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BULLETIN

OF THE

SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

LOS ANGELES, CALIFORNIA

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Collinsia monticola
Davidson, sp. nov.

BULLETIN

OF THE

Southern California Academy of Sciences

JANUARY, 1917

Volume XVI, Part 1

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EDITORIAL

PROFESSOR SIMON SARASOLA, S. J., President of the Colegio De Belen at Havana, Cuba, assisted by Professor Laurent Gangoiti, S. J., Director of the Belen Astronomical Observatory, has made a life study of the atmospheric phenomena of the Gulf of Mexico, and his reputation as a weather prophet is world-wide.

It is a matter of history that he sent to the Weather Bureau at Washington a communication announcing that, on or about September 8, 1900, a terrific hurricane would sweep along the Atlantic sea-board from the Gulf of Mexico as far north as Charleston, South Carolina. The authorities at Washington paid no attention to this communication further than announcing that in September, strong winds would prevail throughout the eastern portion of the Southern States.

The prophecy of Professor Sarasola, which, in the consideration of the cataclysm which succeeded, and which prophecy approached the domain of the super-natural, was fulfilled by the tornado which swept from the face of the earth, the beautiful City of Galveston, Texas.

A letter to President Sarasola, asking him to contribute an article for the Bulletin of this Academy, received a reply that requests of a similar character had come to him from Scientific Bodies in all portions of the world, and that the engrossing duties in the college work had compelled him, in every case, to decline; but he would make an exception in favor of the Southern California Academy of Science, inasmuch as the request had come from one who was a friend of his college class-mate, and who had written him a most warm letter of recommendation and commendation.

It is a pleasure to present that article in this Bulletin, and no doubt it will prove of absorbing interest to all our members.

Looking to the future, we hope to induce Mr. Ford A. Carpenter, the accomplished Director at Los Angeles of the Weather Bureau Station, to give us a paper upon the subject of which he is so profound an exponent.

EARLY in the year 1906, John Daggett Hooker, Vice-President of this Academy, proposed to the Carnegie Institution of Washington, the construction of a one hundred-inch reflecting telescope at the Mount Wilson Solar Observatory, and he offered to donate fifty thousand dollars for the expense of a glass disk of that dimension in case the Institution would furnish the necessary mounting and a suitably domed housing.

His offer was accepted, and in September, 1906, he ordered the disk from the French Plate Glass Company, having its works at St. Gobain, France.

During two years many castings were had, and finally, in December, 1908, a disk, nearly 14 inches thick, 102 inches in diameter and weighing more than five tons, was received at Pasadena, but it was found to be imperfect in many respects, as it lacked homogeneity necessary for equable expansion and contraction in that it contained millions of air bubbles and striae.

Mr. Hooker sent Prof. G. W. Ritchey, Superintendent of Instrument Construction, to France for the purpose of instituting a mode for a perfect casting, and, not content with this additional expense, he caused to be erected in Pasadena, a noble fire-proof building in which the grinding, polishing and figuring of the disk, might be done, and for this labor he supplied all the necessary appliances and tools at a cost of many thousands of dollars.

After a stay of several months in St. Gobain, Mr. Ritchey became satisfied that the works were unable to cast a disk more free from flaws than the one forwarded, and, upon his return to Pasadena, he gave the glass a more careful examination. He discovered that the imperfection nearest the parabolic reflecting curve, when polished and figured, would be about a quarter of an inch below its surface, so he decided to proceed with the completion of the disk, which could be removed from its mounting in case a perfect casting should be obtained at a future day.

A more particular account of Mr. Hooker's activities in this regard, was given in our Bulletins of January, 1909, and July, 1911.

The first enunciation of this great project, appeared in our

Bulletin of January, 1909, and as we have exchanges with nearly all the famous Scientific Bodies throughout the world, it proved a material factor for the choice of Los Angeles as the place for the Fourth Conference of the International Union for Co-operation in Solar Research.

In August, 1910, at this city, assembled a body of men and women whose names are distinguished with the word Astronomy. Eighty-nine in all, gentlemen and ladies, coming from Russia, Germany, Austria, Italy, Sicily, Switzerland, Sweden, Holland, France, Spain, England, Scotland, Canada and from all sections of the United States, and representing fifty different observatories and laboratories, from August 31 to September 4, around the Sixty-Inch Reflector on the summit of Mount Wilson, exchanged ideas and discussed the great problems of the oldest of the Sciences.

An interesting report of this Convention, with portraits of the assemblage, was given in our Bulletin of January, 1911.

The exquisitely delicate labor upon this enormous disk has been completed by Mr. Ritchie, who has few to equal him, and none superior, in this scientific work, throughout the whole world. The parabolic curve has been figured to three-one millionths of an inch of perfection, and its focus is 42 feet. Five small mirrors, to be used in combination with the large one, have been polished, and the huge castings of the mounting have safely achieved their perilous ascent over the many miles trail up to the nearly 6000 feet elevation of Mount Wilson.

Professor Walter S. Adams, one of the most accomplished and advanced astronomers, has generously acceded to our request for a description of this Great Reflector, and his article in this Bulletin will be read with absorbing interest by all who delve in the lore of the stars.

A GRAPHIC account of the labors of Professor Albert B. Ulrey, Director of the Venice Marine Biological Station of the University of Southern California, and one of the Directors of this Academy, is presented in this Bulletin, and the fields of his activities are shown in the annexed charts.

The specimens of marine flora and fauna, gathered by him throughout a period of five years have been preserved in a lasting form, and so far as identified, labelled and placed in the Museum of the University.

The hydrography of many Stations,—their depth, temperature, currents and condition of the bottom,—has been recorded. This work requires the greatest time, patience, accuracy and skill, and demands considerable pecuniary outlay. No government aid has been tendered or received and the limited resources of the University have prevented a complete investigation of this character; but the University authorities are considering the providing of the necessary equipment of an accurate hydrographic survey of all the Stations along this coast. ...

No work, covering so large a field of marine biology and hydrography has heretofore been attempted anywhere along the thousands of miles of the Eastern shores of the Pacific Ocean, and it is with no little pride and gratification that, with Ulrey, we find the names of Davidson, Hooker, Carpenter, Watts, Keese, Baumgardt, Spalding, Alliot, Ritchie and others, gentlemen who have become distinguished in Botany, Astronomy, Geology, Seismology, Electricity, advanced Photography, Physics, Atmospheric phenomena and the profound metaphysics of our inner life, who have been officers, directors and leading members of this Academy of Sciences, in whose Bulletins can be read their papers which have attracted world-wide attention and comment.

DAVID WEST CUNNINGHAM, a member of the Southern California Academy of Sciences, died May 11, 1916, at his home in Montrose, Los Angeles County.

He was born December 24, 1829, in Boston, Massachusetts, as were all of his ancestors in the patronymic line, since the landing in 1680 of his immigrant ancestor, Andrew Cunningham.

His great-grandfather was a major in the military forces of Massachusetts Bay Colony, and his grandfather, Andrew Cunningham, served in the Revolutionary Army as a private in Captain Thomas Mayo's Company of Colonel Eleazer Brook's Massachusetts Regiment of Guards, and who, in 1793, was elected Captain of the Ancient and Honorable Artillery Company, and was commissioned Deputy Quartermaster General of the First Division of the Massachusetts Militia. In right of his services, David West, on May 29, 1895, was elected a member of the California Society Sons of the Revolution.

His father, Andrew Cunningham, was also a member of the Ancient and Honorable Artillery Company of which, in 1790, he was elected First Sergeant.

He was also descended from John Alden, of the Mayflower, and the atavism in him, inherited from his Pilgrim and Puritan ancestors, was vehement and strenuous.

His education was received in the public and private schools of Boston, and in Harvard University, and, completing his studies as a civil engineer, his entire life was devoted to this profession.

The canals, bridges, rail-roads, buildings, water-works, mountain roads and trails completed under his direction in Massachusetts, Minnesota, Chile, South America, and in numerous other places, are enduring monuments to his ability and his honor to the responsibilities which he assumed.

After retiring from active work, in 1896, he came to Los Angeles, and soon thereafter he joined this Academy, of which he remained a member to the time of his death. He was a zealous associate, and enthusiastic in our work. His voice was frequently heard at our meetings, and those of us who enjoyed his friendship join in sympathy with his widow in her great bereavement.

AT the City of Los Angeles, on August 18, 1916, died Thomas Powell, who, for many years had been a member of this Academy.

He achieved an extended reputation among the medical fraternity of this portion of the State by his teachings in bacteriology, the action of bacilli, and the cure of diphtheria, infectious and contagious diseases, by electricity. He announced that "all disease is essentially the same—varying forms are different manifestations of the harmful effects of poorly digested and badly assimilated food. To this imperfectly digested food substance he gave the name 'pathogen,' and he blamed it for every human ill."

He was a Free Mason and a member of the American Health League, the American Public Health Association, American Association of Infantile Mortality, and the Royal Societies Club of London.

IN "The World's Work" for January, 1917, a very interesting and cordial tribute is commended to George W. Parsons, who, for many years, has been a Director of this Academy.

During his later years Mr. Parsons has been interested in mining propositions in New Mexico, Arizona, Nevada and California, and his investigations have made him familiar with the mining regions of these great States. In his explorations, he has crossed and re-crossed those enormous desert wastes comprising so large a territory of this western land, but which, unlike the great African Sahara, have no oases, as refuge for the wearied traveler. The hundreds of human skeletons bleaching in the scorching sun, the remains of those who had perished far from the life-giving water, and the necessity for a system of durable signs, directing a road to safety, most profoundly impressed him.

He was Chairman of the Committee on Mines and Mining of the Los Angeles Chamber of Commerce, and through his representation, an excellent Map was published, showing the roads, trails and water-holes of the California and Nevada deserts.

His labors in this regard commenced as early as 1904, and through his insistence, the legislature of California, and some of the counties united in the expense of erecting iron sign-posts indicating the shortest path to water and life. The result which crowned his efforts was in inducing the Congress of the United States to make an appropriation by which the Secretary of the Interior might "erect and maintain suitable and durable monuments and sign-boards . . . containing information and directions as to the location and nature of springs, streams and water holes."

The article in "The World's Work" closes with these words:

"Mr. Parsons' public spirit and unselfish persistence have achieved a humanitarian purpose that will be gratefully acknowledged by thousands of men and beasts."

Holdridge Ozro Collins.

WANTED

Numbers of Volumes III, IV, V, VI, of the Bulletins to complete files.

Address the Secretary, Room 719 San Fernando Building, Los Angeles.

STUDIES OF CLOUD FORMATIONS IN HAVANA

By Professor Simon Sarasola, S. J.
President Del Colegio de Belen, Habana

THE scientific value of careful observations of clouds, for the prognostication of tropical cyclones, was strikingly attested in the hurricanes of September and October, 1906.

In the observatory of the College of Bethlehem the direction of clouds is observed regularly every two hours, from four o'clock in the morning until ten o'clock at night, and this system of observations has been maintained since October 1st, 1879. The Director, P. Viñes, who had previously made a study of cloud movements, deduced from the accumulated data the principles of cloud formation and direction which led to his celebrated prognostications of the hurricanes of 1875 and 1876.

"From the ten daily observations," writes the Rev. P. Gangoiti, present Director of the Observatory, "seven, in an average, are utilizable almost all the year, in determining the direction of the clouds. The investigator who seeks abundant data upon the atmospheric circulation of the tropics may consult with profit a little work entitled *"Las diferentes corientes de la atmosfera en el cielo de la Habana par el P. Gangoiti, Director del Observatorio del Colegio de Belen."* In this work there is a detailed study of the direction (movement) of the clouds based upon observations from 1892 to 1902, covering the greater part of each year and taking account of the seven daily observations which, as said above, are almost always available. It should be noted that such a great abundance of observations is of incalculable value, although to utilize the data properly requires an attentive study of the atmosphere under the most varied circumstances that can be presented, and at the same time an intimate knowledge of the relations of high and low currents with storm movements and the distribution of barometric pressures.

What has been the result of this sustained and earnest study of clouds? To the man who seeks to prognosticate hurricanes an attentive and intelligent observation of clouds may be of great value in indicating the direction of the storm movement, its intensity, its attendant conditions and inherent characteristics. For about thirty years this observatory, in its prognostications of the hurricanes of the Antilles both from the barometer and sometimes in advance of the barometer, has found no better method of forecasting than the diligent observation of air currents manifest in clouds.

Following is a brief description of the cloud phases presented in the hurricane of October 17th and 18th, 1906, as communicated to the press of Havana:

"Precursory signs,—October 16th was serene and tranquil, nothing of an extraordinary character appearing; wind from the North East, and, if we except a tendency of the barometer to fall slightly, there appeared no sign of a hurricane S. S. W. of Havana.

"Cirrus clouds, well defined, extended in the sky in the form of a fan; they were like the arms of an aerial river carrying in their bosoms the currents shot forth by the hurricane. These lines converged in an apparently fixed center of great magnificence which remained nearly the whole of the 16th. This nucleus seemed to be the point of convergence not only of the most elevated cirrus clouds, but also of the high and low cumuli. A halo, like a crown of glory, surrounded the sun all day. All of these phenomena we observed and noted with great care, as if observing a masked enemy hiding himself under an agreeable breeze and peaceful weather. On the morning of the 16th we entertained serious fears that a cyclone was moving and that in its recurve it would pass over our island."

From our experience and that abundance of data at our disposal we are able to shed some light upon a current opinion, subjecting it to the test of facts, which should be the supreme test rather than *a priori* reasoning.

Mr. Bigelow denies that the highest currents in cyclones are *divergent;* yet, it is worthy of note that, in his own diagrams and maps, there is manifest a *convergence* of superior currents. He holds, however, that the cirri and cirri-strati in cloud formations do not enter into the cyclonic circulation, but that they float in the higher strata of atmosphere, which according to the observations of the United States Weather Bureau, have a general drift from West to East. If Mr. Bigelow should restrict himself to the assertion that currents do not take a radial or divergent direction in the *storms* of high latitudes, perhaps we would let his position pass without contradiction, although such notable meteorologists as Sprung, Angot, Hildebrandsson and others would not concur with him in that. In fact, in the Northern States proofs to the contrary have been submitted by Mr. Clayton and Father Odenbach. But Mr. Bigelow asserts of tropical hurricanes (and Mr. Garriot of the Weather Bureau agrees with him) that the law proposed by Father Viñes has not been established as to the divergent, radial currents in the upper atmosphere. Father Gangoiti in the appendix to the observations of this obsedvatory for 1902, answered the criticisms of these writers; and paying no further attention to them he has continued to reaffirm the law of divergence in his later writings. Let us examine some of the data presented in the appendix referred to which throw much light on the situation:

Father Gangoiti says:

"Omitting many examples which might be adduced of cyclones in their second and third quadrants, observed at Havana by Father Viñes and the writer we will present simply observations on first and fourth quadrants in order to forestall any reasonable criticism. Here Havana is not situated in the front of the vortex, but in the latter part and the cyclone is observed in its first quadrant while the cyclone takes its course to the N., N.-E., E.-N.-E., or E., retreating from our position. On the 13th, 14th, 15th and 18th of August, 1899, while the noted cyclone of Puerto Rico was moving slowly from the canal Nuevo to Cape Hatteras, we observed the cirrous clouds in the N.-E., N.-E. ¼ E. and E.-N.-E. Was the cyclone then approaching Havana? Were we then in the line of its advance?

"Despite the fact that the storm was retreating from Havana and its posterior was presented to view, it shot forth cirri-strati for five days. The radial divergence of the cirri from the vortex of the cyclone was as thoroughly demonstrated to us as the convergence of the lower currents. It is manifest, however, that the number of cases observed of centripetal movement of lower currents is much greater than of divergence in high currents for the reason that lower and intermediate cloud formations frequently obscure the sky making the observation of the superior cyclonic currents impossible.

"To this an objection may be made that the high streamers of cirri and cirri-strati are an effect of a general current of the atmosphere and are not sent forth by the hurricane. It seems to us that the general current of the high atmosphere is in accord with general laws, and is therefore constant. But in the hurricanes of the Antilles we note varying phases, as the cyclone presents to us in one quadrant or another, and the cirri-strati change form as though passing through a series of evolutions. Thus they indicate to us with considerable accuracy where the enemy is to be found. A cause is known from its effects; here one of the effects of cyclonic activity is found in the cirri. These by their form, direction, velocity, etc., reveal to us their origin and the direction from which they proceed."

According to Father Odenbach, the same occurs in the United States. That diligent investigator, writing from his observatory at Cleveland, thus refers to the law of Father Viñes:

"During three years of observation we have found this law of incalculable value, first of all in locating a cyclone before we received the daily weather maps, which, in most cases, showed it in the very direction we had supposed it to be. Secondly, it assisted us in a number of cases, in detecting an irregularity in the course and to correct the prognostication of the morning map. As we write this report, such a case is under consideration.

"Wednesday, May 23, 1900, there is a cyclone central over Prince Albert in the United States. The Weather Bureau of Washington and Cleveland, says, "Cloudy tonight and Thursday; showers Thursday." This was perfectly correct and according to law, but there was a "Low" standing over Dodge City at this very time (8 a. m. of the 23rd). At noon we had not yet seen a cirrus cloud from the "Low" in the N. W.; but they were coming from the one over Dodge City, Kan. We therefore concluded that the latter was advancing from the S. W. Thursday morning brought with it cirrus clouds from the S. showing that the "Low" was on a course towards the Atlantic and would miss Cleveland. On Friday morning the prospects were still poorer; a rising barometer and clouds from the S.-E. showing plainly that a "High" was forming between the "Low" of the N.-W. and the "Low" of the S.-W.; a conclusion that was confirmed by the map on Saturday morning. This is only one of many cases in which cloud observations supply, we may say, an hourly map of the meteorological conditions of almost half the United States. We have demonstrated to our entire satisfaction that the law formulated by Father Viñes holds good in our surroundings, and that we have found in it a most efficient help in the work of fore-casting."

The fundamental law of Father Viñes is that the current of the cirri goes in a radial direction, and it is seen that not only does this hold in a tropical hurricane but also in these cyclones which cross the United States.

Observe how Father Viñes' celebrated law is confirmed: "An experience of about 23 years of assiduous and minute observations, embracing multitudinous experiences under the most varied circumstances, has impelled the conclusion from all evidence before me that, in the storms of the Antilles, the cyclonic rotation and circulation is as follows: The inferior currents are generally more or less convergent toward the vortex; at a greater altitude the currents are approximately circular; at a still greater height they are divergent. It should be particularly noted that the divergence is much greater as the column arises to the point from which the most elevated cirri start out, where, in many cases they are completely divergent, standing out radially from a common center."

In their study of cyclones this is the notable law which the investigators have promulgated. We do not wish to say in this that cirrus clouds are always indicia of a cyclone or storm movement; many times they are not; but under given conditions where they assume certain forms, they are of the greatest value not only in this observatory, but also in Manila, in forecasting cyclones.

The Director of the Observatory of the Orient, Father Algne, in his excellent work on "Cyclones in the far East" notes the radial direction of high currents as among the most thoroughly established phenomena.

CREPIS NANA

By Fred E. Burlew

THE plate is a photograph by the writer of one of two specimens of Crepis nana which were found in bloom on July 13th, 1916, on the easterly side of Mt. San Antonio, some three or four hundred feet below the summit, on the Glen Ranch trail, near a small snow field.

A letter from Professor Harvey M. Hall in regard to the plant says: "It has not before been known from south of Farwell Gap, Tulare County. It is rare even in the Sierra Nevada, where it occurs at a few places of considerable altitude. It ranges north to the Arctic regions and occurs also in the Rocky Mountains."

COLLINSIA MONTICOLA, Davidson, sp. nov.

By Anstruther Dav.dson, C. M., M. D.

PLANT 2 to 6 inches high branching at base broadly triangular in outline; stems and floral parts puberulent with gland tipped hairs, lower leaves obvate narrowing to a petiole, upper leaves 1 inch long and ¼ inch wide, lanceolate with blunt apex contracted to a sessile base below: flowers three or four in a whorl, the subtending bracts minute or absent, the pedicels two to two and a half times as long as the capsule; flowers blue lower lip white, flowers twice the length of the calyx, the segments of the latter narrowly lanceolate blunt, equalling the ripe capsule; pedicels reflexed.

Type Hall's No. 1500 Swarthout Canyon, 6800 ft. alt Illustration Plate 1, fig. 1. The same from Fenner's mine, Big Rock Creek, 7000 ft. Davidson's No. 1489, fig. 2. A depauperate form from the summit of Mt. San Antonio, Fred Burlew's No. 3137, fig. 3.

This has passed as *C. Childii*, but differs from this and from all our local Collinsias in the character of the bracts and the reflexed pedicels. The only specimens seen by the author are those here illustrated. Swarthout Canyon and Big Rock Creek are two streams running north towards the desert from the San Gabriel range, while Mt. San Antonio is a little farther east and on the southern border of the same range.

ADDITIONS TO THE FLORA OF LOS ANGELES COUNTY

By Anstruther Davidson, C. M., M. D.

THE season just closed may be credited with a comparatively large number of additions to our catalogue of the local flora.

The most important additions have been made by Mr. P. C. Standley of Washington, in the volume of the Flora of N. America, devoted to the Chenopodiaceæ. The confusion prevailing in the nomenclature has been rectified and in the process quite a large number of species have been described as new, of which about half a dozen are found in Los Angeles and Orange Counties.

Besides those the following have been added to the list by the members of the Botanical section.

Phalaris paradoxa praemorsa C. & D. Common on La Brea Rancho.

Agrostis alba L. Ditches at Alhambra.

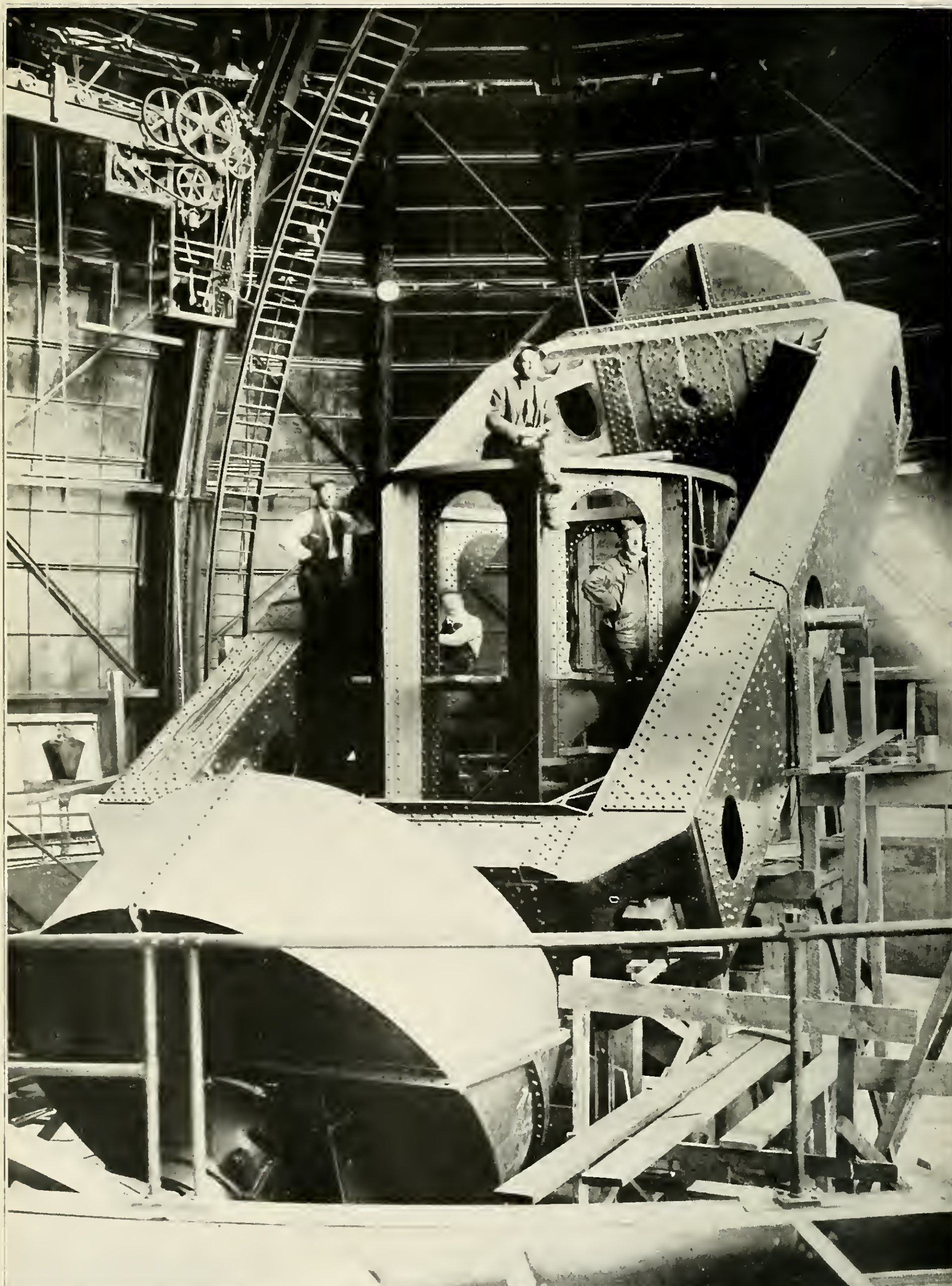
Lepidium draba L. Huntington Beach; threatening to become a weed.

Loefflingia squarrosa Nutt. Roadsides at Crescenta.

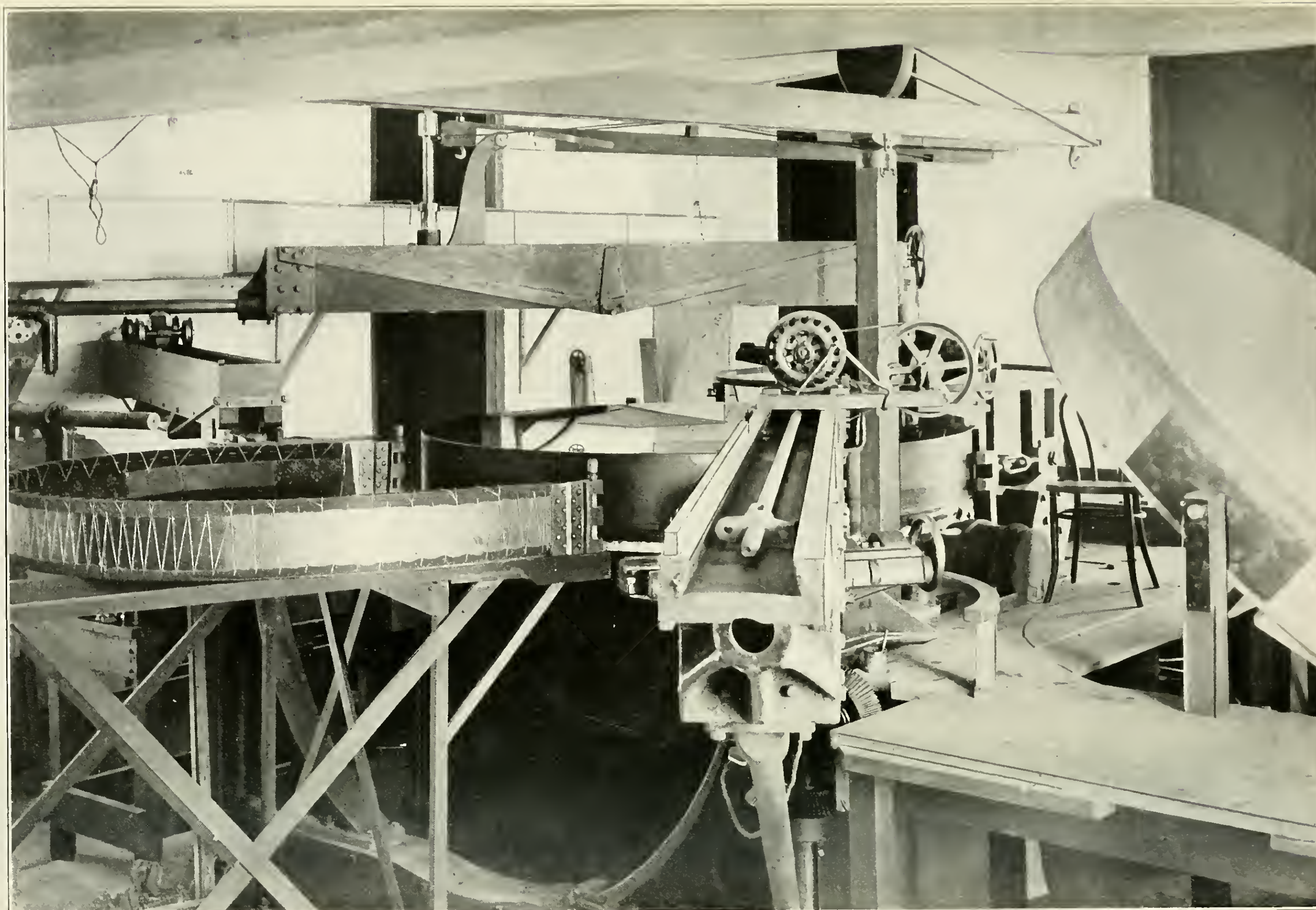
Arenaria Nuttallii of the Catalogue is the var. gracilis Robinson.

Castanopsis chrysophylla A. DC. The Western Chinquapin, Mts. Antonio and Islip.

In the description of Draba vestita Davidson (Bull. S. Cal. Acad., Vol. 15, page 17), I omitted to state that the strap-shaped petals are bluntly toothed at the apex, each narrow petal showing a tooth and a half.



