The following officers were elected for the year 1901–02:

President, Dr. Charles E. Bessey, University of Nebraska, Lincoln, Nebr.

First Vice-President, Dr. E. A. Birge, University of Wisconsin, Madison, Wis.

Second Vice-President, Mr. John Aspinwall, New York City.

Elective Members of the Executive Committee, Dr. A. M. Holmes, Denver, Col.; Dr. V. A. Latham, Chicago, Ill.; Mr. G. C. Whipple, New York.

Secretary, Dr. Henry B. Ward, University of Nebraska, Lincoln, Nebr.

Treasurer, Mr. J. C. Smith, New Orleans, Louisiana.

Custodian, Mr. Magnus Pflaum, Pittsburg, Pa.

Resolutions of regret at the death of ex-President E. W. Claypole, the sad news of which came to the Society as it was in session, were read and ordered spread upon the minutes of the Society.

Henry B. Ward,
Secretary.

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*TOTAL ECLIPSE OF THE SUN.**

Among the unsolved problems for the twentieth century are many relating to the central luminary of our system. Many points of scientific interest to students of solar phenomena are still to be discovered, and it is true that when we come to consider what we do not know about the sun, we are rather startled to find our knowledge about the heavenly body which has most interest to us human beings so incomplete. The distance is not known to the accuracy which we wish it, and very little is known of the laws of motion at the surface of the sun or the manner in which light and heat are sent out. The spectroscope tells us what metals are present at the surface of the sun, but, as yet, it has not decided the question of the extent of the different gases, nor the position of the 'reversing layer.' In fact, the very existence of the 'reversing layer' has been disputed. The most beautiful of all natural phenomena, the corona, is to us an unsolved mystery. Much time has been spent delineating its form, and in late years some connection has been established between the form of the corona and the sun-spot period; but what is the meaning of this connection? and in turn, what is the relation between sun spots and terrestrial magnetism? The spectroscope tells us that 'coronium' forms a constituent of the corona, but what is 'coronium'?

These and many other points are still to be solved by astronomers and physicists. Their solution depends almost entirely on the observations, on the average, of only a few minutes each year, for it is only when the sun is eclipsed that most of these problems can be investigated.

The United States government recognized the importance of these inquiries, and through Congress appropriated money to equip and send out an expedition to observe the eclipse of the sun visible in the island of Sumatra in the East Indies, on May 18, 1901.

This expedition consisted of thirteen, a number which would have caused terror to enter the hearts of people less sensible than astronomers. This is the largest party, we believe, ever sent out by any government for such a purpose.

The thirteen were made up of two separate parties, two members, Professor C. G. Abbot and his assistant, Mr. Draper, representing the Smithsonian Institution, and eleven the Naval Observatory. Six belonged to the staff of the observatory, and consisted of Professor A. N. Skinner, U. S. N.; Professor W. S. Eichelberger, U. S. N.; Professor F. B. Littell, U. S. N.; Mr. L. E. Jewell, Mr. W. W. Dinwiddie and Mr. G. H. Peters. The remainder of the party was made up of Professor E. E. Barnard, Yerkes Observatory; Dr. W. J. Humphreys and Mr. H. D. Curtis, of the University of Virginia; Dr. N. E. Gilbert, of Hobart College, and the writer.

* Read before the New York Academy of Sciences, November 4, 1901.

The members crossed the continent by various routes, meeting together for the first time in San Francisco. Transportation was furnished by government steamers, and on February 16, on board the army transport *Sheridan*, the expedition started to demonstrate that the earth is round by sailing west in order to reach the East Indies. The Army was to care for the party as far as Manila, and from there to Sumatra the Navy Department was to attend to us. Life on board the transport was very pleasant, many entertainments being provided by the officers, soldiers—and astronomers, too—to while away the hours.

Honolulu was reached the morning of February 25. A three days' stay there enabled the party to see most of the sights of the island of Oahu, making a most pleasant break in our voyage of thirty days to Manila. The Social Science Club of the Hawaiian Islands was exceedingly kind to the astronomers. Among the courtesies shown was a drive up the historic Pali, a huge precipice with a sheer drop of 500 feet, over which one of the old kings is said to have driven his enemies to their death. In the evening a meeting of the club was held at which Professor Barnard gave one of his interesting illustrated talks. The three days' stay was exceedingly interesting, giving an excellent opportunity of seeing how the United States was progressing in the government of his new outside dependencies.

The 180th meridian was crossed at 11:40 on the night of March 4, and as a result our day of March 5 was of only twenty minutes' duration. On crossing the line, Father Neptune and his court paid the ship a visit, the celebration of which was greatly enjoyed by soldiers, sailors and passengers.

