time ball, also, was not fit to drop the ball, the blow of the hammer failing to discharge the bolt, so that the hammer had also to be struck at the instant the current arrived from the clock. The coil was fused by lightning on June 12, and from that date until November 20, the ball was dropped by hand. Since November 22 a new lock has been fitted, which gives satisfaction.

The time-ball tower is erected on Tsim-sha-tsui Point, directly facing the shipping. It stands in front of the new police-station beside the mast for hoisting meteorological signals, at the foot of which the typhoon gun, pointed towards the city opposite, is placed. In the police boat-basin, at a short distance north-west of the tower, the small observatory is built. The time-ball tower is about half a mile distant from the observatory, with which it is connected by wire. The base of the tower is about 40 feet above sea-level, and the top of the ball-mast about 84 feet. On the ground-floor is a massive granite pier, which supports the entire apparatus. Dr. Doberck describes at considerable length the arrangements for dropping the ball, for breaking its fall, and for ascertaining that the fall has taken place at the proper instant, but they do not call for special remark. The accuracy of the time-ball signal at 1 o'clock depends, he says, practically upon the error of the standard clock being accurately determined. If the weather has permitted transit observations to be made the previous evening, the error of course will be pretty closely known; otherwise the regularity of the rate of the standard clock must be trusted to. A table of the errors of the time-ball in 1885 is given, showing that the mean probable error of the signal for each month is about 0·2s.

The time service is at present confined to the dropping of this ball, but there would be, Dr. Doberck points out, no difficulty in dropping any number of time-balls along the coast or distributing hourly time-signals to the principal public buildings, &c.

The observatory possesses three chronometers, the rates of which are here given. Of the three, two keep mean-time, and one keeps sidereal time, but one of the former is useful only as a hack watch.

The equatorial of the observatory is the Lee equatorial, described by Admiral Smyth in the "Speculum Hartwellianum" and the "Celestial Cycle." The great length of the polar axis renders the instrument unsteady and sensitive to every motion of the observer. A Maclean star spectroscope has been fitted to it. The object-glass appears to be still in good condition.

The meteor shower (the Andromedes) of November 27 was observed, and it was estimated that about 2000 meteors an hour were visible, most being small; none being brighter than the first magnitude, and only a few so bright. The radiant was determined to be at R.A. 27°, Decl. 40° N., but it was at least 3° in diameter.

THE RAINFALL OF THE CAPE COLONY

OBSERVATIONS of rainfall were begun in the colony about forty-five years ago, but until 1876 no general system of registration was in force; and, except in the case of the Royal Observatory and a few other stations, no continuous records were available. In 1876, however, Mr. John G. Gamble, M.A., M.Inst.C.E., the Hydraulic Engineer to the Colony, induced the Government to grant a sum of 100*l.* for the purpose of establishing rain-gauges throughout the country. This grant has been continued yearly since then, with the result that, although the sum is quite inadequate for the speedy erection of the number required, there are now 250 gauges from which monthly returns are obtained. A gauge is placed at every seat of magistracy, and private persons are also supplied with gauges free of charge on condition that they observe continuously for five years, and forward monthly returns to the Meteorological Commission at Cape Town. All the services rendered by the observers are gratuitous. The monthly returns are tabulated and printed together with other meteorological observations in a report by the Meteorological Commission, which is presented annually to the Colonial Legislature.

At the end of 1883 there were 75 stations at which records had been kept for at least five years. An appendix showing the average rainfall for each month of the year at these stations was published by the Meteorological Commission in their 1883 report, and in their report of the following year some diagrams plotted from these averages were included, which show more strikingly than figures the fluctuation of the rainfall from month to month.

That the observations begun ten years ago are beginning to bear good fruit is evident from the series of rainfall maps exhibited in the Court devoted to the Cape of Good Hope at the Colonial and Indian Exhibition. There are sixteen maps altogether, fourteen of which have been compiled by Mr. Gamble and two by Mr. W. B. Tripp, F.R.Met.Soc. One of those by Mr. Gamble shows the position of the gauges and the districts into which the colony has been divided for the purpose of rainfall registration; the others represent, by means of different colours, the general distribution of rainfall for each month of the year and for the whole year. The contours on the maps for the various months show differences of 1 inch in the rainfall, starting from a contour indicating the area where the fall is less than 0·5 inch. The contours on the map for the year indicate differences of 12 inches, beginning at 6 inches, and going up to 54 inches. The number of inches of rainfall at the various places is marked in figures.

