calcic carbonate deposited to form the spat shell are prismatic and of a wholly different microscopic appearance from that of the fry. The facts presented above prove beyond a doubt, that it is the mantle border of the fry which is the effective agent in achieving firm fixation, whatever may be the importance of a temporary or larval byssus.

This was an interesting and important point to determine, on account of its practical relation to the artificial rearing of the American oyster (Ostraea virginica). But with the foregoing comparatively meagre results we may say, that our success in the artificial culture has ended; and, were it not for the highly encouraging recent reports from France, our efforts might have rested here. The stimulus which has provoked the investigations recently undertaken abroad was, however, probably Dr. W. K. Brooks's success with the American oyster in 1879, and his demonstration of its unisexuality.

The remarkable success of M. Bouchon-Brandely in rearing spat from the artificially fertilized ova of O. angulata at Verdon in France, as reported in the *Annals and magazine of natural history* for October, 1882, and his still later reports to the minister of marine of France in the *Journal officiel de la république française*, are of the greatest moment as applied to practical oyster-culture. M. Brandely, after determining that O. angulata was unisexual like the American species, conceived the idea of rearing the spawn by artificial means. In order to do this, two adjoining oyster claires, or ponds, fed by the tides were arranged at Verdon; the one acting as a reservoir from which the fresh sea-water (brackish) was drawn through a tube, provided with a filter consisting of a sponge at either end, into the lower experimental claire. The water percolated out of the latter through a bed of fine sand; in this way the embryonized ova placed in this pond were kept from escaping. Fertilized eggs were then put into the experimental pond from day to day, while a number of collectors, or tiles, were at once submerged in the same. In somewhat more than a month, success had attended his experiments; and in the course of further experiment still greater success was attained when about four thousand spat had been found affixed to a single tile under circumstances which admitted of no doubt as to their having been the product of the artificially impregnated eggs placed in confinement in their vicinity. It was found, moreover, that the artificially fertilized eggs had actually developed into spat in the closed claire a month before any had made their appearance on the thousands of tiles placed on the natural banks in the Gironde.

From a personal investigation of the anatomy of O. angulata, we can affirm that it is remarkably similar to O. virginica in the structure of the generative organs, and that there is no reason why as great success should not attend the culture of that species by the same apparently very practicable means. It remains to be seen, however, what proportion of the artificially reared spat will reach the adult condition. With an abiding faith, however, in the final achievement of the solution of the question of the artificial culture of the American oyster, which will soon become a positive necessity to its culture, I think it not improbable that another season's work will conclude the required preliminary research, and realize for us all the success we could hope for.

J. A. RYDER.

THE MAPPEMONDE OF SEBASTIAN CABOT.

THE library of Harvard College, in Gore Hall, has recently been enriched with a photographic facsimile of the large map of the world in the national library in Paris, known as the map of Sebastian Cabot. This interesting memorial was discovered in Germany about the year 1844, in the house of a Bavarian curate, and, through the good offices of M. de Martius, was in that year purchased for the Paris library. It is a large elliptical *mappemonde*, engraved on copper, 1 m. 48 cm. in width, 1 m. 11 cm. in height. Along each side of the map, that is to say, outside the circle, is a table 30 cm. in width; the first, on the left, inscribed at the head, Tabula Prima, and that on the right, Tabula Secunda. On these tables are seventeen *legendes*, or inscriptions, in duplicate, — that is to say, in Spanish and in Latin, — printed, and pasted on the map. Each legend in Latin immediately follows the Spanish original, and bears the same number. Besides these seventeen inscriptions, there are five others in Spanish which have no Latin *exemplairs*.

This ancient map, composed, as we shall see farther on, in the year 1544, while Cabot was yet living in Spain, contains geographical delineations of discoveries down to about that period. In representing the north-east coast of our continent, Newfoundland is laid down as a group of islands; and we easily recognize the river and bay of St. Lawrence,

Cape Breton, and the Isle of St. John. The west coast of America is delineated as far north as lat. 35°, California being drawn from the well-known chart made by the pilot Castillo in 1541. To the north of this, of course, is the unknown region; for nobody then knew certainly whether America and Asia were one continuous continent, or were divided by straits, and the conjectures of geographers were at variance.