Manila was reached on March 18, and a stop of eight days was made while arrangements were made with the Navy Department to carry us the remaining 2,200 miles to Sumatra. The Manila observatory, which was visited several times, is doing an exceedingly important work, the value of which is recognized by the United States authorities. The predictions for typhoons come from the observatory, and in view of the enormous shipping of the port, this service is invaluable. A time service and weather bureau with 76 stations are about to be instituted by the observatory authorities. Of course, the most interesting sights to Americans were the Spanish wrecks at Cavite, monuments to the valor of Admiral Dewey.

The U. S. S. *General Alava*, a former Spanish ship, was put at the disposal of the expedition, and on March 26 we set sail for Sumatra. Pleasant weather was experienced through the China and Java Seas. The equator was crossed on March 31, and 'Neptunus Rex' was celebrated in true man-of-war style.

On April 2, the ship passed within half a mile of Krakatau, excellent opportunity thus being given to see this historic volcano. Where, before the eruption of 1883, had been a hill of perhaps 1,000 feet, bottom is now not reached at the depth of 164 fathoms.

On April 4, the *General Alava* steamed into the beautiful harbor of Emma Haven, the port of Padang, the capital of the island of Sumatra, and a first glimpse was obtained of the Malay, with whom the next two months were to make us so well acquainted. We were the first astronomical expedition to arrive, ours being, in fact, the first American ship which ever entered port there. But in a few days Professor Perrine and the astronomers from the Massachusetts Institute of Technology arrived, to be soon followed by parties from England, Holland, France, Russia, Japan and India.

It took some time to get accustomed to the East Indian ways, particularly the cus-

toms of eating and bathing, and many amusing incidents were the result. In the East Indian hotels the bath rooms are away out in the yard, a hundred yards or more from your bedroom. There is no bath-tub like ours—in fact, plumbing of any sort is unknown there—and the bath is taken by dipping water from a cistern by means of a bucket and throwing it over yourself—and a very good bath it gives, too. One of our English friends mistook the cistern for his tub, and got in, greatly to the consternation of the Malays.

The Dutch did everything in their power to make our stay in the island pleasant, with the result that everything was accomplished with remarkably little trouble and difficulty. Free passes were furnished to all astronomers, all freight was transported without charge, and laborers, consisting mainly of convict coolies, were furnished in as large numbers as were wished. In fact, too much cannot be said in praise of the courtesy and kindness of the Hollanders to all the foreign astronomers. The scientists became known so quickly to the Dutch and Malays, that 'Zoneclips' soon became the talisman that made all things work together for our good.

Before reaching Sumatra it had been decided to divide the expedition into two parts, the main portion going to Solok, near the central line of totality, and a smaller number to Fort de Koch, near the northern limit of the path; both stations being on the line of the 'Staatsspoorweg op Sumatra,' the government railroad running about 100 miles inland. After two weeks' stay in the island, and in view of the fact that so much cloudy weather was experienced each day at the time of totality, it was decided best to still further divide the expedition. Consequently, another station was established at Sawah Loento, the terminus of the government railroad, twenty miles beyond Solok.

The American governmental party was thus divided into three. Everybody was hard at work by the middle of April, but as we had to depend on Malay bricklayers and carpenters, work did not progress as rapidly as was desired. These *orang tukang* are frightfully slow, always squatting down to work, and using tools of the most primitive sort. It was a sore trial, indeed, seeing everything proceed at such a snail's pace, but by dint of hard labor, and much talking of Malay on our part, with several English expletives thrown in, everything was all up and adjusted in good time.

At Solok, where the main part of the expedition was located, an almost ideal spot was found for an eclipse camp. This was an old fort recently evacuated by the Dutch, the buildings serving as most excellent sheds for storing the instruments. Professor Barnard had with him the 61½-foot lens with which he obtained such good results at the 1900 eclipse at Wadesboro. This was used in connection with a cœlostat, the telescope tube being horizontal, and ending in a dark room where the plates, in holders, were to be placed on a sliding carrier at eclipse time. One plate used by him, measuring 40 x 40 inches, was to be exposed at the middle of totality for two minutes and a half. The other plates were 30 x 30 and 11 x 14, but notwithstanding their great weight, so carefully was the construction looked after that the plates were changed remarkably quickly. True, totality lasted 5 min. 51 sec. at Solok, but the seconds are valuable, even with such a great duration.

Professor Abbot was prosecuting his researches along two lines. With a highly sensitive bolometer, which has been brought to such a high degree of excellency at the Smithsonian Institution, he was investigating the heat of the moon and the corona; and with four photographic lenses of 11 feet focus, searching for intra-Mercurial plan-

ets. A region about $20° \times 24°$ was covered in the vicinity of the sun, and the exposures were duplicated in order to check all suspected objects.

