

GENERAL VIEW OF THE ASTRONOMICAL STATION AT CAROLINE ISLAND.

suffers less from the direct rays of the sun, and not at all from the reflected and radiated heat. As the entire route from Suakin to Berber is subject to heats fully equal to those of the vicinity of Suakin, it may be safely asserted that it is impracticable for European foot-soldiers to make the march between those two points during the spring and summer months, except by using the night and early morning exclusively for marching.

The climate of the province of Berber is very similar to that of Dongola; but, owing to the effects of the waters of the river Atbara, in some parts of this province fevers are more prevalent during the summer months, and of a worse type than in Dongola.

In the province of Taka and the district of Gallabat, the climate from June to October is deadly for Europeans. During that season the rains are there copious, and, mingling with the floods of water coming down from the mountains of Abyssinia, cause the rich soil to become like a saturated sponge, while the rank vegetation and the exhalations from the soil render the air poisonous. From many districts the natives abandon the country in May, taking with them their families, their flocks and their herds,—to save themselves and their families from fever; and their flocks and herds from the ravages of the stinging insects which, during the season of rains, infest the country. These people go north to the deserts, and remain until the latter part of October, when they return, to find their own country delightful in climate, and glorious in vegetation. These conditions remain through the winter, and the air is healthful until April.

The climate of Khartum is hot, damp, and exceedingly unhealthy from April until October. The winter climate is not disagreeable; but even in winter the place can hardly be considered healthy, owing to the peculiar location of the town between the Blue and White Niles, and to lack of sanitary rule in the construction of the streets and houses. During the past twenty years, more care has been taken in the construction of dwellings; and the conditions are now more favorable than they formerly were.

The province of Kordofan is visited by less rain than that of Khartum or of Taka. During the winter, from the last of October until the 1st of March, the climate is very agreeable and quite healthy. The prevailing winds are from the north. The temperature is not high, ranging in the middle of the day from 80° to 88° F. The air is bracing and invigorating, while the nights are cool and pleasant.

March, April, and May are there the hottest and most disagreeable season, though not unhealthy. In June the season of rains commences, and it lasts until the latter part of September or early October. The winds are then from the south and south-west. The rains come in showers, sometimes daily, but oftener once in three or four days. The air is debilitating; and fevers, intermittent in form, strike all excepting the natives.

No matter what care may be taken to guard troops from the effects of climate, the death-rate among soldiers is always great during this wet season. In an expedition which I sent into that province, well organized, well and very carefully commanded, well supplied, with good medical attendance and good hospital supplies, six per cent of the soldiers died during four months of the season of rains, while during the remainder of the year there were very few deaths.

The climate of Darfur closely resembles that of Kordofan. The rains come at the same time of year, and the sanitary effects of the different seasons are nearly the same; yet the fevers, according to the reports of the medical officers, seem to be more often severe in type in Darfur than in Kordofan. C. P. STONE.

THE CAROLINE ISLAND ECLIPSE EXPEDITION.

THE protracted duration of totality of the eclipse of May, 1883, early attracted the attention of astronomers; but an examination of its shadow-track on the earth showed the unfortunate fact that it would begin in the Pacific just east of Australia, and completely traverse the ocean, finally leaving the earth before the South American continent was reached. Only one eclipse had ever been observed with a greater duration of totality; and the possibility that an observing-station might be available in the small islands of the South Pacific determined Mr. Charles H. Rockwell of Tarrytown, N.Y., to endeavor to organize an observing expedition from the United States. Through his representations, the National academy of sciences was brought to consider the matter, and it was expected that Professor Young of Princeton would have the entire charge of the expedition. Unforeseen circumstances prevented this, and the party was finally organized with Professor Holden as chief, and sci-

