# INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

## GOVERNMENT ORGANIZATIONS.

### Naval bureau of ordnance.

*Experiments at Annapolis.* — By direction of the Naval bureau of ordnance, experiments with the six-inch steel gun were resumed at the experimental battery recently, the chief object being to develop and encourage the home manufacture of steel projectiles. Steel projectiles manufactured by the Midvale steel company near Philadelphia, having different physical characteristics as to toughness, extensibility, etc., were fired at a target consisting of two mild steel five-inch plates strongly bolted together, and backed with twenty inches of live-oak. The first and the second shots broke up; the third pierced the plates, and was stopped by the backing; while the fourth perforated target and backing, and buried itself in a mound of earth beyond the target. This projectile had an initial velocity of 1,983 feet, and weighed 75 pounds. The charge of powder was 32 pounds, and the striking energy per inch of shot's circumference was 108 foot-tons. The results indicate that there will be no serious difficulty in procuring the proper material for armor-piercing shells in this country.

A somewhat remarkable result was obtained with a projectile weighing 52 pounds, and a charge of 33 pounds of powder. The muzzle velocity obtained was 2,323 feet per second, with a pressure of about 13 tons. The ratio of charge to projectile was adopted as being nearly that which will be used in the new ten-inch guns designed by Commodore Sicard. These guns will be manufactured at the Washington navy-yard, and are intended for the batteries of the four double-turreted monitors.

It does not necessarily follow that results equally favorable will be obtained with the ten-inch gun, since the masses of both charge and projectile will be greatly increased. The pressures will doubtless be higher; but these guns will be sufficiently strong to withstand a working pressure of more than 25 tons to the square inch. The indications, however, are, on the whole, extremely favorable to the success of the ten-inch gun.

This experiment is likewise interesting when compared with the record of a six-inch gun constructed by Sir William Armstrong, in which, with an 80-pound projectile and a charge of 55 pounds of powder, a muzzle velocity of 2,297 feet was reached with a pressure of 21 tons. In the latter case the ratio of charge to projectile is 11:16, whereas in the former case the ratio is 11:17⅓. It is to be regretted that the size of the chamber of this experimental gun does not permit the employment of a larger charge of powder.

Two six-inch guns, representing the types proposed for the broadside batteries of the new steel cruisers, are now in process of construction at the Washington navy-yard, and will be ready for testing in August. — J. M. R.

### U. S. magnetic observatory at Los Angeles, Cal.[1]

*Magnetic observations.* — There is at present but one self-registering magnetic observatory within the limits of the United States. That observatory is located in Los Angeles, Cal.; and the object of the present article is to present a brief description of the observatory and its work, together with a short account of its origin.

Continuous series of magnetic observations, covering longer or shorter periods, have been made at several stations in North America; but, with two exceptions, they have all been made on the eastern side of the continent. We have a series of observations of five years (1840–45) at Girard college, Philadelphia, by A. D. Bache; six years' observations at Key West, Fla. (1860–66), by the U. S. coast-survey; and a long series, still continuing, at Toronto, Canada (1841–83). We have, further, a series of nearly five years of photographic records taken at Madison, Wis., by the U. S. coast and geodetic survey.

On the western coast the only continuous series of magnetic observations we have, were made by the Russian government at Sitka at the magnetic and meteorological observatory established in March, 1842, and maintained until the cession of Alaska to the United States in October, 1867; and the series of hourly observations at Point Barrow in 1852–54 by Capt. Maguire, R.N. Up to the present time, a great part of these observations have remained undigested and undiscussed.

It was therefore contemplated by the coast-survey, many years ago, to obtain a continuous series of magnetic records from some station on the western coast of the United States; and, with this end in view, an Adie magnetograph of the latest and most approved pattern was purchased in 1860. The outbreak of the war, however, prevented the carrying-out of this plan.

