REPORT OF THE SUPERINTENDENT
OF THE
UNITED STATES COAST SURVEY,
SHOWING
THE PROGRESS OF THE SURVEY
DURING
THE YEAR 1870.

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APPENDIX No. 16a.

REPORT ON THE ECLIPSE OF THE SUN ON THE 3D OF DECEMBER, 1858, BY BENJAMIN VOUCHER, LL.D., SUPERINTENDENT UNITED STATES COAST SURVEY.

(From the Coast Survey Report for 1871.)

Certain astronomical phenomena of rare occurrence and high importance for the advancement of human knowledge have, in all civilized countries, since modern science has been cultivated, been deemed matters of national importance. Among these arc total eclipses of the sun; and for many years it has been customary for the great nations to organize expeditions for the observation of these.

The first total eclipse visible in this country since the formation of the Government was that of June, 1806. This was accurately observed at several points, and a valuable painting was made of it. We were not favored with another until November 30, 1831, when the moon's shadow passed over the continent from northwest to southeast. This eclipse was observed by R. T. Peirce, esq., of Boston, at Beaufort, South Carolina. A third eclipse did not visit our country until 1859; hence, at that time this wonderful phenomenon was for most American astronomers a matter of hearsay.①

The path of the eclipse of July 15, 1859, was from Washington Territory to the northern shores of Labrador, and thence across the ocean to Spain. This eclipse was observed by an expedition organized under the Superintendent of the Coast Survey, and the results are published in the report for that year. It was also observed by the astronomers of several governments abroad, and was the first total eclipse which was photographed. In 1858 British, French, and German expeditions were fitted out for the observation of a total eclipse in India. On this occasion brilliant discoveries were made in regard to the spectrum of certain rose-colored prominences seen about the sun at such times; and these discoveries have been increasing in interest ever since. In 1859 another total eclipse was visible in the United States. It was observed by parties organized by the Coast Survey and other Government bureaus. The results were of high importance. Photographs of the whole corona were taken for the first time; the first observations were made upon the spectrum of the corona; the radial polarization of the corona was first observed with care, while the former knowledge of the subject was advanced in every direction. The results of these two eclipses were of such importance in regard to one of the chief scientific problems of our time—the constitution of the sun—so to excite the profoundest interest throughout the world. It was felt by everybody even casually interested in science that the eclipse of 1859 afforded an opportunity for removing the last obscurity from the subject of the corona, such as ought not to be left slip, the more so as no other eclipse was expected to be observed during this century.② In accordance with these views the Hon. John A. Bingham, of Ohio, introduced a joint resolution, which was approved by Congress and the Executive, authorizing the fitting out of an American expedition, such as were to be sent out by Germany, by France, by Great Britain, by Italy, and by Spain, to study the phenomena of this eclipse. The late unhappily war prevented the first two nations from sparing any of their energy for this peaceful emulation, but extensive preparations were made by all the others. The American and English parties were in co-operation, and afforded each other mutual aid. It is hoped that the good feeling thus engendered was not without influence beyond the circle of science. The observations of this eclipse had for their general result the triumphant vindication of the American observations of the year before, the novelty of which had made them somewhat