But the interest in this map centres principally in its inscriptions; and, though the most of these contain little of value in a geographical or historical point of view, a few of them are of special significance. The seventeenth inscription, by turning it into English, reads as follows: —

"Sebastian Cabot, captain and pilot-major of his sacred imperial majesty, the emperor Don Carlos, the fifth of this name, and the king our lord, made this figure extended on a plane surface, in the year of the birth of our Saviour Jesus Christ, 1544, having drawn it by degrees of latitude and longitude, with the winds, as a sailing-chart, following partly Ptolemy and partly the modern discoveries, Spanish and Portuguese, and partly the discovery made by his father and himself: by it you may sail as by a sea-chart, having regard to the variation of the needle," etc.

Then follows a discussion relative to the variation of the needle, which Sebastian Cabot claimed to have first noticed. Here we have the declaration, that the map was made by Sebastian Cabot, pilot-major of the Emperor Charles V., and in the year 1544, at which time we know he was living in Spain and held that office. And this is accompanied by the statement, that, in making the map, he was guided by the discoveries of his father, John Cabot, and himself.

Inscription No. 8 reads thus: —

"This country was discovered by John Cabot, a Venetian, and Sebastian Cabot his son, in the year of our Lord Jesus Christ, MCCCCXCIV [1494], on the 24th of June in the morning, which land they called '*prima vista;*' and a large island adjacent to it they named the Island of St. John, because they discovered it on the same day," etc.

This is an important statement made or authorized by the alleged author of the map, said in the inscription No. 17 to be Sebastian Cabot; and, though the year of the discovery expressed is believed to be a typographical or a clerical error, the whole passage bears evidence of proceeding from Sebastian Cabot himself. The body of the map itself contains numerous inscriptions, some brief, and others of greater length, with references by numbers to the legends on the sides; so that these tables belong to and are a part of the map itself. The *prima vista* of legend No. 8, or '*prima tierra vista*,' that is, the land first seen by the Cabots, is inscribed on the map near the head of the delineation of Cape Breton.

Like many of the large maps of that period, a number of figures of men and animals, the supposed natives of the countries described, are introduced into the body of the map. Savages are at war with each other, and tigers and bears are roaming over the American continent; the Emperor of Tartary is depicted in state; and Prester John, holding a cross, is placed near the great lakes, the sources of the Nile. In the original map the figures are colored. The map has no name of engraver or publisher, or place of publication. One would naturally say it was published in Spain; but the policy of the government was opposed to the publication of maps which delineated their own possessions. Dr. Kohl thinks it was published in Germany or Belgium. In one corner of the map is depicted the double-headed eagle displayed on the arms of Germany.

I do not propose to discuss in this brief notice all the questions which have arisen, or which suggest themselves, respecting the genuineness and value of this map, but simply to describe it. It can be studied now by means of the photographic copies taken, as it never could be studied before from the position of the original in the national library in Paris.

We now know, from sources independent of this map, that John Cabot, in a single vessel from Bristol, discovered North America in the year 1497. His son Sebastian may have been with him. The expedition returned in about three months. In the following year, 1498, John Cabot sailed again with a larger number of vessels, and Sebastian no doubt went with him. They had not returned by the end of October. Nobody knows when they returned, and nobody knows what became of John Cabot. Sebastian returned, and lived fifty years after this second embarkation. He or his father, or both of them, made maps at the time, illustrating the voyage of discovery; but these are lost. Writers in the sixteenth century, before Hakluyt's time, often speak of Sebastian Cabot's maps (they never speak of John Cabot), but without describing them. Ortelius in 1570 had a copy of a map by Cabot engraved on copper, without the

