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.