann and Hermann Ebert. Third revised and enlarged edition (Brunswick: F. Vieweg and Son.) In this work the principles of physics are described with special reference to physico-chemical methods. The volume should be in the hands of every student of physical chemistry familiar with the German language. It is a book both for physical and chemical laboratories, and it contains a course of practical work which should be completed by every student before he begins the study of chemistry.—Messrs. Macmillan and Co. have published the first volume of the sixth edition, revised and enlarged, of "The Elementary Part of a Treatise on the Dynamics of a System of Rigid Bodies," by Dr. E. J. Routh, F.R.S. The dynamical principles of the subject are given in this first volume, together with the more elementary applications, the more difficult theories and problems being reserved for the second volume. Many additions and improvements have been made in the work.—Messrs. Hodder and Stoughton have published a cheap edition (twenty-fifth thousand) of the late Dr. Drummond's "Lowell Lectures on the Ascent of Man."

THE additions to the Zoological Society's Gardens during the past week include a Rhesus Monkey (*Macacus rhesus*, ♀) from India, presented by Mr. J. Fleming; a Macaque Monkey (*Macacus cynomolgus*, ♂) from India, presented by Mr. G. H. Cheverton; a Wood Brocket (*Cariacus nemorivagus*, ♀) from Buenos Ayres, presented by Mr. C. Passingham; a Purplish Death Adder (*Pseudechis porphyriacus*), a Brown Death Adder (*Diemenia textilis*), a Shielded Death Adder (*Notechis scutatus*) from Australia, presented by Mr. E. H. Bostock; two Grooved Tortoises (*Testudo calcarata*) from South Africa, deposited; a Green-billed Toucan (*Ramphastos discolorus*) from Guiana, purchased; three Bar-tailed Pheasants (*Phasianus reevesi*), three Amherst Pheasants (*Thaumalea amherstiæ*) bred in the Gardens.

OUR ASTRONOMICAL COLUMN.

THE PERIODIC COMET D'ARREST.—M. Gustave Leveau publishes in the *Astronomischen Nachrichten* (No. 3434) a more accurate ephemeris for D'Arrest's comet than has yet appeared. It may be mentioned that the comet has not only been observed by Mr. Perrine at the Lick Observatory, but also at the observatories of Algiers and Toulouse. By employing these observations the following ephemeris has been computed.

Ephemeris for Paris Mean Midnight.

1897		α h. m. s.		δ ° ′
Aug. 5	...	3 35 13	...	+5 43·8
,, 7	...	39 10	...	34·4
,, 9	...	43 0	...	24·3
,, 11	...	46 43	...	13·5
,, 13	...	50 18	...	2·0
,, 15	...	53 46	...	4 49·9
,, 17	...	3 57 5	...	4 37·1

NATAL OBSERVATORY REPORT.—Mr. Nevill, the Government Astronomer, in his report to the Colonial Secretary for the year 1896, points out that although he has been able with his small staff to cope with the ordinary routine work of the observatory, there is still a great amount of useful and important work which has accumulated, and which awaits printing and publishing. Among these is a valuable contribution to the theory of the moon, which consists of the reduction of all the observations of the moon to a uniform basis and their comparison with the portion of Hansen's tables, whose theoretical accuracy is undoubted. From the difference between these two results must be determined the approximate value and probable period and character of all the terms of long period and their associated terms of shorter period, which are indicated by the observations and shown by the comparison to be required to be added to the known portion of the complete theory in order to enable it to properly represent the motion of the moon. A second piece of work, which is far advanced, consists of a simple and powerful method of calculating from theory the values of such terms as those mentioned above, and to apply them to the computation of the exact values of all the terms shown to exist by the comparison between theory and observation. It may be mentioned that both these investigations have been in progress for some years, and now that they are so near completion their publication should not be delayed. The report contains a detailed account of all the meteorological observations made at the observatory for the past year, in addition to tables of "mean values" for the past eleven years.