The instruments remained packed until 1878, when a favorable time seemed to have arrived to put it to use. Assistant C. A. Schott, aided by Mr. Suess, then set it up for trial in the basement of the coast-survey office in Washington. Some minor defects of construction were remedied, and the magnetograph set to work in January, 1879. It was kept going for about two weeks on trial, and found to perform satisfactorily. During this time, it was inspected by Superintendent Patterson, and its workings observed by various members of the survey. At the close of this trial it was packed up for shipment to some station in California.

It was found, however, that more money would be required to run the instrument than could be then set apart for this work, and it therefore remained in the coast-survey office.

In response to the invitation of the International polar conference, our government consented, in 1881,

[1] Communicated, with permission of the superintendent of the U. S. coast and geodetic survey, by MARCUS BAKER, acting assistant in charge of the observatory.

to the establishment of two observing stations in high northern latitudes. Observations, especially of meteorology and magnetism, were to be undertaken; and it was arranged to carry on these observations under the joint auspices of the signal-service and coast and geodetic survey. The executive management of these stations, the selection of observers, etc., were put under the direction of the chief signal-officer. The coast-survey co-operated by furnishing such magnetic instruments as were on hand, and by training, during the short time available for their work, the magnetic observers selected by the signal-office. It is to be regretted that there was not time enough to procure suitable differential instruments for the stations.

Two parties were despatched to the north, — one to Lady Franklin Bay, near the northern end of Greenland, under the charge of Lieut. A. W. Greely; and the other to Point Barrow, Alaska, under the direction of Lieut. P. H. Ray. Both these parties reached their destination in the fall of 1881.

It was the wish of the International polar conference that all the northern stations should be occupied three years; and a special effort was to be made to secure a complete and continuous record from August, 1882, to August, 1883. In the spring of 1882, additional observers were selected by the signal-office to replace any of the former ones that might have become disabled, or to act as auxiliaries, should such be needed. These magnetic observers, like their predecessors, received instruction at the coast-survey office prior to their departure for the north; and a set of differential magnetic instruments, hastily constructed, was sent to Point Barrow.

The spring of 1882 seemed, therefore, a peculiarly favorable time to put the Adie magnetograph to work, and to secure at one and the same time the long-desired series of magnetic observations from the western coast, and a series which would also be available for comparison with those observations made at the International polar conference stations. It was therefore mutually agreed by the signal and coast survey offices to establish a magnetic station at the joint expense of the two offices. In the case of the northern stations, the management was intrusted to the signal-office. The expense of the Lady Franklin Bay station was specifically provided for by act of Congress. The expense of the Point Barrow station was to be borne by the signal-service and coast and geodetic survey jointly. In the new station to be established in California, and which was to be devoted to observations of magnetism only, the management was left entirely to the coast-survey.

At first San Diego was suggested as the site of the new station, it being the place on the western coast of the United States farthest from the northern stations. A somewhat better location, nearly as far south, was, however, finally selected in Los Angeles, Cal.

Plans for a building were prepared in Washington, and forwarded to Assistant J. S. Lawson of the coast and geodetic survey, who proceeded to Los Angeles, and superintended the selection of a site, and erection of a building, in June and July, 1882.