Polar Axis and First Section of Tube, One Hundred-Inch Reflector.



The One Hundred-Inch Mirror on the Polishing Machine.

A BRIEF DESCRIPTION OF THE ONE HUNDRED-INCH REFLECTING TLESCOPE OF THE MOUNT WILSON OBSERVATORY

By Professor Walter S. Adams, D. Sc.
Mount Wilson Astronomical Observatory

With the introduction into astronomy of the instruments used in the physical laboratory for analyzing light sources and studying their brightness and mode of radiation the telescope has come to be regarded mainly as an instrument for collecting light. The physicist to a certain extent has the light source at his control, but the light of a star is a fixed quantity, and the only way in which the astronomer can increase the brightness of the image which he desires to examine or to analyze is to increase the aperture of his telescope. One instrument of twice the diameter of another will collect four times as much light, and will form an image of a star four times as bright, other things being equal. At a period in astronomy when powerful spectroscopes are being employed for studying the motions and the chemical constitution of stars, and when the problem of the structure of the universe requires that we discover and determine the brightness of as many as possible of the faintest stars in the heavens, the value of a great telescope is obvious.

The project of the 100-inch reflecting telescope took form in 1906, when Mr. John D. Hooker provided the funds for the purchase of a suitable disk of glass, the erection of a building for the necessary optical work, and the employment of skilled opticians to figure the surface of the mirror. In the winter of 1908 a disk was received from the St. Gobain Glass Company of France. On examination it was found that owing to the method in which molten glass had been poured into the mould a considerable number of particles of unmelted material and of air bubbles had found their way into the interior of the disk. Although in the case of a reflecting telescope the light does not enter the glass at all, and the mirror material may as well be opaque as transparent, it was feared that strains might be present in the body of the glass which would prevent the maintenance of a perfect optical figure under varying conditions of temperature. Accordingly no attempt was made to utilize this disk, and further trials were begun by the St. Gobain Company to secure a fully transparent block of glass. These, however, were unsuccessful, and after considerable delay it was decided to have recourse to the original disk. Before the extensive work of figuring the mirror was carried far, tests were made at varying temperatures and in different positions of the disk to determine the existence of strains or flexure. No such effects were found and the optical work was continued. The mirror was finally completed in the summer of 1916. During this long period the work was not strictly continuous, it being necessary occasionally to suspend polishing for considerable intervals on account of unsuitable temperature conditions.

It is not possible here to enter into a detailed description of the process of figuring the mirror. Roughly speaking it may be divided into two stages. In the first stage the mirror was brought to a spherical figure: in the second this spherical form was charged to a paraboloid. The second process though requiring much less time than the first involved very great care and frequent optical tests to avoid the introduction of zonal errors. The largest deviation of the paraboloid from the sphere in the case of this mirror is only one one-thousandth of an inch. All of the optical work, with the exception of the first rough shaping, was carried on with wooden tools of various sizes and forms, and the use of rouge and distilled water as the polishing material.

After the completion of the mirror a series of photographic tests was made to determine the accuracy of its figure. These showed a remarkably high degree of perfection, every portion of the surface having the same focal length to within one part in about 90,000.

A few figures may be of interest in this connection. The finished mirror weighs 4½ tons, about one ton of glass having been removed in the process of shaping and figuring. Its diameter is closely 101 inches, and its thickness at the edge 13 inches. The depth of the curve at the center is about 1¼ inches. The focal length of the mirror is five times its aperture, or 42 feet. A direct photograph of the moon at this focus, accordingly, would have a diameter of 4.4 inches. As in most modern reflecting telescopes the 100-inch reflector will be provided with two small convex mirrors to be attached to the upper end of the tube, either of which may be utilized to increase the focal length in much the same way as telephoto lenses are used in ordinary photography. With these mirrors focal lengths of 134 and 251 feet may be obtained and the magnification correspondingly increased.

As soon as the optical work upon the mirror disk was fully under way the design of the telescope mounting was begun. In view of the great size and the immense weights involved the "closed fork" type was finally adopted. In this form of mounting the telescope tube is hung in the center of a rectangular frame of massive steel girders, the bearings providing for north and south movements of the tube being built into the two side members. The entire rectangle is mounted on bearings at top and bottom which furnish the east and west motion of the telescope. To relieve friction the system of mercury flotation used most successfully for the 60-inch reflector is employed, there being two large steel floats and corresponding mercury tanks.

one at either end of the rectangular axis. These floats carry about 98 per cent of the moving parts of the telescope, or some 90 tons, the remaining two per cent being carried by two large spherical defining bearings. The instrument is controlled by electric motors which provide for three rates of speed in both north and south and east and west directions.

The driving clock which moves the telescope at a uniform rate corresponding to the rotation of the earth is placed within the concrete pier which supports the instrument and near the south end. The driving shaft extends from the clock and meshes with a worm wheel 17 feet in diameter which is attached to the telescope axis. The cutting of the gear of this large wheel is now nearly completed after continuous work for several months. Since the successful operation of the telescope depends mainly upon the smoothness and uniformity of the motion communicated to it by the clock, this operation has been a task requiring great care and accuracy. After the cutting is finished the shaft and wheel will be ground together for several days in a bath of oil and pumice stone to insure accurate meshing and the removal of all rough surfaces.

The telescope is mounted on a concrete pier 33 feet high and about 40 feet long. Within this pier are located a room for silvering operations, an electric elevator for carrying the mirror when removed for silvering, and the apparatus for maintaining a circulation of water through coils of pipe around the mirror. In this way it is hoped to keep the glass at a relatively uniform temperature.

The building and dome which enclose the telescope form a steel structure 100 feet high and 95 feet in diameter. The walls and roof are double throughout to admit of the free circulation of air, and thus help to equalize the temperature within the building. The shutter is of the double section type, divided in the center, and when fully open provides an aperture 20 feet wide. Like the observing platform, the crane hoist and the dome mechanism, it is operated by electric motors. The dome is mounted on 24 four-wheeled trucks running on specially ground rails, and power is applied by two driving trucks at opposite sides. When rotated the motion of the dome has been found to be remarkably smooth and free from vibration in spite of the great weight involved which is approximately 600 tons.

At the present time the dome and buildings are completed and the erection of the mounting has reached the point at which the sections of the tube are placed in position. After the completion of the tube and the adjustment of the mechanical attachments which control the movement of the telescope the mirror will be transported to Mount Wilson and placed in its cell. It is expected that the telescope will be ready for use by the middle of the coming summer.


MAP OF
SANTA CATALINA ISLAND
INCLUDING THE TRAWLING STATIONS
OF THE
ANTON DOHRN
DEPT. OF BIOLOGY
UNIVERSITY OF SOUTHERN CALIFORNIA
SCALE OF MILES
N
SAN PEDRO CHANNEL
OUTER SANTA BARBARA PASSAGE
Bird Rock
Isthmus Cove
Fisherman's Cove
Catalina Hbr.
Little Hbr.
Lone Pt.
Whitley's Cove
Avalon
30 Fathom Curve
100 Fathom Curve
1783
2109
1673
T 95
T 94
T 93
T 92
T 162
T 161
T 160
T 141 [T 101*]
T 142
T 133 [T 100*]
T 132 [T 99*]
T 131 [T 97* - T 98*]
T 130 [T 196*]
T 129
T 159
T 128
T 158
T 157
T 156
T 155
T 154
T 150
T 140 [T 107*]
T 139 [T 106*]
T 138 [T 105*]
T 137 [T 104*]
T 136 [T 103*]
T 135 [T 102*]
T 134
T 152
T 151
T 127
T 149
T 148
T 126

Plate IV.


LOS ANGELES HARBOR
AND VICINITY
FROM THE UNITED STATES COAST
AND GEODETIC SURVEY - JUNE 1911
LONG BEACH
WILMINGTON
SAN PEDRO
Rocky Pt.
Pt. Fermin

Plate III.

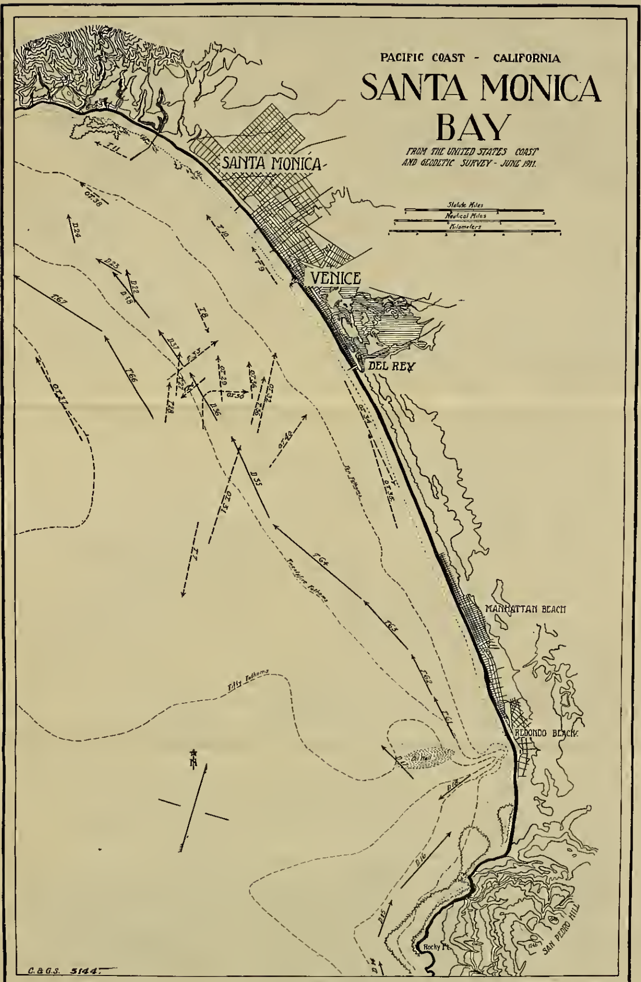

PACIFIC COAST - CALIFORNIA
SANTA MONICA BAY
FROM THE UNITED STATES COAST AND GEODETIC SURVEY - JUNE 1911.
Statute Miles
Nautical Miles
Kilometers
SANTA MONICA
VENICE
DEL REY
MANHATTAN BEACH
REDONDO BEACH
Rocky Pt.
SAN PEDRO HILL
Fifty Fathoms
C.&G.S. 5144.

Plate II.

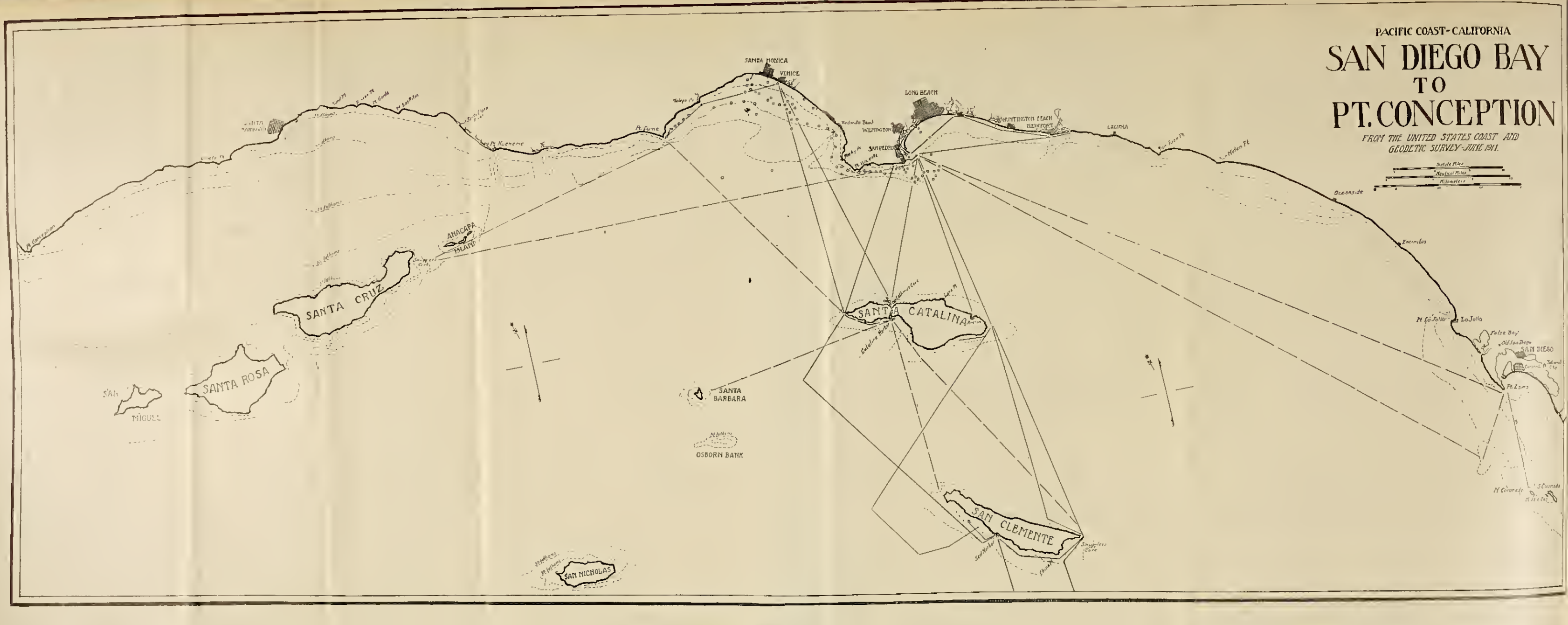

PACIFIC COAST-CALIFORNIA
SAN DIEGO BAY
TO
PT. CONCEPTION
FROM THE UNITED STATES COAST AND GEODETIC SURVEY-JUNE 1911.
SANTA MONICA
VENICE
LONG BEACH
WILMINGTON
SAN PEDRO
HUNTINGTON BEACH
NEWPORT
LAGUNA
Oceanside
Encinitas
La Jolla
SAN DIEGO
Pt. Loma
Pt. Hueneme
Pt. Dume
Pt. Conception
ANACAPA ISLAND
SANTA CRUZ
SANTA ROSA
SAN MIGUEL
SANTA BARBARA
OSBORN BANK
SANTA CATALINA
SAN CLEMENTE
SAN NICHOLAS

Plate I

THE OPERATIONS OF THE LAUNCH ANTON DOHRN IN SOUTHERN CALIFORNIA WATERS

By Professor Albert B. Ulrey, A. M.,
Director of the Venice Marine Biological Station of the University of Southern California

THE character of the work of the Marine Biological Station of the University has been determined in large measure by the operations of the station launch the Anton Dohrn. The immediate field of her activities has been chiefly the region between Pt. Dume and Newport Bay and the Santa Catalina Island region. The extreme limits of her sailings at this date extend from the Coronado Islands on the southeast to Anacapa Island on the northwest and out at sea to San Clemente Island.

The launch has been used (1) in a biological survey of Southern California waters, (2) to procure living material for the marine station, (3) to provide supplies for special lines of research in progress, (4) for investigation of special problems of economic importance.

The maps published herewith indicate the field of activities in the biological survey. A series of thirty-five trips were made from June to November, 1914, in the interest of the U. S. Fish Commission work relating to the Albacore problem. Each trip made by the launch was directed by a biologist who recorded the data obtained and preserved representatives of most of the animal and plant life found in the various localities. During the five years' work the records kept aggregate a considerable volume of biological data and the specimens preserved represent many of the species of the fauna and flora of Southern California waters.

It would have been impossible to accomplish without ample funds the results attained except for the fact that we were able to use the energy and enthusiastic devotion to a scientific goal found in the students and instructors of the University. This is particularly true with reference to operating and caring for the launch. No service was too severe or task too difficult for these volunteer sailors to undertake. The fact that the launch has sailed without mishap many times over the sea from Point Dume to Newport and out at sea to Catalina and San Clemente islands and has visited San Diego, Santa Rosa, Santa Cruz, and Santa Barbara islands, speaks eloquently for the amateur seamanship of these men.

The list of men to whom credit is due for service on the launch is too long to publish here in full. The following have given special time and service to the work. The responsibility for carrying into execution the work of the Anton Dohrn has been borne by Percy S. Barnhart and J. Ross Beck during the period November, 1912, to June, 1914; from that time to June 30, 1916, by Elmer Higgins and J. Ross Beck; July 1st to August 1st, by Frank Yocom, and at present by Allen Hobbs. Student assistants who have given considerable time and have rendered efficient service are: Walter Hepner, Henry Wheeler, Ervin Wahrenbrock, Mervin Oakes, Frank Yocom, Ernest Trevor, Allen Hobbs, and Stanley Patton. Dr. Samuel Rittenhouse directed the scientific work of the launch on most of the cruises made since September, 1915.

Description of the Anton Dohrn.

The Anton Dohrn is thirty-five feet long with ten feet beam. It is strongly built, every part being constructed for the one purpose, exploration of the sea. The cabin forward has four double berths with lockers beneath. It is separated from an equally large engine room by a water-tight bulkhead. Off from the cabin are two small rooms for galley and toilet. The continuous deck of the cabin and engine room is raised above the deck two feet, while a bulwark fourteen inches high is supported by strong stanchions. Davits have been placed on the port side and at the stern a rail of galvanized pipe. Two oil tanks are provided, having a total capacity of eighty-five gallons. A two-cylinder sixteen-horsepower Samson gasoline engine propels the vessel at seven miles per hour, while in a fair breeze the mainsail and jib are used. By means of a special clutch the engine is connected with the gear that drives the reel on to which is wound one thousand feet of hemp steel cable for taking soundings, bottom deposits, water samples and temperatures and to support the nets for dredging, trawling and plankton hauls. A meter indicates the amount of cable used at each station.

In the engine room a centrifugal pump has been installed with which a two-inch stream of water is thrown to any point desired. On long voyages living material kept in live tanks is thus supplied with an abundance of fresh water.

Methods and Apparatus Employed in the Survey.

The apparatus used consisted chiefly of the following: (1) A beam trawl of the usual sled runner type having a width of five and a half feet. The frame is so constructed that it can readily be adjusted to any width desired or can be packed in a small compass when not in use. (2) An otter trawl with a stretch of twenty-five feet and a bag thirty feet in length. (3) A Nansen closing plankton net with number twenty mesh cloth. (4) Several surface plankton nets. (5) The dredge used had a width of three and a half feet. (6) A series of traps, one set for deep water; others those ordinarily used for lobster fishing. (7) A series of tangles is now in process of construction. (8) Large galvanized iron tanks for carrying living specimens from the islands to the aquarium. (9) A supply of different forms of fishing tackle, glass containers and preserving fluids. (10) Sounding apparatus.

A total of one hundred twenty-five sailings have been made. During these trips, one hundred seventy-two hauls have been made with the trawl; forty-two hauls with the dredge and forty-three hauls with plankton nets.

The location of the stations at which the hauls were made was usually determined by the use of the sextant at the beginning and end of each haul. From this and other data the position of the haul was indicated on detail maps of the U. S. Coast and Geodetic survey. The time of trawling was usually one half hour. In some cases one hour hauls were made and in a few instances a shorter time was used.

In the use of the trawl or dredge the launch is stopped, the engine is connected with the mechanism operating the cable reel. The net is dropped overboard and the sextant reading is made. The launch advances slowly during thirty or sixty minutes when a second sextant reading is made. The haul is then brought to the surface and emptied on a series of screen cradles on the deck. Here a stream of water from the pump is carefully played over the material to aid in separating the mud from the animals and plants present. The catch is placed in suitable containers with appropriate labels and preserving fluids, usually eighty per cent alcohol. The recorder places on the log of the launch the sextant readings, depth, character of the bottom, and all the data obtained concerning the abundance and character of the catch.

The collections are brought to the laboratory where the several groups are separated and accessioned. The data of the log is typewritten in duplicate. The accession cards facilitate reference to the data of the log and the material on the shelves of the laboratory. These cards are arranged in numerical order. Another series of cards is made on which the name and museum number of the species is placed when identification is completed. The genera are arranged alphabetically. A museum record is arranged in numerical order.

In the work done prior to this date it has not been feasible to secure complete hydrographic data concerning each station at which hauls were made. Some observations were made as to depth, condition of bottom, temperature, currents, etc., and in each case a record was made of this data. With the facilities at hand we have not felt that we could profitably attempt systematic hydrographic work of a sufficient degree of accuracy to make it worth the effort expended. We hope to provide the necessary equipment and workers to begin accurate hydrographic investigation at each station.

It will be apparent that this more or less mechanical part of the work of the biological survey has been time consuming. It is equally evident that the value of any results to be attained will depend very largely upon the painstaking accuracy of this initial work. A large part of the time we have been able to give to the marine station work has been devoted to equipping for the survey; operating the launch and caring for it; preserving the material and making suitable records. It was deemed expedient to continue this phase of the work until we had in a general way covered the regions we had planned to explore, extending from Pt. Dume to Newport Bay and Santa Catalina Island.

The identification of the species of plants and animals collected is yet incomplete. We have fairly complete lists of the Starfishes, Brittle Stars, Crustacea and Fishes collected. The remaining material is in the hands of specialists for identification.

In the groups of animals identified some new species have been found and a much larger number of species well known elsewhere have not previously been reported from this locality. Thus among the Amphipod Crustacea identified four new species are found and the fishes in our collections contain more than a score of species which have not been recorded as found in the locality from which these were taken. The value of the collections, however, is not determined chiefly by the new and rare species found, although these do have a real value. Much more important, in many instances, are some of the most abundant and widely distributed forms found in these waters, whether considered from the standpoint of theoretical or economic biology. The problems of distribution, inter-relation of the different kinds of life, their relation to environment and many others we have only begun to study.

The map Pl. I, indicates the general region covered by the sailings of the launch. Plates II and III show the position of the hauls made by the dredge and trawl off the Santa Monica Bay region and the San Pedro region. Plate IV shows the hauls made about Santa Catalina Island. These maps do not cover two regions at which hauls were made; they are: (1) In Newport Bay and off the coast at Balboa and Huntington Beach; (2) off the coast from Pt. Dume to a point near the Long Wharf at Santa Monica.

The stations at which the dredge was used are indicated by the letter D, the trawl by T. The numeral following indicates the number of the dredge or trawl respectively. The numbers in brackets represent stations practically coinciding with those indicated by the preceding numbers.

The drawing for Plate I was made by the Drawing Department of the University. Those for Plates I, II and III were made by Elmer Higgins.

MARK TWAIN

"Si fractus illabatur orbis,
Impavidum ferient ruinae."

By Holdridge Ozro Collins, LL.D.

SAMUEL LANGHORNE CLEMENS, known the world over as Mark Twain, was one of the great men of our country:

Great in his scorn of all that was detestable and ignoble; great in his denunciations of fraud and graft in private and public corporations; great in his arraignment of political parties which violated their solemn pledges; great in his castigation of those in public office, from the highest to the lowest, who proved untrue and false to the trusts reposed in them, and great as a second Sir Walter Scott in rendering unto Cæsar the things that are Cæsar's. No one who has read his serious commentaries upon our own times and his philosophical essays can fail to appreciate the pulchritude of that soul, the moving factor of his nobility of action.

With the loving and tender heart of a woman, an adverse fate took from him his boy; the daughter in whom were centered all his hopes for a happy future, and the wife who had been his companion and solace for a too short time; and he pursued the remainder of his journey, a weary, sorrowful and broken-hearted man.

Truly indeed, was he, as Homer says of Ulysses, a man of many wanderings and many sufferings and had seen many cities and knew the hearts of men.

Who can read without emotion the lines he caused to be graved upon the tomb of the lost daughter,

"Warm summer sun, shine kindly here,
Warm southern wind, blow softly here;
Green sod above, lie light, lie light.
Good-night, dear heart, good-night, good-night."

To him, as has come to all of us who have lost, came the great problem, why should those be taken from us, in the happy days of their youth and loveliness, when their presence was a joy and made life a sweet content, while others, whose existence is a shame, live a scourge to the world? Their premature death "is one of those brutal facts of human history which are enough of themselves to destroy the untenable myth of a 'wise Providence' and an 'all loving Father in Heaven.' "

From Voltaire, Rousseau, Thomas Paine and Robert G. Ingersoll, who preached from the text, "An honest God is the noblest work of man," have come similar reflections upon a so-called God, whose acts are claimed to be always just, but whose record, as given us, shows that he is as weak as the most fallible of mankind.

Is it strange that the early joyous and care-free spirit of this man, in brooding over the eternal loss of those whose presence had been his very life, should have become darkened, and which, in his last days, gave voice to the words which are now resounding from ocean to ocean in our land.

As we read his posthumous work, "The Mysterious Stranger," we are profoundly impressed by the uncertainties in that troubled soul, regarding creation, existence, a material universe, and an infinite hereafter of identity.

Its pages are disappointing in that they present to us only the sordid, tragic and ignoble side of life and ignore the higher, spiritual aspirations of man which make him strive for the greater good, and sometime be worthy of liberty.

In theology a "distinction" is made—which is no distinction,—between Free-will and Foreordination, Predestination and Prescience. The teacher of Metaphysics tries to explain the absolute certainty of Free-will, although everything has been foreordained and foreknown by a great First Cause, who created us; but in his didactics he admits that we have no Free-will, for no one can desire evil as evil, all our acts being restricted by the strife for an end denominated the "*summum bonum.*"

"Finis non cadet sub electione."

In "Purgatory," Dante says:

"All indistinctly apprehend a bliss
On which the soul may rest; the hearts of all
Yearn for it; and to that wished bourn
All therefore strive to tend:"

and he inquires from the spirit of Marco Lombardo:

"The world indeed is even so forlorn
Of all good, as thou speak'st it, and so swarms
With every evil. Yet, beseech thee, point
The cause out to me, that myself may see,
And unto others show it; for in heaven
One places it, and one on earth below."

To this the reply is given:

"The world is blind;
And thou in truth comest from it. Ye, who live,
Do so each cause refer to heaven above,
E'en as its motion, of necessity,
Drew with it all that moves. If this were so,
Free choice in you were none; nor justice would
There should be joy for virtue, woe for ill.
Your movements have their primal bent from heaven;
Not all; yet said I all; what then ensues?
Light have ye still to follow evil or good,
And of the will free power, which, if it stand
Firm and unwearied in Heaven's first assay,
Conquers at last, so it be cherish'd well,
Triumphant over all. To mightier force,
To better nature subject, ye abide
Free, not constrain'd by that which forms in you
The reasoning mind uninfluenced by the stars.
If then the present race of mankind err,
Seek in yourselves the cause, and find it there."

Dante, giving his absolute allegiance to the creeds of the so-called Infallible Church of his day, seems to have been buffeting the troubled waves of doubt concerning this question of Free Will, for he again alludes to it in "Paradise," where he makes his ancestor Cacciaguida say:

"Contingency, whose verge extendeth not
Beyond the tablet of your mortal mold,
Is all depictured in the eternal sight;
But hence deriveth not necessity,
More than the tall ship, hurried down the flood,
Is driven by the eye that looks on it."

In this perhaps we are as abysmally ignorant as we are concerning an existence in the eternal hereafter.

Perhaps some of the expressions in this book would imply a partial adoption of what is called "Christian Science," that peculiar creed which disavows the material, but so inconsistently runs to the dentist when the tooth throbs with pain, or consults the oculist when the eye-sight fails.

At the conclusion of this strange and remarkable work, when Satan says "I must go now, and we shall not see each other any more," a question is asked, "In this life, Satan, but in another?" the answer is given, "There is no other." . . .

Life itself is only a vision, a dream." . . . "Nothing exists; all is a dream. God—man—the world—the sun, the moon, the wilderness of stars—a dream, all a dream; they have no existence. Nothing exists save empty space—and you: And you are not you—you have no body, no blood, no bones, you are but a thought." . . . "In a little while you will be alone in shoreless space, to wander its limitless solitudes without friend or comrade forever—for you will remain a thought, the only existent thought, and by your nature inextinguishable, indestructible. Strange that you should not have suspected years ago—centuries, ages, eons ago, for you have existed, companionless, through all the eternities. Strange, indeed, that you should not have suspected that your universe and its contents were only dreams, visions, fiction! Strange, because they are so frankly and hysterically insane—like all dreams: A God who could make good children as easily as bad, yet preferred to make bad ones; who could have made every one of them happy, yet never made a single happy one; who made them prize their bitter life, yet stingily cut it short; who gave His angels eternal happiness unearned, yet required His other children to earn it; who gave His angels painless lives, yet cursed His other children with biting miseries and maladies of mind and body; who mouths justice and invented hell—mouths mercy and invented hell—mouths Golden Rules, and forgiveness multiplied by seventy times seven, and invented hell; who mouths morals to other people and has none Himself; who frowns upon crimes, yet commits them all; who created man without invitation, then tries to shuffle the responsibility for man's acts upon man, instead of honorably placing it where it belongs, upon Himself; and finally, with altogether divine obtuseness, invites this poor, abused slave to worship Him.

You perceive now, that these things are all impossible, except in a dream. You perceive that they are pure and puerile insanities, the silly creatures of an imagination that is not conscious of its freaks—in a word, that they are a dream, and you the maker of it. The dream-makers are all present; you should have recognized them earlier.

It is true, that which I have revealed to you; there is no God, no universe, no human race, no earthly life, no heaven, no hell. It is all a dream—grotesque and foolish dream. Nothing exists but you.

And you are but a thought, a useless thought, a homeless thought, wandering forlorn among the empty eternities."

Some of us, those of the highest intellectual order, can say:

"In nature's infinite book of secrecy
A little I can read,"

but who, even the materialist, adopting as his creed,

"De nihilo nihil; in nihilum nil posse reverti,"

can satisfy the longing for a compelling satisfaction of the great question—What of the hereafter?

"Into this Universe, and *Why* not knowing
Nor *Whence*, like Water willy-nilly flowing;
And out of it, as Wind along the Waste,
I know not *Whither*, willy-nilly blowing.

