

*Reconnaissance and extension westward of the triangulation of the State of Pennsylvania.*—The continuation to the westward of the triangulation of the State of Pennsylvania was committed to Professor Mansfield Merriman, Acting Assistant. He took the field July 1, 1882, starting from the line Gov. Dick-White Horse. The first station occupied was Gov. Dick, a point about six miles south of Lebanon, Lebanon County. Work here was finished August 5, and the party moved to station White Horse, at which a tower thirty-five feet high had been erected for the support of the instrument. The observations at White Horse were completed August 31. Measurements of a single angle being necessary at stations Blackspot, near Reading, and Smith's Gap, about fifteen north of Allentown, these two stations were occupied between September 1 and 21. During the remainder of the season, which closed October 11, four stations were visited to examine their marking; at three of these no station marks had been established, the general locality only having been determined by previous reconnaissance. Professor Merriman had their positions located and carefully marked. He reports that for the due development of the triangulation northward a special reconnaissance is desirable. Statistics of the work are as follows:

Positions of stations determined (primary).....	14
Secondary stations (spires, steeples, &c.) determined.....	44
Number of measurements of angles.....	1, 613

The records of the work have been transmitted to the office.

*Determination of boundary line between Pennsylvania and West Virginia.*—In compliance with a request from the Joint Commission of the States of Pennsylvania and West Virginia for the detail of officers of the Coast and Geodetic Survey to execute the work of tracing out the boundary line between Pennsylvania and the "Pan Handle" of West Virginia, Subassistant C. H. Sinclair was directed in April, 1883, to proceed with Col. James Worrall, the chairman of the Commission, to Pittsburgh, and to attend the meeting held there of the Joint Commissioners, in order to be fully informed of their views, and to give such information in regard to the mode of tracing and marking the boundary line, and the degree of accuracy which I deemed useful and practicable, as might be called for by the conference.

Instructions subsequently issued directed Mr. Sinclair to run the meridian line required, taking offsets to such of the old monuments as might be found. Subassistant C. H. Van Orden was assigned to duty with the party in order to execute the topography in the immediate vicinity of the monuments.

The work was making good progress at the date at which this report closes.

### SECTION III.

MARYLAND, VIRGINIA, AND WEST VIRGINIA, INCLUDING BAYS, SEAPORTS, AND RIVERS. (SCHEDULES Nos. 1, 4, 5, AND 6.)

*Determinations of gravity by pendulum experiments at Baltimore and Washington.*—In continuation of the work of the gravitation party previously authorized, Assistant Charles S. Peirce was directed at the beginning of the fiscal year to make comparative observations of gravity between Baltimore and Washington. This duty occupied the greater part of the month of July. Instructions then issued to Mr. Peirce involved gravity determinations at stations already mentioned under the heading of Section II. Upon his return to Washington in October, the work of measuring the pendulums used during the summer was continued and completed; the observations for the flexure of the Baltimore piers were finished, and the installation of a pendulum station at the Smithsonian Institution was begun. A stone structure having been erected for the pendulum support, two new invariable reversible pendulums were swung here and also at the Coast and Geodetic Survey Office. As already mentioned under the heading of Section II, the same pendulums were oscillated at the stations in Montreal, Albany, and Hoboken.

In this work Messrs. E. D. Preston, Carlisle Terry, jr., and Robert A. Marr, aids in the Survey, assisted Mr. Peirce. He gave instruction and general supervision to the parties of Messrs. Smith,

Preston, and Marr, referred to in Part I of this Report under the heading "Determinations of Gravity."

Mr. Peirce devoted such time as could be spared from field operations to office work. He read proof for papers relating to gravity determinations; prepared for publication a report on the pendulum work at three stations, Allegheny, Ebensburg, and York, in Pennsylvania; prepared a memoir on the spectrum meter; edited the report of the pendulum conference, and prepared a memoir on the effect of the flexure of pendulums themselves.