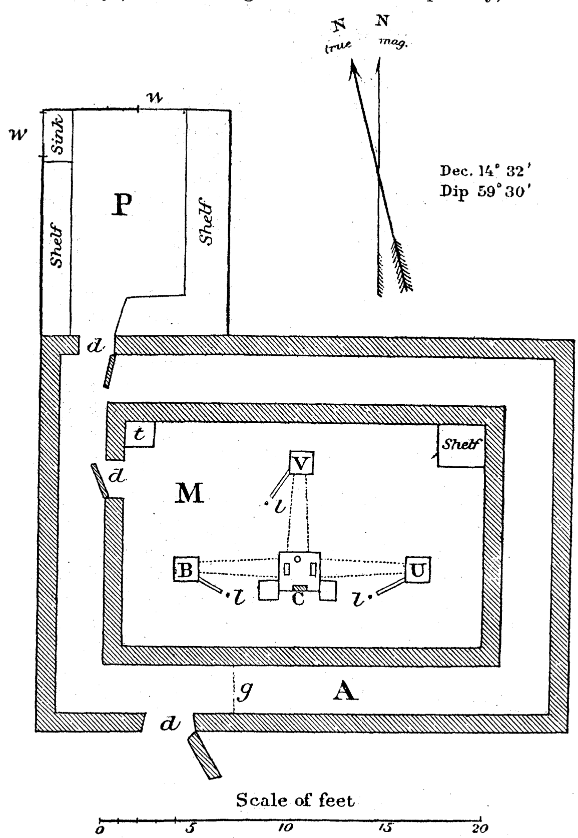
In July, 1882, the instruments, were shipped to Los Angeles, Cal., in the care of Mr. Werner Suess, a skilful mechanician in the coast-survey, and who had attended to the mounting of the instrument in 1878, and to its packing up after the test trial was complete.

At the same time, the writer was assigned to the charge of the observatory, with instructions to mount and adjust the instrument, determine its constants, and proceed to bring out a continuous record of the changes in the elements of the earth's magnetism. Leaving Washington July 26, he arrived in Los Angeles Aug. 7, 1882, where he found Mr. Suess in waiting, and the observatory complete.

After arranging preliminaries, the work of mounting and adjusting the instrument was begun, and pushed forward as rapidly as possible. Observations for the determination of the constants and scale values were made; the compensation of the vertical-force magnet for temperature was made; temperature coefficients were determined; and finally, on Sept. 28, every thing was in readiness, and the first sensitive paper was put upon the cylinders, and the first record made. The first few days were in the nature of a trial. A slight re-adjustment was made on Oct. 13, after which every thing worked satisfactorily. On Oct. 31 the horizontal and vertical force constants were redetermined; and since that date the instrument has continued to work almost perfectly, and to make a complete and continuous record of the changes of all the magnetic elements.

The observatory is situated in latitude 34° 03′ N., longitude 118° 15′ W. from Greenwich, and 317 feet above the level of the sea. It is on a rather steep hillside sloping to the south-west in the grounds of the Branch normal school in the city of Los Angeles, exactly one mile, in a direct line, from the centre of the plaza, or park, in the centre of the old town, or about a mile from the central business part of the town. Street-cars run within two squares of the observatory. It is on adobe soil underlaid by clay, and in the midst of an orange plantation formerly known as Belle Vue Terrace.

The observatory is built of redwood fastened with copper nails, is double walled, with an air-space 2.5 feet between the walls; which walls are fourteen inches thick, and filled with adobe soil. It is twenty-eight feet long by twenty-one feet wide, and painted white. The entrance to the observatory is on the south side. On the north side is the photographic or dark room, P, where the various photographic processes are carried on. This room is twelve feet long by ten feet wide. The accompanying plan will show the arrangement of rooms and instruments. The three magnets are placed, the unifilar or declinometer, U, to the east, the bifilar or horizontal-force magnetometer, B, to the west, and the vertical-force magnetometer, V, to the north, of the central driving-clock, C. A picture of the instrument, showing it as a whole, and also showing details, may be found in Gordon's Electricity and magnetism. For illumination, student-lamps burning kerosene-oil are used, and yield satisfactory results. The record is made on paper sensitized by the bromo-iodide process. The paper is sensitized at the observatory. Each trace contains two days' record; and the record is absolutely complete and continuous, except the time lost in changing papers to begin a new record, and in 'moving spots,' or shifting the luminous dots to get the second day's record on the same sheet. The time required for the first operation is from seven to eight minutes; for the second, from two to three minutes. Thus only about ten minutes are lost in two days, or an average of five minutes per day,—




a quantity too small to be of any importance on any occasion thus far observed.