name of the place or printer. Yet, forty years ago, no one, for two centuries and a half, had seen a copy of a map by Cabot. When, therefore, it was announced that the National library in Paris had found a Cabot map, a great interest was excited. The distinguished geographer, M. d'Avezac of Paris, wrote a description of it in the *Bulletin de la société de géographie* (4th ser. tome xiv. pp. 266–268); and M. Jomard produced a facsimile of it, without the inscriptions, for his great work, the *Monuments de la géographie*, 1842–1862. Geographers have been trying to study it ever since; but the inscriptions had never been copied, and it required a visit to Paris to inspect them. In the glass case in which the map was shown, it was scarcely accessible for study. Having occasion last winter to make a study of the Cabot voyages, I wrote to Paris to have a copy made for me of several of the inscriptions on this map, — the greater part of which in their Spanish form were nowhere accessible. The great charge for the work was explained by the difficulty of access to the map, of which I have spoken. About this time, being in consultation with the librarian of Harvard University, — Mr. Winsor, — he suggested the practicability of having a photograph made of the map and its inscriptions. As the Hon. Robert C. Winthrop, the president of the Massachusetts Historical Society, was about to sail for Europe, the matter was laid before him; and he readily entered into the plan, and, thanks to his kind intervention during a late visit to Paris, the work was accomplished, and the photograph is a great success. The skilful photographer employed by Mr. Winthrop was M. Sauvanaud, who made for him ten copies, which have been taken by different libraries and societies in this country, dividing the expense between them.

This map has a curious connection with other historical memorials of three hundred years ago, and an interesting piece of literary history might be made of it. I will state briefly some of the points of interest. Richard Hakluyt, the great collector of voyages and travels, in a folio volume published in 1589, called The principal navigations, etc., printed "An extract taken out of the map of Sebastian Cabot, cut by Clement Adams, concerning his discovery of the West Indias, which is to be seen in her Majesty's privy gallery at Westminster, and in many other ancient merchants' houses." The 'extract' which follows this heading is in Latin, and is in substance the same as legend No. 8 on the Cabot map in Paris, from which I have made a quotation above, relating to the discovery of unknown lands. I say it is in substance the same; but the grammatical construction is quite different, indeed, so very unlike that I suggested some years ago that the Latin of the Paris map and the Latin of Clement Adams, or that which he copied, were independent translations from a Spanish original. Now, here we see another Cabot map in London, from which Clement Adams, a learned schoolmaster, made copies, with the same legends upon it in Spanish, or in Latin, or in both; if in Latin, quite different from that on the Paris map. Possibly it had only the legends in Spanish, and Adams made his own independent translation, as suggested above.

Again, in 1594, — second edition, 1599; third edition, 1606, — there was published a rare and curious volume, edited by a German traveller, Nathan Kochhaf, or, as he was called by his Latin name, Chytraeus. He was in England in 1565, picking up whatever of antique and curious legends and monumental inscriptions he could find for his book; and while apparently at Oxford, he saw a document, with some geographical tables, containing several inscriptions in not very elegant Latin, he says, but which, on account of the value of the matter contained in them, he copied and printed in his volume, filling twenty-two pages of this book. They are wholly in Latin, and they correspond substantially with the Latin inscriptions on the sides of the Cabot map in Paris. There is this difference: The inscriptions here are but nineteen in number, while on the Paris map there are twenty-two, five of them in Spanish only. Legend No. 17, which I have quoted above in part from the Paris map, has the date 1549 inserted as the year in which the map to which the inscriptions belonged was composed; instead of 1544, as on the Paris map. This which Chytraeus saw may be a second edition of the Paris map, made after Cabot had returned to England. So here, again, we have another Cabot map to be added to our cartographical bureaux, along with that of Clement Adams and the map from which he made his copies, which were hanging up, in Hakluyt's time, 'in many ancient merchants' houses,' — all of which we must class with the *desiderata*.