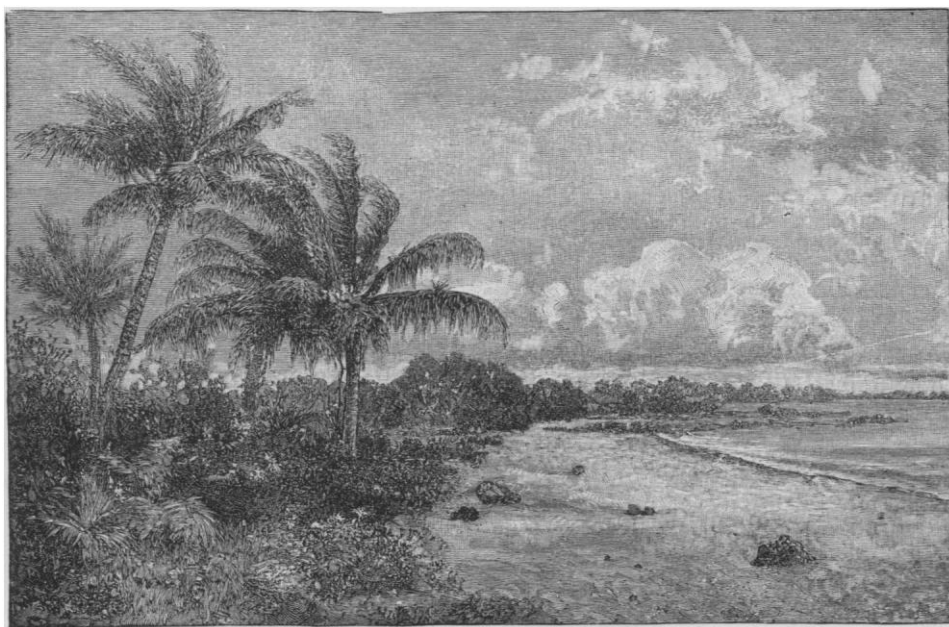
Report of the eclipse expedition to Caroline Island, May, 1883. In vol. ii. of the *Memoirs of the national academy of sciences*. Washington, 1884. 146 p., 22 pl. 4°.

entific director. Pretty full accounts of the expedition, its objects, methods, and results, have already been published in *Science*, vol. i., at pp. 299 and 594, and vol. ii. p. 237.

Some idea of the magnitude of the undertaking may be gained when it is known, that, in addition to the elaborate home preparations of the instruments and apparatus for specialized investigations, the observers were absent from the United States more than three months, during the most of which they were travelling (some fifteen thousand miles, in all), and that ten full weeks were passed at sea.

They were expected to take up their abode

wisely devoted themselves to the study of the island in every particular; and their researches, although secondary to the main purpose of the expedition, have quite as much of interest as, if they are not of equal importance with, the results pertaining purely to the eclipse. First, Professor Holden gives us the history of the island; from which we learn that it was first seen in 1795, that it was once known as Thornton Island, and that in 1868 Capt. Nares, R.N., took possession of it for the British. Ten years later guano was exported from the island, — an item of interest when connected with the fact, that, in seeking for the deposits, the for-



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somewhere on a small group of islands, about which nothing of importance could be ascertained beforehand, save the bare fact of their existence at a known spot in mid-ocean. The whole undertaking, however, was accomplished without a mishap of any kind occurring to interfere with the success of the work.

On the morning of the eclipse there were three rain-showers, and several persistent banks of clouds. The critical moments of totality, however, were passed with an unclouded sky; and the observations of the parties were successful, owing to the apparent accident of the dissipation of a local cloud.

So little was known of Caroline Island, that Professor Holden and the members of his party

mer owners of the island came upon native *marais*, or burial-places, numbering altogether fifty, in which they found stone axes and relics of various sorts.

The island, as it was in 1883, is well described by Professor Holden and Lieut. Qualtrough, the former quoting from Dana's 'Coral and coral islands,' and Darwin's 'Voyage of the Beagle,' their accounts of typical coral atolls. By supplementing these descriptions with the statement that Caroline Island is in general a pear-shaped ring of islets encircling a lagoon, the characteristic features of the islands become perfectly understood. A few facts from Lieut. Qualtrough's paper will be of interest: that there are, in all, twenty-five islets, well

covered with trees and shrubbery; that tidal observations in the lagoon show no relation between the rise and fall inside the lagoon, and outside; that the weather, though mostly fine, is somewhat changeable, with occasional sudden showers; and that the climate of the island, though warm, is delightful, the surrounding sea conducing to an equable temperature.