"What, without asking, hither hurried *Whence?*
And, without asking, *Whither* hurried hence!
Oh, many a Cup of this forbidden Wine
Must drown the memory of that insolence!"

"La vie est vaine:
Un peu d'amour
Un peu de haine—
Et puis-bonjour!

La vie est brève
Un peu d'espoir,
Un peu de rêve
Et puis-bonjour."

Perhaps, when the record of our weaknesses, our frailties and our sins shall be read,—as some believe and all hope,

"Il y aura amnistie générale."

Rejoyce Collins Edwards

Los Angeles, California
December 23, 1916.

On parent knees, a naked new-born child
Weeping thou sat'st while all around thee smiled;
So live, that sinking in the last long sleep,
Calm thou may'st smile while all around thee weep.

Sheba was never
More covetous of wisdom and fair virtue
Than this pure soul shall be, * * And those about her
From her shall read the perfect ways of honor.

Directors' Meeting

A REGULARLY called meeting of the Directors was held in the office of the Secretary at 11 o'clock a. m. on Friday, September 29, 1916.

Present: Messrs. Benton, Collins, Keese, Parsons, Spalding and Watts.

The Treasurer presented a statement of the financial condition of the Academy, and he was authorized to institute such action as he might think proper in the premises.

The Secretary was instructed to notify all members who are more than two years in arrears for their dues, that immediate payment is required and in case responses were not made within ten days, to drop their names from the Roll of Members.

It was decided to have the October meeting of the Academy, a combined business and social function and the Secretary was requested to make all necessary preparations.

Board adjourned.

Directors' Meeting

A legally called meeting of the Directors was held in the office of the Secretary on Thursday, October 5, 1916.

Present: Messrs. Beeman, Benton, Collins, Keese, O'Brien, Spalding and Watts.

Mr. Keese, as Treasurer, reported that the bequest of $10,000.00 by the late Bancroft E. Beeman had been paid by the Executrix of the Will and the disposition of the sum was presented for consideration.

Several propositions for its investment were discussed, but the matter was finally deferred for a final decision, until additional information could be obtained concerning certain securities which had been offered.

The Board adjourned to re-assemble at the same place at the hour of 4 o'clock p. m., October 10, 1916.

Directors' Meeting

On Tuesday, October 10, 1916, the adjourned meeting of the Directors was called to order in the office of the Academy.

Present: Messrs. Alliot, Beeman, Benton, Collins, Keese and O'Brien.

On motion of Mr. O'Brien, seconded by Mr. Beeman, the Treasurer was instructed to loan to the Mortgage Guarantee Company of Los Angeles the sum of $5000.00 at the rate of interest of five and one-half per centum per annum, interest payable quarterly; and to loan to the Fidelity Savings and Loan Association the sum of $5000.00 at the rate of interest of six per centum per annum, interest payable semi-annually.

The Treasurer was given full power to act in the premises.

Board adjourned.

Directors' Meeting

A meeting of the Directors was held on Tuesday, December 5, 1916, in the office of the Academy.

Present: Messrs. Alliot, Benton, Collins, Keese, O'Brien, Spalding and Watts.

A lengthy discussion was held relating to the disposition of our fossil mounts and collections in the various branches of Science, now upon exhibition in the Museum at Exhibition Park, and the future policy to be adopted for the publication of the Bulletin, but no definite action was had other than appointing Mr. Spalding as an additional member of the committee heretofore appointed to consult with the Board of Governors of the Museum and the County Supervisors, as to the best mode of settling the indeterminate and unsatisfactory conditions under which the properties of this Academy are, at present, located in said Museum.

The meeting adjourned to be re-assembled in the Academy office on Thursday, December 7, 1916, at 4 o'clock for further action, and the Secretary was instructed to send an urgent request to all the Directors that their presence at that meeting was required.

Board adjourned.

Directors' Meeting

Pursuant to adjournment from December 5, 1916, all of the Directors having been officially notified, a meeting was held in the office of the Academy, at the hour of 4 o'clock p. m. on Thursday, December 7, 1916, with the following named gentlemen present, to-wit: Messrs. Alliot, Benton, Collins, Keese, Parsons, Spalding and Watts.

During the temporary absence of the President, the meeting was called to order by Vice-President Watts.

The record of the meetings of the Directors, held on May 8, and December 5, 1916, was read, as this meeting had been called for the purpose of a definite settlement of the questions discussed at those two meetings.

The matters of the future status of the Bulletin and the indeterminate conditions under which our scientific collections have been deposited in the Museum of Science, History and Art, located in Exposition Park, were most earnestly discussed during a period of two hours, and the sanction was ratified against the consolidation of our Bulletin with any other publication, or any proposition accorded whereby the identity of this Academy may be endangered or in any manner placed in jeopardy.

No resolution of any kind was adopted or proposed, and the two questions were left open for consideration and examination with the announced purpose of a final disposition thereof at a future meeting.

Academy Meeting

The December meeting of the Academy was held in the evening of the 13th day of the month at the Banquet Hall of Christopher's Restaurant, No. 739 South Broadway.

The President and the three Vice-Presidents not being present, Mr. W. A. Spalding presided.

After investigating the various courses of good things placed upon the tables, a short period of post-prandial addresses ensued.

By a hearty and unanimous vote the Secretary was instructed to send the greeting of the Academy to Dr. A. Davidson, with the hope that he would speedily recover his old-time vigor.

Mr. S. J. Keese, from his lantern, exhibited upon the screen views of polarized light, and he was followed by exquisite color-photographs of flowers, plans, mountains, valleys, waterfalls, cañons and lakes in California, Oregon, Wyoming, Arizona, the Yellowstone Park and the Grand Cañon, taken by Dr. S. C. Low and Dr. D. L. Larker, taken by the Lamere process in which photographs are obtained of objects in their natural colors.

The festivities closed at a late hour.

Directors' Meeting

A legally called meeting of the Directors was held on Wednesday, January 24, 1917, at 4 o'clock, in the office of the Academy.

Present: Messrs. Beeman, Collins, Keese, O'Brien, Parsons and Spalding.

The President and Vice-Presidents being absent, Mr. Spalding wass elected Chairman.

The record of the meeting of December 13, 1916, was read and approved.

Mr. A. Campbell Johnston, of Garvanza, was elected a member of the Academy.

Whereas, Mr. Louis de Schweinitz has made a gift of money to the Treasury of this Academy, the Secretary was requested to express to Mr. de Schweinitz our appreciation and thanks for his generous donation, and the Treasurer was instructed to add said sum to the Bulletin endowment fund.

The Treasurer reported that the $600.00 Bond of the Empire Securities Company had been called in and paid, and he was authorized to loan said amount and any other funds that may be available for addition to the endowment aforesaid to the Mortgage Guarantee Company of Los Angeles, at the rate of 5½ per centum per annum, interest payable quarterly; and also to pay the note of this Academy for $100.00 now outstanding.

Messrs. Spalding, Benton and Keese were elected a Committee to consult with Mr. G. Allan Hancock, Prof. Hector Alliot, the Board of County Supervisors and the Board of Governors of the County Museum at Exposition Park, relating to the disposition of our La Brea fossils and other scientific collections now loaned to said Museum.

Meeting adjourned.

HOLDRIDGE OZRO COLLINS, Secretary.

BOTANICAL SECTION

THE first meeting of the Botanical Section for the season 1916-17 was held in the Music Room of the Public Library, October 26, 1916. Sixteen persons were present.

Mr. Moxley showed some plants from Idaho, collected by Mrs. Bertha H. Fuller; some collected at Hot Springs, Tulare Co., Cal., by Miss Mary A. Moxley, and some collected at La Crescenta, Cal., by Dr. Davidson. An interesting specimen of *Boschniakia strobilacea* Gray, collected by Mr. Burlew on Mt. San Antonio, was shown. Specimens of *Ericameria cuneata* Gray and *Razoumofskya occidentalis* (Engelm.) Kuntze, collected in the higher altitudes of the San Gabriel Mountains by Fordyce Grinnell, Jr., were also shown.

Mr. J. C. Oliver, discoverer of *Helianthus Oliveri* Gray, was present and gave some interesting reminiscences concerning its discovery.

Mr. Henry Hillman made some interesting comments concerning the office of hairs and thorns in desert plants, as he had observed them.

The Botanical Section of the Southern California Academy of Sciences met on Thursday evening, November 23, 1916, in the Music Room of the Los Angeles Public Library.

On account of the illness of Dr. Davidson it was necessary to elect a chairman for the year, Mr. Geo. L. Moxley being elected to that office, and Mr. Theodore Payne, Secretary.

Mr. Moxley spoke briefly on the status of our *Cheilanthes*. He also showed a specimen of a curious leaved *Ficus*, species unknown.

Mr. Fred Burlew exhibited a large number of fresh specimens of native ferns and wild flowers from his own grounds.

Mr. Payne showed a specimen of hybrid *Ceanothus* originating in Santa Barbara from seed saved from a bush of *C. arboreous* and supposed to be a cross between that species and *C. spinosus*, as both kinds were planted in the same grounds.

Mr. E. E. Hadley exhibited a number of very interesting fossil specimens of leaves found at Alhambra.

The Botanical Section of the Southern California Academy of Sciences met on Thursday evening, December 28, 1916, in the Music Room of the Los Angeles Public Library.

In spite of the rainy weather ten persons were present.

Mr. E. P. Terry, of the Gardena High School, showed a number of specimens collected on a recent trip to the mountains.

A general discussion on plant life followed, in which all present took part.

The regular meeting of the Botanical Section of the Southern California Academy of Sciences was held Thursday evening, January 25, 1917, in the Music Room of the Public Library. Mr. Geo. L. Moxley, Chairman, presided. Fifteen persons were present.

Mr. Stuart Towne showed a number of plants from the hills near Hollywood.

Miss Mohr exhibited a specimen of *Cneoridium dumosum* Hook, collected at Laguna Beach.

Mr. Payne showed a large number of ferns collected by Mr. John Spence at Cordova, State of Vera Cruz, Mexico.

Mr. F. Burlew exhibited specimens of *Lathyrus splendens* Torr., *L. laetiflorus* Green, and *L. Alfeldi White* grown in his own grounds.

Mrs. Bertha H. Fuller gave a short talk on a botanical trip in Southern Idaho, mentioning among other things some of the difficulties the irrigators of that section have with certain filamentous algae which clog up the irrigation canals.

Mr. E. E. Hadley showed some seeds of the *Ginkgo biloba,* grown at Alhambra.

THEODORE PAYNE, Secretary.

BULLETIN

OF THE

SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

JULY, 1917

Volume XVI, Part II.

LOS ANGELES, CALIFORNIA

BASKET-SHAPED BOTTLE

Use long unknown, now fully explained by the asphaltum covered exhibits next to it, waterproofed with asphaltum and decorated with bird-bone sections and beads, used as water vessel.

Abalone shell containing asphaltum and black stones. Very rare specimens from the A. S. Clem Collection, Southwest Museum.

BULLETIN

OF THE

Southern California Academy of Sciences

JULY, 1917

Volume XVI, Part II.

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PRE-HISTORIC USE OF BITUMEN IN SOUTHERN CALIFORNIA

By Hector Alliott.

SOME ten miles off the coast of California, between Redondo Beach and Santa Catalina Island, there issues from the bed of the Pacific Ocean a fountain of bitumen.

For centuries past this spring has sent forth small masses of asphaltum, which, being lighter than the water, have floated landward, been divided by the action of wind and wave into numerous globules, and finally found lodgment along the shore. These balls—varying in size from that of a filbert to as large as an orange—are often, after a storm, a source of considerable annoyance to bathers, who unawares step upon the sticky particles and anathematize a near-by oil refinery, crediting its management with inexcusable negligence in thus permitting oil waste to pollute the beaches.

Ages before companies for the exploitation of petroleum deposits had been thought of, the Californian aborigine doubtless trod with his bare feet upon similar viscous particles. While he must at first have looked upon the soft, black beach pebbles with annoyed curiosity, the practical native soon discovered a means of applying the sticky substance to his own good use.

Recent expeditions of the Southwest Museum to the Santa Barbara Channel Islands have established conclusively the antiquity of man's knowledge and use of asphaltum in California, long before Cabrillo explored the Pacific. The specimens now in the possession of the Museum demonstrate a remarkably wide employment of the material by the Pacific Coast natives. Since it was only by laborious and slow stages that the stone age man accomplished progression in the use of any material, these articles represent a long period of evolution in manufacture.

Exploration of burial sites on the Channel Islands has disclosed evidence that establishes the fact that primitive man of that region made a very general application of bitumen to the manufacture of his weapons, utensils and ornaments. In fact it was so commonly employed, and in such a great number and variety of artifects, that together with the steatite peculiar to the quarries of Santa Catalina Island and generally used, it may be said to indicate a distinct local phase of advanced culture of the neolithic age in Southern California.

Bitumen, no doubt, played an important part in the very settlement of the Channel Islands by adventurous spirits from the mainland. In the early days of the stone age, the aboriginal fishermen and navigators used clumsy rafts made of rushes, and rudimentary boats. The numerous sea-faring canoes reported by Venegas and other early Spanish historians as dotting the Pacific Ocean near the Islands, indicate that by slow degrees the making of boats of wood had by that time developed to a remarkable stage on the Southern shores of California.

Stout canoes, quite sea-worthy, and capable of withstanding the buffeting of the northwest gales, were necessary to transport persons across fifty miles of open seas. The primitive emigrant entrusted the precious burden of his family and his belongings to a well-calked craft; a canoe, paved over with bitumen as a waterproof covering, became his means of navigation. This construction, suggested by the early historians, is confirmed by miniature steatite models found, and by information secured from the few surviving descendants of the native tribes still living in Southern California.

This precious cement, impervious to moisture, aboriginal artificers found most useful, too, in mending the steatite utensils that became cracked, thus transforming them into admirable storage vessels.

New implements of warfare, hitherto unknown, the native made with the aid of asphaltum. By using the rib of a whale as a shaft rolling one end about in bitumen until a heavy mass of the substance was formed, he had an effective weapon, a new kind of war club, of unusual manufacture. Applied as a handle to the primitive knife or saw, asphaltum made the implement much more convenient and practical. Later when the islander had perfected his stone knife, and learned to fit it with a wooden handle, he found that bitumen made an excellent adhesive between wood and his flint or obsidian blades. Arrow and spear points were affixed to their shafts with the same material.

By the time this was accomplished, after generations of slow progression, he dared to make a boat of wood large enough to accommodate many men, and in it set forth to explore the seas far from his accustomed fishing grounds. With infinite care and patience he felled trees, laboriously split them, and roughly hewed them into planks, which he with difficulty transported to the shore. There he surfaced and smoothed them, fitted them together—binding them with thongs,—and waterproofed his craft by the application of liquid asphaltum. This curious method of construction is well established by specimens from San Clemente and San Nicolas Islands and Redondo Beach. The surfacing process, as practiced by the natives before the Spaniards came, was most unique and interesting. According to one of the oldest survivors of the Gabrielinos (probably the last one) who was personally interviewed by the writer, a rope of hide—made of the skins of sea lions, which were very numerous—was attached to a plank, and at low tide several men would drag the slab back and forth over the wet sand, one of their number riding on the board to weight it; thus by friction and much toilsome effort the wood was gradually polished. The building of one of these roughly fashioned craft required many weeks of unremitting toil.

It was in the application of the asphaltum, however, that the ingenuity of the primitive mind is exemplified in that fascinating manner that renders its study such an endless source of delight to the technically curious.

In small steatite vessels the native melted his bitumen over a slow fire. After all impurities had been removed, he drained the liquid into great abalone shells and set it away to cool and harden. The abalone was his favorite and must nutritive food, and he preserved the shell of that mollusk with as much solicitude as we do today; ordinary ones were kept aside to be used as containers, while the exquisitely colored, more nacreous ones, were employed as ornaments or in the making of mosaic work. When the asphaltum was needed for the paying over of boats or other purposes, the artificer heated small pebbles, deposited them upon the solid mass in a shell, and it was soon liquefied. He then placed another shell over the first, and without burning his hands, without cracking the container, he poured the warm, fluid asphalt dextrously where needed.

The numerous fishing boats reported by early Spanish explorers as plying between the Islands and the mainland, were doubtless the bitumen-covered craft of these pelagic people. There is evidence of the sea-worthiness of these boats in the well authenticated reports that the Santa Catalina people travelled north many hundreds of miles, in search of adventure and new fishing beds.

Bitumen, curiously produced by a natural source far off shore, had turned a new page in the experience of the Southern California native, and the chance discovery of that material changed the trend of his culture to such a degree as to modify his customs, habits and aspirations.

It was not only for boats that the native used an asphaltum coating. Since it could be applied to stone and wood with equal facility, he reasoned that it would serve as well for waterproofing basketry, and this he proceeded to do. Experience and skill demonstrated the advantages of a bottle-shaped vessel, payed over with asphaltum, as the most practical water container. So pleased was the discoverer of this process with his efforts,, that he decorated and ornamented the neck of his unbreakable water jug with beads and bird-bone sections, set in the plastic substance in lines and geometric patterns.

Later, when the native learned the gentle art of music, asphaltum aided him to a marvelous degree in his æsthetic advancement. His albatross-bone flute, his pelican-bone whistle had certain tonal qualities due entirely to the length and thickness of the bone employed. With the aid of asphaltum, however, remarkable changes took place in the manufacture of these instruments. Many of the flutes and whistles had the size of the air passages reduced within the bone by the introduction of layers of asphaltum of varying thickness. This modification gave an individual tonality to most of the instruments;; orchestral effects were rendered possible, and not improbable. Favorite instruments were covered on the exterior with bitumen upon which choice bits of abalone shell were inlaid in geometric patterns.

Stone pipes and vessels were often incised, the spaces filled with asphaltum, and elaborate designs wrought upon them in sections of bird-bone inset.

Having thus reached what must be considered a high natural and independent development, neolithic man first came in contact with the white man. From him he learned much, but forgot, also, most of his own customs and industries. He no longer buried his people as his forefathers had, yet he retained his appreciation of asphaltum—the precious material of his ancestors—and payed the caskets of his Christianized people with it, as a last reminder of his original culture.

Nehemiah, when he poured the thick water on the sacrifice "a great fire kindled," but long before that marvelous occurrence which must have inspired its beholders with fearsome awe, bitumen had already played an important part in the world's civilization. According to the accounts of Herodotus it cemented together the walls of Babylon.

In the Book of Genesis are found two notable references to the use of slime—("slime" was bitumen in the Vulgate)—: "Slime had they for mortar" in the construction of the Tower of Babel; and we are told (Genesis XIV, 10) that the vale of Siddim "was full of slime pits." In Job we find that "the rock poured me rivers of oil."

Diodorus records that the bitumen of Lacus Asphaltites (Dead Sea) was collected by the inhabitants and sold to the Egyptians for the purpose of embalming the dead. In China and Persia traditions exist concerning the religious and economic use of bitumen, as do they also in Mexico and South America.

And here on the California shores we discover new confirmation of the universal brotherhood of man in his practical application of occasional material. It substantiates the claim that handicraft has from the infancy of the race, determined, in no small degree, the advance of the genus homo on the long and wearisome path of cultural progress.

PAYNE'S NEW HYBRID LILAC

Ceanothus spinosa X C. *arboreus.*

SHRUB, stems slightly angled, not spinescent; leaves three nerved, above, dull green smooth but not glossy, lighter

Plate II.

underneath, ovate, serrate 1½ in. long by ¾ in. wide; petioles 3 lines long; young leaves puberulent beneath, in age only microscopically puberulent on mid-vein; flower thyrsus blue, 6 in. long and 2 in. broad; fruit round crested. No. 3232 type in author's herbarium; cotypes in Berkeley and Smithsonian.

In this hybrid *C. arboreus* is the dominant factor in the foliage and *C. spinosus* in the fruit and flower. The leaf is intermediate in size, but in shape venation and serration, though the latter is less marked, it is that of arboreus. The conspicuous tomentum of the underside of the leaf in *C. arboreus* is but faintly represented by the puberulency on the mid-vein. In habit of growth it is more of a shrub than a tree.

A few years ago Mr. Theodore Payne acquired some seeds of *C. arboreus* from a garden in Santa Barbara. These when sowed produce 50 per cent of *C. arboreus*, the others all similar were of an unknown variety. These latter grew rapidly and produced blooms one of which is shown in the illustration. Mr. Payne visited the source of the original seeds and found *C. arboreus* and *C. spinosus* grouped together in one patch. No other Ceanothus grew in the neighbourhood. He naturally and I think correctly concluded that this unknown tree was a hybrid between *C. arboreus* and *C. spinosus*.

A number of these hybrids have been planted in the gardens of Los Angeles as they promise to be one of the most ornamental and hardy of our native shrubs. It is more foliaceus than *C. spinosus* and produces a larger flower than either of the parent plants.

C. spinosus has not been found in proximity to *C. arboreus* in Catalina Island so they have not been subjected to the possibility of cross-fertilization in their native habitat.

Some of the lilacs in cultivation have been produced by cross-fertilization to which the whole genus readily responds. On this account it has long been suspected that some at least of our accepted species are really hybrids. *C. vestitus* Greene has been considered a hybrid by some writers, but the evidence in this district is against this supposition as our plants are found in the desert regions far from any other species. *C. soriedatus* is the only lilac in this district that looks like a hybrid. This plant is rather rare here, and where it does occur the plants are few and disseminated. Its appearance suggests a cross between *C. divaricatus* and *C. oliganthus*. Cultural experiments alone will determine the status of our doubtful species.

Anstruther Davidson, C. M., M. D.

Rhamnus Catalinae Davidson. sp. nov.

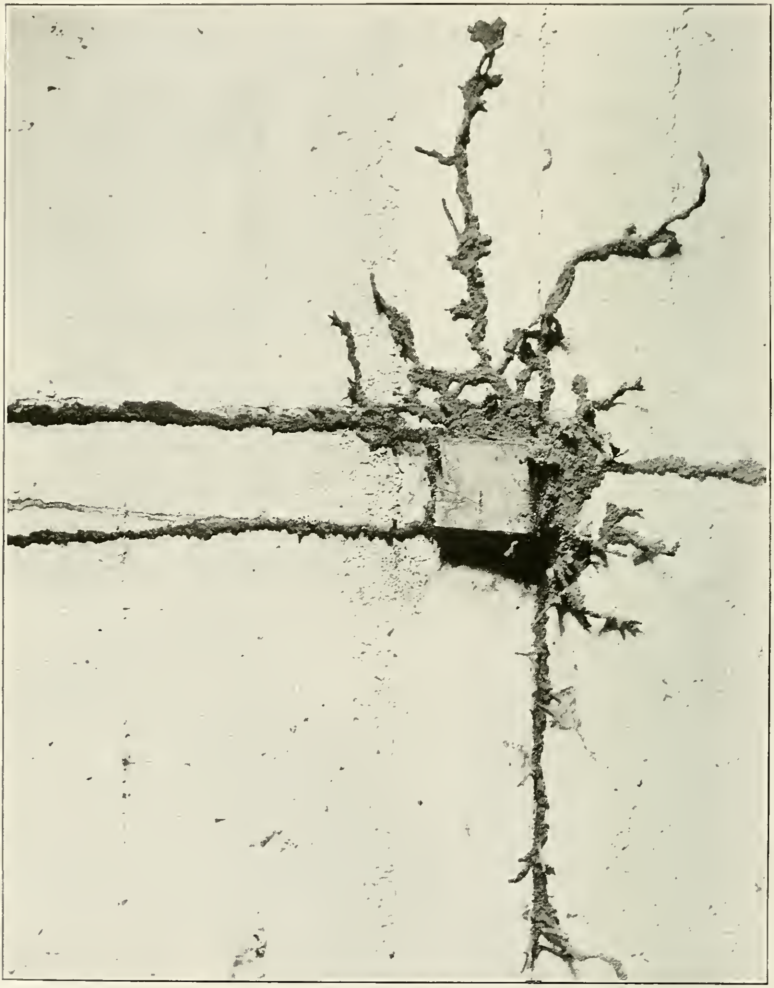
Tall evergreen shrub; young shoots puberulent, leaves ovate or ovate lanceolate apiculate, 1 in. long, ½ in. wide, finely serrate throughout, dull green in color, smooth but not glistening, lighter below with slight puberulency on mid-vein, veins not prominent; petioles 1½ to 2 lines long; fruit as in *R. illicifolia*.

Type No. 2344, Catalina Island, author's herbarium; cotype Smithsonian Institute. Mr. P. S. Standley of the latter informs me that a specimen of Grants from Catalina in the Smithsonian resembles mine. My thanks are tendered to Messrs. Standley and Hall for their kindly help with specimens. In the University of Cal. herbarium Hall's 8270, Swain's Canyon, Catalina, is a typical *R. Catalinae*. Brandegee, Catalina Island, May, 1889, shows two specimens of the same. One is similar to Hall's, the other has the leaf broader, emarginate and with the apiculation more marked.

Of allied species we have accredited to S. California *R. crocea* Nutt. *R. illicifolia* Kell., and *R. insulare* Greene. The latter I have not found, the other two are common. In the neighbourhood of Los Angeles *R. crocea* is always a deciduous shrub, *R. illicifolia* is an evergreen. This with other distinctive differences is sufficient to keep them specifically distinct rather than class *illicifolia* as a variety of *R. crocea*. If that distinction holds good and *R. insulare* is reduced from specific rank to the variety, it necessarily becomes *R. illicifolia insulare* as it too, is an evergreen. This latter plant with its large orbicular or obovate polished leaves seems to me worthy of the specific rank accorded it by Greene.

Anstruther Davidson, C. M., M. D.

THIS curious structure, Plate III, that looks like an artistic streak of mud on a whitewashed wall, is the home of our latest immigrant, the white ant. So far as we are aware this is the first notice of their arrival on this city. This construction as



here depicted was first noticed by Mr. C. C. Pierce, the photographer, in April of this year. It appeared then as in the photograph. The radiating lines are really tubes composed of granules of wood dust and earth in which these termites or white ants live. The square centre shown is a block of wood fixed in the cement wall of the cellar in which the ants burrow and find nutriment.

The conditions as regards light and moisture in cellars are particularly favorable to the multiplication of those insects so that every cellar with woodwork requires investigation. In this same building in two other places where wood is embedded in cement the ants are already at work.

In buildings constructed wholly of cement those insects can do no harm to the building, but they are liable to injure stored papers, books or leather, just as they do wood; but in cellars with building supports standing on the cement, these may be so heavily attacked as to cause collapse of the building.

The white ants have been troublesome in Washington, D. C., and southward, and those interested will find a full account of their habits in Farmers Bulletin No. 759.

The species of white ant found here is probably *Leucotermes flavipes* Koller, but its exact identity will be established by the Department of Agriculture.

FREMONTODENDRON MEXICANUM sp. nov.

BRANCHING shrub 10 to 20 ft. high, branches clothed with dense stellate pubescence, leaves dark green above, white pubescent beneath, 3-lobed or 5-lobed 2½ in. long and the same wide; petioles longer than the blade; flower 3-4 in. in diameter, sepals obovate orange above red at base, and conspicuously veined, the inner larger, all mucronate, the rounded basal pit devoid of hairs; capsule 1½ in. long densely haired; seeds ovate 2 lines long, black.

Type 3234 author's Herbarium; cotypes in Gray's Herb., and Smithsonian Institute.

The flower in *F. Californicum* is a pale canary yellow. This species is orange colored red at base and along the midvein, of a larger size, and is altogether more showy, while the larger leaf gives it a more foliaceous and ample appearance. As a decorative shrub it will entirely supplant our native species now so frequently used by the horticulturist. The seeds of *F. Mexicanum* are smaller and darker than those of *F. Californicum.*

This plant was discovered by Miss Kate O. Sessions of San Diego, who raised it from seed collected near Ensenada, Lower California. She says that "25 years ago there were two trees of this species in San Diego and they thrived there under very trying conditions." The specimens from which the description has been taken were gathered by Miss Sessions 15 miles from San Diego and forwarded to Mr. Payne, the seedsman, who directed my attention to them. He has a number of these growing in his nursery, and their manner of growth is at first characteristically different. The seedlings shoot up straight as a miniature tree, while those of *F. Californicum* branch from near the base at an early stage.

Anstruther Davidson, M. D

THE RED HILL POOLS

S. B. Parish

AMONG some interesting plants sent me this spring by Mr. Ivan Johnston, an acute and enthusiastic botanical student at Pomona College, were specimens of *Pilularia americana* A. Br. and of an Isoetes, which one naturally expected to be I. *Orcuttii* A. A. Eaton, a little known species founded on plants collected by Orcutt in winter pools on the mesa at San Diego. But on comparison with Eaton's description it was found to be quite distinct from that species. Mr. Maxon, to whom I sent specimens, informs me that they match well with material in the U. S. National Herbarium also collected by Orcutt in the San Diego pools, and which Mr. A. A. Eaton had referred to *I. melanopoda* var. *pallida* Engelm., the type of which was collected long ago in Texas by E. Hall. That, however, is described as having leaves 20 cm. long, while those of Mr. Johnston's plants are very slender and but 3-5 cm. long. But for the present it may bear that name. It is now first reported from the state.