CHRONOMETERS.—Those who are specially interested in the performance of chronometers will find Prof. Raoul Gautier's report on the "Concours International de réglage pour chronomètres de poche de haute précision," which was presented last year, a very interesting pamphlet. The object of this competition was to examine in every respect the performance of chronometers sent by standard makers, and to award prizes to those which behaved best under the given conditions. The marks were divided into four groups: 100 points for mean daily error, this must not *exceed* ± 0·75s.; 100 for mean error of position, which must not exceed ± 2·5s.; 100 for error of compensation, which must be under ± 0·20s.; and 50 for "reprise de marche," which was not allowed to exceed 5·00s. Of the 142 chronometers examined 12 exceeded 256·7 points, while 32 obtained over 233·3. The most highly rewarded "series of three chronometers" obtained in the mean 271·5 points, one of these, No. 298,225, having received 284·7 points. For further details regarding the actual errors measured, we must refer the reader to the original pamphlet, where he will find all the required information minutely discussed and tabulated.

NEW DETERMINATION OF PRECESSIONAL MOTION.—The *Astronomical Journal* (vol. xvii. No. 21) contains a new determination of the constant of precession which was undertaken by Prof. Simon Newcomb at the request of a conference held in Paris in 1896. This conference was brought together to discuss a report on what was to be considered the best system of fundamental stars to be adopted for international use. Prof. Simon Newcomb was chosen to represent this part of the inquiry, and his work having now been accomplished, he publishes, previous to his official communication, a brief abstract of the results at which he has arrived. The discussion, he tells us, was beset with difficulties, the most troublesome being the parallactic motion of the stars arising from the solar motion. Another difficulty was the fact that the proper motions of the stars did not follow the normal or exponential law of error on which the method of least squares and the practice of taking them are based. Prof. Newcomb divided the work into four parts, employing what he calls the statistical method, the method of individual stars, the method of zones and regions, and a method of which the parallactic motion is eliminated. The results may be briefly summed up in the following table.

	Struve-Peters.	New.	Diff.
	"	"	"
General precession	5025·24	5024·53	− 0·71
Luni-solar ,,	5038·23	5036·84	− 1·39
Value of 100 m.	4607·65	4607·11	− 0·54
,, 100 n.	2005·64	2005·11	− 0·53

DIAMONDS.[1]

IT seems but the other day I saw London in a blaze of illumination to celebrate Her Majesty's happy accession to the throne. As in a few days the whole empire will be celebrating the Diamond Jubilee of our Queen, who will then have reigned over her multitudinous subjects for sixty years, what more suitable topic can I bring before you than that of diamonds! One often hears the question asked: "Why *Diamond* Jubilee?" I suppose it is a symbol intended to give a faint notion of the pure brilliancy and durability of the Queen's reign; and in thus associating Her Majesty with the precious diamond, to convey an idea of those noble qualities, public and private, which have earned for her the love, fealty, and reverence of her subjects.

From the earliest times the diamond has occupied men's minds. It has been a perennial puzzle—one of the riddles of creation. The philosopher Steffans is accredited with the dictum that, "Diamond is quartz which has arrived at self-consciousness!" and an eminent geologist has parodied this metaphysical definition, saying, "Quartz is diamond which has become insane!"

Prof. Maskelyne, in a lecture "On Diamonds," thirty-seven years ago, in this very theatre, said: "The diamond is a substance which transcends all others in certain properties to which it is indebted for its usefulness in the arts and its beauty as an ornament. Thus, on the one hand, it is the hardest substance found in nature or fashioned by art. Its reflecting power and refractive energy, on the other hand, exceed those of all other colourless bodies, while it yields to none in the perfection of its pellucidity"; but he was constrained to add, "The formation of the diamond is an unsolved problem."

Recently the subject has attracted many men of science. The development of electricity, with the introduction of the electric furnace, has facilitated research, and I think I am justified in saying that if the diamond problem is not actually solved, it is certainly no longer insoluble.

GRAPHITE.

Intermediate between soft carbon and diamond come the graphites. The name graphite is given to a variety of carbon, generally crystalline, which in an oxidising mixture of chlorate of potassium and nitric acid forms graphitic acid easy to recognise. Graphites are of varying densities, from 2·0 to 3·0, and generally of crystalline aspect. Graphite and diamond pass insensibly into one another. Hard graphite and soft diamond are near the same specific gravity. The difference appears to be one of pressure at the time of formation.

