REPORT
OF
THE SUPERINTENDENT
OF THE
COAST SURVEY,
SHOWING
THE PROGRESS OF THE SURVEY
DURING
THE YEAR 1862.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1864.
THE UNITED STATES COAST SURVEY.

Developed a general extent of coast of over four thousand five hundred miles, and a shore-line of about twenty-three thousand miles, determining nine thousand four hundred and fifty-two geographical positions.

For longitudes determinations, eighty-five stations had been selected; for latitudes, one hundred and twenty-seven, and for azimuth, eighty-four stations.

The topography had extended over an area of nearly seventeen thousand square miles, having a general coast line of four thousand miles, and over forty-two thousand two hundred miles of shore-line, measuring the indentations.

The hydrography extended over an area estimated at forty-six thousand square miles, in which one hundred and ninety-six thousand miles were run in sounding six million three hundred and ninety-eight thousand soundings were made, and over eight thousand four hundred specimens of the bottom obtained.

The number of manuscript maps and charts constructed was two thousand one hundred and eighty-one, and of engraved maps, charts, and engravings there had been produced four hundred and ninety-three plates.

DISTRIBUTION OF ANNUAL REPORTS AND MAPS.

It has been judged expedient during the past year to hold still in abeyance the usual foreign distribution of the printed annual reports through the Smithsonian Institution, as was done during the year which ended with October, 1861, as was stated in my last annual report.

During the past year, 4,000 copies of reports of various years have been distributed to institutions and individuals in the loyal States of the Union, leaving on hand a limited number of copies for the years 1851 to 1859, inclusive. Of those remaining on the 1st of November there were of the report for 1851 two hundred and twenty copies; of that for 1855, four hundred and twenty copies, and of that for 1857, three hundred and eighty-two copies left. Of the dates 1853, 1856, 1859, and 1860, the copies disposable for general distribution is larger. This doubtless unequal number of copies of the report of various back years makes it necessary to discriminate carefully in their issue. It is also to be remembered that for the years 1850 and 1860 no copies have been sent to the States which now dissolve their allegiance to the government of the Union, but which will at some future day feel interested, in common with the others, in the information which they embody. To provide for the best issue of those remaining reports (1851 to 1860) a circular has been sent to the principal libraries in the more important cities of the north, and to those of universities, colleges, and other institutions, to ascertain what reports may be needed in order to complete their series, so that entire sets may in future be within reach for purposes of reference in all the States to which they are now sent.

As already stated under the head of maps and charts, upwards of forty-four thousand copies of printed maps, charts, and sketches have been sent from the office since the date of my last report—a number more than double the distribution in the year 1861, and upwards of five times the average annual distribution of former years. This larger and increasing issue of charts within the past two years has been due to the constant demands of the Navy and War Departments, every effort to supply which still continues to be made.

Besides the printing of charts by the transfer process, the production of the hydrographic memoirs of the coast with facility offers further proof of the advantages of establishing a lithographic division at the office, through induced as it was by the exigency of last year for copies of charts. The course taken in the preparation of the hydrographic notes was mentioned in my report of last year, and has also been alluded to in this, under the head of maps and charts. The testimony from the different commanding officers as to their value have been numerous and enthusiastic.

A summary of the details of diffused or of the annual reports, maps, charts, &c., is contained in the report from the miscellaneous division of the office, Appendix No. 11.

RECORDS AND RESULTS.

I call attention again to the fact that this publication is postponed for more auspicious times, as I have repeated applications for copies. The present appropriation equally enables us to prepare the materials for publication, but not to publish.

LONGITUDE.

The history of the determination of longitudes, in conjunction with the survey of the coast from the north and south of reorganization of 1844 to 1858, was given in my report for 1858, included the methods by astronomical observations, by the transportation of chronometers, and by the electrical telegraph. The
problem of longitudes by observations of the Planets is described in the appendix of my report for 1856.