Mr. Johnston found these plants growing in winter pools at a place near Upland, locally known as Red Hill. By his kindness I was enabled to visit the place on the fourth of May in the present year. There are four or five of these pools, none of them more than a few yards wide in any part, and in depth less than two feet below the surface of the red clay mesa in which they are situated. At the time of my visit all the water had evaporated, but the black loamy muck which forms the bottoms of the pools was still moist. Both Isoetes and Pilularia had nearly disappeared, so that by diligent search only a few withering plants could be found. But the other vegetation of the pools amply rewarded our visit. In all of them there was an abundant growth of *Psilocarphus globiferus* Nutt. and *Navarretia prostrata* Greene, and in two of them patches of *Callitriche longipedunculata* Morong, the type of which was also collected by Orcutt in pools of this kind on the San Diego mesas. The slender stems creep on the surface of the mud bottoms, forming a close carpet, and are submerged when the pools are full. They were now beginning to wither, and were without flowers, but the black fruits were abundant. These are buried in the mud, a character not noted by Morong, and which classes this species with *C. sepulta* Wats and *C. Nuttallii* Torr. So far as I am aware the present species is known only from the type station, but a Callitriche collected by Hasse in pools near Santa Monica is probably the same.

Over the dried pools waved the slender panicles of a Deschampsia. I do not forgive myself for neglecting to collect specimens of this grass, for it is likely to be *D. gracilis* Vasey, another plant which was first found by Orcutt in the San Diego pools.

Red Hill offers on a small scale a very clear example of the ecological limitation of plant growths. The vegetation of the mesa is composed of the native and naturalized plants common everywhere in the region in similar places. Not one of them had intruded on the pools, from which they are excluded by the presence of water at the time when their seeds sprout. It would be interesting to observe if they are able to enter in those very dry seasons when the deficient rainfall fails to fill the pools. Of course none of the plants of the pools are able to pass beyond their narrow limits. With two exceptions they are among the least known plants of Southern California. The exceptions are *Psilocarphus globiferus* and *Navarretia prostrata,* which appear to be not uncommon in desiccated pools in the coastal district of Los Angeles county. But neither the commoner nor the rarer species have been found elsewhere at any but places remote from this station. Botanists who are acquainted with the location of such winter pools should examine them with care early in the rainy season to ascertain if the rarer plants are not to be found in them. After the more conspicuous plants are in condition for collecting the smaller ones will probably have entirely disappeared.

THE WORLD'S MOST POWERFUL TELESCOPE

By William H. Knight

At last the 100-inch mirror specially housed at the laboratory of the Mount Wilson Observatory in Pasadena, was ready to be packed and transported to its future home on the mountain top, 17 miles distant, and 6000 feet above sea level. For four years expert hands had been engaged in grinding and polishing the great mirror and now it was daintily packed in thick cushions to relieve any possible jar. It was then placed in an octagon shaped box which was strongly reinforced by a crate of bolted timbers and heavy iron rods. The whole mass, weighing nearly seven and a half tons, was anchored edgewise upon a powerful auto truck weighing five tons, and constructed expressly for this journey. The wheels, seven feet apart, formed an ample base, so that the top of the load, twelve feet from the ground, swayed but little from the perpendicular.

At 7 o'clock on the morning of July 1, 1917, the truck bearing the world-famous mirror left the Pasadena laboratory amid a throng of keenly interested spectators, and motored over the mesa to the toll house at the foot of the mountain roadway, where another crowd of 200 people were gathered to witness the final ascent, and where thirty or forty automobiles lined the avenue.

At the invitation of Mr. Francis G. Pease, who has been doing notable work on the 60-inch refractor for several years, and previously at the Yerkes Observatory, the writer occupied a seat in his automobile which immediately followed the motor truck bearing the precious burden. Mrs. Pease and Mars Baumgardt were the other passengers in our vehicle. Preceding the main truck was another provided with cables and machinery ready for use in case of emergency, but fortunately they were not needed on the trip of nine and a half miles from the toll house to the observatory building. The wonderful mountain road, much of it forming a narrow shelf carved from the massive granite rock, with many reentering curves and steep grades, was traversed without a single mischance, and much credit is due the skill and forethought of the Mack Motor Truck Company for the entire success of the enterprise.

The 100-inch mirror has an interesting history. To one man in particular should be given large credit for the inception of the idea. Mr. John D. Hooker, a prominent business man of Los Angeles, was for several years vice president of the Southern California Academy of Sciences, and he took such great interest in the Astronomical Section that for ten years its meetings were held in a hall of his private residence on Adams street.

When the work of equipping the Mount Wilson Observatory was in progress Mr. Hooker asked, "Why not have a hundred-inch telescope on the mountain? It would be the largest in the world for many years, and might accomplish great things for astronomical science." The reply was made that the cost of a glass of that size and its mounting would be so great that such a project would be impracticable. "How much would such a lens cost?" asked Mr. Hooker. "Probably not less than $50,000," was the off-hand reply. "Put me down for that $50,000," was Mr. Hookers impulsive exclamation, and the magic glass was ordered at once from the French Plate Glass Co. in Europe.

Several unsuccesful attempts were made to produce a disc large enough to fill the order. But at last one was made by three pourings of the melted material. It formed a circular mass 101 inches in diameter and 13 inches in thickness. The three pourings did not mix so as to form an absolutely homogeneous mass, but it was sent to its destination in Pasadena for trial, to be accepted and paid for if it proved satisfactory.

The Director of the Mount Wilson Solar Observatory, Dr. George E. Hale, a man of scientific and mechanical acumen, deemed the experiment worth while, and the grinding, polishing and silvering of the great mirror has been accomplished under the special direction of Professor G. W. Ritchey, whose previous experience in optical work ensured the best results.

But, to carry forward this great enterprise, give the giant mirror an adequate mounting, make all its possibilities available for practical use, large additional sums were required, and these were forthcoming from the munificent fund of the Carnegie Institution, founded by that great philanthropist, Andrew Carnegie.

The immense castings for the equatorial mounting of the telescope, weighing about one hundred tons, had been ordered from the large works at Fore River in the East. These are already in position in the magnificent observatory building constructed expressly to house the future telescope. The building and the dome which surmounts it are 100 feet in diameter—far the laregst ever constructed to house a single telescope. The great dome and the revolving observing platform, as well as the massive mounting, are all moved by electric power, and the touch of an electric button sets them in motion. A ten-ton electric crane is used in placing the various sections of machinery.

When the crate containing the 100-inch mirror was backed into the wide entrance of the observatory to a place beneath the hole in the several floorings above, it was unfastened from the truck and siezed by the crane and lifted to the observing floor forty feet above. Here it will be taken from the box and fitted

PHOTO BY W A HUGHES

into the bottom of the gigantic telescope tube, where it will play its part in future astronomical research, and whence important discoveries are anticipated.

The clear aperture of the so-called 100-inch mirror is nearly 101 inches. The depth of the curve in the center is one and one-fourth inches; the thickness of the finished glass at the edge is twelve and three-fourths inches; and the present weight of the glass is nearly 9,000 pounds—or four and a half tons. The area of the 101-inch mirrored surface is 8,012 square inches—a trifle over 55.6 square feet. The focal length of the mirror is 507.5 inches—approximately 42.3 feet.

Dr. Walter S. Adams, Assistant Director of the Mount Wilson Solar Laboratory, and having special direction of its large affairs during the frequent absence of Director Hale in the East and in Europe, has been closely identified with the development of the 100-inch telescope and the construction of the great observatory building from the first. His special line of investigation is stellar spectroscopy, and he hopes for important results from the use of the new telescope which it is expected will reveal stars in the Milky Way and in distant star clusters down to the 22nd magnitude.

The large force in the Mount Wilson Solar Observatory, the people of Southern California who have a special pride in the great enterprise, the attaches of all other observatories on the globe, and in fact all intelligent persons interested in the achievements of astronomical science, will feel a sense of relief in the successful completion of the great mirror and its safe housing in its permanent home on Mount Wilson.

TRANSACTIONS OF THE ACADEMY

Monthly Meeting

THE monthly meeting of the Southern California Academy of Sciences was held in the auditorium room of the Polytechnic High School on Tuesday evening, April 24, 1917, President Mr. Benton presiding.

A beautifully illustrated and scientific lecture on the illumination of the Panama-Pacific International Exposition was given by Mr. W. D'Arcy Ryan of New York. Mr. Ryan has an international reputation as an illuminating engineer and it was he who designed and executed the lighting effects at the Panama-Pacific International Exposition. The beautiful lighting of the buildings and grounds at the exposition were shown on the screen in colors. Mr. Ryan also illustrated with slides the proposed plan for making Broadway in Los Angeles one of the most beautifully lighted streets in the country.

The hall was filled with an appreciative audience.

Arthur B. Benton, President.

Annual Meeting

The annual meeting of the Southern California Academy of Sciences met on June 19, 1917, at the Friday Morning Club hall. In the absence of the President, Mr. Hector Alliott, Vice-President, presided.

The election of officers for the ensuing year resulted in the old Board being unanimously elected, which consists of the following Directors:

Hector Alliot, George H. Beeman, Arthur B. Benton, Holdridge O. Collins, Anstruther Davidson, Samuel J. Keese, George W. Parsons, William A. Spalding, Albert B. Ulrey, William L. Watts, T. L. O'Brien.

Dr. John Adams Comstock, Curator of Entomology, Southwest Museum, gave an interesting illustrated address under the subject of "Collecting Butterflies," which was illustrated by Paget and autochrome lantern slides which were especially prepared for the occasion and were presented by Dr. Dain L. Tasker. This lecture was followed by an address by Vice-President Dr. Hector Alliot, who is also a Director of the Southwest Museum, on the subject of "Visual Education in Museums," in which Dr. Alliot explained the work.

Arthur B. Benton, President.

Treasurer's Report, Fiscal Year June 1, 1917

Balance in Bank June 7, 1916		$ 45.87
Receipts:		
Dues from members		333.00
Bequest from Mr. B. E. Beeman		10,000.00
Donation from Mr. and Mrs. Luis de Schweintiz		25.00
Empire Security Co., Redemption of Bonds		600.00
Loan from First National Bank		100.00
Interest from Loans		262.13
Total Receipts		$ 11,366.00
Disbursements:		
Bulletin Account	$ 269.71	
Lecture Account	69.27	
Office Rent	97.50	
Sundries	50.48	
Paid Loan of First National Bank	100.00	
Paid Interest on Same	2.35	
Total Disbursements	$ 589.31	
Balance on Hand:		
Investment with Fidelity Savings Loan	$ 5,600.00	
Investment with Mortgage Guarantee Co.	5,000.00	
Cash in First National Bank	176.69	
	$ 11,366.00	

S. J. Keese, Treasurer.

Director's Meeting

The regularly called meeting of the Board of Directors of the Southern California Academy of Sciences was held at the University Club rooms, Los Angeles, June 25, 1917. Directors present: Arthur B. Benton, Hector Alliot, Dr. Anstruther Davidson, Professor William L. Watts, George W. Parsons, and S. J. Keese.

The election of officers for the ensuing year being in order, Hector Alliot was elected chairman, G. W. Parsons, Secretary. Upon ballot the following members of the Board of Directors were duly elected: Arthur B. Benton, President; Dr. Anstruther Davidson, First Vice-President; Dr. Hector Alliot, Second Vice-President; Professor W. L. Watts, Third Vice-President; S. J. Keese, Treasurer; Holdridge O. Collins, Secretary.

Professor Melville Dozier and Mr. G. W. Parsons were appointed to audit the accounts of the Treasurer and report at the next regular meeting.

There being no further business the meeting adjourned.

G. W. Parsons, Secretary pro tem.

BOTANICAL SECTION

OWING to the fact that the fourth Thursday in the month fell on February 22, Washington's Birthday, and the Public Library Building being closed, the Botanical Section did not meet this month.

The Botanical Section of the Southern California Academy of Sciences met on Thursday evening, March 22, 1917, in the Music Room of the Public Library. Mr. Geo. L. Moxley, Chairman, presided.

Twelve were present.

Mr. Moxley exhibited specimens of Arabis holboelli Hornem from Pacoima, Wash.; Sophia pinnata (Walt) Howell, from San Fernando Valley, also another Cruciferae not yet determined. Mr. E. P. Terry showed specimens of Crossosoma californica Nutt found on a recent trip to Catalina Island. Theodore Payne showed Crossosoma bigelovi, Watson, sent in by M. S. Gordon of Palm Springs. Mr. Gordon also sent in specimens of Beloperone californica Benth, Larraea mexicana and Encelia farinosa Gray, from the same locality.

The Botanical Section of the Southern California Academy of Sciences met on Thursday evening, April 26, 1917, in the Music Room of the Los Angeles Public Library.

Eleven present.

Mr. Francis M. Fultz exhibited a number of fresh specimens of the spring flora of the immediate vicinity of Los Angeles.

Mr. Frank South exhibited a number of specimens of exotic cacti from his garden.

Chairman Moxley reported Dr. Anstruther Davidson much improved in health and exhibited a number of specimens collected by Miss Mohr and identified by Dr. Davidson.

The regular meeting of the Botanical Section of the Southern California Academy of Sciences was held Thursday evening, May 24, 1917, in the Music Room of the Los Angeles Public Library. Mr. Geo. L. Moxley, Chairman, presided.

Eight were present.

Mr. Moxley exhibited a number of grasses collected around Los Angeles by Dr. Davidson.

Theodore Payne showed a large number of fresh specimens of wild flowers from the "Wild Garden" at Exposition Park, Los Angeles.

Mr. Francis M. Fultz exhibited a number of fresh specimens of wild flowers collected around Los Angeles and adjoining country.

Mr. Fred Burlew showed a specimen of Frasera parryi Torr. grown by himself from seed collected near Clark's grade, San Bernardino mountains.

THEODORE PAYNE, Secretary.

Southern California Academy of Sciences

Los Angeles

VOLUME XVII.

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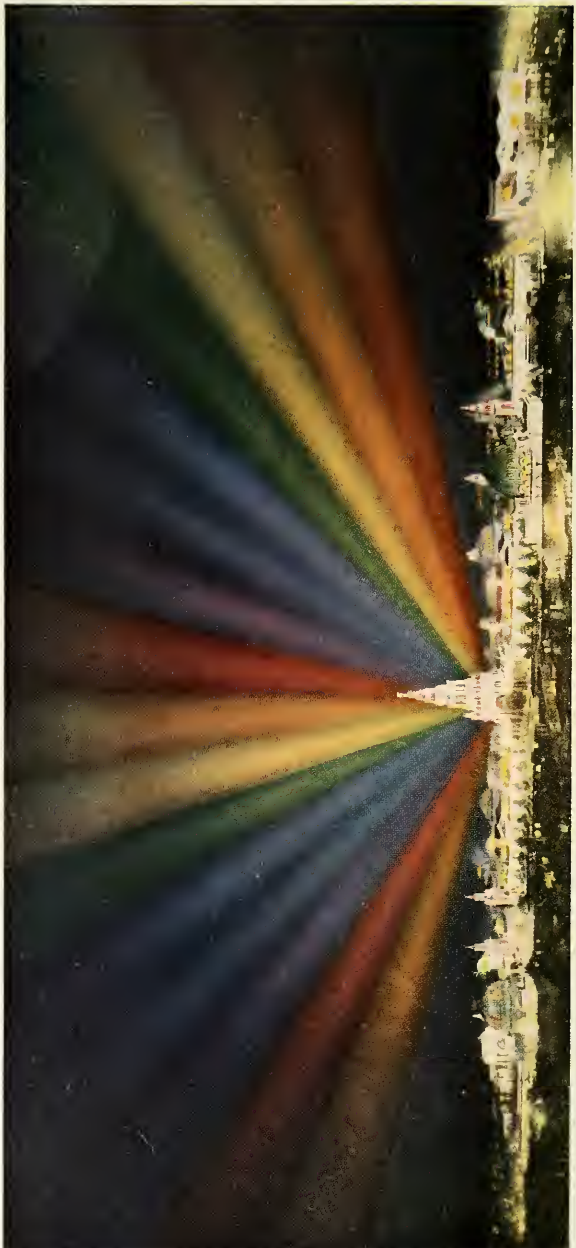
OF THE

SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

LOS ANGELES

JANUARY, 1918



BULLETIN

OF THE

Southern California Academy of Sciences

[illegible]

Volume XVII, May [illegible]

COMMITTEE ON PUBLICATION

Holdridge Ozro Collins, LL.B., [illegible]

Anstruther Davidson, C.M., M.D. William A. Spalding

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Panoramic View from Fillmore Hill

BULLETIN

OF THE

Southern California Academy of Sciences

JANUARY, 1918

Volume XVII, Part I.

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Southern California Academy of Sciences

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ARTHUR B. BENTON .... President
WILLIAM L. WATTS .... First Vice-President
ANSTRUTHER DAVIDSON .... Second Vice-President
HECTOR ALLIOT .... Third Vice-President
SAMUEL J. KEESE .... Treasurer
HOLDRIDGE O. COLLINS .... Secretary

George H. Beeman — George W. Parsons
Thomas L. O'Brien — William A. Spalding
Albert B. Ulrey

Committee on Finance

Samuel J. Keese — William A. Spalding — George H. Beeman

Committee on Program

William L. Watts — George W. Parsons — Thomas L. O'Brien

Sections of the Academy

Astronomical Section

Samuel J. Keese, Chairman — Melville Dozier, Secretary

Geological Section

William L. Watts, Chairman — George W. Parsons, Secretary

Biological Section

Albert B. Ulrey, Chairman — C. H. Phinney, Secretary

Zoological Section

James Z. Gilbert, Chairman — George W. Parsons, Secretary

Botanical Section

George L. Moxley, Chairman — Theodore Payne, Secretary

EDITORIAL

SINCE the publication of our Bulletin for January, 1917, the work of Professor A. B. Ulrey, head of the Department of Biology and director of the Venice Marine Biological Station of the University of Southern California, has attracted a very marked attention, not only from departments and individuals on the Pacific Coast, but from Scientific Bodies generally throughout the United States.

Many lettters have been received asking for further information, particularly relating to the fisheries interests and the quantity and quality of our sea-food products.

In view of the food proposition now confronting our country, to which, with Canada and the Argentine, the eyes of the whole world are now most anxiously turned, the life-supporting products of the ocean have become one of the most valuable factors for an emphatic, successful and permanent termination of the war against autocracy, barbarity and despotism.

The waters of the Pacific Coast teem with untold food wealth, both animal and vegetable, and the years of most devoted study and the profound and practical investigation of this department of the Sciences have been such an open sesame to the acquaintance of Professor Ulrey with the secrets of the deep, that there are but a very few in this environment who stand with him in the frant ranks of marine biological interpreters.

The matter has been placed before the professor with a most urgent appeal that *extra muros* of his lecture rostrum, and in the pages of our Bulletin, he will instruct us concerning these things which are of so vital an importance.

He has most generously acceded to our wishes and, although it will be a great tax upon his time and a huge draft upon his professional duties in the University, he will, from time to time, furnish us with monographs which will be presented to the world in our Bulletin.

These articles probably will run a period of two or three years, and embrace not only in detail the food fishes, but generally the rare fauna and flora of our waters, and the hydrography of many miles of our coast. They will be illustrated with half-tone and colored tableaux of under-sea life, of a character heretofore not imparted in any publication relating to the Pacific Coast.

We hope to present the first paper of this series in our Bulletin for next July.

Work on the 100-inch telescope is proving to be all and even more than was expected. Mechanically the working parts are doing everything expected of them. It is an enormous test of mechanical skill for the most ponderous telescope in the world to have all its multifarious parts so nicely adjusted that they move upon each other with absolute precision.

Optically the great mirror has already proved to be wonderfully accurate. A few test observations have been made, and so far they have shown the great mirror to be a perfect disc, capable of revealing exceedingly minute detail. The workmen are engaged in grinding and polishing some small plane and concave mirrors to be used in focusing and conveying the gathered light of the large mirror to the eye of the observer. This powerful instrument will probably be in full observational use in the early spring months.

The Directors are pleased to announce that, at an early day, the members of this Academy and their friends will have the rare opportunity of being entertained at a function of a character such as, at no time, has been presented in the City of Los Angeles.

A gentleman—a Native Son of the Golden West—who has devoted many years of intense investigation of the history of our Pacific Coast, and whose great and invaluable Library, containing the very *crême de la crême* of literature and art relating to the State of California, excelled by none, except the Bancroft collection, has prepared for us an intellectual symposium of an unique character. His most rare accumulation of the beautiful etchings of the artist Ford and many other exquisite prints and engravings, representing the Missions, their patron Saints, the Presidios, earliest cities, California scenery and the customs of her first settlers, have been photographed upon slides for the lantern, and these, with the relation of his boyhood experiences during the early days, before the advent of the Argonauts had obliterated the recollection of the romances of this land of the vine, the fig, the orange and the mocking-bird, will afford us an entertainment such as probably, there are none other in our midst can equal.

Holdridge Ozro Collins.

WANTED

Numbers of Volumes III, IV, V, VI of the Bulletin to complete files. Address the Secretary, Room 719 San Fernando Building, Los Angeles.

ILLUMINATION OF THE PANAMA-PACIFIC INTERNATIONAL EXPOSITION

By W. D'A. Ryan

Abstract of Paper

In this paper the author, who was Chief of Illumination for the Panama-Pacific International Exposition in San Francisco, describes the system of lighting adopted for the Exposition, which was generally conceded to have initiated a new era in the art of illumination. From a narrow engineering point of view the lighting would have been regarded as inefficient, but the object striven for was to suppress high intrinsic brilliancy, while bringing out the architectural beauties of the Exposition structures in the most effective manner, bathed in a harmony of color. Many beautiful effects were obtained by the various installations which are described, and one of the most original features was the successful effort to preserve the curvature and detail in relief by the use of lights of different strengths and colors thrown from different or opposite directions upon the same object.

The illumination of the Panama-Pacific International Exposition was finally classed by the International Jury of Awards as a "decorative art," largely because it appealed to the imagination and feelings of the masses, and carried a message much the same as painting or music, as demonstrated by the happy enticing effect of the heraldic banners on the Avenue of Progress, the deep mystery of the Court of Abundance, the grandeur and uplifting effect of the great candle-fountains in the Court of the Universe, the quiet peaceful illumination in the Court of the Four Seasons and on the Palace of Fine Arts, the Alladin dreams and fairy-like suggestions of the illuminated towers. flags, reflections and other features which made up the lighting as viewed from the South Gardens.

In this connection I wish to quote Edwin Markham's impressions gained on try-out night, February 15th, 1915:

"I have tonight seen the greatest revelation of beauty that was ever seen on the earth. I may say this, meaning it literally and with full regard for all that is known of ancient art

Note: The colored illustrations in this issue of our Bulletin were contributed with the compliments of Mr. W. D'A. Ryan, Illuminating Engineer and the Illuminating Engineering Laboratory, Schenectady, New York, to whom the Academy of Sciences is greatly indebted for this beautiful donation. We are also indebted to the American Institute of Electrical Engineers of New York City, which has kindly allowed abstracts from Mr. Ryan's paper to be copied from Volume XXXV of its Transactions.

It is well known that Mr. Ryan's plans and designs for the lighting of Broadway, Los Angeles, were accepted and within a few months that avenue will be one of the most beautifully lighted in all America.

S. J. K.

and architecture, and all that the modern world has heretofore seen of glory and grandeur. I have seen beauty that will give the world new standards of art and a joy in loveliness never before reached. This is what I have seen—the courts and buildings of the Panama-Pacific Exposition illuminated at night."

The illumination of the Exposition was based on developments of the science of lighting, and represents results of personal experience in this field extending over a period of twenty years.

The lighting for the Exposition was completely designed in the latter part of 1912 and every feature was carefully calculated, as there was practically no opportunity for trial, owing to the radical nature of the scheme and scope. The buildings of previous expositions had in the main been used as a background upon which to display lamps. The art of incandescent outlining, notably the beautiful effects obtained at the Pan-American Exposition at Buffalo, could probably not be improved upon, and furthermore, this form of lighting had been extended to amusement parks throughout the world and had become commonplace. Its principal disadvantages were the diminution of artistic effectiveness at close range, similarity in effects from different view-points, the suppression or complete obliteration of architectural features, and the economic necessity of extensive untreated surfaces. Furthermore, the glare from so many exposed sources when assembled on white or light-colored buildings, caused severe eye-strain.

The lighting scheme and scope of the Panama-Pacific International Exposition called for a radical departure from previous practise. Incandescent outlining on the main group of palaces was avoided, and screened or masked flood and relief lighting to produce the third dimension of depth, substituted, and great care was exercised to preserve the architectural features and color, with proper relative intensities. For the first time at an international exposition, the illuminating sources, whether arcs, incandescent or gas, lost their identity as such. While a uniform system was maintained throughout, each court possessed its individual characteristics with radical differences, and at the same time the transition from one effect to another was harmonious, even to the extent of an intermediate step or carnival effect on the Avenue of Progress connecting the Zone and the main group of palaces.

During the pre-exposition period, there were many who maintained that the general public would not be attracted except by the glare of exposed brilliant sources. The lighting of the Exposition, however, immediately disproved this theory and a strong psychological appeal was made by the highly artistic lighting effects.

During the period elapsing between the Louisiana Purchase Exposition and the Panama-Pacific International Exposition, wonderful advances had been made in the efficiencies of all types of lighting units. This made it possible to illuminate in the main group of buildings, approximately 8,000,000 sq. ft. (743,200 sq. m.) of horizontal and vertical surfaces to an illumination ranging from 1/10 to 1/4 of a foot-candle in the incidental gardens and roadways, from 1/4 to 3 foot-candles in the building facades and adjacent lawns and gardens, and from 5 to 15 foot-candles on the towers, flags and sculptural groups. The lighting load on the main group of buildings, including the window lighting and the scintillator, was approximately 5000 kw. The total connected load for all purposes, including Zone, Foreign and State sections and exhibitors, for light and power, was 13,954 kw., with a maximum peak of 8200 kw. and an average peak of 7880 kw. During the Exposition period of approximately ten months, a total of 16,057,790 kw.-hr. was purchased from the Pacific Gas and Electric Company. Of this amount, 5,582,906 kw.-hr. were sold to exhibitors and concessionaires, the remaining 10,474,884 kw.-hr. being used by the Exposition.

In order to obtain a harmonious illumination scheme, it was necessary to visualize the lighting as a whole, and to establish illumination and color values for every part of the Exposition before definite specifications for lighting equipment could be made. The preliminary tests and calculations on lighting units that had been selected for use at the Exposition were made at the Illuminating Engineering Laboratory. The lighting units were all new developments, in many cases used in new ways. This necessitated a vast amount of preliminary investigation which usually took the form of calculations of the illumination on the grounds, facades and towers. From these calculated values it was possible to determine if the selected lighting units were of the right size and were properly arranged on the preliminary plans. As soon as any particular phase of the lighting was fully decided upon, the illumination and luminous flux values were calculated in all their minute details, so that long before the Exposition opened there were on hand complete sets of illumination diagrams for all the various courts, buildings and towers.

The principal features of the lighting are described under their respective headings and illustrated by the accompanying plates.

LUMINOUS EFFECTS IN TOWER ILLUMINATION.—This illumination consisted in flood-lighting the towers with a white rising light which created shadows. The shadows were in turn illuminated by concealed colored light on the various stages, thereby producing detail in shadow. This combination gave the structures a luminous effect never before obtained. These towers further illustrated the preservation of depth, or the third dimension in light, which feature predominated throughout the Exposition. The Tower of Jewels was flood-lighted by batteries of arc projectors located on the roofs of the main group of palaces, the South Garden pavilions and the Scott Street entrance gate. In order to obtain the proper gradation of light with an economic distribution, it was necessary to equip the majority of the projectors with properly designed diverging doors. A complete set of color screens at each projector enabled the changing of the color tone of the tower on very short nitice. The base section was necessarily carried in the same relative illumination as the building facades. Above this section there was a rising illumination to approximately 20 foot-candles on the top ball. The average value for all levels was 10 foot-candles. The shadows cast by the rising searchlight beams were illuminated by rose red relief lighting. At the top level there were four 30-in. (762-mm.) arc projectors equipped with changeable color screens for spectacular and heightening effects. The twin Italian towers at the entrances to the Courts of Palms and Flowers were lighted in a similar way.

THE ELECTRIC-STEAM COLOR SCINTILLATOR.—The scintillator consisted of combining searchlights in systematic drill in colored and white beams with smoke and steam, so as to produce spectacular effects or fireless fire-works, both aerial and on the ground, possessing artistic color combinations and blendings impossible with ordinary fireworks. This was further enhanced by the running of a large express locomotive at high speed under brake so as to produce large volumes of smoke and steam which were illuminated in color. Other steam effects were in the form of fans, plumes, wheels, fighting serpents, etc. This battery was composed of 48 36-in. (914-mm.) hand-controlled arc projectors. They were operated at nominal 110 volts, 110 amperes, and with the resistance consumed a total of 581 kw. The beam candle power of each was approximately 55,000,000, or an aggregate of 2,640,000,000 for the battery. With the equipment of each projector was a set of seven colored gelatine screens, treated with spar varnish and turpentine as a protection against moisture.

The locomotive, steam apparatus and fireworks mortars were located on the south breakwater of the yacht harbor. In addition to supplying the various steam effects such as plumes, chromatic wheels, fairy feathers, etc., this locomotive, which was a modern Southern Pacific oil-burning passenger type, was blocked up and locked so that the wheels could be driven at a speed of 60 miles (97 km.) per hour under brake. Thus great volumes of steam and smoke were produced, which, when illuminated with various colors, created a wonderful spectacle.

THE CREATION OF MYSTERY IN THE LIGHTING OF OPEN COURTS.—In designing the Court of Abundance, the architect wished to impress as far as possible a feeling of mystery, or something carrying the mind down through the ages. This effect was strengthened by a harmonious blending of illumination by searchlights, incandescent lights, gas flambeaux and illuminated steam.