I have spoken of the volume of Chytraeus, which contains substantially the legends as on the Paris map in Latin. The language in which the legends were originally written was Spanish; and on the Paris map, as I have already said, they appear in Spanish as well

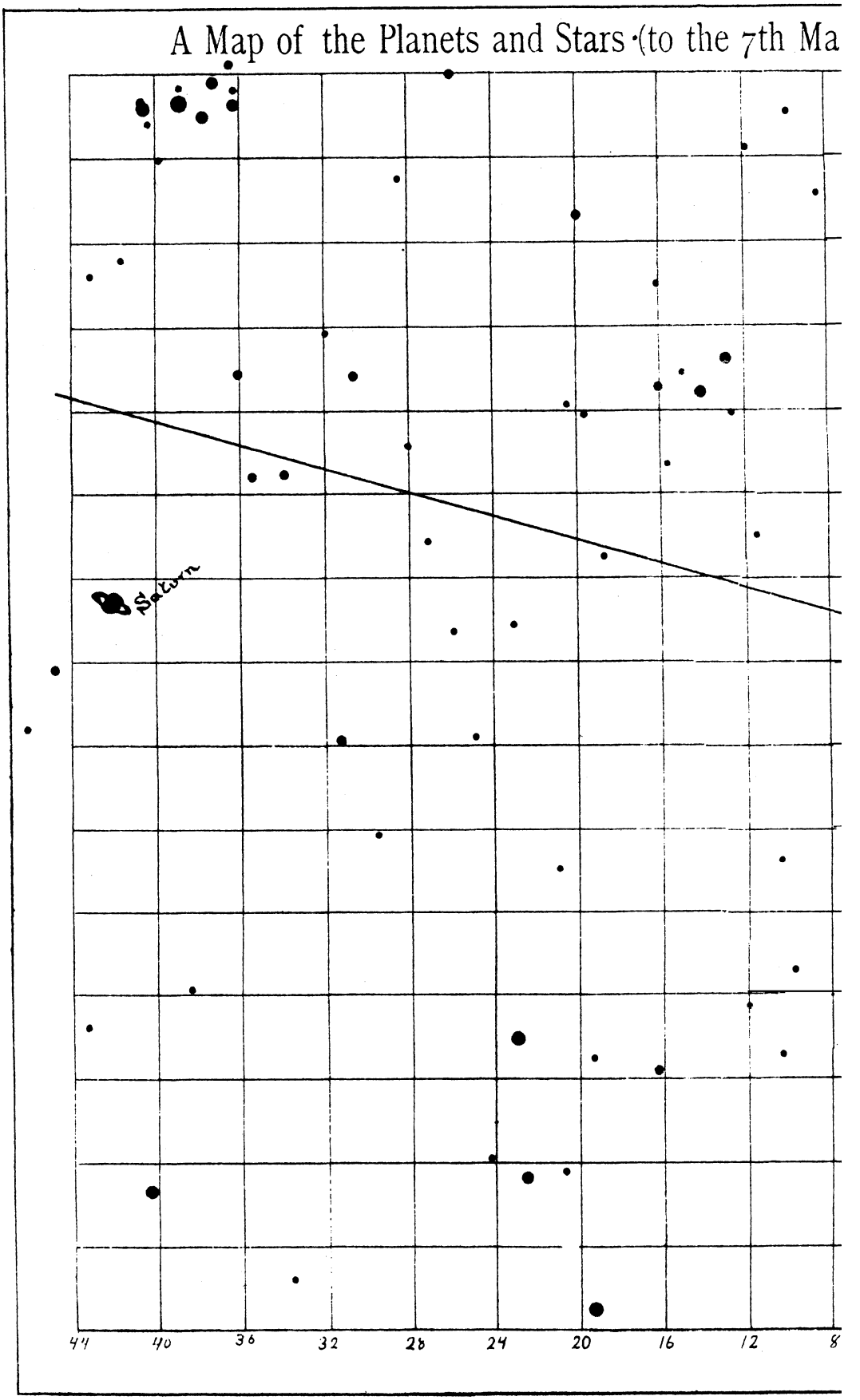
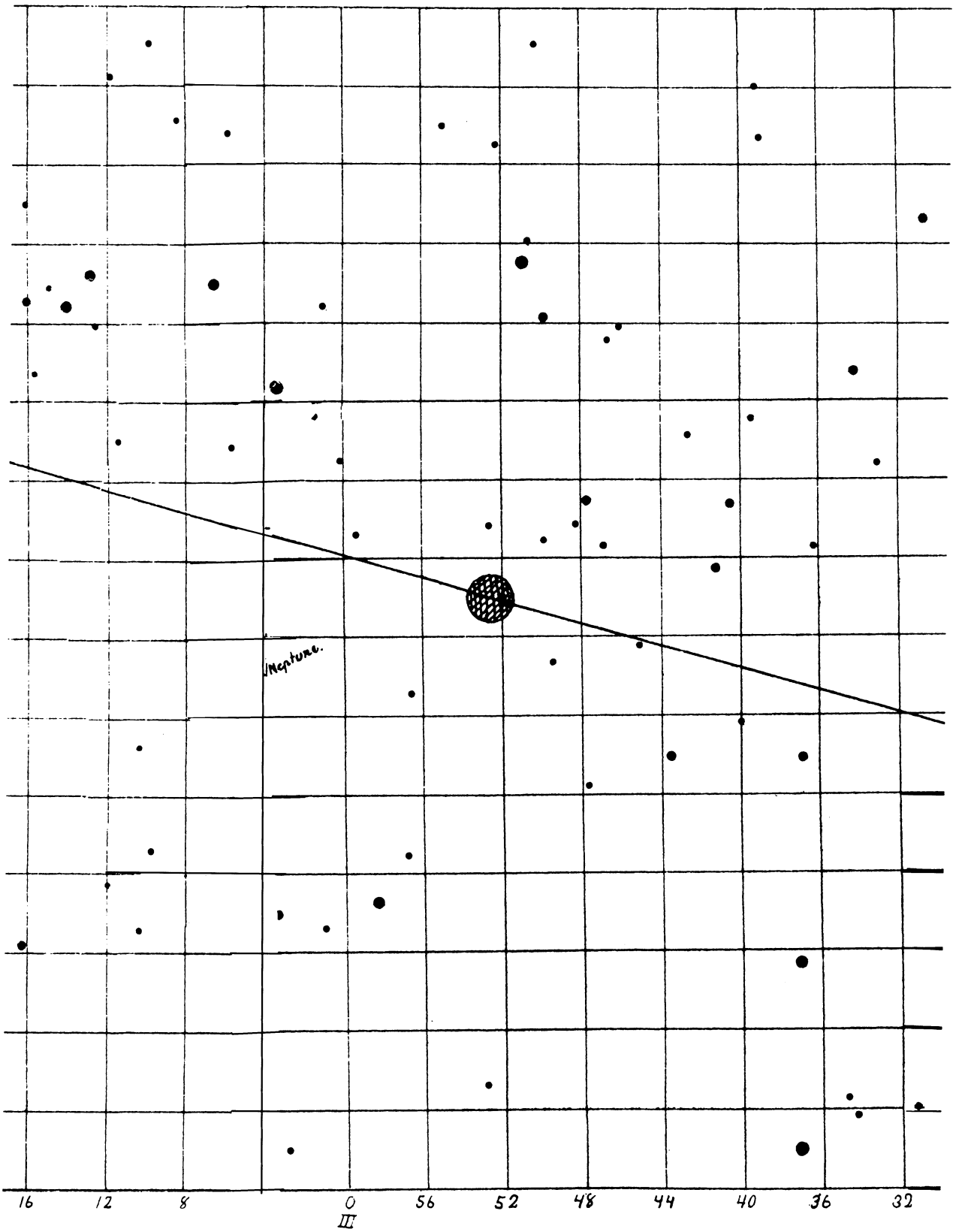