Mr. Tripp's maps are intended to show the relation between the physical configuration of the country and its rainfall—one map representing contour-levels every 1000 feet up to 4000 feet, and the other representing the mean annual rainfall.

A casual examination of the various maps is sufficient to show that the conditions which determine the rainfall are not the same for the whole of South Africa. Thus in the south-west district of the Western Province the chief portion of the rain falls in the winter months, while in the Eastern Province, and in Natal and the Orange Free State, the greater portion falls in the summer, from October to March. On the southern seaboard of the Cape Colony the rainfall is irregularly distributed throughout the year, the greatest monthly fall at any place varying from one-ninth to one-eighth of the total.

A glance at Mr. Gamble's map showing the distribution in the year, shows that the north-west part of the colony is almost rainless. With the exception of the tract occupied by the Namaqualand Mountains, the average yearly fall in this desert is less than 6 inches; at Pella, a village on the Orange River, the rainfall for the year is 2½ inches, one-fifth of which falls in May. Some of the months at this place are rainless. Throughout the greater part of the colony the yearly rainfall varies from 6 to 18 inches, the smaller falls being characteristic of the regions in the interior, generally known as "The Karroo," from 2000 to 4000 feet above sea-level, and of a plateau nature; while the greater falls are found nearer the sea, and in the mountainous parts. In the south-west district, excluding the Cape Peninsula, and on the narrow strip of country on the south coast, between Swellendam and Port Elizabeth, the yearly rainfall ranges from 18 to 30 inches, except in the forests of George and Knysna, where it exceeds 40 inches. In the Cape Peninsula the rainfall varies from 25 inches at the Royal Observatory to 54 inches on the south-east side of Table Mountain. In the eastern districts of the colony, and in the neighbouring territories, where the main portion of the rain comes in summer, the fall averages from 18 to 30 inches,

with somewhat higher records from the Amatola forest region. There are doubtless many places in this great tract, notably in the Drackensberg, where the rainfall exceeds that shown on the maps, but there are no records to admit of the area being mapped.

With regard to the causes which determine the variation in the rainfall, Mr. Gamble has pointed out that this is due chiefly to the sea-currents and the prevailing winds. "Natal and the Eastern Province (of the Cape Colony) get their rains chiefly in summer, when the south-east trade wind blows," while "the western portion of the Western Province gets its rain mainly in winter with the north-west wind" (*Trans.* Philos. Society of South Africa). From whatever direction the rain may come, it seldom penetrates beyond the mountain-range which runs parallel to the coast. This barrier, as shown by Mr. Tripp's contour map, separates the elevated central plateau from the tract of lower country on the coast. During some of the summer months it would appear as if the south-east clouds were carried over parts of this barrier, but generally all the rainfall in the midland districts of the colony comes from thunder-showers of a very local character, heavy rain falling on one farm, while it is dry all round. It might be asked why, if the western portion of the Western Province gets its rain with a north-west wind, should the midlands not get their supply from the same source. To this Mr. Gamble answers: "We may note that the anti-trade of the Western Province comes apparently from a portion of the equatorial regions that is occupied by sea, while the north-west winds that blow in the Eastern Province, if they really keep their theoretical curvilinear path and are not interfered with by the height and temperature of the ground, come from a portion of the equator where there is land and consequently small evaporation."

As might be expected, the areas occupied by given rainfalls alter in position and size from month to month, but these fluctuations cannot well be described without the aid of maps. It may be noted, however, that in May, which marks the beginning of the wet season at Cape Town, the area over which the rainfall varies from 0·5 to 1·5 inch occupies nearly the whole of the colony. The maps for October to March are extremely interesting, as marking the gradual advance of the rains which come from the south-east. Concerning droughts and floods, Mr. Gamble has made the pregnant remark:—"It is frequently said that in such and such a year there was a drought in the colony; in another year, heavy floods in the colony. This way of speaking is incorrect, for, in consequence of the very distinct climates of the east and and west respectively, it is very rare that a drought occurs all over South Africa at the same time."