Professor Peirce has been engaged since 1854 in stimulating observers to a new series of observations, by preparing predictions and charts of the occultations, as explained in my report for the year 1858. These observations were collected during the period from 1857 to 1863, or until the moon’s path ceased to pass among those stars. While this new series of observations was in progress with modern instruments and methods, Professor Peirce was occupied in recomputing the older series, for the period 1828 to 1848, by the aid of the new ephemeris tables. The results are given in his report, which was printed as Appendix No. 17 in my report of last year. "The conformity of the observations with theory is quite remarkable, and shows that his, the most delicate of all the observations of the moon, demands not the strictest precision of calculation. The final determination of the longitudes will, undoubtedly, surpass all others in precision."

Some of the particulars of this interesting series of results are stated in the professor’s report, Appendix No. 12. Certain of the occultations which were observed both in Europe and America will serve to determine the errors of the tables, and hence to compute with suitable corrections those which were observed only in America, and to obtain a second determination of the longitudes. Professor Peirce remarks that "the various observations will also serve the subsidiary purpose of determining the relative longitudes of the different places which are upon the same continent either of Europe or America, and also to correct the places of the stars, and, finally, to determine the value of the lunar semi-diameter, and the necessity of having regard to the protuberance of the moon in the complete solution of the problem."

Professor Peirce has addressed to me a special letter in relation to the tables of the moon used in the reduction of the observation of the Planets, (Appendix No. 13). The professor gives his reasons for using Hansen’s tables in the computations, and, referring to the "full and generous" statements of Mr. Lubbock, in the thirty-ninth volume of the Memoirs of the Royal Astronomical Society, in praise of the American tables prepared by Professor Peirce for the Nautical Almanac under the direction of Captain Davis, U. S. N., corrects some historical statements in reference to the labors of mathematicians who have been occupied with the important task of improving the lunar tables.

The observations made by telegraph for the difference of longitude between Macao, Gez, and Eufonia. Also, in the working season of 1862-63, have been discussed by Dr. B. A. Gould. He reports that the difference in time between the astronomical stations is, Eufonia (3.50° west of Macao), which result, he adds, cannot be erroneous by more than five-hundredths of a second of time.

The detailed report on the results of the observations made in Georgia and Alabama is in course of preparation. I have placed in the Appendix No. 14 Dr. Gould’s report on the progress which has been made in computing the results for all the stations between Calais and New Orleans.

MAGNETISM.

The publication of the results of a discussion of the Girard College observations, from the Smithsonian Contributions to Knowledge, commenced in my reports of 1859 and 1860, is continued in this, embodying the discussion of the observations of horizontal magnetic force. The difficulty which stands at the threshold of this discussion of these observations is the correction for temperature, the magnetic bars changing in their own intensity of force with changes of temperature. The attempt to obtain the value of this correction are fully stated, and their application is shown and verified in various ways in Part IV of the memoir, (Appendix No. 15). Tables of the results, reduced to a standard temperature of 66° Fahrenheit, are then obtained, and corrected for the progressive change in the readings of the magnets. The observations are next expressed into regular and disturbed readings by the aid of Peirce’s criterion, and the disturbances being taken out, there remain the normal results for the hour, day, and year. These show the same period of ten or eleven years in number and extent of disturbances which was deduced from the declination observations, corresponding with the period of change in the solar spin. The results agree very well with those obtained at Toronto, Canada. The curves of daily changes of horizontal force come out very perfectly in each year’s results, the curves showing two maxima and two minima in the course of the day, and the day changes being much more considerable than those of the night.

The next part of the memoir, Part V, (Appendix No. 16) contains the investigation of the diurnal and annual variations of the horizontal magnetic force from the means of the results for the five years of observation. The normal value of the horizontal intensity for the several hours of the day and months of the year of the five years is deduced, applying all the required corrections. The summer and winter results are compared in formulas, and by curves, with the mean for the whole year. At 6 a.m. there is scarcely any change...
The United States Coast Survey.

Archives and Library—The archives and library have continued under the care of Mr. E. Fitzgerald.