Photo-Lithographed expressly for "SCIENCE," by The Forbes Co., Boston.

(to the 7th Mag. inclusive) near the Sun, May 6th, 1883, by Edward S. I



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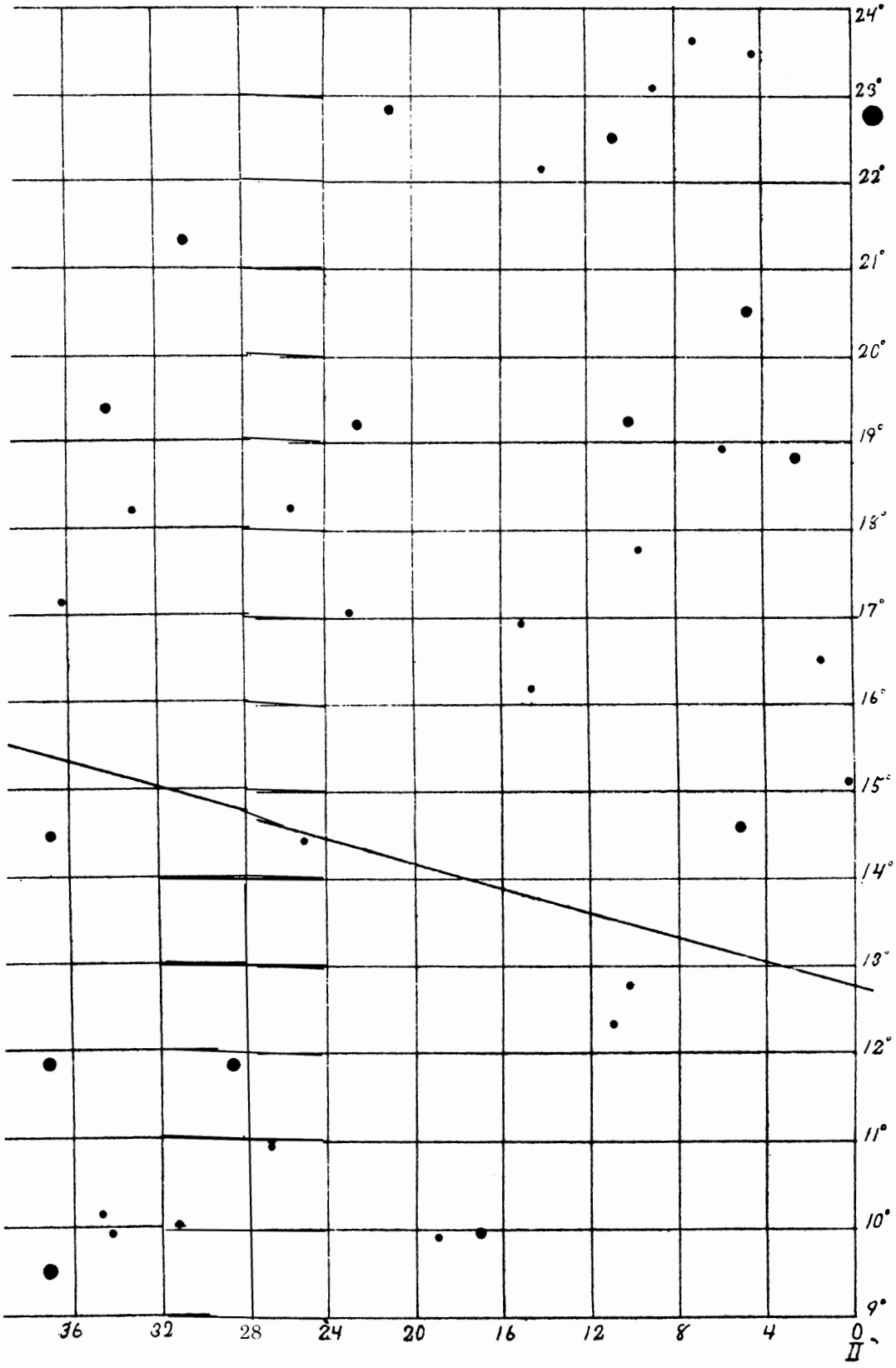
y Edward S. Holden. (The places are for 1855.0)



as in a Latin version. By means of these photographic copies of the map, the legends in Spanish are made accessible. I am not aware that they have ever been published as a whole. There is something more than a suspicion that some of the legends in Latin contain statements not to be found in the Spanish. A committee of the Massachusetts historical society, to whom a copy of this map, presented by the president, has been referred, intend to publish an English translation of the legends, with the result of a comparison with the Latin version.

CHARLES DEANE.

MAP OF THE PLANETS AND STARS NEAR THE SUN, MAY 6, 1883.