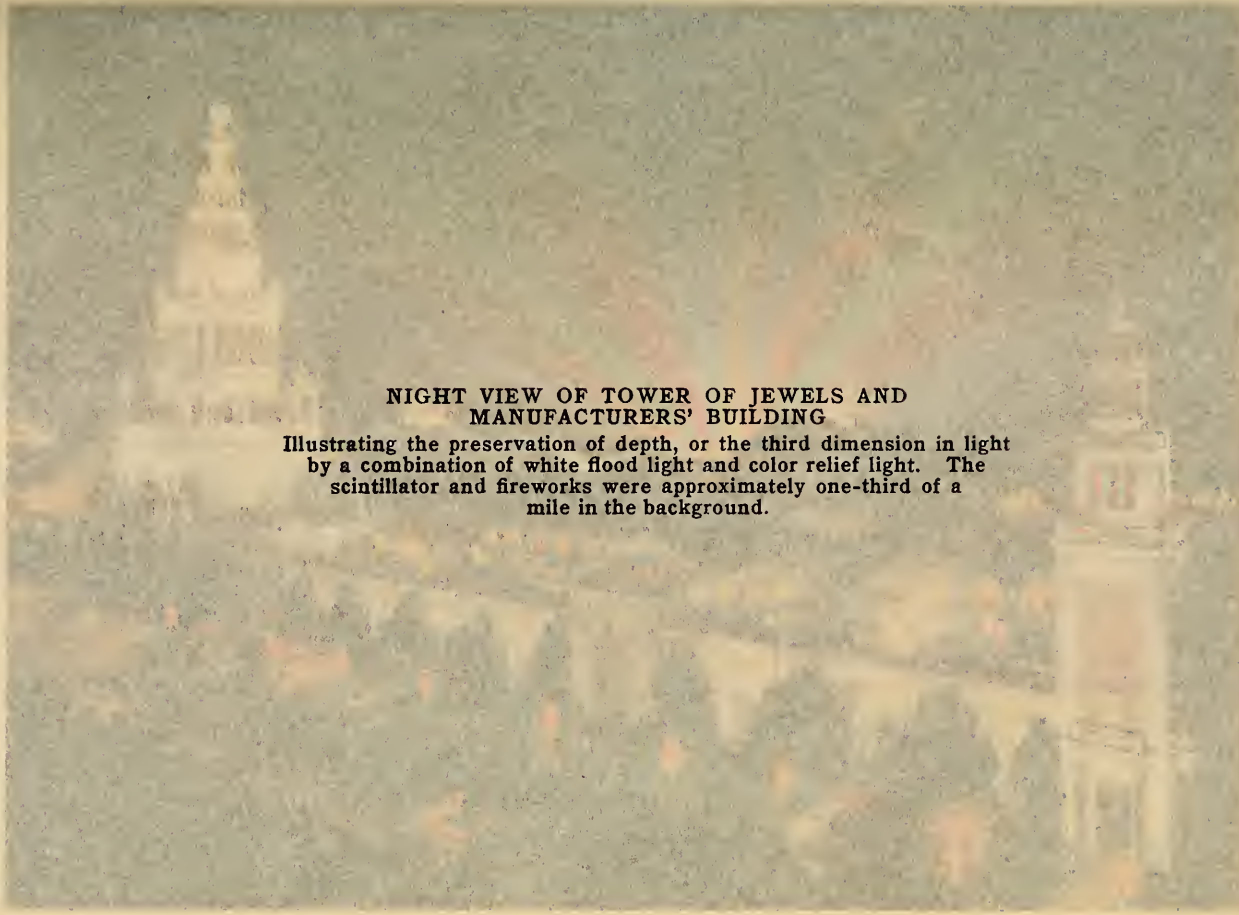
The general illumination of this court came from three sources: the snow cyrstal standards, the cloister lanterns and the gas flambeaux. The snow crystal standard, or as it was sometimes called, the "sunburst" (because of the design suggestion), contained over 600 15-watt round globes orange-dipped incandescent lamps. There were two of these standards in the main court and four in the north approach to this court. On either side and at the spring line of each cloister arch there was suspended a Gothic lantern with orange glass panels. In addition to lighting the cloister and the adjacent gardens these lanterns were especially valuable for their decorativeness. The gas flambeaux were formed by four rising serpents hissing fire into a flaming caldron. There were six of these located in the court proper and sixteen in the north approach to the court.

In conclusion, the lighting consisted primarily of direct, masked, concealed and projected effects, created by a harmonious blending of luminous arcs, searchlights, mazda lamps and gas lights.

The high-current luminous arc lamp was selected for general flood lighting of the facades, lawns and shrubbery, on account of the white quality, high efficiency and relatively low maintenance cost where great quantities of light were required.

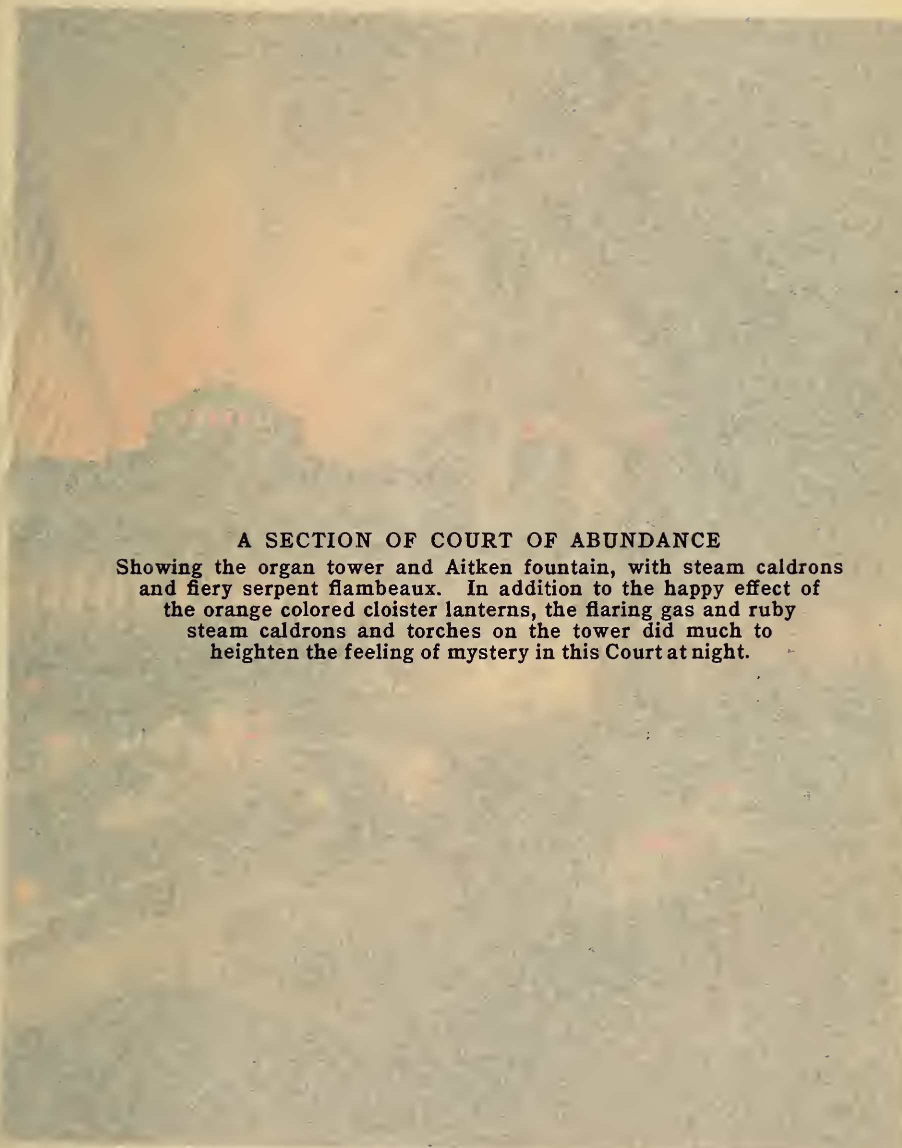
The searchlights were used for illuminating towers and minarets, flags and other features where concentration and high intensity were necessary.

The unusual consideration given to esthetics and the suppression of high intrinsic brilliancy effects, naturally introduced certain features in the lighting whch, from a purely engineering point of view, would be regarded as inefficient. Taken as a whole from the point of effects obtained, initial cost, maintenance and general efficiency, it was broadly conceded that the illumination of the Panama-Pacific International Exposition surpassed that of all previous expositions.



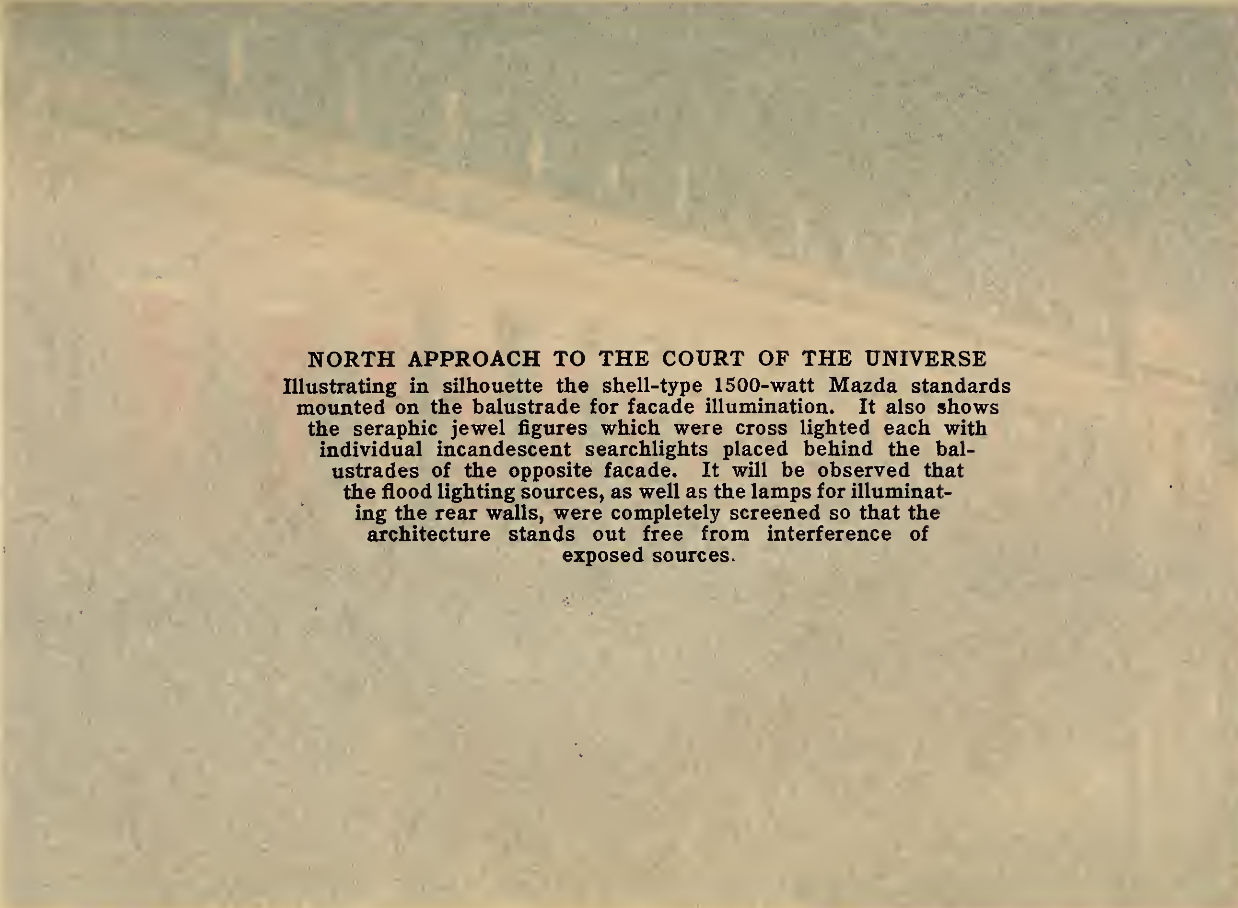
NIGHT VIEW OF TOWER OF JEWELS AND MANUFACTURERS' BUILDING

Illustrating the preservation of depth, or the third dimension in light by a combination of white flood light and color relief light. The scintillator and fireworks were approximately one-third of a mile in the background.



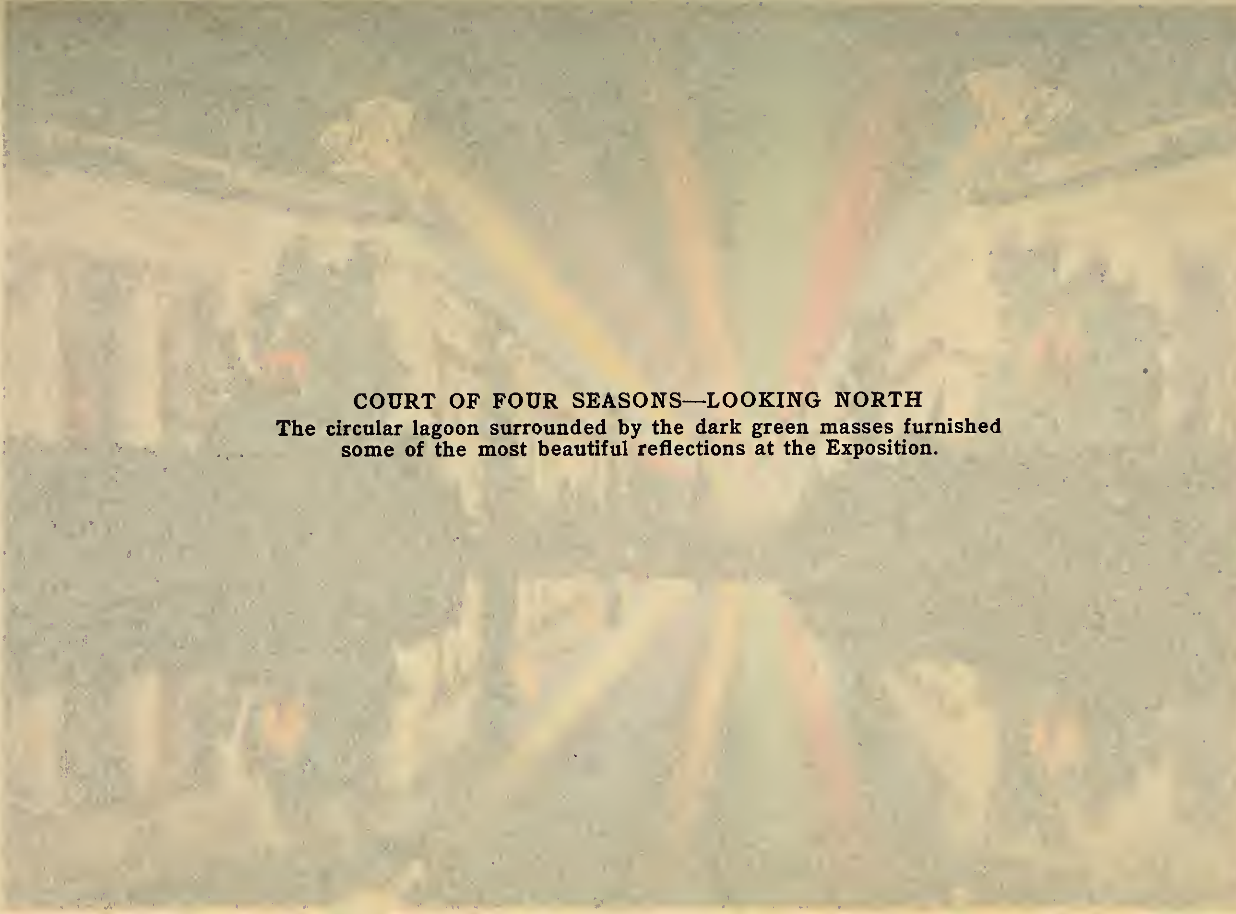
A SECTION OF COURT OF ABUNDANCE

Showing the organ tower and Aitken fountain, with steam caldrons and fiery serpent flambeaux. In addition to the happy effect of the orange colored cloister lanterns, the flaring gas and ruby steam caldrons and torches on the tower did much to heighten the feeling of mystery in this Court at night.



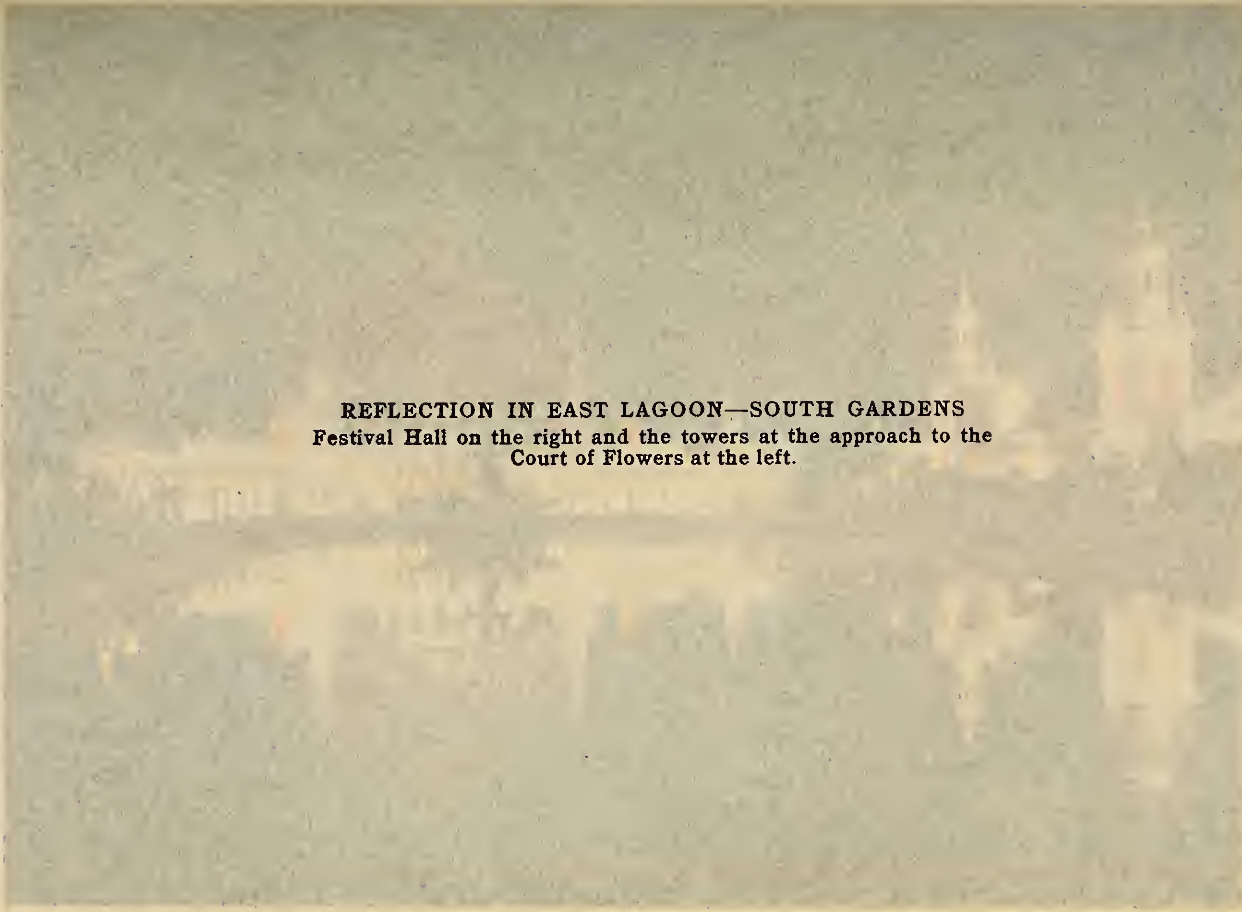
NORTH APPROACH TO THE COURT OF THE UNIVERSE

Illustrating in silhouette the shell-type 1500-watt Mazda standards mounted on the balustrade for facade illumination. It also shows the seraphic jewel figures which were cross lighted each with individual incandescent searchlights placed behind the balustrades of the opposite facade. It will be observed that the flood lighting sources, as well as the lamps for illuminating the rear walls, were completely screened so that the architecture stands out free from interference of exposed sources.



COURT OF FOUR SEASONS—LOOKING NORTH

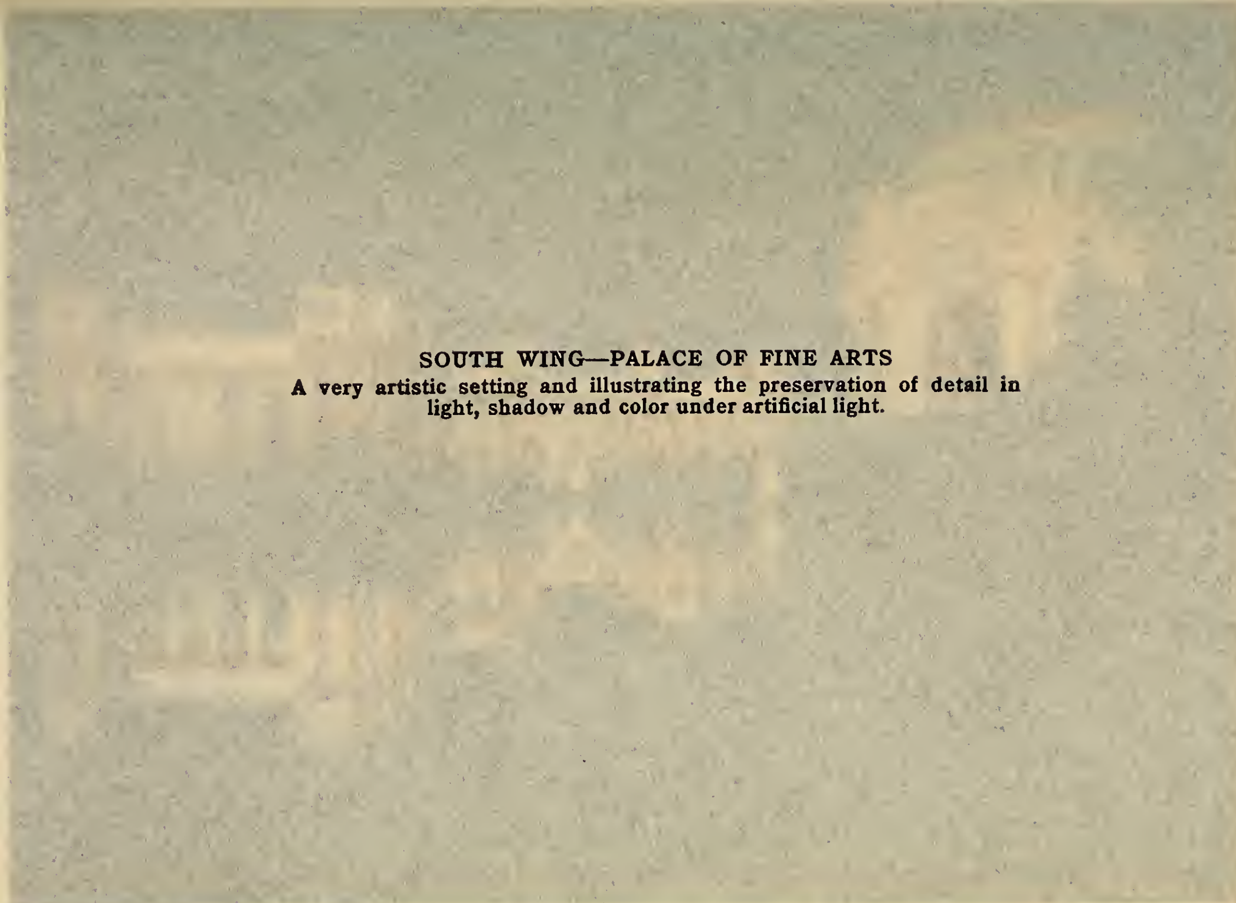
The circular lagoon surrounded by the dark green masses furnished some of the most beautiful reflections at the Exposition.



REFLECTION IN EAST LAGOON—SOUTH GARDENS
Festival Hall on the right and the towers at the approach to the Court of Flowers at the left.

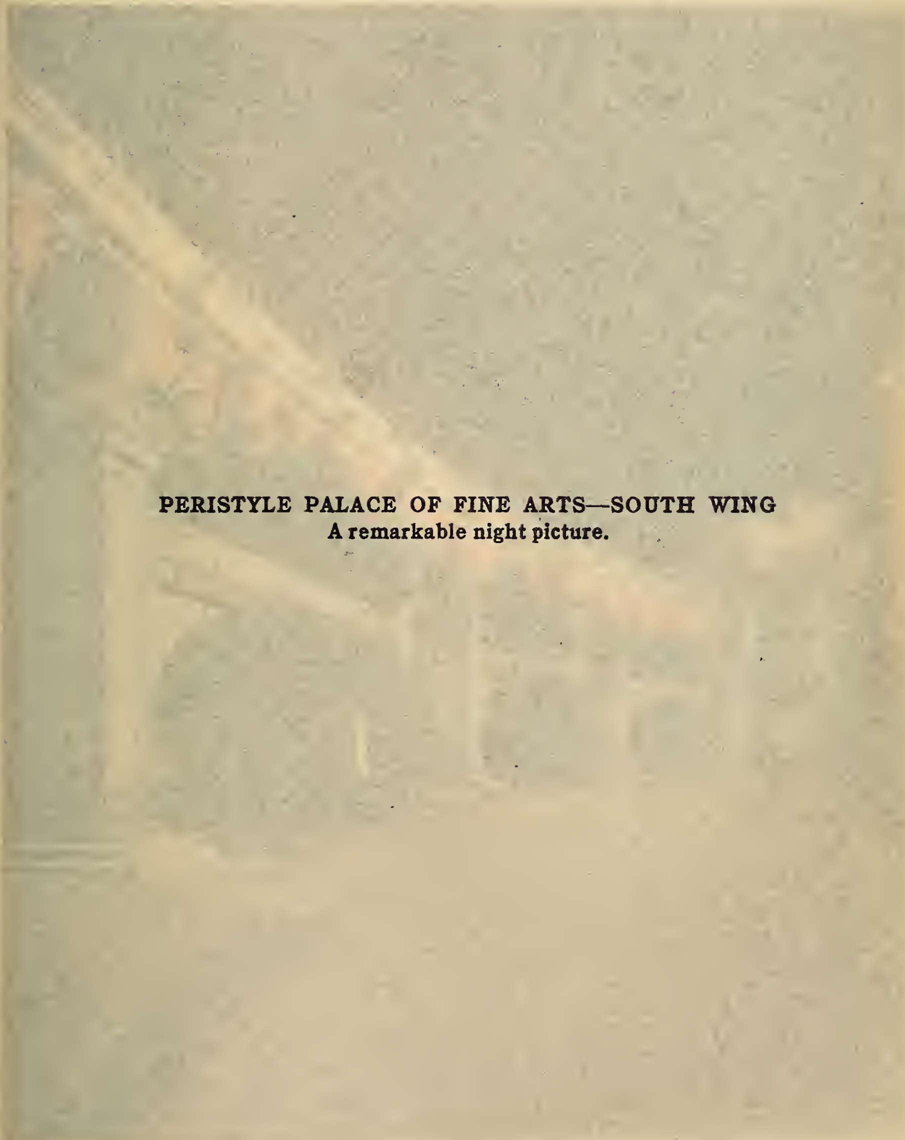
Reflections of the Colonnade of the Palace of Fine Arts as seen from the rotunda.

Reflections of the Colonnade of the Palace of Fine Arts as seen from the rotunda.

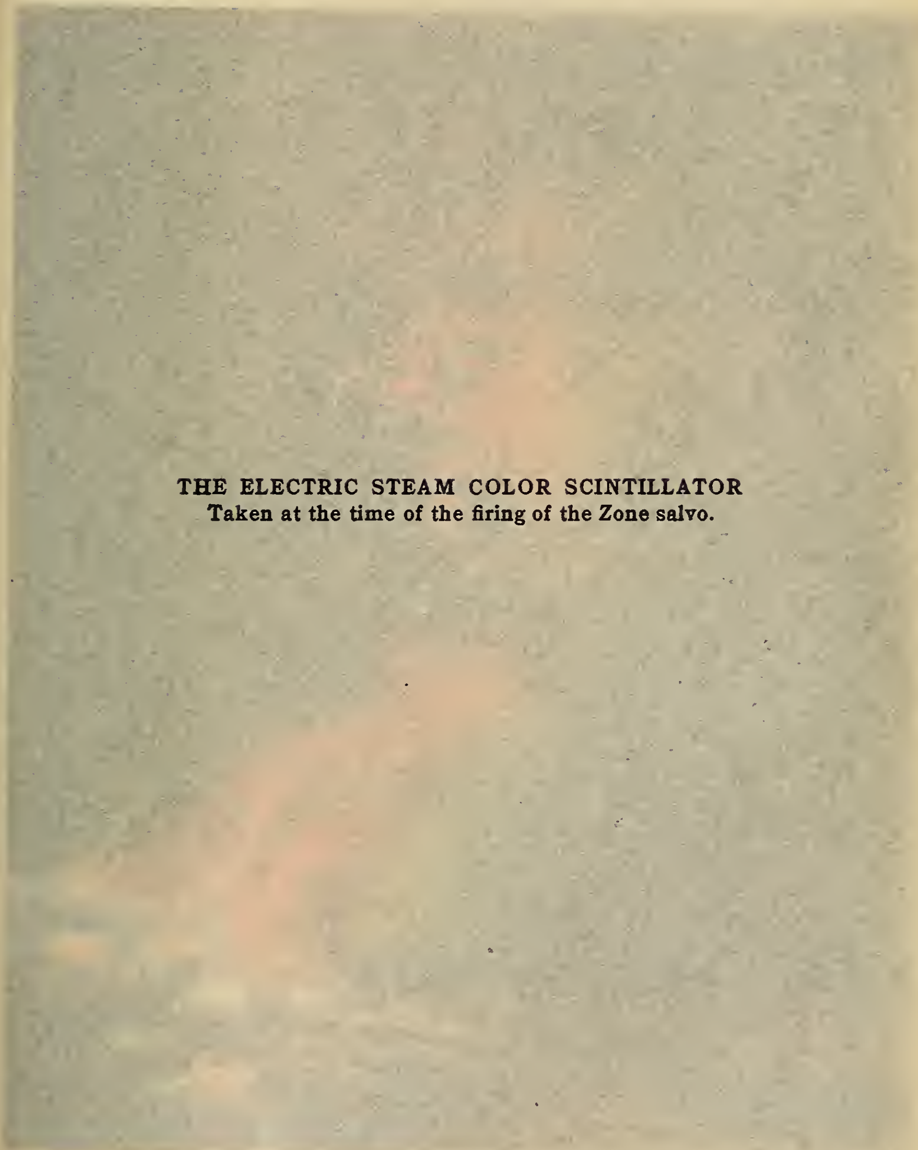


SOUTH WING—PALACE OF FINE ARTS

A very artistic setting and illustrating the preservation of detail in light, shadow and color under artificial light.



