MESSRS. J. J. GRIFFIN AND SONS have recently published the third edition of their illustrated and descriptive catalogue of chemical apparatus. A few of the new instruments are worthy of notice. For instance, a new pattern of Tate's air-pump, described in the catalogue, has been designed with valves at each end of the barrel so that no air can exist between them and the pistons, hence, at each stroke, all the air contained in the barrel is expelled. Metallurgists will be interested in a new form of gas furnace capable of carrying on operations at a white heat without the aid of a blower; the power of the furnace may be judged from the fact that one pound of cast iron can be melted in thirty-five minutes. A cathetometer which enables the operator to turn the telescope in any direction without moving the instrument bodily, is another noteworthy feature. Arnold and Hardy's apparatus for the estimation of sulphur in steel and steel-making iron; benzoline blast furnaces attaining a temperature of 2100° F.; Prof. Roberts-Austen's electrical pyrometer; and many other pieces of apparatus, for use in teaching and research, have been introduced into the catalogue.

A CONSIDERABLE addition to our knowledge of the chemical history of hydrazine or diamide and its derivatives is contributed by Prof. Curtius, its discoverer, and his assistants, to the current issue of the *Journal für praktische Chemie*. An interesting account is given of the position of diamide as a salt-forming base, and its relations in this respect to ammonia and the fixed alkalies. Diamide itself, $\begin{array}{c}NH_2\\|\\NH_2\end{array}$, is an extremely unstable substance, so much so that it is still doubtful whether the anhydrous gas has yet been obtained, or is even capable of separate existence. On the other hand, the liquid hydrate, $N_2H_4.H_2O$, is a very stable substance, as Prof. Curtius has long ago shown. It is interesting to note that this is the opposite of what is the case with ammonia, where the gas itself is stable and the hydrate particularly unstable. Moreover, while ammonia is a mon-acid base, diamide is di-acid; and just as we accept the idea of a hypothetical ammonium radicle NH_4, so we are bound likewise to admit the conception of a divalent radicle $\begin{array}{c}NH_3\\|\\NH_3\end{array}$, which Prof. Curtius terms diammonium, in the hydrazine salts. Thus the normal chloride of hydrazine is $\begin{array}{c}NH_3Cl\\|\\NH_3Cl\end{array}$ and the sulphate $\begin{array}{l}NH_3\\|\\NH_3\end{array}\!\!>SO_4$. Diammonium would thus seem to be analogous to the divalent metals of the alkaline earths, and the parallel would appear to be further justified by the sparing solubility of the sulphates and their inability to form alums with sulphates of the alumina group. On the other hand, diammonium exhibits properties which point to a close similarity to the alkali metals. For the hydrate behaves in by far the greater number of instances as a mon-acid base, like ammonium hydrate. The neutral chloride above mentioned, $N_2H_6Cl_2$, decomposes below 100° into hydrogen chloride and the chloride N_2H_4HCl, which cannot be made to lose more hydrochloric acid without destruction of the base. The hydrate $N_2H_4.2H_2O_2$ is only capable of existence in solution; it passes on evaporation into the hydrate $N_2H_4.H_2O$, which latter substance boils without decomposition. Dry ammonia gas only displaces half the acid of the sulphate $N_2H_4.H_2SO_4$, and leaves the stable sulphate $(N_2H_4)_2H_2SO_4$. Moreover, Prof. Curtius has only succeeded in preparing one nitrate, $N_2H_4.HNO_3$, and one thiocyanate, $N_2H_4.SCNH$. Hence he concludes that diammonium is capable of acting both in a monovalent capacity as $(N_2H_5)'$, and as a divalent radicle $(N_2H_6)''$, the former resulting in the production of the more stable salts.