The spectroscopic work was under the general direction of Mr. Jewell. He himself used a 21-foot concave grating, used without slit as an objective grating. Mr. Dinwiddie employed a 6-inch prismatic camera, and Professor Littell a flat grating with slit, in order, if possible, to detect the rotation of the corona. Professor R. W. Wood's apparatus was used by Dr. Gilbert, and several small cameras by Mr. Curtis.

At Fort de Koch were two instruments, the 40-foot photoheliograph and the spectroscope in charge of Mr. Peters and Dr. Humphreys, respectively. The latter was a direct concave grating used without slit, and had a ruled surface of 8×5 inches. It was one of the last gratings ruled by Schneider under the direction of Professor Rowland, and was the largest grating ever made. Unfortunately, the diamond broke down in the middle of the ruling, and it was found necessary in Sumatra to cover up half of the grating; but notwithstanding this fact, spectra of remarkable brilliancy and definition were obtained.

At Sawah Loento were placed two instruments under the direction of the writer. The spectroscope was a 6-inch flat grating of 15,000 lines, used without a slit in connection with a quartz lens of 72-inch focus. The camera had a focal length of 104 inches and an aperture of 6 inches, which, however, was stopped down to $4\frac{1}{2}$ inches.

This was the instrumental outfit of the governmental parties.

At Sawah Loento were also situated the Massachusetts Institute party, and Mr. and Mrs. Newall, of Cambridge, England, the work of the former embracing a general photographic program, together with investigations of the magnetic disturbance during the eclipse. Our English cousins had some very important spectroscopic problems to carry out.

The three stations situated within fifty miles of the equator had difficulties to contend with that could not be shouldered on to the backs of the Malays. The hot tropical country requires a great amount of rain, and from our experience it seems to get all it needs. At Padang, according to the meteorological reports, there is an annual rainfall of 187 inches, an average of half an inch each day. In fact there is seldom a day without rainfall. Up to the first of May, the sun had hardly been seen by us in Sumatra. The result was that great difficulty was experienced in getting enough clear weather to adjust the instruments, the nights being as cloudy as the days. Professor Barnard carried with him some portrait lenses in order to continue his photographic work on the Milky Way, and carry his investigations into the southern heavens. Those who know Professor Barnard will acknowledge that he tried hard enough to make the exposures, but he failed, owing to continued cloudy weather, to get a single fully exposed plate.

As the time approached closer and closer to the day of the eclipse, great concern was felt as to the probability of a clear sky for the all-important six minutes shortly after noon, on the day of May 18, 1901.

At Sawah Loento it dawned clearer than it had been for a week, but about eight o'clock it clouded up and dashed the hopes of everybody to the ground. About ten it cleared beautifully, and our hopes soared again. First contact was observed with a perfectly clear sky, but soon clouds began to gather, and half an hour before totality the sky was completely overcast.

A direct-vision spectroscope was employed to watch the 'flash,' but so cloudy was it that the first 'flash' passed unnoticed and the total phase had begun before we were hardly aware of it. It remained

cloudy throughout the eclipse, but was a trifle clearer than at the beginning of totality, so that the 'coronium' line was very well seen. The second 'flash' appeared stronger than we would have thought possible through the clouds. The reappearance of the sun was welcomed by a shout from the Malays assembled in the valley.

On the spectrographs taken during totality nothing of the coronal spectrum was visible. The hydrogen lines H and K appeared, but these were due to the upper chromosphere. Although an exposure was made about the time of the first flash, nothing was found of this on the photographic plate. The second flash, however, showed more than was expected, and gave results fairly well developed. The photographs of the corona showed an extent of about a diameter, but with very few details of streamers.

At Solok the weather was even worse than at Sawah Loento; so dense were the clouds, in fact, that the position of the sun could hardly be seen. Mercury and Venus, which were visible at Sawah Loento throughout totality, were seen only for a few seconds at Solok. So cloudy was it that Professor Abbot did not even attempt anything with his bolometer. With the exception of this, all other programs were carried out as if it had been clear. The results, however, were almost *nil*. Where Professor Barnard had hoped for marvelous results of detail on his large 40 x 40 plate, hardly a trace of even a prominence was seen.

One hour after the eclipse was all over, the clouds cleared away, and a beautiful blue sky remained for the rest of the day. Alas! that the eclipse did not occur at one o'clock instead of at twelve.

