by Mr. F. H. Agnew. The observations for magnetic dip at Manomet, were made by Mr. C. S. Peirce, as well as the larger part of the other magnetic observations at that station.

Hydrography of Duxbury Harbor, Massachusetts.—The soundings made near Duxbury define the two channels, one of which passes up the east side of the bay to the vicinity of Powder Point, the other branching from the main channel off Clark's Island, and running towards the west shore of the bay. The work was done at low water. Tidal observations were made during twenty-six days of the month of November.

This survey was made by Sub-Assistant Horace Anderson, aided by Messrs. C. P. Dillaway and R. B. Palfrey. The following is a summary of the hydrographic statistics:

Miles run in sounding 75
Angles 455
Number of soundings 7,453

Mr. Anderson had been previously engaged in the northern part of this section, and also in Section VIII.

The work done near Duxbury connects with the hydrography of Plymouth Harbor, which was surveyed in 1857.

Latitude observations at Nantucket, Massachusetts.—After closing at Farmington, Maine, the series of observations for latitude, mentioned in the last annual report, Assistant Boutelle transferred his party to Nantucket, the southern end of the arc of about 3°.3 of the meridian, the length of which was to result from close determinations of the latitude of the two places named. A proper site for the temporary observatory was found in the garden of Peter Folger, esq., at a point about midway between Nantucket Cliff and South Towered Church, two of the stations of the triangulation. Stone blocks not being procurable in the vicinity, Mr. Boutelle mounted the transit instrument upon a short section of a ship's mast, imbedded three feet in the sandy soil, and placed the zenith telescope upon a portable wooden stand, contrived by him for this purpose. He reports that the changes in azimuth and level resulting from that arrangement are not greater than those incident to the use of stone blocks. Seventy-one pairs of stars were selected for observation at Nantucket. One set of thirty-nine pairs were observed from the 26th of November until the 5th of December, the remaining thirty-two pairs from the 7th until the 26th of December, 1866. In all, four hundred and eleven observations were recorded for the latitude, and in connection with them observations were made on seventeen nights of the same period, for local time. After the 8th of December the latitude observations at Nantucket were continued by Mr. F. H. Agnew, the attention of Assistant Boutelle being requisite at Calais, Maine, in connection with the determination of difference of longitude by means of the Atlantic cable, reference to which was made in the last annual report. Observations for time during the same period were continued by Mr. C. B. Boutelle.

The computed latitude of the station near Nantucket, resulting from these observations, is 41° 17′ 14″.17, of which Assistant Boutelle reports the probable error to be only 0″.10.

During the winter and early spring the records of observations which had accumulated in this party were duplicated, and the field computations were made.

The geodetic observations at Nantucket requisite for connecting the latitude station with the chain of primary triangles were taken up in May of the present year. Mr. Boutelle erected at Nantucket Cliff an observing tripod and scaffold twenty-two feet high, and posted heliotropers at Indian Hill and Shootdying Hill. Primary and secondary angles were here measured, and the stations South Towered Church, Folger, and Sankaty Head Light were also occupied. Twenty angles were measured at these stations upon nineteen objects, by seven hundred and twenty observations. The height of the primary station and of the astronomical observatory were determined by leveling. Twenty consecutive tides were observed for determining the plane of mean level of the sea, to which the heights were referred.

A comparison of the effects of lateral refraction, with reference to the differing character of the lines observed, is thus concluded in the report of Assistant Boutelle: "Generally it has been my experience, that when a geodetic line passes near the surface over varying depths and *temperatures*, clear vision throughout its length will rarely be obtained, and lateral refraction will surely be encountered." One of the lines here alluded to passed within twenty feet of the water on Tuckernuck Shoal, though the ends of the line were respectively eighty-one and a half and two hundred and sixty-five feet above the sea level.

ASTRONOMICAL INFORMATION, ETC.

CHRONOLOGICAL CYCLES.

Dominical Letter	. B	Julian Period	. 6583
Epact .	. 28	Solar Cycle .	. 3
Lunar Cycle, or Golden		Roman Indiction .	. 13
Number .	. 9		

SIGNS OF THE PLANETS.