PROF. CURTIUS has succeeded in preparing a large number of double salts containing diammonium, and describes them in a separate memoir in conjunction with his assistant, Herr Schrader. Ammonium, as is well known, forms three classes of double salts containing sulphuric acid, namely, the alums, the double sulphates with $6H_2O$, and the peculiar and as yet little understood salts usually formulated as $R''SO_4.nNH_3$ in which the anhydrous gas is assumed to enter into combination with the metallic sulphate. All efforts to obtain alums containing diammonium sulphate, $N_2H_6SO_4$, have so far failed: but salts of the other two types, containing the more stable sulphate $(N_2H_5)_2SO_4$, are readily obtained. It is somewhat singular, however, that they contain no water of crystallisation, a fact which is possibly explained by the difficult solubility of the compounds. The divalent metals present may be copper, nickel, cobalt, iron, manganese, cadmium or zinc, but not magnesium. They are at once precipitated upon mixing concentrated solutions of the metallic sulphate and diammonium sulphate. It is further remarkable that the latter may be either of the two sulphates of diammonium; indeed, the solution may contain free sulphuric acid. Moreover, the sulphate $N_2H_6SO_4$ is difficultly soluble, while the more stable sulphate $(N_2H_5)_2SO_4$ is deliquescent, and yet the sparingly soluble double salts always contain the deliquescent diammonium sulphate. In addition to these, salts of the type $R''SO_4.2N_2H_4$ and $R''SO_4.3N_2H_4$ have been obtained; in those of the former type R'' may be zinc or cadmium, corresponding to the ammonia compounds $R''SO_4.4NH_3$, and in those of the latter type nickel or cobalt, these salts being analogous to the well-known compounds $NiSO_4.6NH_3$ and $CoSO_4.6NH_3$. In direct opposition to the ammonia compounds, the salts containing anhydrous hydrazine are almost perfectly insoluble in water.

THE additions to the Zoological Society's Gardens during the past week include two Pig-tailed Monkeys (*Macacus nemestrinus*, ♂ ♀) from Java, a Vervet Monkey (*Cercopithecus lalandii*, ♀) from South Africa, presented by the Rev. Sidney Vatcher; a Rhesus Monkey (*Macacus rhesus*, ♀) from India, presented by Mr. E. Logan; a White-backed Piping Crow (*Gymnorhina leuconota*) from Australia, presented by Miss Vincent; a Manx Shearwater (*Puffinus anglorum*) from Cornwall, presented by Mrs. E. S. Smith; two Robins (*Erithacus rubecula*), South European, presented by Mr. A. T. Binny; a Chameleon (*Chamæleon vulgaris*) from North Africa, presented by Mr. W. L. Strong; a Deadly Snake (*Trigonocephalus atrox*) from Trinidad, presented by Dr. A. Strading; a Yak (*Poëphagus grunniens*, ♂), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

THE RIO DE JANEIRO OBSERVATORY.—The Brazilian National Observatory, situated on the Morro do Castello, the most easterly hill of Rio de Janeiro, is to be removed. The *American Meteorological Journal* reports that the unfavourable situation of the Castello for astronomical observations has led to the selection of a site across the bay, near Petropolis, at an elevation of about 3500 feet. A road is now being built up the mountain, and it is hoped that the new observatory will be completed within two years. The sum of five hundred thousand dollars has been voted by the Government for the installation.

OBSERVATIONS OF MARS.—The current number of the *Observatory* contains a short article in which Mr. Stanley Williams directs attention to certain important features of Mars, which, it will be remembered, is in opposition on Saturday. With regard to the canals or channels, he remarks that a few points upon which observations are desirable are: "How far is the visibility of the canals in different parts of the planet affected by seasonal changes? Their duplication, when does it occur? How long does it last? How does it occur? And again, how far is it subject to seasonal changes?" Mr. Williams commenced observations in the latter part of August, and he found that the plainer canals were conspicuous, and even those of average distinctness could be seen without much difficulty. At the date of writing (September 18) he had observed about thirty of the canals, although only about two-thirds of the planet's face had been examined. *Ganges* was seen double on August 29, but not so clearly as in 1892. *Gehon* was also seen plainly double on the same date. Three other canals—*Eunostos*, *Cyclops*, and *Cerberus*—were found distinctly duplicated, and the germination of *Phison* was suspected. The observations were made almost exactly at the time of the summer solstice of Mars' southern hemisphere. Mr. Williams has observed a few small dark spots similar to the "lakes" detected by Prof. W. H. Pickering at Arequipa in 1892.