Mr. Upton presents a very full paper, occupying nearly one-third of the volume, on the meteorology of the island during the period of two weeks extending from April 25 to May 9. Frequent observations were made with the ordinary meteorological instruments, and with special radiation apparatus furnished by the chief signal-officer. The meteorological bearings of the eclipse were carefully attended to, and the observations are fully discussed, and the results clearly presented in graphical form.

One section of the report was prepared by Professor Trelease, and relates to the botany of Caroline Island as represented by the collections of Dr. Dixon, U. S. navy, who contributes also a page or two of interesting notes on the zoölogy of the island. The lepidoptera received attention, and the valuable collection made by Dr. Palisa was taken to Vienna for identification. At Professor Holden's request, however, he very kindly made and presented to the American expedition as complete a collection of duplicates as was possible; and these are reported upon by Mr. Butler of the British museum, and Mr. Strecker of Pennsylvania.

Coming now to the physical and astronomical results of the expedition, we find first a condensed statement of Professor Holden's plan of operations on the day of the eclipse, followed by the reports of all the observers on the special fields of work assigned to them. During the period of totality, Professor Holden devoted his own attention to the search for intra-mercurial planets, with the negative result long since known, and which he regards as conclusive to such an extent that "at future eclipses it will not be necessary to devote an observer and a telescope to the further prosecution of this search." Dr. Hastings, with an unusual equipment for polariscopic and spectroscopic work, gave his entire time to the solar corona. He found that with delicate methods the brighter portions of the corona ought to be observable more than a minute before totality. Dr. Hastings presents his own observations, and concludes that "the enormous change in the extent to which the 1474 line could be traced east and west of

the sun, with very slight change of the moon's place, precludes the explanation hitherto accepted of a gaseous atmosphere extending as far as implied by the spectroscope." Regarding these results, then, as strongly indicating the need of a different explanation of the observed phenomena, he institutes a thorough review of the results of all the observations of the corona at previous eclipses, and groups them under the head of spectroscopic analysis, polarization, and photography. The hitherto accepted explanation of the phenomena is then briefly set forth; and following it his own explanation is proposed, which is, that the coronal phenomena may be fully accounted for by applying the well-known principles of diffraction to the sunlight which grazes the edge of the lunar disk, and is propagated to the eye of the observer.

THE PHYSICAL FEATURES OF BRAZIL.¹

THE greater part of the empire consists of an elevated plateau, having the mean elevation of from 300 to 1,000 metres, limited on the north and west by the great continental depressions of the Amazonas and Paraguay basins, which are almost united through the valley of the Madeira, and its tributary the Guaporé. A portion of the elevated plateau of Guiana, nearly the whole of the great Amazonian depression, and the upper part of that of the Paraguay, are also included in the empire. In addition to these four grand natural physical divisions, there is also an Atlantic border-region, forming a narrow strip between the ocean and the eastern margin of the great continental plateau.

Although generally represented as wholly mountainous, the Brazilian plateau consists in great part of tablelands, which, from the deep excavation of the innumerable river-valleys, have become very much accidented, so as to present a mountainous aspect. The true mountains (restricting the term to the elevations formed by upheaved strata) are mainly in the eastern and central portions, and may be considered as constituting two groups, nearly separated by the elevated tablelands of the Paraná and São Francisco basins.

The eastern or maritime group accompanies the coast of the Atlantic at a short distance from the sea, from near the north-east shoulder of the continent at Cape São Roque, to or near the southern limits of the empire. The central or Goyaz group occupies a part of the southern portion of the province of Goyaz, and that part of the province of Minas Geraes lying to the west of the São Francisco, and is joined to the eastern group by a transverse ridge extending in the direction east-west, across the southern portion of the province of Minas Geraes. This transverse ridge, with the mountains of Goyaz, forms part of the great east and west watershed of the con-

¹ From the *Rio News*.