During the past year three hundred and ninety-nine volumes of original and duplicate records, one hundred and twelve volumes and copies of computations and reductions, one hundred and sixteen rolls from self-registering tide-gauges, and fifty-seven original topographical and hydrographical sheets, have been added to the archives of the survey; also one hundred and eighty-six new-bottom specimens.

Fifty-eight volumes have been purchased for the library, and one hundred and five volumes, including thirty-three volumes of publications of the Royal Observatory, Greenwich, added by presentation during the same period.

The records of triangulation, astronomical, and magnetic work, executed under the supervision of Mr. Hoofer, have been re-arranged by Mr. Rumpf, of the computing division, and a new register made which greatly facilitates reference to them. With the assistance of Mr. Donaghy, of the tidal division, the self-registering tide-gauges rolls have been arranged by sections and years, put up in separate packages and registered. The total number of self-registering tide-gauges rolls now in the archives, as shown by the register, is one hundred and twenty-eight. A new set of sketches showing the limits of all the registered topographical and hydrographical sheets, to take the place of the set now in use in the archives, which was nearly worn out, has been commenced and considerable progress made upon it.

Carpenters.—In the carpenter’s shop, Mr. A. Yurczeny remains in charge, as master carpenter, assisted by one workman and an appren...tice. The work executed during the year consists of 34 sets of new cases for instruments of various kinds, 6 cases for duplicate records, 2 large cases for Coast Survey charts, 2 large cases for copperplates, 3 cases for photographic negatives, woodwork complete for 2 new plane-tables, 6 new plane-table boards, 4 new stands for plane-tables, 6 stands for theodolites, 5 frames for photographic and 16 for electrolyte purposes, 8 battery cells, and 5 vats for electrolyte divisions; 6 rod and 6 signal poles for field parties have been painted and graduated, and 20 tin cases for original sheets have been printed and numbered, 6 large panelled frames for banking purposes have been made, as also one writing table for office. A large amount of miscellaneous work has been done, and the woodwork of instruments returned from the field has been carefully repaired; 90 turning feet of new facing has been put up, and the office buildings kept in repair.

Instrument Shop.—The force of this shop consists of Mr. J. Vierlaken, master instrument-maker; three workmen, and two apprentices. During the year 4 sounding apparatus, 12 specimen caps for sea soundings, 1 winding machine for deep-sea soundings, 2 plane-tables complete, 26 metre scales, 2 theodolites, 4 recon-...structing telescopes, 2 bolometers, 5 prismatic compasses, 2 brass compasses, 2 half-round protractors, 23 metre chains, and 1 clock for office, have been made; and all the repairs of instruments used during the year have been made, consisting in part of 2 sounding apparatus, 3 deep-sea thermometers, 6 self-registering tide-gauges, 27 sextants, 20 theodolites, 26 plane-tables, 5 reconstructing telescopes, 11 bolometers, 4 prismatic and 2 surveying compasses, 28 metre chains, 15 marine spy-glasses, 1 dividing machine, and 4 brass compasses, in addition to a variety of miscellaneous work for the use of the office and parties in the field.

APPENDIX—No. 12.

DEPART OF PROFESSOR BENJAMIN PEIRCE, OF HARVARD, ON THE COMPUTATIONS OF THE OCCULATIONS OF THE SUn FOR LONGITUDE.

CAMBRIDGE, MASS., November 1, 1860.

Sir:—The computation of the group of the occultations of the Pleiades, from 1838-1849, inclusive, and the corresponding determination of the longitudes of America from Europe, are now far advanced, and several of the special reports upon the individual occultations will soon be sent to the editors in their completed form. The conformity of the observations with theory is quite remarkable, and shows that this, the finest limit of all the observations of the moon, demands and justifies the utmost precision of calculation. The final determination of the longitudes will, undoubtedly, surpass all other in precision.

There were eighteen different nights of occultation in the group of 1838-49, which I will number in the inverse order of their occurrence.