THE MASS OF MERCURY.—M. Backlund's recent researches on the mass of the planet Mercury, and the acceleration of the mean movement of Encke's comet, are described by M. Callandreau in *Comptes-rendus* of October 1. Encke's comet is interesting not only on account of the diminution of its period of revolution (about two hours from one apparition to the next), but also from the fact that its movement is disturbed by Mercury. A discussion of the seven apparitions of the comet between 1871 and 1891 has led M. Backlund to conclude that Mercury has a much smaller mass than has hitherto been ascribed to it. The value obtained is

$$\text{Mass of Mercury} = \frac{1}{9,647,000}.$$

It would, therefore, take about 9,700,000 bodies like Mercury to make up the mass of the sun.

To account for the acceleration of Encke's comet, it has been supposed that a resisting medium of some kind is uniformly distributed round the sun. M. Backlund, however, thinks that all hypotheses of a continuous resisting medium of uniform density ought to be discarded, and that the resistance is very probably met only in certain regions. This idea is a very plausible one, for, according to Laplace's hypothesis, in the formation of the planets from the solar nebula, all the substance of the rings would not be used up in the process, and some of it would without doubt travel along the planetary orbits as clouds of very light material. It is suggested that Encke's comet passes through nebulous clouds of this kind, and that the resistance they offer causes the observed acceleration of the mean motion.

BRORSEN'S COMET 1851 III.—This comet first appeared in the month of August 1851, moving in the constellations of Bootis and Draco. On forty-one evenings observations were made, besides numerous measures of position with micrometers, and many have been the attempts to deduce an accurate orbit. Among these may be mentioned Rümker (*Astr. Nach.*, No. 771), Vogel (*Astr. Nach.*, No. 774), Brorsen (*Astr. Nach.*, No. 775), and Tuttle (*Astr. Journal*, II.), who found parabolic elements, none of which satisfied the observations sufficiently. At a later date Brorsen obtained elliptical elements (*Astr. Nach.*, No. 782), which he compared with all the then known observations. In the communication before us, on a new determination of the orbit of this comet by Dr. Rudolf Spitaler (lxi. *Denkschriften der Math. Naturwiss. Classe der k. Ak. der Wissenschaften*), the writer makes use of some new observations and more accurate places for the camparison stars. To limit this note we will state in a few words the result he has obtained. The most probable parabolic elements after two or three "verbesserungen" were

$$\tau = 1851 \text{ August } 26 \cdot 2523 \text{ Paris Mean Time.}$$

$$\left.\begin{aligned} \pi &= 310^\circ\ 57'\ 25''\cdot 7 \\ \Omega &= 223\ \ 40\ \ 21\cdot 2 \\ i &= \ \ 38\ \ 12\ \ 57\cdot 5 \end{aligned}\right\} \text{Eq. } 1851\cdot 0.$$

$$\log q = 9\cdot 9933272$$

An attempt to improve this led to elliptic elements as follows:—

$$\tau = 1851 \text{ August } 26 \cdot 249997 \text{ Paris Mean Time.}$$

$$\left.\begin{aligned} \pi &= 310^\circ\ 57'\ 19''\cdot 2 \\ \Omega &= 223\ \ 40\ \ 33\cdot 9 \\ i &= \ \ 38\ \ 12\ \ 52\cdot 9 \end{aligned}\right\} \text{Eq. } 1851\cdot 0.$$

$$\log q = 9\cdot 9933235$$
$$e = 0\cdot 9999151$$

Both these elements give ephemerides which agree well with the observations, and can be looked upon as accurate within the limit of error of the observations.