In pursuance of instructions dated April 23, 1883, Mr. Peirce left for Europe in May in order to make for the Coast and Geodetic Survey certain observations necessary for completing the connection of the American and English pendulum work and to obtain some additional pendulum apparatus of special construction. He is still abroad upon this duty at the date of closing this report.

*Observations of the Transit of Venus at Washington, D. C.*—The Transit of Venus of 1882, December 6, was observed at Washington by Assistants Charles A. Schott and B. A. Colonna. The place of observation, selected by Mr. Schott, was Fauth's observatory, at the southeast corner of First street west and B street south. Elevation of station above the sea, about 20 feet; geographical position as follows: Latitude,  $38^{\circ} 53' 23''.2$  north; longitude,  $77^{\circ} 00' 33''.5$  west from Greenwich.

Through the kindness of Mr. Fauth, Assistant Schott had the use of a new equatorial of his construction. It is driven by clock-work, and has an aperture of 15.25 centimeters (6 inches) and a focal length of 2.5 meters (8.2 feet). For the morning observation it was used with a magnifying power of 102, and for the afternoon observations with a power of 127. Full aperture was used in connection with a solar eye-piece, the prism of which deflected so much of the sun's heat and light that a light shade-glass sufficed for the protection of the eye. Dr. J. G. Porter, of the Computing Division, recorded time for Mr. Schott.

Light clouds prevailed during the day, with an atmosphere quite unsteady at times. The first contact was lost by clouds, and of the last contact the observation was uncertain on account of the extreme atmospheric tremor. The two interior contacts were satisfactorily observed. Full details are given in Assistant Schott's report, which appears as part of Appendix No. 16.

In this Appendix is included also the report of Assistant Colonna, who observed the Transit at the same station, with a reconnoitering telescope by Plossl, having a clear aperture of 9 centimeters (3.5 inches) and a focal length of 0.96 meters (38 inches). Mr. Colonna obtained observations of the two internal contacts and of the last contact.

*Continuation of the detailed topographical survey of the District of Columbia.*—The detailed topographical survey of the District of Columbia was carried on continuously during the fiscal year by the party in charge of Assistant John W. Donn. The area surveyed embraces some of the most intricate and difficult parts of the topography.

In accordance with the request of the Engineer Commissioners of the District, operations during the early part of the fiscal year were chiefly directed to the survey of the region over or under which the extension of the Washington aqueduct has been projected for the additional water supply; that is, from Rock Creek Valley to the distributing reservoir west of Georgetown. In October, 1882, this work was finished and a tracing was furnished to the Engineer Commissioners. This tracing covered the line of the proposed aqueduct from its western extremity to Smith's Valley, the site intended for the new reservoir, to the east of the line of Sixth street (northwest) extended.

Work was then resumed in the valley of Rock Creek, where during the cold weather a shelter was afforded which permitted the plane-table to be used almost without interruption from the winds. Another winter's work, Mr. Donn thinks, will advance the survey to the crossing of the Milkhouse Ford road, beyond which the hills are comparatively bare and less abrupt. During the months of May and June the work was carried over the open country east of Rock Creek, between Seventh street and Fourteenth street roads, and on the eastern border of the site of the new Observatory.

A map submitted by Assistant Donn with his report shows the area completed at the close of the fiscal year. Upon the scale of the survey, 1-4800, the area covered during the year was about five square miles; the length of roads measured twelve miles, and of creeks fifteen miles.

Assistant D. B. Wainwright aided in the work and showed great interest in its development.

data the older results of the triangulations of 1840-'41-'75-'77-'81; computed part of the triangulation near Tillamook Head, Oreg., 1875; computed the supplementary triangulation of Norfolk Harbor, Va., 1882; revised the results for magnetic intensity obtained by means of magnetometers No. 3 and No. 8; computed the absolute values for magnetic declination, dip, and intensity at Ooglaamie, Alaska, 1881-'82; arranged about fifty volumes of computations for the binder; had charge of the duplicate records; attended to the insertion of resulting geographical positions in the registers of this and of the Drawing Division; prepared geodetic data called for by field parties; and assisted in the preparation of the annual geodetic statistics.