1. The instances of April 13, 1845, which were observed at Edinburgh.

So...
The immersions of January 21, 1842, which were observed at Washington and Cambridge in Massachusetts.

The immersions of November 27, 1841, which were observed at Cambridge in England and at Washington. These observations were made within seventeen hours of full moon, and I have thought that twenty-four hours from full moon was as near an approach to this place as it would be safe to admit.

The immersions of October 21, 1841, which were observed at Dusart, Pulkova, Venice, and Wilna. The moon was so nearly full that these observations are omitted.

The immersions of September 6, 1841, which were observed at Dusart.

The immersions of August 9, 1841, which were observed at Altona, Berlin, Copenhagen, Edinburgh, Geneva, Hamburg, Leyden, and Pulkova.

The immersions of February 27, 1841, which were observed at Edinburgh and Leyden.

The immersions of January 31, 1841, which were observed at Pulkova.

The immersions of December 7, 1840, which were observed at Altona, Berlin, Copenhagen, Gottingen, Hamburg, and Kremmenstuer.

The immersions of October 14, 1840, which were observed at Asbury, Beurlin, Bonn, Brussels, Cassow, Gora, Grieswalde, Hamburg, Konigberg, Kremmenstuer, Leyden, and Venice.

The immersions of November 30, 1839, which were observed at Cambridge, Leyden, St. Louis, Pulkova, Dusseldorf, Washington, and Port Royal (Jamais) which occurred at the time of full moon, and are consequently omitted.

The immersions of September 26, 1839, which were observed at Asbury, Berlin, Brussels, Green-\n
The immersions of August 30, 1839, which were observed at Asbury, Cambridge, England, Hamburg, and Leyden.

The immersions of July 6, 1839, which were observed at Helsing, Philadelphia, Washington, and Yorktown.

The immersions of March 19, 1839, which were observed at Asbury, Cambridge, England, Dusart, Green-\n
The immersions of December 27, 1838, which were observed at Asbury, Berleen, Cambridge, England, Cuscow, Dairy, Edinburgh, Greenivirth, Boston, Dusseldorf, Southwick, Princeton, and Philadelphia.

The immersions of November 20, 1838, which were observed at Philadelphia, and may be neglected on account of the proximity to full moon.

Of these observations, therefore, III, IV, XII, and probably XVIII, will be rejected, and the other 14 accepted. The observations X. XII, and XVII, the two observed in Europe as well as in America, and which can be used independently of the others and without regard to the accuracy of the tables of the moon's longitude, for the determination of the longitude. These observations, together with the others observed in Europe, namely, the I. VI, VII, VIII, IX, XI, and XIV, will serve to determine the errors of the tables, and thence the corrections which must be applied to the tables; to compute the observations II, V. X., and XVIII, which were only observed in America, and thence get a second determination of the longitude. The various observations will also serve the subsidiary purpose of deter-\n
The American tables were actually constructed, as they profess to be, "from Ptolemy's theory, with Alvy's and Longrecter's corrections, Horner's two inequalities of Long period arising from the motion of Venus, and Hansen's values of the secular variations of the mean motion and of the motion of the Perigee." But Lubbock contends that all of Longrecter's corrections of Phases were those of coefficients which had been designated as erroneous by Poniocouldant, "and in eight out of eleven instances the values of Poniocouldant were employed" instead of those of Phases. There is even a suspicion expressed that Longrecter had been unfair to Poniocouldant, and appropriated his corrections without acknowledgment. This suspicion, however, was expressed before having seen the original memoir of Longrecter, the examination of which instantly exonerates Longrecter from so unjust a charge, for Longrecter expressly says: "The coefficients deduced from theory by Deismatius, Phases, Poniocouldant, and these deduced from observation by Lubbock, (though differing considerably), give the solution of the problem accurately when a difference exists. I have carefully compared them with observation, and found them the most probable values." In the only case (see the note at the end) in which Longrecter has "used Poniocouldant's terms, and thereby deduced them to be wrong, the subsequent investigations of Poniocouldant himself, which are published by Lubbock, show that Poniocouldant was in error, although right in the other cases, and, consequently, the skill and accuracy of Longrecter's corrections and the justness of his solutions of the problem are triumphantly confirmed.