☉ The Sun. ⊕ or ♁ The Earth. ♄ Saturn.
☽ The Moon. ♂ Mars. ♅ Uranus.
☿ Mercury. ♃ Jupiter. ♆ Neptune.
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♈ Aries. ♌ Leo. ♐ Sagittarius.
♉ Taurus. ♍ Virgo. ♑ Capricornus.
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♋ Cancer. ♏ Scorpio. ♓ Pisces.

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☌ Conjunction, or having the same Longitude or Right Ascension.
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ECLIPSES IN 1870.

In the year 1870 there will be six eclipses, — four of the Sun and two of the Moon.

I. A *total eclipse of the Moon*, January 17, 1870. The penumbral phase is partly visible throughout the United States. The partial phase is partly visible throughout the Western States. The total phase is partly visible in Colorado, Utah, etc., and wholly visible in the Pacific States.

	Washington Time.	Chicago Time.	Salt Lake Time.	San Francisco Time.
	h. m.	h. m.	h. m.	h. m.
Moon enters Penumbra	6 47.3 A.M.	6 5.1 A.M.	4 28.9 A.M.	3 45.9 A.M.
Moon enters Shadow	7 48.3 A.M.	7 6.1 A.M.	5 29.9 A.M.	4 46.9 A.M.
Total phase begins	8 48.5 A.M.	8 6.3 A.M.	6 29.1 A.M.	5 47.1 A.M.
Middle of total phase	9 38.1 A.M.	7 55.9 A.M.	6 18 7 A.M.	6 36.7 A.M.
Total phase ends	10 27.7 A.M.	9 45.5 A.M.	8 8.3 A.M.	7 26.3 A.M.
Moon leaves Shadow	11 27.9 A.M.	10 45.7 A.M.	9 8.5 A.M.	8 26.5 A.M.
Moon leaves Penumbra	0 29.0 P.M.	11 46 8 A.M.	10 9.6 A.M.	9 27.7 A M.

Magnitude of eclipse = 1.664 (Moon's diameter = 1).

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III. A *partial eclipse of the Sun*, June 28, 1870. Visible at Sydney and at Melbourne, in Australia, and in New Zealand. Invisible in America. Magnitude of the eclipse = 0.633 (Sun's diameter = 1).

IV. A *total eclipse of the Moon*, July 12, 1870. More or less of the penumbral phase is visible east of the Mississippi River, and part of the partial phase is visible in Eastern New England.

	Chicago Time.	Washington Time.	Boston Time.
	h. m.	h. m.	h. m.
Total phase ends	5 34.3 P.M.	6 16.5 P.M.	6 40.2 P.M.
Moon leaves Shadow	6 34.0 P.M.	7 16.2 P.M.	7 39.9 P.M.
Moon leaves Penumbra	7 32.4 P.M.	8 14.6 P.M.	8 38.3 P.M.

V. A *partial eclipse of the Sun*, July 27, 1870. Visible in Northern Alaska. Magnitude of greatest eclipse = 0.075 (Sun's diameter = 1).

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To find the time of high tide, enter the following table* at the

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top with the name of the place, and at the side with the hour of the moon's southing found in the calendar, and in the body of the table will be found a number which, added to the time of the moon's southing, will give the time of high tide.