PERISTYLE PALACE OF FINE ARTS—SOUTH WING
A remarkable night picture.

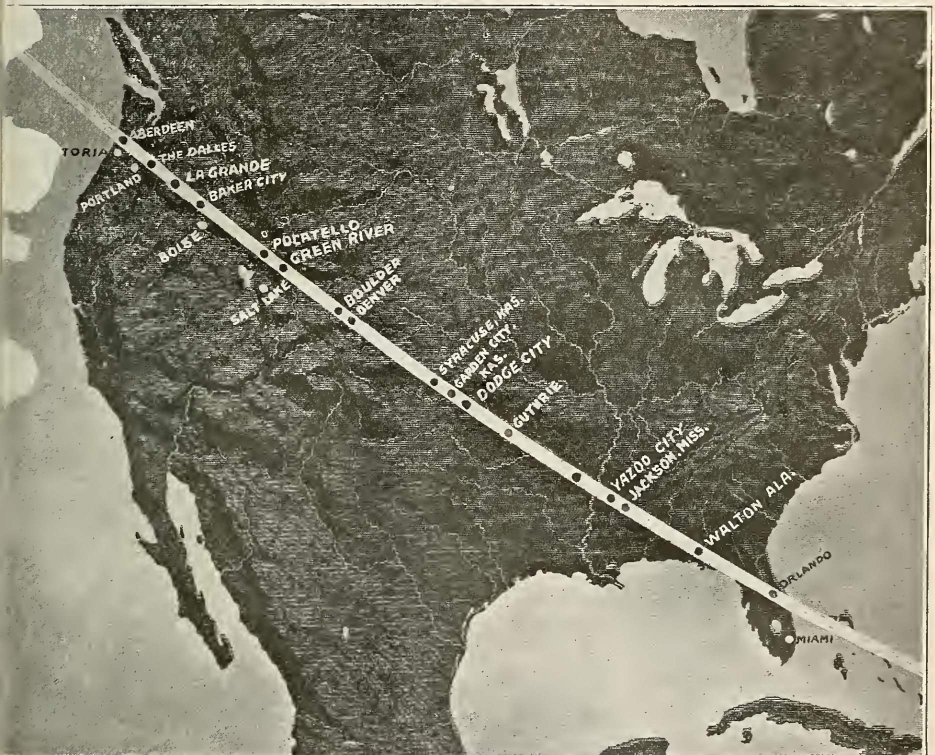


THE ELECTRIC STEAM COLOR SCINTILLATOR
Taken at the time of the firing of the Zone salvo.

TOTAL ECLIPSE OF THE SUN JUNE 8, 1918.

Interesting information incorporated this season by Mr. B. R. Baumgardt in his popular astronomical lectures throughout the United States.

THE path of the Total Eclipse in the United States begins at South Bend, Washington, at 2:55 p. m. local standard time; sweeps through Washington, Oregon, Wyoming, Colorado, Kansas, Oklahoma, Arkansas, Mississippi, Alabama and Florida; terminating at the Bahama Islands at sunset. The eclipse reaches Baker City, Oregon, at 3:05 p. m.; Pocatello, Idaho, at 4:12 p. m. (mountain time); Denver, Colorado, at 4:22 p. m.;



Syracuse, Kansas, at 4:27 p. m.; Dodge City, Kansas, at 5:28 (central time); Enid, Oklahoma, at 5:31 p. m.; Guthrie, Oklahoma, at 5:32 p. m.; Warren, Arkansas, at 5:36 p. m.; Jackson, Mississippi, at 5:38 p. m.; Orlando, Florida, at 5:42 p. m.

Note.—This article is an abstract by Mr. S. J. Keese of Mr. Baumgardt's circular on the Total Eclipse of the Sun, June 8, 1918, Mr. Baumgardt being too busy to prepare a special article for the Bulletin.

Some Interesting Facts and Figures Concerning the Total Eclipse of the Sun, June 8, 1918.

The sun at the time of the eclipse will be in the constellation Taurus close to the first magnitude star Aldebaran. The planets Mercury and Jupiter will be close to the sun, Mercury to the right and Jupiter on the left. Betelgeuse in Orion, Procyon in Canis Minor and Castor and Pollux in The Twins, all first magnitude stars, are close enough to probably become visible during totality. The Pleiades on the sun's right are little above Mercury.

The time required for shadow to sweep through the United States is exactly 45 minutes.

The duration of the Total Eclipse is in Oregon 1 minute and 57 seconds; in Wyoming, 1 minute 41 seconds; in Colorado, 1 minute 31 seconds; in Kansas, 1 minute 20 seconds; in Arkansas, 1 minute 10 seconds; in Mississippi, 1 minute 5 seconds; in Florida, 0 minute 45 seconds.

The Total Eclipse of the Sun

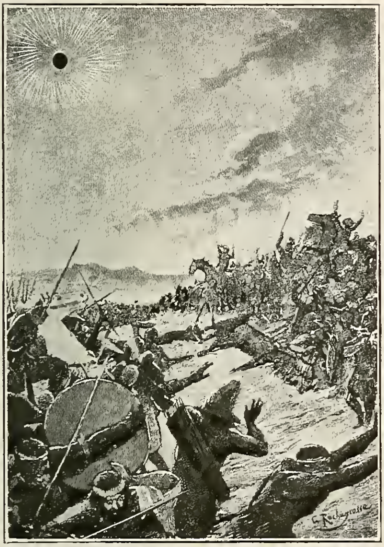
The Eclipse begins with a black notch becoming visible in the sun's disk as the moon creeps up over its surface. The notch

becomes larger and larger until finally it hides the whole of the sun. It is then that the grand climax is reached, the effect being awe-inspiring. Red flames flash out at various points around the circumference, prominences intimately associated with the solar organism. Above these is seen the wonderful Corona.

a metallic solar atmosphere extending some ten millions of miles in space. It is the most sublime spectacle ever presented to the eyes of man.

Eclipses, Past and Future

The shepherd-astronomers in Mesopotamia of old, while watching their flocks at night under cloudless skies, had become acquainted with some valuable astronomical facts. They had observed that the sun, moon and "the wandering stars" (the planets) follow the same path in the heavens, a belt fourteen degrees wide, which they called the Zodiac. They had discovered that when the movements of the sun and moon were along the center of that belt, eclipses occurred; hence the name ecliptic. But, most wonderful of all, they knew from experience that eclipses repeat themselves every 18 years, 11 days and 8 hours. Thales, the Greek philosopher, who had been taught by the Egyptian priests and Chaldean soothsayers, was thus able to foretell the total eclipse of the sun, May 28, 585 B. C. Herodotus relates that this classic eclipse occurred during a battle between the Lydians and Medes, and that the combatants became so stupefied that the battle stopped at once and put an end to the war. Cicero and Pliny make like statements.

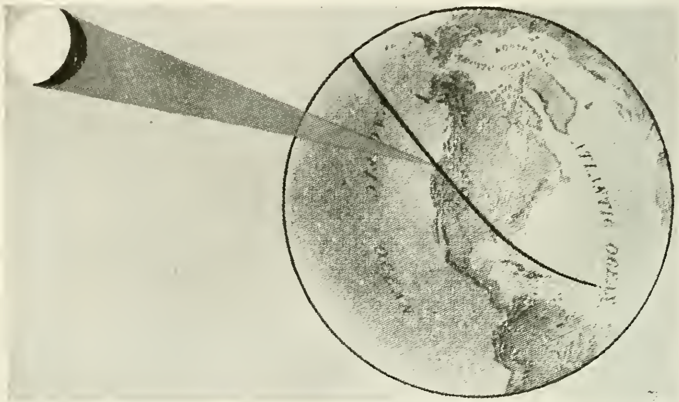


Battle between the Medes and Lydians, arrested by an eclipse of the sun, May 28, 585 B. C.

Explanation of a Total Eclipse of the Sun

The sun and moon are apparently the same size in the sky, and as their motions are along the same plane, the moon sometimes intervenes and cuts off the view of the sun. The moon being a solid body casts a shadow, which is cone-shaped and sometimes long enough to reach the earth. As the earth is turning on its axis this shadow, about fifty miles broad, drags over the surface of the earth. People situated at the time within the path of the shadow in looking up behold the sun eclipsed.

Today, according to Dr. Aitken, of the Lick Observatory, eclipses can be calculated in advance with such precision that for the one of August 23 in the year 2044 we might set our instruments now, with the full assurance that the eclipse would begin within a few seconds of the predicted time; nor would we have to change the position of our instruments but slightly. The clock-like precision with which the movements of the heavenly bodies take place is under the dominion of immutable law. The mechanism of the universe sweeps on resistlessly from eon to eon in obedience to mathematical necessity.



What are we, then, to think of that spark of Divinity, the transcendent human intellect, that is able to attack successfully such apparently hopeless problems? Must we not agree with Newcomb when he asserts that there are tens of thousands of men who could be successful in the ordinary walks of life, hundreds who could wield empires, thousands who could gain wealth, for one who could take up such mathematical problems with any hope of success. The men who have done it are therefore in intelligence the few of the human race—the aristocracy of the intellect, ranking above all others in the scale of being."

Gnaphalium beneolens.
Davidson. n. sp.

GNAPHALIUM BENEOLENS, N. Sp.

By Anstruther Davidson, C. M., M. D.

Two or three feet high, branching freely and loosely from a perennial or biennial herbaceous base; whole plant woolly tomentose, leaves 1½ to 2 in. long, linear 1 line wide, acute sessile and subdecurrent, and 2 to 3 lines wide at base; heads numerous in paniculate or corymbose paniculate clusters; involucre 4 lines wide and 3 deep, scales broadly ovate white; whole plant very fragrant.

Type 3275, author's herbarium. Collected by Fred Burlew at Crescenta, Los Angeles County, September, 1917.

This plant comes closest to *G. microcephalum* with which it has been grouped by the majority of recent authors. The leaves are characteristic, they are never spatulate or rounded at the apex, as are those of *G. microcephalum*. It differs also from that species in having larger heads more ovate and more uniform-sized scales.

G. microcephalum is silvery white on the younger shoots and has a dense tomentum surrounding the involucre, it is also odorless.

The plant is probably fairly common. Mr. Perkins showed some plants at the Botanical Society from Clear Creek and Idylwild.

POI

Hawaii is making a food-saving contribution in the shape of poi, its national dish, made from the bulb of the taro plant. Until 20 years ago poi was made under primitive conditions, the bulbs being peeled, boiled, and pounded in a wooden trencher until a semiliquid paste was formed. But today modern sanitary machinery is used to manufacture the produce, under supervision of health authorities in the island, and five factories at Hilo now turn out several tons daily. This new form of poi is being sent to the United States, reaching markets as far away as New York City, and a demand which began with Hawaiians who had come to the United States is gradually being extended to Americans, who have learned to like the dish. Poi is frequently used in Hawaiian hospitals in the diet of patients whose stomachs are too weak to digest other food, and the war interest in substitute foods is expected to lead to its wider introduction here.

Scientific American Supplement No. 2191.

CHEMISTS' PRESENT OPPORTUNITIES AND DUTIES*

By J. I. D. Hinds,

Castle Heights School, Lebanon, Tenn.

FOR my present purpose, I shall divide chemists into two classes, pure or theoretical chemists, and industrial chemists. To the first class belong those who are doing research work independently, that is, in nobody's interest, with the sole purpose of adding to the store of chemical knowledge, and without the idea of making money out of the results of their researches. Chemists of this class have not been particularly affected by the European war, except as their work has been interrupted, especially in the countries at war. They are usually in the employ of universities, or of the national or state governments, and are working for the advancement of science and for the general good.

To the pure chemists there are now open many rare opportunities. There are vast fields unexplored in physical chemistry, electrochemistry, radiochemistry, in the study of the nature of the atom and of the molecule and of colloids. None of these bid fair to have much commercial importance unless it should be in the study of the atom. If we can ever learn how to decompose and recompose the atom, we may find access to stores of energy which will dwarf all those which we now possess. Our utilizable sources of energy are chemical action, water power, electricity, and the sun. Water power traces back to the sun and electricity is made available through chemical or mechanical energy. The atomic disintegration of a gram of radium or of uranium develops something like a million times as much energy as the combustion of a gram of coal. This energy of atomic decomposition is peculiar, having characteristics not possessed by the energy of chemical action. This atomic decomposition is spontaneous and we know of no way either to cause it or prevent it.

The pure chemist is altruistic. He thinks little of the commercial value of his discoveries. He takes as much interest in estimating the weight of the hydrogen atom as in measuring the heat of combustion of a pound of coal. It is to him,

*By the kind permission of the Tennessee Academy of Sciences, this article is reprinted from Volume Two of its Transactions, January 1, 1914 to May 5, 1917.

however, that real progress is mainly due. He discovers fundamental facts and laws and establishes working hypotheses and theories. The industrial chemist simply applies what the pure chemist discovers. To the pure chemist much honor is due. He is doing his duty well. His chief reward will lie in the consciousness of having enlarged the field of knowledge, and his name will be honored by future generations after the industrial chemist has been forgotten.

Because of the European war and the large decrease of imports, the opportunities of industrial chemists have been wonderfully multiplied. So great is the demand for chemists that the young men are being taken from the universities before they finish their graduate courses and put to work with inadequate training. There has been an increase in almost every line of chemical manufacture, and nearly all manufacturing is now more or less chemical. The increase in prices has caused an increase of output and an extension of business. Many factories have doubled and quadrupled their capacity. The largest development has been in the manufacture of those substances which were formerly imported from Germany and Austria, such as anilin dyes, synthetic vegetable dyes, coal and coal tar products, potassium and barium salts, nitrates and so forth. Of the 29,000 tons of dye stuffs used annually in the United States, 6,000 tons were home made before the war; now it is estimated that three-fourths of the dyes used are made in this country. In the same way the separation and refinement of the coal tar products has been so developed in the past two years that the demand can now be almost supplied by the home manufacture. The production of nitrogen compounds has been greatly increased by saving ammonia as a by-product of the coke and gas industries. In addition to this we have as possibilities synthetic ammonia and the oxidation of atmospheric nitrogen. When the twenty million dollar government plant is finished at Mussel Shoals, our supply of nitrogen compounds will be adequate not only for fertilizing purposes, but to supply the high explosives in case of war. There is so far no sufficient visible supply of potassium compounds. This is being partially compensated for by the use of sodium compounds which in many cases serve as well. The government has taken the matter in hand and is looking for sources of potassium, so far with but little success.

That the chemists and manufacturers are improving the present opportunities is evidenced by the recent chemical exposition in New York. There were more than two hundred exhibitors and some three hundred and thirty exhibits. These covered so nearly every field of chemical endeavor that one is convinced that, should we be indefinitely blockaded by an enemy, we should suffer but little inconvenience.

The industrial chemist should be honest. Chemists as a class are among the most honest of men. Their testimony is usually given full credit. A false report from a chemist disgraces him with the profession. Falsehood is contrary to the spirit and genius of the subject. Accuracy and fidelity to fact is the first principle of the chemist. It is true that some manufacturers instruct their chemists to adulterate the goods and hide the adulterations, but this is the exception rather than the rule. Any first-class chemist under such requirements will seek another employer.

A word now about chemical secrets. There are really no chemical secrets. Whenever a new compound is discovered its description and the method of its preparation are published in the journals. It is one thing, however, to make a small quantity of a substance in the laboratory, and quite another to make it by the ton in the factory. Nearly all chemical secrets are secrets of the factory, secrets of manipulation. These are legitimate secrets and the chemist should keep them faithfully for his employer. The best factory methods are learned only by prolonged and costly experimentation. It is said that one German dye factory spent three million dollars before it sold any of its output.

It is thus seen why the dye business has progressed slowly in this country. The large corporation has many advantages. In the first place, it can afford to incur the expense of the necessary experimentation. In the second place, it employs the best chemical experts and carries out elaborate researches. The General Chemical Company, the General Electric Company, the Edison Company, and other such corporations are spending much money in researches and are making marked discoveries from time to time.

All things considered, I think that the chemists are rising to the occasion and acquitting themselves well. Indeed, in many respects they are leading the world. The American Chemical Society has 8,200 members. It publishes three of the best chemical journals in the world. The Chemical Abstracts is the most complete abstract journal published. It abstracts the contents of some four hundred journals using about two hundred and forty abstracters. The Industrial Journal is in the very front rank and the Journal of the American Chemical Society as the record of original research in America is the peer of any other chemical journal published. Thus, in both pure and applied chemistry, America stands abreast of any other nation in the world.

One of the serious problems which will have to be faced in the future is how to get an adequate supply of motor fuel. At the rate of present consumption of gasoline it will not be a great many years until the supply will be far below the demand. The most probable substitute is alcohol. It is estimated that if the saw mill waste of the country were utilized, it would produce many millions of gallons of alcohol. To this might be added a large amount of organic waste which might be converted into alcohol. One thing seems quite certain, that we must ultimately look to plant life for our fuel as well as for our food. If alcohol could be made and sold for about 10 cents a gallon the question of motor fuel would be solved.

ALTITUDE OF BIRD FLIGHT

An officer of the French Flying Corps, who may be identified with a valued fellow-worker of the R. S. P. B., has taken exceptional opportunities to record observations on the flight of birds and the height at which they fly, especially when migrating. Some of his notes are published in the "Pall Mall Gazette" (Vol. 11, 1916). Swallows, he says, seem to prefer an altitude of 2,000 feet, whereas the wild duck usually fly at 5,000 feet. They are remarkable, also, for the marvelous uniformity with which they follow their leader. The turns and twists are taken with such simultaneity that a flock appears to turn and wheel automatically, so extraordinarily together do they move. When climbing they fly at about sixty-five miles an hour, and are good for 70 once they have got their height and have spread out to let themselves go.

Last March he met some plovers at 6,500 feet, which is the highest altitude that he has seen a company of birds.

From Bird Notes and News.

EDUCATION AND THE MUSEUM

By Hector Alliot, S. D.,
Vice-President Southern California Academy of Science.

Torrance Hall of Fine Arts

Aristotle, and later Lucretius and Horace, have left imperishable proofs of their belief in the need of visualizing science.

Medieval scholasticism recognized as well the value of showing to the student the object which the teacher attempted to explain. Thus the eye conveyed a better meaning to the student's intelligence and complimented the explanatory lecture of the schoolmaster.

The tremendous impulse given to the study of chemistry and biology has been more responsible than any other cause for a profound change in modern education.

The object has become entirely subservient to the lecture. Theories and mathematics have largely taken the place of presenting explanatory information of things that the student may have before him, be able to touch, see and smell.

This has resulted in producing a vast number of highly educated men and women, well versed in the theory of chemistry, biology and associated sciences, but who possess little knowledge of the physical appearance of all they know so much about.

Saner conditions of pedagogy are now again dawning upon modern education. It is with considerable satisfaction that the Southwest Museum of Los Angeles is recognized as the pioneer in the West in this new field of educational endeavor.

For several years that Institution has been alive to the beneficent relationship that should exist between the Museum and the school. It is not now possible, and will not be thought of for many years to come, to visualize science in the school.

To carry out such a program would imply the expenditure of a vast amount of treasure, the necessity of infinite duplication of collections and maintenance of a corps of experts.

It is the function of the museum to collect and arrange exhibits in such a manner as they be of ready use to the student and the inquiring visitor seeking information on scientific matters.

This has been successfully perfect after eight years of practice by the Institution on Museum Hill. The inspiring panorama of the mountains about it prepares the mind more readily to receive the message contained in the great Museum buildings, themselves a living lesson in architecture. Besides its unequalled division of conchology, the rare collections of butterflies, birds, eggs and art objects, the history of evolutionary

HALL OF ARCHAEOLOGY

human culture is attractively illustrated by the implements, weapons and utensils of primitive man in the Southwest.

The principal function of the Southwest Museum is to live up to its name, as the depository of all that which is associated with the footsteps of man in this favored region.

To show the history of modern man and the links uniting it to prehistory and aboriginal culture is the principal aim of that Institution.

The constant aim of its staff is to give positive information upon scientific facts.—which are nothing more or less than natural laws capable of being demonstrated and visualized, leaving theories and hypotheses to others.

The logical idea of popularizing science, divesting it of *all* its forbidding technicalities, so feared by the laity desirous of learning, has resulted for the year 1917 in a matriculated body of 318 students. The educational service has further been brought to the use of the schools, through the Norman Bridge Museum Extension, which was of service to 3500 pupils of all grades, and is now being extended to the Public Library and its branches.

A VOYAGE OF SCIENTISTS IN THE SANTA CATALINA CHANNEL

By Charles Maclay Booth

HAVING no acquaintance with the membership of the Los Angeles Motor Boat Club, I am unaware whether the party which gathered around the table in its assembly hall on the morning of August 8, 1917, was strange to it or not. However that may be, the fact is that when Professor Ulrey stood before us and, with charts and explanations, made clear the scope of the work for the study of the hydrography and the marine flora and fauna of the Pacific waters of our coast, conducted by him as Director of the Venice Marine Biological Station of the University of Southern California, he spoke to an interested and interesting audience.

The Directors of the Southern California Academy of Sciences and a few friends had been invited for a trip upon the launch Anton Dohrn, that they might see for themselves how the work, described in the Academy Bulletin for January, 1917, was carried on.

Including the said Directors, the guests were Arthur R. Maas, Professor of Pharmacy of the University of Southern California, W. C. Musgrave, Charles M. Booth, Dr. and Mrs. A. F. Speicher and their daughter, Miss Florence Speicher, Mr. and Mrs. C. B. Dudderar and Hon. Grant Jackson, Judge of the Superior Court. The men represented Education, Science, Architecture, Jurisprudence and the Commercial world in its various lines, but upon this occasion they conducted themselves more like a crowd of boys upon a holiday, having left their solemnity in Los Angeles. The ladies proved themselves accustomed sailors and expert providers for hungry men. One of the gentlemen shamelessly admitted that he had been a pirate on the Florida coast and he was the only one who claimed sea experience.

The literary-technical information having been imparted, with the call "All aboard," Prof. Ulrey and his charming wife conducted us across the gang-plank and the Anton Dohrn put to sea.

Upon reaching the great breakwater of the outer harbor, the anchor was dropped and all hands called to a most delicious lunch prepared by Mrs. Ulrey and her lady associates. If this was a fair sample of the food for the usual crew of this boat, it is not surprising that Prof. Ulrey always has a sufficient number of volunteer helpers, as he stated. It may be noted here that, as they gazed over the breakwater to the choppy ocean beyond, several of our company seemed to entertain some apprehension as to the stability of that meal, but all determined to enjoy it as extensively and as long as possible.

Mr. Benton, the accomplished President of the Academy, terminated this banquet of good things by the following toast, which was unanimously adopted:

Resolved, That the fervent thanks of all present be hereby tendered to Mrs. Ulrey and the other ladies for the Scientific, Æsthetic and Gastronomically successful luncheon so bountifully provided for them.

The Board of Directors was then called to order for a business meeting. A full report, no doubt, will appear on the Secretary's books, but a few notes by an outsider may be of interest. The first business seemed to be to get the Board partially quieted down and when this was accomplished the Judge was proposed for membership in the Academy. The candidate with becoming modesty lay down on the deck in the bow of the boat at the feet of the Board until action had been taken. When a favorable vote was shown he arose and resumed his lunch, having missed only two helpings of sandwiches. Various other less important matters were brought up, but action was slow since all debate was carried on between bites and several times members were unable to take part promptly in the *viva voce* vote.

Upon adjournment of the Board meeting the anchor was hauled up with the assistance (vocal) of the passengers and, Prof. Ulrey taking the wheel, a start was made for the outside. On the way most of us had our first evidence of war, for it was necessary to stop at the patrol boat and report our departure and destination. About this time a very decided roughness of the water began to show itself and a pardonable uncertainty was evidenced by some who searched for the part of the boat having the least motion, but any demurrers or objections to the playful but somewhat vehement conduct of Father Neptune, whereby some of the ladies were treated to an involuntary bath, were promptly overruled by the Judge.

The dredge was dropped over the side and for half an hour or so the launch held her course at slow speed with nothing to show of the work going on except a taut steel cable running from the winding drum on the boom and down into the water astern of the launch. While the dredging was going on the guests talked,—in fact there was not a quiet moment on the whole trip, each one waiting a chance to get in his word. The conversation ranged from war to astronomy, from architecture to politics, from law to fishing and back over it all again. No one's audience could get away and every one had his chance.

When the word went out that the dredge was coming up everyone went to the stern to see the catch. Up came the vibrating cable getting more and more perpendicular as its load left the bottom and neared the surface until at last the steel-framed canvas bag was swung on to the deck and dumped. There were about a bushel of assorted seaweed, perhaps a dozen starfish, flounders (classified by the Professor), crabs with bodies the size of a match-head and legs and claws as long as a big tarantula, and worms that might have dropped from a fish-hook. The catch, except the fish and kelp, went into bottles of water to be further examined and filed.

The trip back was uneventful, except that the New Member, while sitting in the bow, was savagely attacked by a large wave. Part of the water escaped, but he stood up in the sun the rest of the trip home.

Just before landing the Photographic Treasurer put off in the life boat to take a picture of the party. He stood on a plank resting upon some old piles, and with another pile for a rest, did his work of art.

When the boat tied to the wharf and we made our congé to our hosts who had been so hospitable and unsparing in their efforts for our pleasure in this most interesting excursion, there was a noticeable reluctance to terminate a voyage which had been of an unusual character, unique in some respects and altogether enjoyable."

TRANSACTIONS OF THE ACADEMY

Academy Meeting

Dr. Lyman B. Sperry presented a most graphic description of the volcanos Vesuvius and Aetna, and of Sicily and the environment of Naples, illustrated by beautiful views upon the screen at the meeting of the Academy held on February 2, 1917, in the Women's Club House.

Academy Meeting

The March meeting of the Academy was held on the 15th day of the month in the Auditorium of the Chamber of Commerce Building.

Prof. Gilbert E. Bailey presented a compilation of the economic results of the "Use of Explosives in Agriculture." His discourse was illustrated by slides and moving pictures showing the various phases in the life of an Agriculturist.

Note:—The foregoing records of the meetings of February 2 and March 15, 1917, through oversight, were not inserted in the Bulletin for July, 1917.

Directors' Meeting

A duly notified meeting of the Directors was held Wednesday, August 8, 1917, on board the launch "Anton Dohrn" in the Pacific Ocean off Point Fermin, near San Pedro harbor.

All the Directors were present except Davidson, O'Brien and Watts.

The Committee appointed on June 25, 1917, to audit the accounts of the Treasurer, reported that they had examined same and found that the statement rendered by him at the Annual Meeting on June 19, 1917, was correct in every item and said Annual Account was approved and confirmed.

The Treasurer reported that he had invested the sum of $200 with the Fidelity Savings and Loan Associaion, which action was approved, and he was authorized to sign a proxy to Mr. G. H. Wadleigh to cast the vote of this Academy at all meetings of said Association.

Lyman B. Sperry, M. A. Davids, Alfred E. Norman and Hon. Grant Jackson, Judge of the Superior Court, were elected members of the Academy.

The Secretary was directed to contract for a Telephone to be placed for the use of the Academy in its office.

The following Preamble and Resolution were unanimously adopted, to-wit:

Whereas Director Thomas L. O'Brien has enlisted in the Engineer Corps of the United States Army for service during the prevailing war against Germany, all dues from him are hereby remitted to the end of the year in which he shall be discharged and returned to his usual avocations in civil life, with the hope that his future will be one of peace and prosperity; and the Secretary is instructed to inform Mr. O'Brien of this action and to advise him of the hearty approval and congratulations of this Board upon his chivalrous and patriotic action."

A most hearty vote of thanks was given to Professor Ulrey for the opportunity afforded by him for this Board of Directors to witness the manner in which he conducts the explorations of the depths of the ocean along the California coast.

The hours we cruised in the Santa Catalina channel were an object lesson exemplifying his mode of procedure in dragging from the ocean depths its Biological treasures, both animal and vegetable.

Directors' Meeting

A regularly called meeting of the Directors was held in the office of the Academy on Friday, October 26, 1917.

Present—Messrs. Beeman, Benton, Collins, Keese and Spalding.

The time was devoted principally to a discussion of the financial condition of the Academy and certain recommendations by Treasurer Keese met with unanimous approval.

Upon motion of Mr. Beeman, seconded by Mr. Spalding, the Secretary was instructed to have a Telephone installed in the Academy office.