One minute of time on the traces is represented by $\frac{1}{100}$ of an inch approximately, and a movement through one minute of arc by the unifilar magnet is represented on the trace by $\frac{3}{100}$ of an inch. A motion of the bifilar magnet of one scale division, represented on the trace by 0.027 inch, corresponds to a change of horizontal force of about its $\frac{1}{9000}$ part. The traces can readily be read off within half a scale division, or changes of force of its $\frac{1}{18000}$ part are recorded. This adjustment has not proved too sensitive, as the luminous dot has never left the recording cylinder, except once for a short time during the great magnetic storm of November, 1882.

Visitors are admitted to the observatory, and the traces generally show their presence by a break in the curve.

The instrument records, as is well known, changes of declination, changes of horizontal force, and changes of vertical force. Each of these changes is recorded on a separate sheet, or trace as it is called; and thus, on an average, forty-five traces are produced each month. These traces are six inches by sixteen inches and a half, and are made on plain photographic paper prepared for use at the observatory.

This preparation consists of two processes, salting and silvering. The salting process, as it is called, consists in soaking the paper from ten to fifteen minutes in a bath of iodide and bromide of potassium, with a little tincture of iodine added, after which the paper is hung up to dry. This process is carried on in the daylight.

The silvering or sensitizing process is carried on in a room as dark as can well be made, and then lighted up dimly with a red lantern. Some difficulty has been found in keeping the room dark enough, and on some occasions the silvering has been done at night.

For silvering, four wooden trays are placed in a row: the first containing a bath of nitrate of silver, acetic acid, and water; the second, distilled water; the third, a weak solution of chloride of ammonium; and the fourth, distilled water. A sheet of salted paper is then floated on tray no. 1, special care and some skill being required to prevent (*a*) any of the solution from getting on the *back* of the sheet, and (*b*) any air-bubbles from clinging to the front side of the sheet. The first defect produces stains, and the second, spots. In about nine minutes the paper is transferred to tray no. 2, being floated on as in the case of no. 1, and a new sheet is floated on tray no. 1. In about nine minutes more, the sheets are moved forward, as before; the paper in no. 2 is floated on no. 3; that in no. 1 is transferred, as before, to no. 2, and a new sheet floated on no. 1. This continues till tray 4 is reached; after which the sensitizing is complete, and the paper is then hung up to dry in the dark. Special care is necessary in hanging up the wet paper to avoid stains from the fingers, from the line, or from the pin which holds the paper on the line.

After drying thoroughly, the papers are taken down, packed in a large envelope, and kept in a dark drawer to be used as needed. From this envelope the sheets are transferred to the three recording cylinders prepared to carry them. They remain two days upon the cylinders, and thus receive two days' record. At quarter-past nine A.M. of each alternate day the papers are changed.

Over the central driving-clock is hung a heavy orange-flannel curtain. To change papers, the attendant, with the envelope of sensitive paper, goes behind this flannel curtain, through which sufficient light from the three lamps comes to enable the change to be made without further artificial light. The orange flannel serves to satisfactorily exclude actinic light.

The traces, removed from the cylinders, are then carried in a large envelope to the dark room, and there developed, the developer used being pyrogallic acid. The best developments are those which take place rather quickly, in about ten to fifteen minutes. When the development is slower, the traces are usually found inferior. After the development is complete, the traces are fixed in hyposulphite of soda. cleansed in a saturated solution of alum, washed for about two hours in running water, and then hung up to dry. After drying, the date is stamped upon them. The exact instant of beginning and ending of each line on the trace, together with the corresponding scale value, is written on. Time observations, with sextant and artificial horizon, are taken from time to time, usually monthly, to regulate the standard chronometer.

After the traces have been thus completed, they are practically paper negatives, from which any number of copies may be made photographically. Two sets are made by the well-known blue-print process. The traces require no special treatment, such as oiling, waxing, etc., for the successful application of this process.