Some forms of graphite exhibit a remarkable property, by which it is possible to ascertain approximately the temperature at which graphites were formed, or to which they have subsequently been exposed. Graphites are divided into "sprouting" and "non-sprouting." When obtained by simple elevation of temperature in the arc or the electric furnace they do not sprout; but when they are formed by dissolving carbon in a metal at a high temperature, and then allowing the graphite to separate out on cooling, the sprouting variety is formed. One of the best varieties is that which can be separated from platinum in ebullition in a carbon crucible. The phenomenon of sprouting is easily shown. Place a few grains in a test-tube and heat it to about 170° C., when it increases enormously in bulk and fills the tube with a light form of amorphous carbon.

The resistance of graphite to oxidising agents is greater the higher the temperature to which it has previously been exposed, Graphites, which are easily attacked by a mixture of fuming nitric acid and potassium chlorate, are rendered more resistant by strong heat in the electric furnace.

I will now briefly survey the chief chemical and physical characteristics of the diamond, showing you by the way a few experiments that bear upon the subject.

COMBUSTION OF THE DIAMOND.

When heated in air or oxygen to a temperature varying from 760° to 875° C., according to its hardness, the diamond burns with production of carbonic acid. It leaves an extremely light ash, sometimes retaining the shape of the crystal, consisting of iron, lime, magnesia, silica, and titanium. In boart and carbonado the amount of ash sometimes rises to 4 per cent., but in clear crystallised diamonds it is seldom higher than 0·05 per cent. By far the largest constituent of the ash is iron.

The following table shows the temperatures of combustion in oxygen of different kinds of carbon:—

	°C.
Condensed vapour of carbon	650
Carbon from sugar, heated in an electrical furnace	660
Artificial graphites, generally	660
Graphite from ordinary cast-iron	670
Carbon from blue ground, of an ochrey colour ..	690
,, ,, ,, very hard and black ..	710
Diamond, soft Brazilian	760
,, hard Kimberley	780
Boart from Brazil	790
,, from Kimberley	790
,, very hard, impossible to cut	900

At the risk of repeating an experiment shown so well at this table by Prof. Dewar, I will heat a diamond to a high temperature in the oxyhydrogen blowpipe and then suddenly throw it in a vessel of liquid oxygen. Notice the brilliant light of its combustion. I want you more especially to observe the white opaque deposit forming in the liquid oxygen. This deposit is solid carbonic acid produced by the combustion of the carbon. I will lead it through baryta water, and you will see a white precipitate of barium carbonate. With a little more care than is possible in a lecture I could perform this experiment quantitatively, leading the carbonic acid and oxygen, as they assume the gaseous state, through baryta water, weighing the carbonate so formed, and showing that one gramme of diamond would yield 3·666 grammes of carbonic acid—the theoretical proportion for pure carbon.

Some crystals of diamonds have their surfaces beautifully marked with equilateral triangles, interlaced and of varying sizes. Under the microscope these markings appear as shallow depressions sharply cut out of the surrounding surface, and these depressions were supposed by Gustav Rose to indicate the probability that the diamonds at some previous time had been exposed to incipient combustion. Rose also noted that striations appeared on the surfaces of diamonds burnt before the blowpipe. This experiment I have repeated on a clear smooth diamond, and have satisfied myself that during combustion in the field of a microscope, before the blowpipe, the surface becomes etched with markings very different in character from those naturally inscribed on crystals. The artificial striæ are cubical and closer massed, looking as if the diamond during combustion had been dissected into rectangular flakes, while the markings natural to crystals appear as if produced by the crystallising force as they were being built up.

I exhibit on a diagram a form of graphite from the Kimberley blue ground (reproduced from M. Moissan's work), which in its flaky crystalline appearance strangely resembles the surface of a diamond whose internal structure has been partially dissected and bared by combustion. It looks as if this piece of graphite was ready to separate out of its solvent as diamond, but owing to some insufficient factor it retained its graphitic form.

[1] A lecture delivered at the Royal Institution, June 11, by William Crookes, F.R.S.