Time of Moon's Southing.	Boston, Mass.	New York, N. Y.	Philadelphia, Penn.	Old Pt. Comfort, Va.	Baltimore, Md.	Smithville, N. C.	Charleston, S. C.	Fort Pulaski, Savannah, Ga.	Key West, Fla.	San Francisco, Cal.
h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
0 0	11 38	8 20	1 31	8 55	6 47	7 26	7 38	7 30	9 33	12 5
0 30	11 33	8 18	1 28	8 49	6 42	7 21	7 33	7 25	9 26	11 59
1 0	11 28	8 15	1 25	8 44	6 37	7 16	7 27	7 19	9 19	11 53
1 30	11 24	8 10	1 21	8 40	6 31	7 13	7 21	7 15	9 13	11 47
2 0	11 20	8 6	1 18	8 35	6 26	7 9	7 16	7 11	9 6	11 41
2 30	11 16	8 0	1 14	8 32	6 21	7 6	7 12	7 8	9 1	11 36
3 0	11 13	7 55	1 11	8 27	6 17	7 4	7 8	7 6	8 57	11 33
3 30	11 10	7 52	1 8	8 22	6 13	7 3	7 5	7 5	8 53	11 33
4 0	11 7	7 52	1 6	8 20	6 11	7 2	7 2	7 4	8 53	11 38
4 30	11 6	7 52	1 3	8 21	6 10	7 3	7 2	7 4	8 56	11 46
5 0	11 6	7 53	1 0	8 23	6 10	7 4	7 3	7 4	9 2	11 55
5 30	11 9	7 56	0 59	8 26	6 13	7 6	7 7	7 6	9 10	12 3
6 0	11 13	7 59	0 59	8 32	6 19	7 9	7 12	7 8	9 22	12 11
6 30	11 19	8 5	1 1	8 39	6 25	7 13	7 19	7 12	9 33	12 18
7 0	11 25	8 11	1 7	8 48	6 32	7 17	7 24	7 16	9 49	12 23
7 30	11 32	8 17	1 15	8 58	6 39	7 23	7 32	7 22	10 0	12 29
8 0	11 38	8 23	1 23	9 4	6 44	7 28	7 38	7 28	10 6	12 34
8 30	11 43	8 27	1 29	9 8	6 49	7 33	7 45	7 34	10 7	12 37
9 0	11 47	8 32	1 34	9 10	6 52	7 37	7 48	7 39	10 6	12 38
9 30	11 48	8 34	1 39	9 12	6 54	7 39	7 50	7 42	10 3	12 34
10 0	11 49	8 35	1 42	9 10	6 53	7 40	7 50	7 43	9 59	12 30
10 30	11 48	8 34	1 45	9 8	6 52	7 40	7 47	7 41	9 56	12 24
11 0	11 47	8 31	1 41	9 4	6 50	7 36	7 44	7 37	9 48	12 17
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PLANETS.

Mercury will be visible about the 10th of May, after sunset, and about the 20th of October, before sunrise. On the 10th of May it may be distinguished from Jupiter by being farther from the sun.

Venus will be an evening star until about the 22d of February, attaining its greatest brilliancy about the 17th of January. After the 23d of February it will be a morning star until the 7th of December, attaining its greatest brilliancy on the 30th of March. After the 8th of December it will again be an evening star.

Mars, which in January will be visible after sunset, will begin to rise before the sun during the second week of April, and will continue to rise earlier and earlier throughout the year, without ever reaching opposition and its maximum brilliancy. Upon the last day of December it will rise at about 11h. 10m. P. M.

Jupiter will be seen in the evening, from the 1st of January to the latter part of May. It will at first be seen in the constellation Aries, and after the 4th of January will move into Taurus, passing between the Pleiades and the red star Aldebaran. On the 1st of January it will set at about 2h. 50m. A.M., on the 1st of February, at 0h. 50m. A. M., on the 1st of March, at 11h. 20m. P. M., on the 1st of April, at 9h. 45m. P. M., on the 1st of May at 8h. 20m. P. M., and on the 1st of June at 7h. 0m. P. M. Early in June Jupiter will begin to be a morning star, and will rise earlier and earlier throughout the year, reaching its quadrature on the 17th of September, and opposition on the 12th of December. During the whole of this time it will be in the constellation Taurus. It will move away from Aldebaran until the 14th of October, when it will be stationary, and after that it will slowly approach that red star again.

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The greatest elevation of the earth above the plane of the ring which will occur in fifteen years, takes place about the first of October, 1870. The planet will, on the whole, be most favorably situated for observation during July, August, and September. In several books, August, 1869, is stated to have been the best time for observations of the rings, but this is incorrect.

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h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
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