M. PAPAVASILIORE ON THE GREEK EARTHQUAKES OF APRIL, 1894.[1]

THE earthquake series to which this abstract refers consisted of two principal shocks and a large number of minor ones, the former felt throughout all Greece and far beyond, but chiefly affecting the north-east region of continental Greece, and especially the province of Locris.

The first great shock occurred on April 20, and was registered by a seismoscope at the observatory of Athens at 6h. 52m. p.m., Athens mean time. The region in which much damage was done may be divided into three principal zones. (1) The epicentral zone, comprising the peninsula of Æolymion (west of Cape Theologos). Three villages were completely destroyed; 180 persons were killed, and 27 wounded. (2) The zone in which nearly all the buildings were overthrown. This is in the form of an ellipse whose major axis is 28 km. long, and extends in a south-east and north-west direction from the Bay of Larymne to near Cape Arkitza; the minor axis is 8 to 9 km. in length. Nine villages were affected; 44 persons were killed, and 20 wounded. (3) The zone in which houses were much damaged or partially fell, also in the form of an ellipse. The major axis is 90 km. in length, directed south-east and north-west, and reaches from Dritza to near Molos. The minor axis is 65 km. long, and extends from Levadia to Mantoudi in the Island of Euboea.

During the night of April 20-21, the ground in the first and second of these zones was in a state of almost incessant disturbance, interrupted often by stronger shocks. For three days shocks were very frequent throughout all three zones; then they became more and more rare until, on April 27, a second great shock occurred, more violent than the first, and registered at the Athens Observatory at 9h. 21m. 6s. p.m., Athens mean time. The same continual disturbance of the ground followed as before.

This second shock disturbed a greater area than the first. The major axis of the second zone is 30 km. longer, especially towards the north-west; it reaches from the Bay of Scroponeri to St. Constantin. The major axis of the third zone is lengthened by about 22 km. to the town of Lamia. The minor axes of these zones are also several kilometres longer, especially on the south-west side. The same villages suffered, but the amount of damage was greater.

This earthquake was a remarkable one in several ways. At the moment of the shock, the sea rose in a wave which submerged the whole coast from the Bay of St. Theologos to St. Constantin. The water afterwards retired, except in the Plain of Atalante, where the greater part of the coast is now submerged for a distance of some metres. Several springs have ceased to run, while others have increased their flow. New thermal springs have started up at Ædipsos, near pre-existing ones, and similar in nature. Numerous fissures, occasionally some kilometres in length, have been formed.

But the most remarkable phenomenon of all is the production of a great fissure about 55 km. long. Its breadth varies from a few centimetres to three metres, according to the nature of the ground, being on an average about half a metre. It extends in a constant east-south-east and west-north-west direction from the Bay of Scroponeri through Atalante, until it disappears near St. Constantin. This fissure appears to be a fault, on account of (1) its extraordinary length and its parallelism to the Gulf of Euboea; (2) the constancy of its direction and its independence of geological structure; and (3) the existence of both a throw and horizontal displacement along the fissure, causing a lowering of the Plain of Atalante and a slight shift towards the north-west. The throw is generally very small, often zero on Cretaceous ground, reaching several centimetres on the Tertiary formations, and as much as $1\frac{1}{2}$ metres on the alluvial beds of the Plain of Atalante.

M. Papavasiliore regards this fault as one of the series which, at the end of Tertiary or beginning of Quaternary times, gave rise to the Gulf of Euboea, and the recent earthquakes as due to orogenic movements by which the width of the gulf may in future be still further increased.

C. DAVISON.

[1] Abstract of two papers by M. S. A. Papavasiliore: (1) "Sur le tremblement de terre de Locride (Grèce) du mois d'avril 1894"; (2) "Sur la nature de la grande crévasse produite à la suite du dernier tremblement de terre de Locride."—*Comptes-rendus*, vol. 119, 1894, pp. 112-114, 380-381.