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

taken of the King, and the return journey to India commenced. Returning by Yarkand, the Kara-korum Pass was ascended on June 16, and Stoliczka seems to have suffered from the great height. On the 17th the last record appears in his journal. On the 18th the first symptoms of a new attack of spinal meningitis showed themselves, and, despite all the care of his devoted friends, he breathed his last on the afternoon of the 19th, some eleven marches from Leh, where he was buried beneath a willow-tree. The Government of India placed a suitable inscription over his grave, and other evidences of the esteem and regard in which his memory is held will be found in the Museums of Calcutta and Vienna. And now another, and this not the least, will be found in this too brief, but sympathetic, record of his life and labours, written by one who knew him well, and who was able to appreciate not only the scientific labours of his friend, but his honesty and loyalty. A detailed list of all the scientific papers and published letters of Stoliczka between 1859 and 1874 is appended to this memoir.

THE IRON AND STEEL INSTITUTE

THE summer meeting of this Institute was held on the 6th to the 8th inst., in London, under the presidency of Dr. John Percy, F.R.S. In his introductory remarks, the President made special reference to some of the papers about to be read. He was very pleased to see that the employment of chromium in the manufacture of steel was receiving attention. As far back as 1821 Bertheir, in the *Annales des Mines*, had shown that iron with 1 to 1·5 per cent. of chromium forged well, whilst it took a keen edge when ground, and had a very high tenacity.—Dr. Percy exhibited a portion of a broken ploughshare of American manufacture, which was formed of three metals, and seemed to be produced by casting steel on both sides of malleable iron. He drew attention to mitis metal, but refrained from offering any opinion on the subject, referring simply to the statements put forward that by the use of aluminium in its composition the melting-point was lowered, whilst, as the product was more liquid, it ran better, and sound castings were more easily produced. In speaking of Indian metallurgy, reference was made to the iron column at Delhi, the largest piece of forged iron in the world. The President next drew attention to the development of iron and steel-making in the United States, showing its rapid progress, and how enormously the capacity for production, both in that country and here, was in excess of the demand, as regarded blast-furnaces, Bessemer converters, and open-hearth furnaces. The address concluded with some remarks on diminished cost of production; to what a degree this has been carried, and the influence it has had on the labour market may be inferred from the circumstance that nowadays a single lace-making machine does the work formerly done by 2000 women, that wood-planing, which used to cost 12*s.* per square foot, is now done for 2*d.* or 3*d.*, that the manufacture of gold chains has been reduced from 30*s.* to 3*s.* 6*d.*, and that a gross of steel pens may now be procured for 4*d.* which used to cost 7*l.* Sir Henry Bessemer proposed a vote of thanks to Dr. Percy for his address, which was seconded by Mr. Adamson, the President-Elect.

The first paper read was that of Sir Frederick Abel, F.R.S., and Colonel Maitland, Superintendent of the Royal Gun Factories, Woolwich, on the erosion of gun-barrels by powder-products. This, in the author's opinion is due to a softening, if not fusing, effect exerted upon the surfaces of the metal by the high heat of the explosion, an increase of this softening or fusing effect by the chemical action of the sulphur at the high temperature produced, and the mechanical action of the rush of gases, vapours, and liquid products upon the softened or fused surfaces. There are two kinds of scoring or erosion: muzzle-loading scoring is due to the rush of powder-products over the top of the projectile through the clearance or windage, which has to be allowed for facility of ramming home the shot along the bore in a muzzle-loader; breach-loading scoring is produced by the rush of the powder products behind a shot, acting as a gas-tight plug, during and immediately after its passage through the gun. Evidently erosion will increase with the amount of the powder products, with the pressure in the bore, and with the duration of the time of action, and it is important to ascertain what material best resists erosion by powder products, or what treatment of the material is best calculated to increase its power of resistance to erosion. With this object in view experiments were made on thirteen rifled barrels, of different steels, of 2¼ inch bore, firing 100 rounds each with 10¼ lb. charges of pebble powder and 6 lb shot, fitted with service driving rings; these barrels were screwed into the mouth of the chamber of a 22 cwt. breech-loader. Gutta-percha impressions were taken after each batch of twenty-five rounds. During the preparation of the barrels specimens were cut in prolongation of the bores and tested mechanically, and the proportions of carbon, silicon, and manganese were determined in samples of the metal. The average pressure of the gas was 13 tons to the square inch. The results of the experiments are given in a table, but neither the chemical analysis of the metals nor the testing machine gave any assistance in accounting for the position of the barrels in the mean order of merit in which they were placed by five skilled and independent observers. Thus the worst and the worst but one were respectively the highest and nearly the lowest in carbon, the first, fifth, and tenth were very closely allied both in analysis and as tested by the machine, and it became evident that some agency, hitherto unsought for, dominated the results. Separate and independent investigations were made by the writers of the paper, the one instituting a chemical and the other a mechanical examination of the metals. A chromic solution capable of exerting a very slow solvent action upon the metals brought their structure into relief, and the extent of erosion was found to be more or less referable to the less or greater amount of mechanical treatment the metal had received, and to the consequent extent to which uniform fibrous structure had been developed. Experiments made on the metal as cast, and forged to twice to four times, and to eight times its length proved that the more steel was forged or worked the less it suffered from the eroding effect of powder gas. This was found to be the case both as regarded hard and soft metal. Several members took part in the discussion, notably Mr. Adamson, Sir Frederick Bramwell, Sir Henry Bessemer, and Mr. Frederick Siemens.

The next paper, which was taken as read, was an elaborate report of 137 pages in length by Messrs. P. C. Gilchrist and E Riley, "On the Iron-making Resources of the British Colonies and India, as illustrated at the Colonial and Indian Exhibition." It would appear the reporters are of opinion that, so far as the exhibits are concerned, the iron and coal-producing power of the Empire is rather undershown, as with a proper application of the materials at the disposal of our colonies and India, they should at all events be able to supply their own requirements.

The next papers read were: "On some Early Forms of Bessemer Converters," by Sir Henry Bessemer, F.R.S., and "On Modifications of Bessemer Converters for Small Charges," by John Hardisty. The first of these contains descriptions of the different forms of converters selected by the author as typical of the whole, and which embrace the main features of ten several forms of apparatus which he has from time to time designed for the conversion of crude iron into steel. It was written with the double object of letting those who are seeking to improve the