The Secretary was also directed to make suitable arrangements for an Acadmy meeting to be held on November 9, 1917, at an appropriate place where a banquet could be served.

Board adjourned.

Academy Meeting

Dr. Lyman B. Sperry, who has made tours of extended duration in exploring our late accumulation of the Hawaiian Kingdom and the Islands of the South Pacific, gave us a most graphic account of the wonders, topography and beauties of those distant lands, as well as of the ethnology of their native races, at our regular meeting of December 21, 1917.

The views shown upon the screen were not only unique, but most beautiful.

Holdridge O. Collins, Secretary.

BULLETIN

OF THE

SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

LOS ANGELES

JULY, 1918

Trunk, 8 inches in diameter, of old plant of Lupinus Paynei.

BULLETIN

OF THE

Southern California Academy of Sciences

LOS ANGELES

JULY, 1918

Volume XVII, Part 2.

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Office of the Academy, Room 719 San Fernando Building
Telephone 65741

Southern California Academy of Sciences

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HECTOR ALLIOT .... President
MARS F. BAUMGARDT .... First Vice-President
ANSTRUTHER DAVIDSON .... Second Vice-President
ARTHUR B. BENTON .... Third Vice-President
SAMUEL J. KEESE .... Treasurer
HOLDRIDGE O. COLLINS .... Secretary

George H. Beeman — George W. Parsons
Albert B. Ulrey — William A. Spalding
William L Watts

Committee on Finance

Samuel J. Keese — Arthur B. Benton — George H. Beeman

Committee on Program

William A. Spalding — George W. Parsons — Mars F. Baumgardt

Sections of the Academy

Astronomical Section

Mars F. Baumgardt, Chairman — Samuel J. Keese, Secretary

Geological Section

William L. Watts, Chairman — George W. Parsons, Secretary

Biological Section

Prof. Albert B. Ulrey, Chairman — C. H. Phinney, Secretary

Zoological Section

Dr. F. C. Clark, Chairman — Raymond D. Jewett, Secretary

Botanical Section

Anstruther Davidson, Chairman — Theodore Payne, Secretary

EDITORIAL

SATURDAY ,April 13th, 1918, was celebrated as Arbor Day at Exposition Park, Los Angeles, by patriotic exercises and tree plantings in commemoration of various public bodies and organizations that have identified themselves with the development of the park.

The principal meeting was on the assembly grounds in front of the band stand, a considerable concourse being assembled, which was presided over by Mr. W. P. Jeffries and regaled by patriotic music furnished by the Naval Reserve Band. A stirring address was delivered by Mr. Joseph Scott.

After the conclusion of the general meeting, which occurred at near the noon hour, the assembly resolved itself into four groups and proceeded severally to the sides of the quadrangular sunken-garden, where the ceremonies of tree-planting were carried out.

On the side facing the Museum Building, in the northwest corner of the quadrangle, the exercises were presided over by Mrs. Sloane-Orcott, president of the Park Commission, who, after a few warm words of welcome and appreciation, threw the first shovel-full of dirt in placing the tree, and introduced Rev. J. W. Brougher, who made a short, appropriate and stirring address.

Other trees planted at equal intervals along the north side of the quadrangle, each with appropriate ceremonies, were in commemoration of the following organizations: Southern California Academy of Sciences, address by Past President Wm. A.

Spalding, assisted in the planting by Directors S. J. Keese and George W. Parsons. Historical Society of Southern California, address by Dr. Roy Malcolm, of the faculty of the University of Southern California. Audubon Society, address by Mrs. J. D. Bicknell, President, assisted by a number of ladies constituting the Board of Directors.

On the other sides of the quadrangle there were simultaneous plantings in behalf of the City Council, Glen McWilliams, speaker; Friday Morning Club, Mrs. A. S. Lobingier, speaker; Native Sons and Daughters, Grace Stoermer; Ebell Club, Mrs. C. C. Ashley; Chamber of Commerce, F. Q. Storey and Maynard McFie, and a number of others. The trees planted were all California Live Oaks, and near each one was placed a tablet in stone and bronze giving the date and the name of the organization under whose auspices the tree was planted.

We present herewith the beautiful address of Mr. Spalding as he cast the last shovel-full of soil upon the roots of our Academy Oak:

"We are gathered at this spot to plant an oak tree and unveil a tablet which are to stand as memorials for the Southern California Academy of Sciences. The Park Board has adopted the far-seeing policy of recognizing the efforts of various organizations that have co-operated in establishing this museum and the other attractive and beneficent features of the park, thus making the very landscape an historical memento and a tribute to the builders. As you probably know, the Southern California Academy of Sciences was the first organization to appreciate the importance of securing and preserving for the benefit of this community and its visitors a complete collection of the fossil remains of the Brea Beds discovered at the very gates of our city. Securing a concession from Mrs. Hancock, then owner of the Rancho La Brea, and raising funds therefor from its own members, from subscriptions of public-spirited citizens, from the city council and the county board of supervisors, it placed an exploring party in the Brea Beds, and proceeded on scientific lines to excavate the prehistoric remains, to identify them, assemble them and mount them in complete skeletons. A quantity of these most interesting relics had previously been secured by an expedition of the University of California, but these had all been shipped to the university, were employed mainly for purposes of study, and were lost to the people of Southern California for exhibition purposes. After laboring two or more years and expending several thousands of dollars in the work of securing and making available these relics, the Southern California Academy of Sciences entered into a mutual contract with the county of Los Angeles, the Historical Society, the Audubon Society and the Art League, whereby they were to join forces in organizing and conducting the museum inclosed in the beautiful building which stands before us. To this museum the Southern California Academy of Sciences loaned its most valuable collection of prehistoric relics, and other organizations made loans or contributions according to their possessions. An agreement was entered into for a period of fifty years, providing for a Board of Governors which should be composed of representatives of the various bodies and organizations party to the contract; and in this body is vested the conduct and management of the museum. It is well known, of course, that the county of Los Angeles furnished the money which built this stately and beautiful building, provided its fittings and defrays all expenses of operation. It has seemed proper to me that this statement should be made, and that the present is a most fiting occasion to make it, defining the relationship of the Academy to the Exposition enterprise, and awarding a proper recognition to our Academy of Sciences, which really secured this most unique and invaluable natural-history collection, (the Brea Bed fossils), for the benefit of the people of Southern California and the visitors within our gates for all time.

A few months ago I had the honor to participate in the unveiling of a tablet which commemorates the historic palm trees standing on the other side of the park, successfully removed from another part of the city and established there by the management. Those trees are suggestive of oriental traditions and Bible history as well as of deserts and tropical lands, and they have come down through a vista of early California history which recalls the sway of the Dons, part Spanish, part Mexican, part Oriental, part American pioneer life. Today we plant oak trees,—California live oaks,—which are peculiarly appropriate for these strenuous times and suggestive of memory, hope and courage. Hearts of oak,—filled with English tradition and early American history; hearts of oak, expressive of the hope of civilization which stands trembling in the balance of the most terrific struggle the world has ever seen.

This apparently simple ceremony of planting a small tree, if we regard it in its symbolic aspect, is fraught with deep significance and, let us hope, with enduring import. Here it is, a mere sapling, a mere wisp of plant growth;—any vandal hand might pull it up and utterly destroy it now or at any time for years to come; any beast might trample it under foot, any predatory rodent or parasite might sever its apparently slender hold on life. And yet we plant this tree on the open ground, under the blue arch of the skies, subject to all the changes of weather, all the storms, and winds and frosts and drouths that may come, and, with the reasonable care and protection which we know it will receive during its earlier period, we feel certain that it will strike its roots deep into the soil and rear its graceful head aloft; it will adapt itself to its environment; it will draw rich juices from the earth; it will appropriate chemical elements from the atmosphere; it will utilize the very energy of the sunbeams; and in the wonderful chemical laboratory which nature has provided, it will co-ordinate, convert and combine these elements to form fiber and build up trunk and branch and twig, leaf and bloom and fruit, performing its full round of existence as foreordained from the beginning of creation. And this tree, grown to ample proportions, so that the birds of the air find shelter and nesting-place in its branches, and men find grateful shade under its spreading arms,—this tree shall not pass away when we who are standing about today must pass,—this tree will stand here fifty, a hundred, perhaps five hundred years hence, and will bear testimony for a people long past and forgotten. Thus, with this simple twig are we united in the great mystic bond of existence, and thus do we appeal to the twig as the stronger, the more enduring form of life to speak for us when we can no longer speak for ourselves; when our generation and the next and the next shall have been swept into oblivion. This great mystery of existence, this great riddle of the universe has been beautifully set forth by Tennyson in his apostrophe:

Flower in the crannied wall,
I pluck you out of the crannies;—
Hold you here, root and all, in my hand,
Little flower,—but if I could understand
What you are, root and all, and all in all,
I should know what God and man is."

At the Annual Meeting of this Academy on May 28, 1918, Mr. Mars F. Baumgardt was elected a Director, and at a subsequent meeting of the Directors he was chosen one of the Vice-Presidents.

In June, 1913, Mr. Baumgardt was graduated from the School of Optical Engineering by Columbia University, and, locating at his home in Los Angeles, he has achieved an advanced position and remarkable succes in treading the path of this more modern branch of the sciences.

Mr. William A. Clark, son of Senator Clark, in the spacious grounds surrounding his beautiful home on West Adams street, has caused to be erected an Astronomical Observatory of capacious dimensions and picturesque design. It is veneered with brick and its dome revolves fifty feet above its base.

The entire furnishing, control and management of this Observatory and its valuable contents have been entrusted to Mr. Baumgardt, who has made a collection of appliances, instruments, maps, charts, engravings and photographs such as perhaps can be found in no other private Observatory in California.

The six-inch objective equatorial telescope stands upon a steel construction extending from a solid base of concrete many feet below the surface of the ground, and it is entirely disjoined from all portions of the external tower. There are an eight-inch Brashear Reflector, a Spectroscope and a collection of photographic instruments of the latest inventions, and several designs showing the condition which the evolution of our astronomical system has compassed, are from the brain and hands of Mr. Baumgardt.

Mr. Clark has most generously tendered to the members of this Academy the facilities of his Observatory for inspection and study, for which he has our hearty thanks.

We place upon record the name of

THOMAS L. O'BRIEN

now serving in France as a soldier of the Engineer Corps of the United States Army.

Down to the last Annual Meeting of this Academy, he was one of our Directors, and during the entire period he held that position he was enthusiastic and energetic in his devotion to our work. He is a man of eminent executive ability and great intellectual endowments, and believing his acquirements might be of value to our country in this hour of heavy affliction, he severed his connection with all business engagements and tendered his services to that department in which he thought he might be most useful.

We most profoundly appreciate the patriotism which induced him to dissolve the affectionate associations of his home, and our Directors, in the record of their meetings, have inscribed a just tribute to his devotion to the cause of righteousness.

Nearly all the gentlemen of this Academy,

"As venerable Nestor, hatched in silver,"

have passed beyond the age when they can march with the rifle to the fields of warfare but, at Milton wrote in the sonnet to his blindness,

"They also serve who only stand and wait,"

and we send our younger brothers, our sons and others who are dear to us, to uphold the fight for those principles of humanity, honor and justice which are the very foundation stones of that structure we prize—our National Integrity.

The whole history of the human race contains no chapter of atrocity like the atrocity of the Germans; and while our hearts beat with dread as to the fate of our departed dear ones, in this great cause, if they fall, we accept the sacrifice with resignation, for we know it was cheerfully made for us and our children.

"Amour sacré de la patrie,
Rends nous l'audace et la fierté;
A mon pays je dois la vie,
Il me devra sa liberté.
Plutôt mourir que rester misérable."

Holdridge Ozro Collins.

FROM THE PRESIDENT

OF THE

SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

Fellows and Members of the Southern California Academy of Sciences:

At the last annual meeting of the Board of Directors, Arthur B. Benton, who has so successfully guided us for the past five years, declined to be nominated again for President.

By the unanimous choice of my associates and friends of many years, I have been called upon to succeed him and to assume the honor and the responsibilities of President of the Academy.

Eager to serve Science and the cause of our Institution, I have accepted this new mark of regard and confidence. I realize fully, however, the difficulties of the office I am called upon to fill, in these troubled times, when most of scientific research is cast into the background of human activities.

No deviation from our well-defined path of usefulness is to be introduced, but more intensified work and results are expected from the sections.

Greater efficiency is expected from our Committee on Publications. Our Bulletin has enjoyed, for nearly a quarter of a century, the proud position of being the oldest continuous record of the activities of any Scientific Society on the Pacific Coast. With its approaching silver jubilee its position and standing must be further enhanced, that it may become the representative scientific publication of this region.

My administration dedicates itself to emphasizing the work of the Academy, in its sections, its publications and course of lectures, which are its natural functions; to co-ordinate these efforts towards the better knowledge and the greater propagation of study in our well-defined domain, the Pacific Coast and the Southwest; to bringing in closer and friendly contact, the various local scientific endeavors, that Southern California may be known better at home and abroad as a center of sincere and earnest searching after the truth; through the scientific efforts of the Academy.

In the carrying out of this simple and logical program of activities I count upon your enthusiastic support and co-operation.

HECTOR ALLIOT, President.

WANTED

Numbers of Volumes III, IV, V, VI of the Bulletin to complete files. Address the Secretary, Room 719, San Fernando Building, Los Angeles.

THE STARFISHES OF SOUTHERN CALIFORNIA

By Albert B. Ulrey, A. M.

Director of the Venice Marine Biological Station of the University of Southern California.

THE starfishes (Asteroidea) of Southern California have received comparatively little attention from students of marine life. Without access to extensive monographs it has been impossible to make even approximate identifications of the commoner forms off our coast. The starfishes afford abundant illustrations of a wide range of biological problems. At this time especially we are warranted in asking first whether these forms have an important economic relation.

It is well known to biologists and those concerned with the oyster industry that the starfishes constitute one of the worst pests found on oyster beds. Most starfishes are carnivorous by preference, feeding largely on the barnacles and mollusks attached to the rocks or among which they live. While they are very destructive to mussels and oysters they feed also on limpets, chitons and small snail-like gasteropods.

The destructive action of starfishes in oyster beds on the Atlantic coast becomes at times a serious menace. There a single small species **(Asterias forbesi)** is responsible for the damage done. On the Pacific coast we have about forty related species with similar habits and these species are much larger, some of them two feet across. It will be seen that the starfishes on the Pacific coast must always be a great hindrance to the cultivation of oysters, mussels, etc., except where the water is too brackish for starfish life.

The Feeding Habits of Starfishes. In the case of the commoner forms of starfish found attached to rocks there will be seen in a groove on the ventral side of the ray a large number of strong, tube-like muscular feet each with a perfect sucker at the tip. With these the starfish adheres firmly to the rocks, moves from place to place or opens the shell of its prey. Usually there are four close rows of such suckers the entire length of the ray; estimating 200 to a ray there would be 1000 on a five-rayed form. In the larger five or six-rayed species there may be 4000 to 8000 present. The number is enormously increased in the large twenty-rayed or twenty-four rayed forms such as the "sun star" **Pycnopodia helianthoides,** probably 40,000 or over.

In feeding on an oyster too large to swallow entire the rays are wrapped about the victim and with their numerous suckers a long and steady pull opens the shell. These starfishes are able to evert the large bag-like stomach and wrap it around its prey until digestion is completed, when the stomach is retracted by a special set of muscles for this purpose.

Reproduction. A knowledge of the breeding habits of starfishes is necessary in dealing with them in relation to the oyster industry.

In most starfishes the sexes are distinct and they can not be distinguished externally. Two general types of reproduction may be considered: (1) The female in most cases produces a vast number of minute eggs which are fertilized in the water. These develop into peculiar free-swimming larval forms (bipinnaria, brachiolaria) which do not at all resemble the adult starfish. These larvae swim about by means of the cilia covering them or they may be carried in great numbers a long distance by suitable currents of water in which they are found. After some days or weeks, depending upon the species and the surrounding conditions, the larvae develop into small starfish able to get their food in the usual manner. These facts enable one to understand why oyster beds may be free from young starfish and in a few days be seriously infested with a host of vigorous young forms menacing the entire industry in that region.

(2) Certain species of starfishes do not produce so large a number of eggs but care for those formed in certain ways which prevent so large a proportion from being destroyed. These eggs do not develop into free swimming larvae, but are retained in clusters about the mouth. There they pass through an abbreviated development into minute young starfishes. This method has been observed in several species of **Henricia** and other genera. In **Leptychaster** a large dorsal brood pouch is formed over the genital orifices. In this marsupium the eggs are laid, fertilized and develop, the young escaping by a rupture of the membrane which later heals up.

Distribution. The starfishes are widely distributed over the earth at present and extended far back into geological history. Their number each succeeding year is approximately maintained by a series of nicely adjusted checks to a vast prodigality of reproduction. If these checks could be removed even in part a vast plague of starfish would soon fill the seas with their progeny. Some of these checks are as follows: Thousands of eggs are never fertilized; many embryos do not find suitable conditions for development; many of the ciliated larvae before developing a hard exoskeleton become the prey of other animals, while many of the mature animals are destroyed by animal foes, disease or unfavorable environment. With all of these vicissitudes we observe the maintenance of the race in a moving equilibrium.

Concerning the Pacific coast starfishes. Verrill 1914, states that "The Northwestern Coast of North America seems to be the headquarters or metropolis of shallow-water starfishes. No other region, so far as known, has anything near so many species, nor so many generic and family types, in shallow water, nor so great an abundance of individuals. The species and genera confined to the deep waters seem equally numerous. The abundanec and variety of starfishes in these shallow waters is apparently greater than at Panama, the West Indies, or the most favorable parts of the East Indies in similar depths. The coast seems admirably adapted for the permanent occupation and evolution of starfishes and similarly for certain other groups of marine invertebrates and fishes."

The explanation suggested for the great variety, numbers of individuals and persistence of the starfishes, as well as certain other groups of animals on the Pacific coast of North America is found in the fact that the temperature in this region was not seriously reduced during the Glacial Period. On the Atlantic coast, on the other hand, these animals were largely exterminated or driven southward.

Another possible factor is found in the influence of the great Japanese tropical current of water which tempers the climate of the whole coast south of the Aleutian Islands. It is well known that equality of temperature, especially during the breeding season, is a factor of prime importance in the prosperity of most marine animals.

Number of Rays and Regeneration. Nearly all of the Echinoderms, living or fossil, are normally five-rayed. This pentamerous condition is found in the sea-urchin, sea-cucumber, brittle stars as well as in the starfishes.

This rule of a five-rayed condition has numerous exceptions among starfishes. Some species normally five-rayed have at times six rays; such are, **Henricia leviuscula, Pisaster ochraceus, Asterias miniata.**

Some species have normally six or more rays while variations show five rays present. Among the multiradiate starfishes may be mentioned **Heliaster** with its twenty and in some species as high as forty-four rays. In **Pycnopodia** the number of adult rays is twenty while the very young stages show six equal rays; the new rays appear first one on each side of the primary rays, then other pairs just back of these and so on in succession.

Regeneration of lost parts occurs in starfishes in a marked degree. Specimens are frequently found in which the rays show all degrees of regeneration from the smallest rudiment to a well developed ray. In the case of **Linckia columbiae** single rays alone are found living and these regenerate the disk with its comet like condition as shown in Plate VI.

The following list represents most of the starfishes known to occur in Southern California waters. The species indicated by an asterisk were taken during the trawling and dredging expeditions of the Anton Dohrn described in the Bulletin of the Southern California Academy of Sciences January, 1917, pp. 23-27 with maps. A series of these species has been placed in the Museum of the University of Southern California and a duplicate series in the Museum of the California Academy of Sciences and another in the Museum of Leland Stanford University.

I am indebted to Dr. Walter K. Fisher of Leland Stanford University for the idenitfication of those species in the University collection with the exception of **Pisaster ochraceus** and **Solaster dawsoni.**

Plates IV, VI, VIII, IX, X, and XI were taken from the monograph by Walter K. Fisher, 1911. Plates I, II, III, V and VII are copied from the monograph by Addison E. Verrill, 1914. These excellent publications have been used for the lists of Southern California starfishes other than those in the University collections and for other data.

The distribution maps were made by Mr. W. A. Sharp, the data being derived from the log of the Anton Dohrn in its dredging and trawling expeditions. Valuable assistance in compiling the data and preparing the manuscript has been rendered by the Misses Gladys Cone and Millie P. Bradley.

The region included in this report extends from Point Conception on the northwest to Lower California on the southeast. The species figured are those taken in the region covered by the explorations of the Anton Dohrn, viz., from Point Dume to Newport Bay and Santa Catalina Island.

A. Shallow-water Starfishes of Southern California Waters.

(Less than one hundred fathoms.)

Phylum Echinodermata.

Class **Asteroidea.**

Order I. **Forcipulosa.**

Family I. **Asteriidae.**

Subfamily I. **Asteriinae.**

*__Pisaster capitatus__ (Stimpson) Plate I.

Synonym: **Asterias capitata** Stimpson.

Distribution: Monterey, Cal.; San Diego; *Point Fermin; *Venice; *San Pedro.

*__Pisaster ochraceus__ (Brandt). A. Agassiz. Plate II.

Synonym: **Asterias ochraceus** Stimpson.

Distribution: San Diego to Alaska. *San Pedro, on rocks.

*__Orthasterias__ sp. Verrill Plate III.

Several specimens, the species has not been determined.

Order II. **Spinulosa** Perrier.

Suborder I. **Avelata.**

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*Specimens in the collections of the University of Southern California.

Family I. **Echinasteridae** Verrill (restricted).

*__Henricia leviuscula__ (Stimpson) Fisher Plate IV.

Synonyms: **Linkia leviuscula** Stimpson; **Cribrella leviuscula** Verrill.

Distribution: From Aleutian Islands, Alaska, to Monterey Bay, Cal., in a typical form, and thence south to the Santa Barbara Channel, and San Diego, Cal., the southern forms not being typical. The typical form is found along shore at low tide, or in comparatively shallow water.

Locality	Fathoms	Nature of Bottom
Cortes Bank, of San Diego	26	Broken shells.
Off Santa Cruz Island	48	Fine, gray sand.
Off Santa Cruz Island	30-41	Mud, gray sand.
*Off Long Wharf, Santa Monica	4	
*Off Long Wharf, Santa Monica	25	

Family II. **Solasteridae.**

*__Solaster dawsoni__ Verrill. Plate XII.

Distribution: Monterey Bay, California, to the Aleutian Islands.

*Off Venice in about 50 fathoms, the specimen was badly broken.

Family III. **Asterinidae** Gray.

*__Asterina miniata__ (Brandt) Plate V.

Synonyms: **Asterias miniata** Brandt; **Astericus miniatus** Stimpson; **Patiria miniata** Verrill.

Distribution: Sitka, Alaska, all the way to San Diego, Cal., in sutiable localities, thence to Gulf of California north of La Paz, Lower California; low tide to 165 fathoms, on rocks, shells, gravel, and hard sand.

Locality	Fathoms	Nature of Bottom
Santa Barbara Channel, Cal	31	Gray sand and broken shells.
Cortez Bank, off San Diego (long. 119° 3′ W.)	26	Broken shells.
San Pedro Bay (lat. 33° 36′ N.)	26	Broken shells.
Off Santa Barbara	26	Sand, stones, coral.
Off Santa Barbara	165	Fine gray sand, rocks.
Off Anacapa Island	27	Gravel and broken shells.
San Diego	36	
San Pedro	Shore	
Santa Catalina Island	Shore	
Gorda, Cal.	Shore	
Near Santa Cruz	Shore	Rocks.
*Foot of San Pedro breakwater	8	
*Catalina Harbor	Shore	
*Venice	30	
*White's Point	15	Green mud and sand.

Order III. **Phanerozona** Sladen (emended).

Suborder I. **Valvulosa** Verrill.

*Linckia columbiae Gray. Plate VI.

Synonyms: **Linckia ornithopsus** Verrill; **Linckia diplax** Perrior; **Linckia pacifica var. diplax** Sladen; **Phataria (Linckia) fascialis** Monks; **Phataria (Linckia) unifascialis** Gray, **var. bifascialis** Monks.

Distribution: California (Santa Catalina and San Clemente Islands, San Pedro, San Diego) and Lower California (La Paz); Columbia, west coast (Gray); Galapagos Islands.

Locality	Fathoms
Santa Catalina Island	Shore
Santa Catalina Island	30-40
Santa Catalina (Avalon)	
La Jolla, San Diego	
San Clemente Island	
San Diego	
*Off Portuguese Bend	25
*Entrance Catalina Harbor	30
*Catalina Harbor (west shore)	
*Catalina Harbor	
*Rocky Point	

Miss Sarah P. Monks of San Pedro, California, has studied this species with reference to its variation and autotomy. She finds the rays varying from four to nine; due mainly to autotomy and irregular restoration of rays.

The regeneration occurring is not only the usual regeneration of lost rays, but a ray may regenerate a new body. Frequently comet rays occur, that is stars with one long ray and a number of small rays extending from a minute disk. Single rays are found without any external sign of a disk.

Color in life "mottled reddish brown and ash color, with tips of rays, or new portion of the rays a brighter and uniform red" (Monks).

Family II. **Goniasteridae** Forbes (restricted).

Subfamily I. **Mediasterinae** Verrill, 1899.

*Mediaster aequalis Stimpson. Plate VII.

Distribution: From the Alaskan Peninsula (Chignik Bay) south to northern Lower California, in shallow water (9 to 160 fathoms).

Locality	Fathoms	Nature of Bottom
Off San Miguel Island	53	Broken shells, sand.
Santa Barbara Channel	96	Sand, mud.
Santa Barbara Channel	44	Fine gray sand.
Santa Barbara Channel	31	Gray sand, broken shells.
Cortez Bank, off San Diego	47	Fine gray sand.
Off San Diego	69	Fine gray sand.
Off San Diego	36	Gray sand.
Off San Diego	47	Gray sand.
Off Wilmington	27	Fine gray sand.
Off Wilmington	20	Gray sand, broken shells.

Locality	Fathoms	Nature of Bottom
Off Anacapa Island	30	Rocky.
Off San Miguel Island	55	Green mud, gray sand, broken shells.
Near Santa Barbara	21	Green mud.
Near Santa Barbara	21	Sandstones.
Near Santa Barbara	27	Fine gray rocks.
Near Santa Barbara	61	Green mud.
Near Santa Barbara	73	Green mud.
Between Santa Cruz and Santa Rosa Islands	21	Gray sand, broken shells.
Off Anacapa Island	36	Gravel and broken shells.
Off Anacapa Island	46	Gray sand.
Off Avalon, Santa Catalina	47	Fine gray sand.
Off Avalon, Santa Catalina	80	Fine gray sand.
Off Santa Catalina	59	Fine gray sand.
Off Santa Cruz Island	30	Fine gray sand.
Near San Diego	110-143	Green mud, fine sand.
Near Los Coronados		
Between Santa Catalina and Santa Barbara	55-155	Fine gray sand.
Between Santa Barbara and San Nicholas	160-141	Fine gray sand, mud, rocks.
	38-32	Fine gray sand.
Near Santa Cruz Island	30-41	Mud, gray sand, rocks.
Off San Pedro	23-40	Green mud and sand.
San Diego		
*Off Newport (T89)		

Suborder II. **Paxillosa** Perrier (sense restricted).

Family III. **Astropectinidae** Gray (restricted).

***Astropecten armatus** Fisher. Plate VIII.

Synonyms: **Astropecten sideaealis** Verrill, sp. nov.; **Astropecten erinaceus** Gray; **Astropecten orstedii** Lütken.

Distribution: Ranges from San Pedro, California (and probably from north of this point to Ecuador (Punta St. Elena, Puerto Portrero). Only Californian specimens have been examined, however. Shore to about 30 fathoms.

Locality	Fathoms	Nature of Bottom
Long Beach		
San Diego	Shore	Sandy.
San Diego, Beacon 3 Shoal		
San Pedro	2½	Seaweed.
San Pedro	7	Dark-brown mud.
San Pedro	11½	Shore sand.
San Pedro	4	Coarse sand.
San Pedro	13	
San Pedro	102-30	Soft, sandy mud.
*Off Venice	14-22	
*Off Newport and Balboa		

***Astropecten californicus** Fisher. Plate IX.

Distribution: From north of Bodega Head (north of Point Reyes), California, to Lower California; 10-244 fathoms. Abundant in Monterey Bay and off San Pedro.