As the future prosperity of South Africa depends on irrigation, it is almost needless to point out the importance of the work done by Mr. Gamble. Considering the small outlay which has been incurred, the results are remarkable. Whether the work will in future be carried on in the same scientific spirit as it has been hitherto is somewhat doubtful in view of the backward tendency at present in course of development in the colony.

THOMAS STEWART

FERDINAND STOLICZKA

IN an interesting memoir, published by order of the Government of India, Mr. V. Ball gives a sketch of the life and work of Dr. F. Stoliczka, for many years Palæontologist to the Geological Survey of India. This memoir appears in connection with the publication of the scientific results of the second Yarkand mission, of which Stoliczka was Naturalist, and during the return journey of which he met his untimely end.

Born at Hochwald, in Moravia, in May 1838, Stoliczka obtained his early education at Prague, from whence he proceeded to Vienna, where he took the degree of a Doctor of Philosophy. To Prof. Süess he was indebted for his first regular training in geology, and he received the kindliest help in palæontology from Dr. Hörnes, who was for some years Director of the Austrian Imperial Mineralogical Cabinet, and was well known by his researches on the Mollusca of the Vienna Tertiary. He died in the prime of life, but not before he had seen the firstfruits of Stoliczka's labours on the Cretaceous fossils of India. Stoliczka's first contribution to science was made (1859) to the Vienna Academy of Science as a memoir on some fresh-water Mollusca from the Cretaceous formation of the North-Eastern Alps, and in 1861 he became one of the staff of the Austrian Geological Survey, of which Dr. Haidinger was then the chief. Here he had the fullest opportunities of working at his favourite pursuit, and well does he seem to have availed himself of them. There was a conscientious accuracy as well as an extensive knowledge of his subject displayed in Stoliczka's writings of this period that early marked him out for a brilliant career.

In the year 1862 he received the appointment of Assistant to the Geological Survey of India, and was present with Dr. Oldham, the Superintendent of the Survey, at the meeting of the British Association at Cambridge over which Prof. Huxley presided. There are many who may still remember his slight figure, and dark hair brushed back: in after days he became rather stout. At that time he knew but a few words of English, but very shortly afterwards we find him not only speaking and understanding English well, but actually writing notes in his journal in English.

On his arrival at Calcutta he at once commenced to work on the Cretaceous fossils of Southern India, and the splendid series of memoirs on these forms, of which Part 1 appeared in 1863, was not completed until ten years afterwards. These memoirs, in which as to the Belemnites and Nautilus he was assisted by Mr. Blanford, form a work of over 1400 pages, illustrated by 176 plates, a record in itself of a laborious life. The work of arranging and describing the fossils collected by others was, however, only a small portion of the work performed by Stoliczka. He threw himself with ardour into everything that pertained to the natural history of his adopted country, and there was scarcely a division of the animal kingdom that he had not a tolerable acquaintance with, and to the published records of which he did not add something—Mammalia, birds, reptiles, molluscs, Polyzoa, arachnids, Crustacea.

From time to time his work took him from the Museum workshops, and he visited now the North-Western Himalayas, and again the Andaman Islands, and portions of Burmah. In all and every place he visited he found something new and interesting, and by the numerous papers which he published as the result of his travels, one might almost follow him in his journeyings.

In 1873 it had been arranged that Stoliczka should go to Europe to take charge in part of the splendid collection of minerals and fossils sent to the Great Exhibition of Vienna from the Geological Survey of India, but he was tempted to go instead as one of the mission from the Government of India to the King of Yarkand and Kashgar. On May 17 he left Calcutta on a journey from which he never returned. Yarkand was reached on November 8. Early in October, and shortly before crossing the Sanju Pass (16,500 feet high), Stoliczka had been seriously ill from apparently a slight attack of spinal meningitis, from which, however, he rallied, and he seems to have enjoyed the three weeks' sojourn at Yarkand. On December 4 Kashgar was reached, but the formal presentation to the King of Her Brittanic Majesty's letters did not take place till January 10, 1874. In February an excursion was made to Artish and Kalti Ailak, and on March 17 leave was