THE map which is given in this number of SCIENCE has been prepared to aid astronomers, who may observe the total solar eclipse of this year, in a search for Vulcan. It does not need to be said that the eclipse of May 6 is the most favorable for this purpose that will occur for many years, and it is to be hoped that the unique opportunity will not be lost.

The present map has been compiled with care from the *Durchmusterung* catalogue, checked by comparison with the maps and by proof-reading. It contains all the stars of the *Durchmusterung* within the region near the sun, down to the seventh magnitude inclusive, together with a few stars of a slightly lower magnitude, which are only added when their omission would spoil a configuration. The planets Saturn and Neptune are also added. The positions of the map are amply accurate for the purpose intended.

EDWARD S. HOLDEN.

Washburn observatory, university of Wisconsin, Madison, Jan. 11, 1883.

FIRST USE OF WIRE IN DEEP-SEA SOUNDING.

IN view of the great impetus recently given to deep-sea sounding and dredging (especially in the United-States navy and coast survey work) by the application of steel piano-wire in place of line, it is interesting to learn the fate of the first experiments in that direction. These have been extracted by Commander J. R. Bartlett, U.S.N., of the hydrographic office, from the log-book of the United-States schooner Taney, Lieut. J. Walsh, U.S.N., commanding, October, 1849, to June, 1850.

The Taney took on board at the Brooklyn navy-yard, Oct. 22, 1849, a large iron reel containing 7,000 fathoms iron wire graduated Nos. 7 to 13; an extra reel with 5,900 fathoms wire, size not stated; and a small reel with 300 fathoms iron wire, size No. 5.

The Taney sailed Oct. 26, 1849, to take deep-sea soundings in the North Atlantic. On the 15th of November preparations were made for sounding with wire in lat. 31° 59′ N., long. 58° 43′.5 W., not far from Bermuda. After reeling out 5,700 fathoms, the wire parted near the surface, owing to the fact that the splices had some projecting ends which caught upon each other. The No. 7 wire parted. It is noted in the log, that the circumstances were favorable and the sounding plumb. It seems, however, that the lead used was altogether too small, about twelve pounds only; and this was the reason why so much wire ran out without its being recognized that bottom had been reached. The weight of the wire of course carried it out, and would have continued to do so as long as any wire was left. The lead was armed with a Stellwagen cup, but the detaching apparatus and dynamometer for sounding were then unknown.

The same experience was repeated on the 9th of May, 1850, when 2,200 fathoms of wire were lost; and on the 18th, when 2,050 fathoms were lost, with the thermometer, twelve-pound lead, and Stellwagen cup. On the 22d of May the last attempt was made with the same results; the wire parting in every instance owing to one splice catching upon another on or near the reel. The last time only an eight-pound lead was used, with 1,900 fathoms of wire out when it parted. The party returned to New York, June 3, 1850, shortly after which Lieut. Walsh died. This ended the trial of wire for the time; to be revived when the invention of steam reeling-apparatus, detaching sounding-cups, the dynamometer, and 'accumulators' had rendered its use practicable. It seems singular, however, that the difficulty as to the splices was not remedied on the spot, and that heavy leads were not tried.

WILLIAM H. DALL.

AN EXTENSION OF THE THEOREM OF THE VIRIAL AND ITS APPLICATION TO THE KINETIC THEORY OF THE CONSTITUTION OF GASES.[1]

CLAUSIUS has designated as the theorem of the virial the equation which he first arrived at in a paper upon a *New mechanical theorem applicable to heat.*[2] This theorem applies to stationary progressive motion, such as the molecules of gases are assumed to have in the kinetic theory of gases, and, when so applied, may be written in the form

$$akt = \tfrac{2}{3} pv + \tfrac{1}{3} \Sigma rR \quad . \quad . \quad . \quad . \quad (1)$$

[1] Abstract of a paper read by H. T. EDDY, Ph.D., University of Cincinnati, before the Ohio mechanics' institute, Jan. 18, 1883.

[2] Phil. mag. [4], vol. 40, p. 122.