For tabulating from the traces, it is found most convenient to use a ruler subdivided into hourly divisions for the time scale, and a triangular piece of card-board upon the edge of which is ruled the scale corresponding to the trace to be read. The unifilar and bifilar traces have all been read, tabulated, and the means calculated. The vertical-force traces have not yet been read.

There is also in the magnet-room of the observatory a thermograph, which records the temperature every half-hour. From the records produced by it, the time of maximum temperature in the observatory is found to be about five P.M., and the time of minimum temperature, about half-past eight A.M. At these hours the thermometers under the bell glasses and near the magnets are read; and from these readings it appears that the magnets are subjected to an average daily range of temperature of about $1\frac{3}{4}$° C.

On the 14th, 15th, and 16th of each month, observations are made to determine the absolute declination, dip, and intensity. These observations are made in the usual manner of taking such observations by field parties in the coast and geodetic survey. Monthly reports and returns of results are made to the superintendent of the survey.

The declinations and dips have all been computed, but the intensities only approximately as yet. The following table contains the declinations and dips resulting from the monthly absolute determinations. Each declination is the mean derived from the elongation on three successive days, and each dip is the mean of six sets with two needles on the same three days.

*U. S. magnetic observatory at Los Angeles, lat. 34°03′, long. 118°15′ W. G.*

| | Declination. | Dip. |
|---|---|---|
| 1882, Sept. 14, 15, 16 | 14°35.5′ E. | 59°30.1′ |
| Oct. 14, 15, 16 | 33.7 | 30.2 |
| Nov. 14, 15, 16 | 34.6 | 29.7 |
| Dec. 14, 15, 16 | 32.7 | 31.6 |
| 1883, Jan. 14, 15, 16 | 35.1 | 30.8 |
| Feb. 14, 15, 16 | 31.5 | 28.4 |
| March 14, 15, 16 | 32.4 | 31.7 |
| April 14, 15, 16 | 32.1 | 29.2 |
| May 14, 15, 16 | 32 5 | 29.7 |

The horizontal intensity is approximately 5.97 in British units = 0.275 dyne.

U. S. magnetic observatory,
Los Angeles, Cal., June 1, 1883.

## NOTES AND NEWS.

Professor Huxley has been elected president of the Royal society of London, in the place of Mr. Spottiswood.

— The recently issued report of the signal-office for 1881 contains a record of primary and secondary observing stations, established in that year in Alaska, with summaries of observations at some Alaskan stations in preceding years. There is also some account of the fitting-out of the Greely expedition to Lady Franklin Bay and that to Point Barrow. But the most important article for arctic students is the report of Prof. E. W. Nelson on the meteorology of St. Michaels, Norton Sound, where, as is well known, he had been stationed for four years; his leisure being employed in pursuing investigations into the natural history and ethnology of the region with the greatest energy, devotion, and success. The article itself being a summary and an abstract, with somewhat wider limits in regard to the treatment of auroras and the so-called 'polar band' formation of clouds, it will not be attempted to condense it here, but merely to call attention to some of its leading features. According to observations by Danenhower, the position (hitherto somewhat uncertain) of St. Michaels is latitude 63° $28\frac{1}{4}$′, and longitude 162° $04\frac{3}{4}$′ west. The mean annual temperature for the period is 25°.5 F. The highest observed temperature was 75°, and the lowest, — 55°. A curious fact was noted with great regularity. In early winter darkness comes on between three and four P.M., and the temperature falls until about six P.M., when a *rise* follows of two or three hours' duration, and sometimes five or six degrees in extent, followed by the usual steady nocturnal fall. It does not result from changes in the wind, but may be due to greater radiation immediately after sunset from the land, resulting in local atmospheric movements, causing warmer air from the adjacent sea to flow in the vicinity of the station.

Alongshore, winds N., N.E., S., S.E., S.W., are most prevalent. Winds off the sea, N.W. and W., are the least frequent, not exceeding together over ten per cent of the whole. Topographical bias is, however, distinctly evident, as at most stations in Alaska.