A few hours after the work was over at Solok, word came to the despondent people there, that at Fort de Koch the weather had been perfect and that the program had been carried out without a hitch. This was good news indeed. Several excellent spectrographs were obtained with the concave grating; the photographs taken with the 40-ft. showed splendid detail in the polar and equatorial streamers. Thus it happened that one party of the American expedition met with perfect success, one with partial success, but the third with no results at all to show for the hard work and time spent.

The other observers in Sumatra fared about as well as did the Naval Observatory party, the clouds being general over the region covered by the scientists. Nowhere else were they as dense as at Solok, but at no place where an astronomical expedition was located were perfect weather conditions experienced except at Fort de Koch.

To meet such a perplexing state of affairs is rather disappointing after traveling half way around the world in search of scientific knowledge, but it is to be expected when the object of investigation is the sun. The conditions were not so bad as at the eclipse of 1896, when no sun at all was seen, but, coming so soon after the 1900 eclipse which was so generally observed in this country, and with such perfectly blue and tranquil skies, the contrast was anything but pleasant.

At Sawah Loento, totality lasted 5 min. 41 sec. The chromosphere and prominences at mid-totality would, it would have been thought, have been so thoroughly covered up that the atmosphere would not have been lit up to any great extent, and consequently it would be very dark during totality. This was expected, and to prepare for it lanterns were got ready to aid the time-keepers and observers to see. But the expected did not happen, and at no time during totality was it too dark to see the hands of an ordinary watch. In fact, it was hardly any darker than at the eclipse of last year, which the writer saw from

Griffin, Ga., situated near the northern edge of the path of totality and experiencing a duration of only 38 sec. The reason for the brightness of the air was evidently the sun shining on the clouds, which in turn illuminated the atmosphere. The clouds were cirro-cumulus, and, no doubt, very high.

It is almost too early to tell just how much our knowledge of the sun has been increased, but it is certain that much of scientific value will be added to science as a result of the observations of the eclipse of May 18, 1901.

To astronomers the voyage itself was interesting in showing the stars of the southern hemisphere, and in losing sight for a couple of months, of Polaris, the star that appeals to all of us as a personal friend.

Perhaps, outside the eclipse, the most striking feature of the expedition astronomically was the independent discovery on May 3 of the great comet, the honor belonging to Mr. Dinwiddie of the Naval Observatory. It was indeed a magnificent sight, appearing shortly after sunset, with a sweeping tail visible to the naked eye for more than eight degrees in length. We watched eagerly during every clear night—but unfortunately there were not very many beautiful nights—and it was photographed by Professor Barnard. But, if the great comet was seen, the sudden outburst of the star in Perseus escaped our attention. After leaving San Francisco, heavy weather and cloudy nights were experienced till after leaving Honolulu, February 28. As there is as yet no cable to the Hawaiian Islands —but this, we hope, is to come in the near future—no tidings were received of the new star until after the arrival of the party in Sumatra, when Perseus was no longer visible.

The expedition arrived in San Francisco July 16.

The next eclipse that will be generally observed is that of August 30, 1905, which will be visible in Labrador, Spain, and northern Africa. The points of investigation will be along the same lines as carried out by the American parties, but it is to be hoped that better weather conditions will be experienced than in the Sumatra eclipse of May 18, 1901.

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SCIENTIFIC BOOKS.

Alaska: Volume I., Narrative, Glaciers, Natives, by JOHN BURROUGHS, JOHN MUIR and GEORGE BIRD GRINNELL; Volume II., History, Geography, Resources, by WILLIAM H. DALL, CHARLES KEELER, HENRY GANNETT, WILLIAM H. BREWER, C. HART MERRIAM, GEORGE BIRD GRINNELL and M. L. WASHBURN. New York, Doubleday, Page and Company. 1901. [Superimprinted] Harriman Alaska Expedition, with the cooperation of the Washington Academy of Sciences. [Edited by DR. C. HART MERRIAM.] With 39 colored plates, 85 photogravure plates, 5 maps and 240 text figures. Pp. xxxvii + 383. Price, $15.

The Harriman Expedition of 1899 was one of the scientific events of that year; and the issue of this sumptuous summary of results is one of the literary events of the current year. Conceived as a pleasure trip, matured in mind as a summer school for a family and a few friends, the Harriman outing took final form as an expedition for research in a region of paramount present interest to science, industry, commerce and public policy. The sea trip—the essential part of the expedition—was made in the steamer *George W. Elder*, with an aggregate personnel (including officers and crew) of 126. The 'scientific party' numbered 25, and there were three artists, two photographers, two stenographers, a surgeon, an assistant surgeon and a trained nurse, besides eleven hunters, packers and camp hands. Nor was the 'scientific' corps such in name only; none were smatterers, and all ranged from distinction through eminence to preeminence in their respective lines, which included anatomy, botany,