① Mr. G. F. Peard had observed the eclipse of 1851 in Sweden.
② Nevertheless, the British government has sent out parties to another eclipse in 1871, in India and Australia; and three American astronomers have been invited, through the Superintendent of the Coast Survey, to join the expedition.
Baron Waltershausen, who surveyed that vicinity previously to the year 1814. It is gratifying to note the very close accordance between the earlier astronomical determinations and those taken thirty years afterward. Time signals by heliostopes were sent and received by the observers at Catania, and at the Monte Rosso station. Mr. Schott included, in his paper, a table giving the positions, the three places occupied in the garden of the convent, two by the English party in charge of Mr. J. Surnin Lockyer, and the other by Mr. J. H. Lane, of the Office of United States Weights and Measures, Washington, and fully prepared for spectroscope observations, was prevented by unfavorable weather from recording special results. The photographic party secured forty-five negatives of the sun, seventeen during the eclipse and before totality, and fourteen after it, at irregular intervals, taking advantage of breaks in the clouds. The direction of a parallel of declination was indicated by the image of a thread, so adjusted before the eclipse that a solar spot might be seen as moving along the thread during the transit. Mr. Fitz operated the equatorial and timed the passages. An attempt was made by means of an ordinary camera to secure an impression during the momentary appearance of a portion of the corona. The time of the first contact was noted by Mr. Schott, who was apprised by a pistol fired by a member of the English party, (the reporters) indicating that Mr. Lockyer had already seen peculiarly noted an approach of the moon's corona. The dense clouds which came from the direction of Mount Etna, and to the west of it, defeated all attempts at observing the times of the important events on the last contact. Of Schott, however, saw, through a rift in the cloud, a part of the corona, to the northward and eastward of the sun's center, for about two seconds. It appeared in sharp outline nearly concentric with the moon's limb, of white silver light, extending, by estimation, to about one-third of the moon's radius. The light tint of orange-yellow tints accompanying total eclipses was seen about the southern and eastern horizons. The first contact or beginning of the eclipse, as predicted from data in the American Ephemeris, was only 0.9 seconds earlier than the time actually noted in observing at Catania.

My own station was about three miles north of Catania, at the villa of the Marchesi di San Giuliano, whose obliging courtesy is a subject of grateful remembrance. There the weather was more favorable than at the center, and afforded a full view of the corona, the study of which was made a special object. Mr. C. S. Peirce observed with a polarscope and obtained good results. Mrs. C. S. Peirce was successful in drawing the corona, and distinctly recognized the dark rifts which have become a subject of discussion, and which were photographed by Mr. Brothers, of the British party, at another station. Further north were stationed Herst Reiglander General H. L. Abbott, United States Engineers, Professor Bessee of England, and Signor Arnerigo de Schio, Dr. Vogel, of Berlin, and others. Their object was to observe the phenomena of the eclipse at the greatest possible distance from the center of the moon's shadow, for comparison with those observed at stations near the sea. The weather was so bad that this party was regretted by a snowstorm which obscured the sky, and obliged them to leave the station near the time of the eclipse.

Peter was on the westward and northwest of Catania, at one of the triangulation stations on the western peak of Mount Etna, Dr. C. F. Peters, of Hamilton College, Clinton, New York, and Sub-Assistant W. Emsbeck selected a position for observing the eclipse. Dr. Peters had a spectroscope apparatus, and Mr. Emsbeck a sextant-comet. This party also had favorable weather, but succeeded in noting the times of the first contact and of the last contact; but the last through thick haze. The interior contacts were lost on account of a passing hailstorm. Mr. Emsbeck also assisted Mr. Schott in recording transit and other observations at Catania. C. Watson, of Ann Arbor, Michigan, occupied a station on the high ground near Calvistula. The weather there was favorable during the total eclipse. Professor Watson made observations, which resulted in two colored drawings of the corona of unearthly fullness of detail and accuracy. Dr. T. W. Parsons, of Syrausum, also made an elaborate colored representation of the eclipse.

It will thus be seen that my party in Sicily were distributed to the north of the track of total eclipse, with stations to the south of it, were occupied by the party from the Navy Observatory. Stations on the central line were occupied by the Italian astronomers, including the Padre Senci, Professor Garzatore, and others.
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A detailed account of the results of observations will be found in the Appendix No. 16 of the report of 1870.

I take this opportunity to mention the kindness of Henry Suter, esq., Her Britannic Majesty's vice-consul at Larissa and Veolo, who, when it was contemplated to send a party to Larissa, afforded every facility for the prosecution of inquiries, and was in readiness to assist further if it had been expedient to occupy a station near that city.