Mr. Myrick H. Doolittle adjusted the triangulation of the east coast of Florida south of Saint Augustine, including the Indian River, of 1860-'61, of 1880-'81, and of 1882 and computed the traverse-work south of Indian River Inlet, 1882; computed the main triangulation in Western New York, intended to connect the triangulation of Lakes Champlain and Ontario, 1880-'81-'82; fitted the secondary triangulation of Lake Champlain of 1870-'71-'72 to the primary work; revised the triangulation connecting Jacksonville, Fla., with the sea-coast, 1854-'55; supplied a few additional positions of the old survey of Savannah River, and of Charleston Harbor and Saint Augustine, 1882, computed the triangulation at Sabine Pass, Tex., 1882; computed the base-line at Laguna Madre, Tex., 1882, and connected it with the triangulation; computed the traverse and geodetic work coast of Texas between Galveston and Sabine Pass, 1882; computed the triangulation of the coast of Oregon between Tillamook Head and Tillamook Bay, 1875, and of Tillamook Bay, 1866; assisted in the preparation of the annual geodetic statistics, and made progress with the reduction of the vertical angles of the primary triangulation of California.

Dr. Jermain G. Porter prepared the least-square abstract of resulting horizontal directions at primary stations Mount Como, Nev., 1879, Mount Grant, Nev., 1879, Carson Sink, Nev., 1880, Vaca, Cal., 1880, and Mount Tamalpais, Cal., 1882; revised the computations for latitude of Northwest Yolo base station; computed the magnetic observations of 1875, and of the northern boundary of Wyoming of 1882; assisted me in the reduction of the magnetic declinations to epoch 1885; made some miscellaneous magnetic computations and solved the normal equations containing the distribution of the declinations in Alaska; computed the spirit levels, Mount Diablo to Martinez East, Cal., 1880; assisted in the comparisons of the five- and six-meter standards (already referred to), and in the computations relating thereto; assisted me in the computation of the length of the Yolo Base, Cal., 1881; made the computation connecting the Yale College Observatory with the coast triangulation; supplied some miscellaneous geographical positions; prepared revised abstracts of resulting angles at all the stations of Pennsylvania and New Jersey, forming the so-called horseshoe triangulation, and established the first set of conditional equations for its adjustment.

Mr. Alexander S. Christie computed time and astronomical azimuth at the following stations: Northwest base Yolo, Cal., 1880; Monticello, Cal., 1880; Vaca, Cal., 1880; Venado, Tex., 1881; North base Laguna Madre, Tex., 1882, and made progress with station Mount Tamalpais, Cal., 1882; computed latitude and azimuth of station Ooglaamie, Alaska, 1881-'82; applied correction for changes of temperature to spirit-level results between Hagerstown, Md., and Athens, Ohio, and prepared abstract of results for the whole line between Sandy Hook, N. J., and Saint Louis, Mo., as printed in Appendix No. 11, report for 1882. Mr. Christie supplied the mean places of stars required by our astronomical parties.

Mr. Charles H. Kummell made the office computation of the following differences of longitudes as determined by the electric telegraph, viz: Nashville, Tenn., and Columbus, Ohio, 1877; Columbus, Ohio, and Washington, D. C., 1877; Columbus, Ohio, and Cambridge, Mass., 1871; Columbus, Ohio, and Cleveland, Ohio, 1871; Cleveland, Ohio, and Cambridge, Mass., 1871; Savannah, Ga., and Cedar Keys, Fla., 1874; Savannah, Ga., and Punta Rasa, Fla., 1874; Oakland, Ky., and Cambridge, Mass., 1871; Shelbyville, Ky., and Cambridge, Mass., 1871; Falmouth, Ky., and Cambridge, Mass., 1871; and commenced Baton Rouge, La., and Atlanta, Ga., 1880. Mr. Kummell also furnished some star places for field parties and revised vertical angles at Mount Diablo, Cal., 1880.