In regard to the decision of priority I may be mistaken; but it seems to me that the whole series of observations of the moon is properly used by the astronomers of the present day, and that the tables of Phases alone have been given the credit of first bringing the lunar theory to a degree of perfection sufficient for the practical solution of the problem of the moon's position at any moment by means of lunar observations."

I am moreover convinced that a still higher claim can be established for Lubbock and Poniocouldant. They have subjected the tables of Hansen to a much stricter examination than that to which observations of the moon, so far as I have seen, have been subjected. The mean error of the
tables in longitude seems to be less than a second of arc, during the period embraced by my investigations. It is thought that more recent observations indicate wider discrepancies; but if this be so, I believe that will be evident that when our American tables are revised, so they must be; the small differences between them will disappear; and they will then assume the same degree of accuracy which I am now disposed to attribute to those of Hansen. The time, then, seems to be at hand when additional observations of the moon will be long since to test the accuracy of the tables; when extraneous observations will be set aside as useless and unnecessary; especially when the observations of occultations on the dark limb of the moon will assume a new importance; and when it will be admitted that a single observation of an occultation yielded by the exclusive aid of the lunar tables without any use of simultaneous observations, will determine a longitude with a probable error not exceeding a second of time. The geosters to whom the final credit of this great result must be given are Laplace, and Peirce. What test is reserved for the ultimate confirmation of the theories of Laplace, Hansen, and Delaunay? Very respectfully,

BENJAMIN PEIRCE.

Superintendent of the Coast Survey.

Note.—There is still a fourth coefficient, that of degree 5, in which copy's constant of 5° 56' was rejected, and Laplace's constant, of 3° 56', is adopted. The value of the coefficient is 5° 56', which is adopted in the American tables, and the mean, and is an entirely new and important correction in that work. The answer to the question of authority in this case must, therefore, be sought by Mr. LeConte, from the American Naval.

APPENDIX No. 14.

REPORT OF DR. B. A. GOULD ON THE PROGRESS OF COMPUTATIONS FOR DEJECTING LONGITUDE FROM OBSERVATIONS BY TELEGRAPH BETWEEN CALAIS, ME., AND NEW ORLEANS, LA.

Cambridge, November 13, 1862.

DEAR SIR:—During the last year the Coast Survey operations under my direction have consisted exclusively of computations and reductions, the field work being suspended in consequence of the war. The same cause has acted to retard the progress of the reductions to a considerable extent, and but for the decision of my party which it has so far delayed, I might at present enjoy the satisfaction of reporting the whole of the longitude work as completely reduced. So small progress has, however, been made, and the work has been completed upon four of the campaigns, viz.: Calais—Bangor; Apalachicola—Havana; New York—Bengal; Penobscot—Mobile.

The discussion of these observations, although extended and minute, has elicited few results of general scientific interest which have not been brought to light by the composition of former longitude measurements. The phenomena attending the transmission of signals have been found similar in their speed and in former campaigns. The same velocity of transmission, and the same dependence upon the position and strength of the battery. So too, the same results have been derived from the examination of the personal differences of observers, and it is now beyond doubt that, by the chronographic method, at least, the personal equations, although manifest, are very far from constant, varying greatly with external circumstances and with physical condition. Indeed, their variability is so decided as to lead me, in the discussion of the observations, to aim always at their elimination, rather than at their determination, contrary to the course originally pursued.

The mean error of observations appears to vary but little for the same observer, its average ranging, for different observers, between nine and fourteen hundredths of a second for a single arc. The change of azimuth during the period of observation have been referred to previous reports, and constitute one of the most interesting and useful phenomena which the computations have brought to light. In all the telegraphic longitude measurements without exception, both in summer and winter, in the northern and southern hemispheres, the transit instruments have been found affected by a motion in azimuth differing in