Mr. Henry Farquhar completed the computation for magnetic declination in California, Oregon, Washington Territory, and Idaho in 1881; computed the spirit levelings of Yolo Base, Cal., and of the line between Sandy Hook, N. J., and Hagerstown, Md.; revised the computations for two astronomical azimuths in Texas, 1881-'82, and computed the latitudes of Monticello, Cal., 1880, of

Carson Sink, Nev., 1880, and of Toiyabe Dome, Nev., 1880. He also computed the spirit-leveling between Flora, Ill., and Saint Louis, Mo., and made some progress with the continuation of this line to Etlah, Mo.; he also gave some attention to pendulum matters in charge of Assistant C. S. Peirce.

Mr. Alexander Ziwet was assigned to the Computing Division August 15, 1882, and has been engaged on the following work: The determination of the run of micrometers used at stations, Monticello, Cal., Vaca, Cal., and Como, Nev.; the computation of geographical positions (under Mr. Courtenay's special direction) coast of Connecticut, Long Island Sound, Delaware River and Bay, 1881-'82, and Norfolk Harbor, 1882; assisted in checking computations in connection with the length of Yolo base and other miscellaneous computations; plotted the position of the magnetic declinations for the new isogonic charts, and nearly completed the computation and adjustment of the triangulation connecting Suisun Bay, Cal., with Mount Diablo, 1880. He also assisted in the metric comparisons.

Mr. O. W. Henderson attended to the clerical duties of the Computing Division, chiefly furnishing copies of descriptions of stations and copying star-places for field parties, entering geographical positions in the registers of the Computing and Drawing Divisions, &c.

Mr. J. W. G. Atkins succeeded Mr. Henderson December 26, 1882, as copyist; he was ordered to field duty May 1, 1883.

Mr. V. J. Fagin acted temporarily as clerk to the Computing Division between May 10 and May 21, 1883.

Mr. P. R. Stansbury reported for clerical work in the Computing Division May 23, and continued to discharge this duty to the close of the year.

The following computers were temporarily assigned for duty in the Computing Division:

I. Winston between July 1 and July 18, and two days in August, 1882, was engaged on revision of magnetic computations.

C. B. Turnbull between July 7 and July 19, 1882, was engaged on miscellaneous copying.

Subassistant J. F. Pratt reported for duty January 11 and continued to May 25; was engaged on miscellaneous computations; computed geographical positions on the Saint John's River and other localities, and made satisfactory progress with the reduction of the spirit-levels between Mitchell, Ind., and Saint Louis, Mo.

Mr. J. C. Power was assigned to the Computing Division January 10, and continued to April 28, 1883; was mostly engaged in copying and some light computations.

CHAS. A. SCHOTT,  
*Assistant in Charge Computing Division.*

R. D. CUTTS, Esq.,  
*Assistant in Charge of Office and Topography.*

ANNUAL REPORT ON THE FIELD AND OFFICE WORK RELATING TO THE TIDES FOR THE YEAR  
ENDING JUNE 30, 1883.

TIDAL DIVISION, COAST AND GEODETIC SURVEY OFFICE,  
June 30, 1883.

DEAR SIR: I respectfully submit this report on the work of the Tidal Division, of which I have been in charge during the year.

OBSERVATIONS.

Self-registering tide-gauges have been used at the following stations: North Haven, Me.; Providence, R. I.; Block Island, R. I.; New London, Conn.; Sandy Hook, N. J.; Sausalito, Cal.; Kadiak, Alaska; and Honolulu, Sandwich Islands. Nothing more has been learned about the observations at Mazatlan, Mexico. The Alaska Commercial Company was furnished some time ago with a box-gauge for temporary use at Copper Island, off the Asiatic coast of Bering Sea, but no return has yet been received.

S. Ex. 29—13