Locality	Fathoms	Nature of Bottom
Off San Miguel Island	53	Stones, broken shells.
Off Point Conception	13	Sand.
Off Santa Cruz Island	53	Fine, gray sand.
Off Point Conception	96	Sand, mud.
Off Point Conception	31	Gray sand.
Cortes Bank	60	Rocks, sand.
Cortes Bank	26	Broken shells.
Cortes Bank	55	Gray sand.
Cortes Bank	67	Fine gray sand.
Cortes Bank	47	Fine gray sand.
Cortes Bank	69	Fine gray sand.
Los Coronados Islands, Lower California	60	Mud.
Los Coronados Islands, Lower California	34	Gray sand, shells.
Los Coronados Islands, Lower California	36	Gray sand.
Off San Diego	36	Gray sand.
San Pedro Bay	47	Fine gray sand, stonesfl
San Pedro Bay	26	Shells, stones.
San Pedro Bay	20	Gray sand.
Between Santa Rosa and Santa Cruz Islands	21	Gray sand, broken shells.
Off Santa Rosa Island	57	Broken shells, rocks.
Off Santa Barbara	165	Sand, stones, coral.
Off Santa Barbara	20	Sand, stones, coral.
Off Santa Barbara	21½	Sand, stones.
Off Santa Barbara	27	Fine gray sand.
Off Santa Barbara	30	Coarse mud.
Off Santa Barbara	26	Gray sand, pebbles, stones.
Off Santa Barbara	29	Fine gray sand, mud.
Off Santa Barbara	61	Green mud.
Off Santa Barbara	68	Green mud.
Off Santa Barbara	73	Green mud.
Off Santa Cruz Island	36	Gravel, broken shells.
Off Santa Barbara	31	
Off San Diego	124	
Vicinity of San Diego	25	Coarse yellow sand, shells, gravel.
Vicinity of San Diego	62?183	Gray sand, rocks.
Near Los Coronados Islands	55-155	Fine gray sand.
Near Los Coronados Islands	244	Rocky.
Off San Diego	46-50	Dark green mud, fine sand.
Off San Diego	82-134	Green mud.
Off San Diego	164-85	Gray sand.
Between Santa Barbara and San Nicholas Island	32-33	Fine gray sand.
Between Santa Barbara and San Nicholas Island	229-298	Gray mud, rocks.
Between Santa Barbara and San Nicholas Island	31-32	Gray sand, shells.
Off Santa Rosa Island	30-41	Mud, gray sand, rocks.
Off San Pedro	2½-102	Hard and soft sand, green mud, brown mud and pebbles.
*Off Long Wharf, Santa Monica	10-11	
*Off Del Rey	24	

Locality	Fathoms	Nature of Bottom
*Off Long Wharf	25	Heavy mud and sand.
*S. W. of Venice, 1½ miles	25	
*Off San Pedro breakwater	20	
*S. E. Point Fermin 5 miles	25	
*Off Long Wharf	8	
*Off Point Dume		Coarse sand, rocky.
*Off Del Rey		
*Off Santa Monica	27	Heavy gray mud and sand.
*Off Point Fermin	15	
*Near Point Dume	25	Heavy mud and sand.
*Off Santa Monica	15-20	
*Off Point Dume		Heavy mud.
*Off Venice	30-40	
*Off Santa Monica	5-10	
*Off Santa Monica	25-35	
*Off Rocky Point	20-25	
*Off Santa Monica	25	Fine gray sand.
*Off Long Wharf		
*Off Venice 6 miles		
*Off Venice	About 25	Muddy and sandy.
*Off Del Rey	22½	Heavy gray mud.
*Off Venice	About 27	
*Off Redondo	About 34	Coarse yellow sand.
*Off Breakwater, San Pedro		
*Long Beach Wharf		
*Off Malibu		
*Outer Harbor, San Pedro		
*South of San Pedro breakwater ¼ mile		
*Off Santa Monica	25	Heavy gray mud.
*Off Long Point	25	
*Off Del Rey	25	
*Off Malibu pier	25	Fine sand and mud.
*Off Long Wharf	10	
*Off Long Wharf	15	
*Off Manhattan Beach	15	
*Off Long Wharf	25	
*Off Santa Monica	23	Heavy gray mud, sand.
*Off Del Rey	23	
*Off Point Fermin	15	
*Off Malibu Cove	21	Heavy blackish mud and sand.
*Off Del Rey	15	
*Between El Segundo and Del Rey	5½	
*South of Breakwater, 5 miles	20	
6End of Long Wharf		
*Off Venice, 3 miles S. W. pt. S. from pier	22	
*Off Venice		
*Off Long Beach	10	
*Off Long Wharf		

Family IV. **Luidiidae** Verrill.....**Luidiinae** Sladen.

*__Luidia foliolata__ Grube. Plate X.

Distribution: Southeast Alaska (Kasaan Bay) to San Diego, California, and probably to Mazatlan, Mexico; found in 10 to 189 fathoms, usually in less than 80 fathoms; so far as known not found above lowest tide marks.

Locality	Fathoms	Nature of Bottom
Off Santa Barbara	53	Fine gray sand, mud.
Off Point Conception	96	Sand and mud.
Off Point Conception	44	Fine gray sand.
South of Santa Cruz Island	48	Fine gray sand.
South of Santa Rosa Island	52	Fine gray sand.
Santa Barbara Channel	29	Fine gray sand.
Santa Barbara Channel	73	Green mud.
Off San Diego	55-58	Fine gray sand, mud.
Off San Diego	75-134	Gray sand.
Off San Diego	164-85	Gray sand, rocks.
Between Santa Barbara and San Nicholas Islands	32-38	Fine gray sand.
Off Santa Rosa Island	30-41	Mud, gray sand, rocks.
San Pedro	13	
*Off Venice	30	

***Luidia ludwigi** Fisher. Plate XI.

Distribution: Monterey Bay, south to San Pedro, California, in 15 to 50 fathoms; mostly on bottoms of fine gray sand and mud.

Locality	Fathoms	Nature of Bottom
Off Santa Barbara	30	Coarse mud.
Off Santa Barbara	31	Mud.
Off Santa Barbara	26	Gray sand, pebbles.
Off Santa Barbara	29	Fine gray sand, mud.
Off Santa Rosa Island	30-41	mud, gray sand, rocks.
Off San Pedro	28-24	Sand, fine mud, shells.
Off San Pedro	23-25	Mud, sand.
Off San Pedro	25-22	Rocky in spots.
Off San Pedro	19-11	Sandy, kelp.
Off San Pedro	15	Sand and cobbles.
*Southwest from Venice pier	22	
*Off Santa Monica	Near 35	
*Southwest of Venice 2 miles	About 25	
*Off Redondo	About 30	Coarse yellow sand.
*Off Venice	Near 30	
*Off Malibu pier	25	Fine sand and mud.
*Off Manhattan Beach	About 18	
*Off El Segundo	23	
*Off Malibu Cove	21	Heavy blackish mud and sand.
*Off Long Beach	10	

Pisaster lutkenii australis Verrill.
Verrill, 1914. Pl. XL. P. 1.
San Diego, Cal.

Leptasterias aequalis (Stimpson).
Verrill, 1914. Pl. XVI, XVIII, XXV, LVI.
San Diego to Puget Sound.

Leptasterias aequalis nana Verrill.
Verrill, 1914.
Common on California coasts.

Orthasterias gonolena Verrill.
Verrill, 1914. Pl. LXVII, LXVIII, LXXXII.

San Diego, Santa Barbara, Santa Cruz Island.

Orthasterias (Asterias) forreri (de Loriol).
Verrill, 1914. Pl. LXV, LXVI, LXX, LXXVII, LXXx.
Santa Cruz to Monterey.

Echinaster tenuispinus Verrill.
Verrill, 1914. Pl. CVII.
San Diego to Panama (Monterey?).

Henricia aspera Fisher.
Fisher, 1911. Pl. LXXV.
Santa Barbara to Behring Sea, 26 to 313 fathoms.

Odonaster crassus Fisher.
Fisher, 1911. Pl. XXIX.
San Diego to Monterey, in 43 to 284 fathoms.

Hippasteria spinosa Verrill.
Verrill, 1914. Pl. I, XCVIII.
Catalina Island, in 80 fathoms to Behring Sea, in 121 fathoms.

Asteropetcen ornatissimus Fisher.
Fisher, 1911. Pl. VI, VII, LI.
Catalina Island, San Pedro, etc., Cerros Island to Lower California, 47-207 fathoms.

B. Deep Sea Starfishes of Southern California. (More than 100 fathoms.)

Thrissacanthias penicillatus Fisher.
Fisher, 1911. Pl. 17, 18, 53.
Lower California to Washington, 277 to 822 fathoms. Usually on green mud or fine sand.

Dipsacaster anoplus Fisher.
Fisher, 1911. Pl. 16, 52.
San Diego to Washington, 300 to 800 fathoms, usually on mud.

Heterozonias alternatus Fisher.
Fisher, 1911. Pl. 96, 112.
San Diego to Washington, 316 to 603 fathoms.

Pteraster jordani Fisher.
Fisher, 1911. Pl. 100, 101, 117.
Lower California to Washington, 266 to 984 fathoms on mud or sand.

Dytaster gilberti Fisher.
Fisher, 1911. Pl. 17, 53.
San Diego, 2196 to 2228 fathoms.

Luidia asthenosoma Fisher.
Fisher 1911. Pl. 20, 21, 54.
Lower California to Monterey Bay, 11 to 339 fathoms.

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Pectinaster agassizi evolpus Fisher.
Fisher, 1911. Pl. 28, 55, 57.

Off San Diego, in 984 to 1059 fathoms on green mud.

Odontaster crassus Fisher.
Fisher, 1911. Pl. 29, 56.
San Diego to Monterey Bay, 92 to 243 fathoms, on gray sand, broken shells.

Pseudarchaster pusillus Fisher.
Fisher, 1911. Pl. 32, 33, 57, 59.
Lower California to Monterey Bay, 216 to 339 fathoms; shells, black pebbles, green sand.

Ceremaster leptoceramus Fisher.
Fisher, 1911. Pl. 39, 58, 60.
Off Southern California between San Diego and Point Conception, 216 to 638 fathoms.

Hippasteria californica Fisher.
Fisher, 1911. Pl. 45, 60, 111.
Southern California to Washington, 266 to 847 fathoms.

Cryptopeltatus lepidonotus Fisher.
Fisher, 1911. Pl. 47, 58, 60.
Santa Cruz Island.

Poraniopsis inflata Fisher.
Fisher, 1911. Pl. 58, 63, 112.
San Diego to Oregon, 26 to 159 fathoms.

Henricia polycantha Fisher.
Fisher, 1911. Pl. 78, 111.
Off San Diego in 359 fathoms, on mud.

Henricia clarki Fisher.
Fisher, 1911. Pl. 78, 111, 112.
Santa Cruz Island to Mexico, 745 to 510 fathoms; black mud, broken stones.

Solaster exiguus Fisher.
Fisher, 1911. Pl. 90, 112.
Off Anacapa Island, Cal., 603 fathoms; green mud, two specimens. Known here only.

Pteraster trigonodon Fisher.
Fisher, 1911. Pl. 99, 115, 116.
Off canta Cruz Island, Cal.; 447 to 510 fathoms; black mud, rocks; known here only. One specimen.

Pteraster coscino peplus Fisher.
Fisher, 1911. Pl. 102, 116.
Off Southern and Central California, 287 to 1062 fathoms; green mud, hard sand.

Nearchaster aciculosus (Fisher).
Fisher, 1911. Pl. 24, 26, 55, 56, 118.
Off San Diego and San Clemente Island, Cal.; 542 fathoms; green mud.

Henricia asthenactis Fisher.
Fisher, 1911. Pl. 77, 111.
Off Santa Barbara Island to Behring Sea, 178 to 682 fath-

oms; green mud, gray sand, rocks, shells.

Solaster borealis (Fisher).
Fisher, 1911. Pl. 91, 92, 113.
Off San Diego to Behring Sea and to Japan, 225 to 1044 fathoms.

Peribolaster biserialis Fisher.
Fisher, 1911. Pl. 97, 114, 115.
Off Southern California to Behring Sea; 57 to 313 fathoms; fine gray sand and rocks.

Hymenaster perissonotus Fisher.
Fisher, 1911. Pl. 109, 115, 117.
From San Diego, Cal., to Behring Sea, 225 to 1771 fathoms; green mud, gray ooze.

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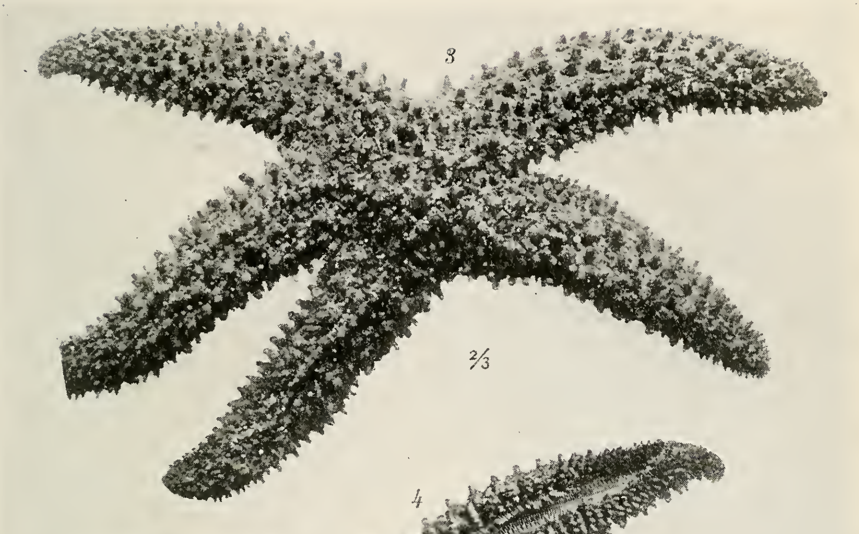
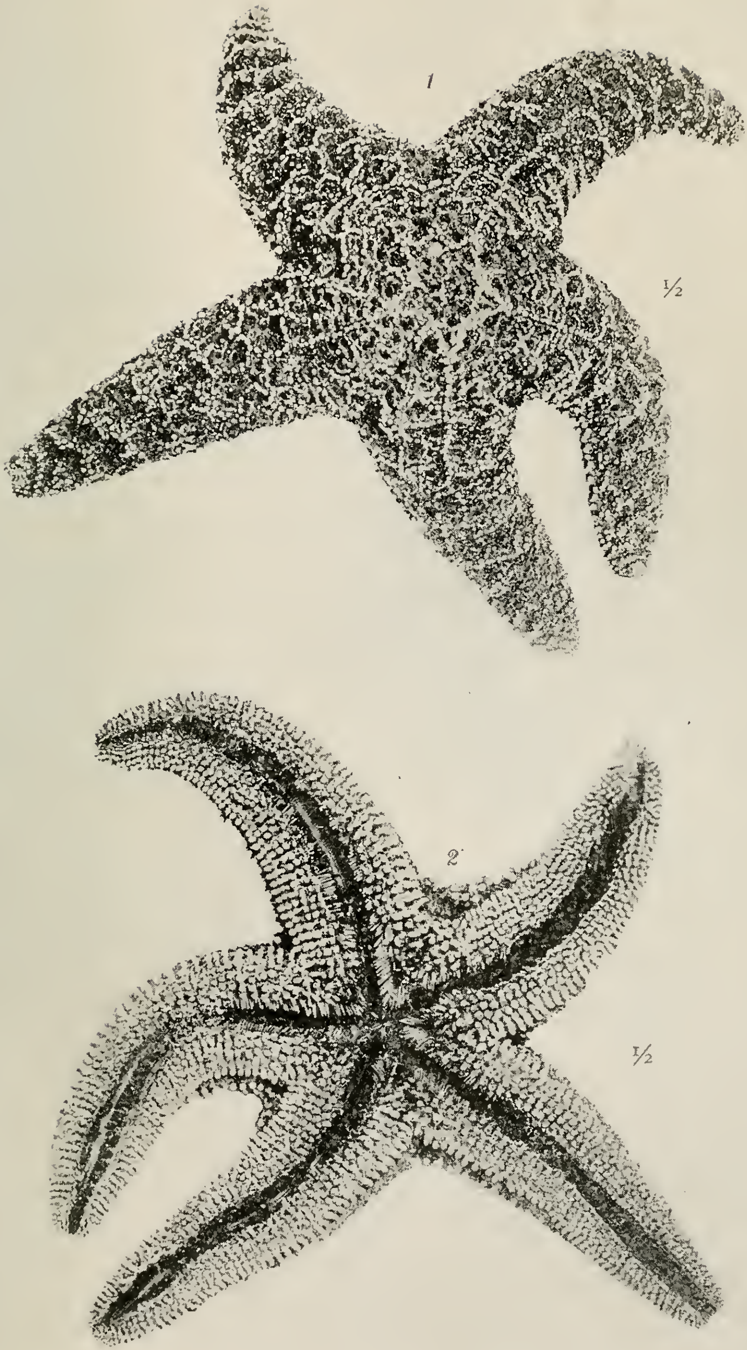
Verrill, A. E.
1914. Monograph of the Shallow-Water Starfishes of the North Pacific Coast from the Arctic Ocean to California. Smithsonian Institution, Harriman Alaskan Series, Vol. XIV. Part I, Text, 408 pp. Part II, 110 pls.

A more complete bibliography is found in each of these monographs.

Plate I.

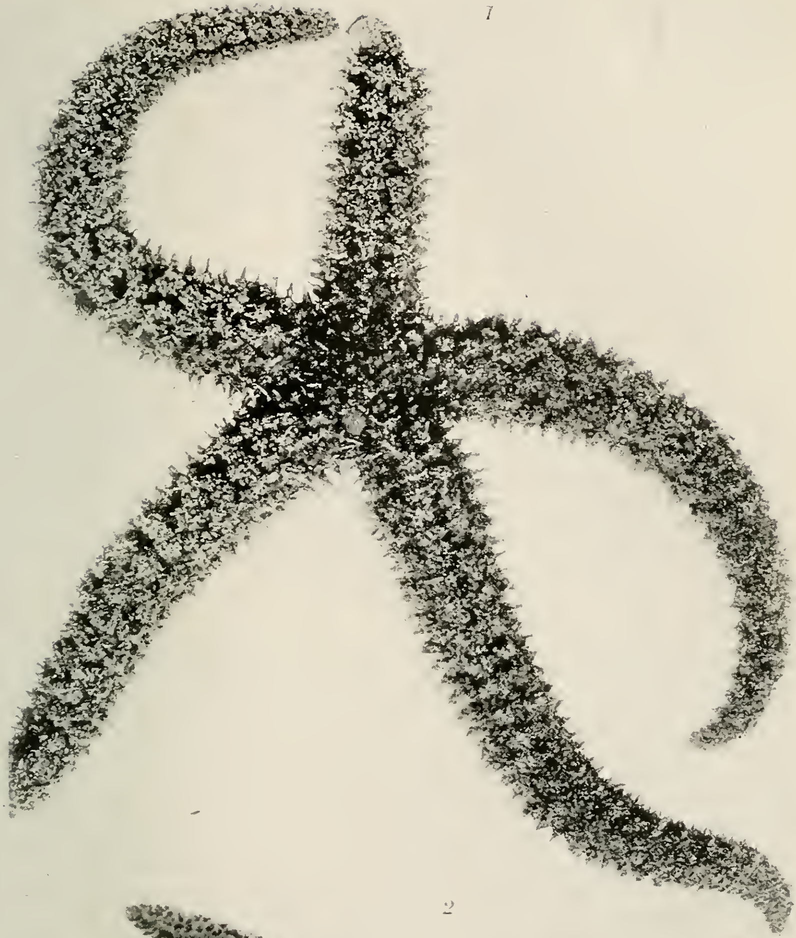


Pisaster capitatus.
Dorsal and Ventral View.



Pisaster ochraceus.
Dorsal and Ventral View.

1



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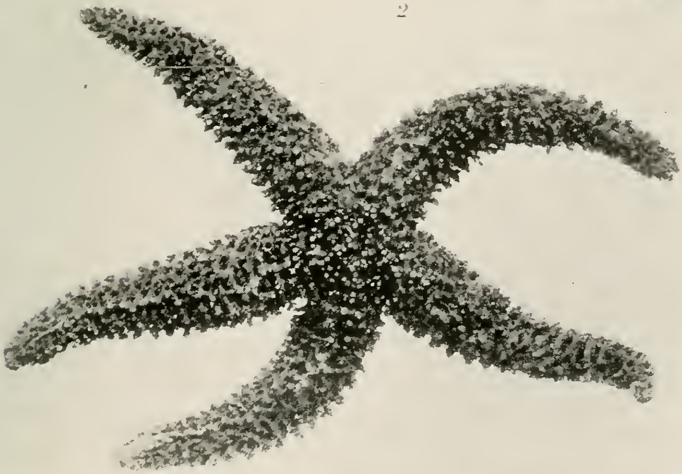
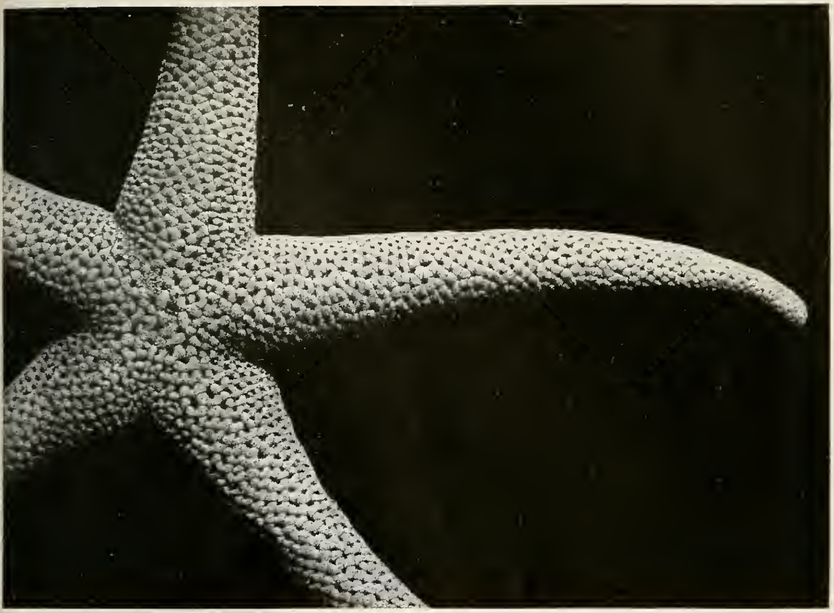
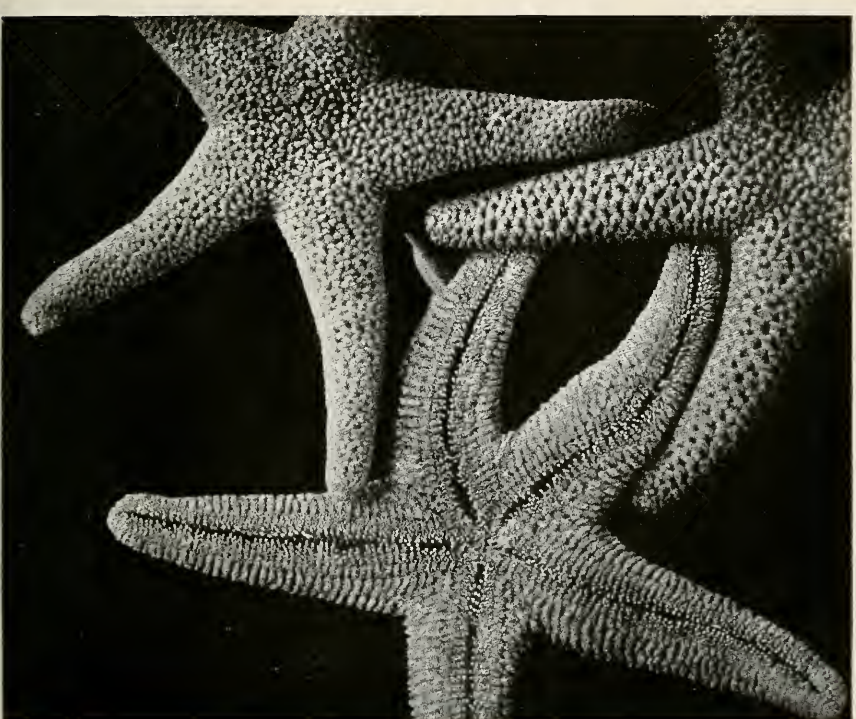


Orthasterias forreri. Fig. 1..
Dorsal View.
O. columbiana. Fig. 2.
Young Dorsal View.

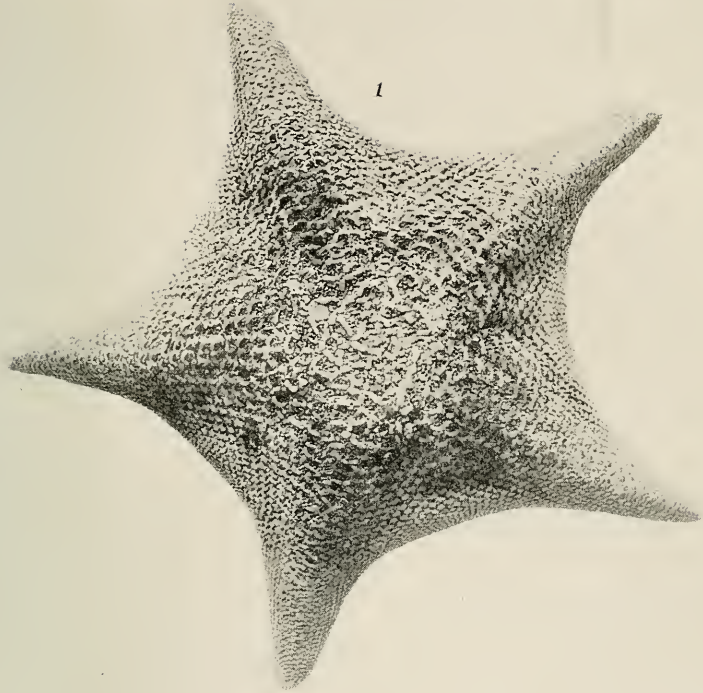




Henricia leviuscula, Variety A.
Upper Figure, Dorsal View.

Lower Figure, Variety B.
Dorsal and Ventral View.

1



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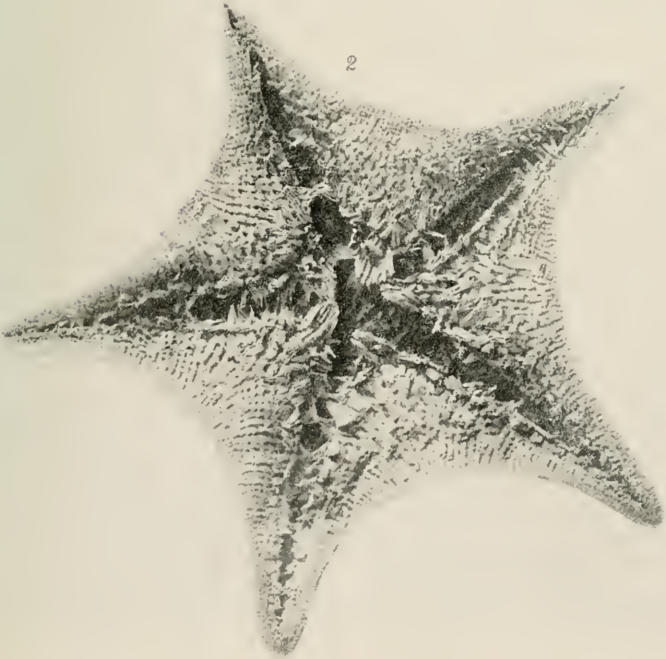
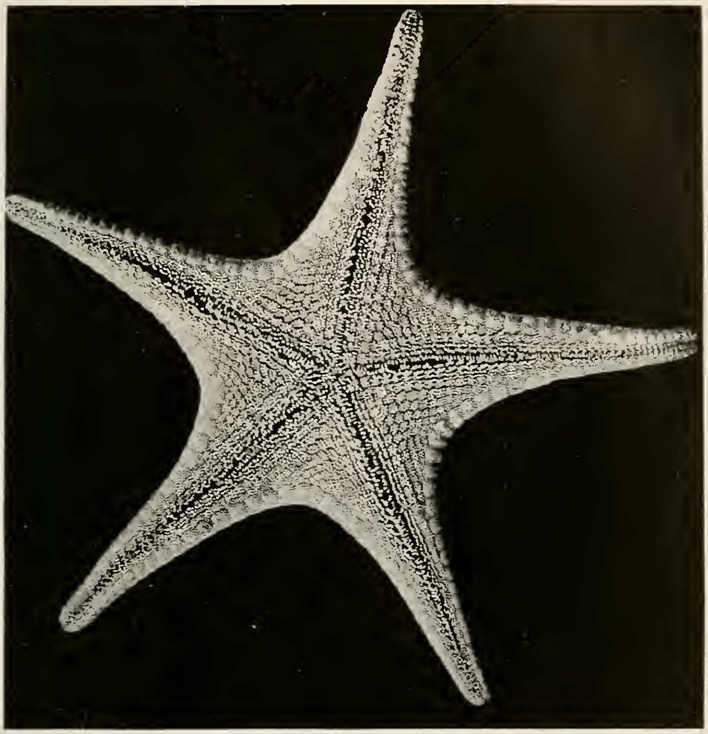
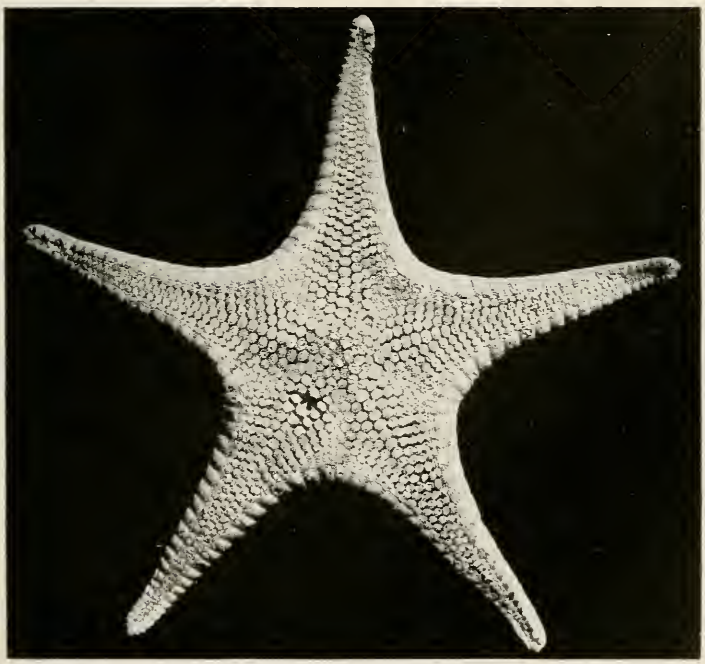


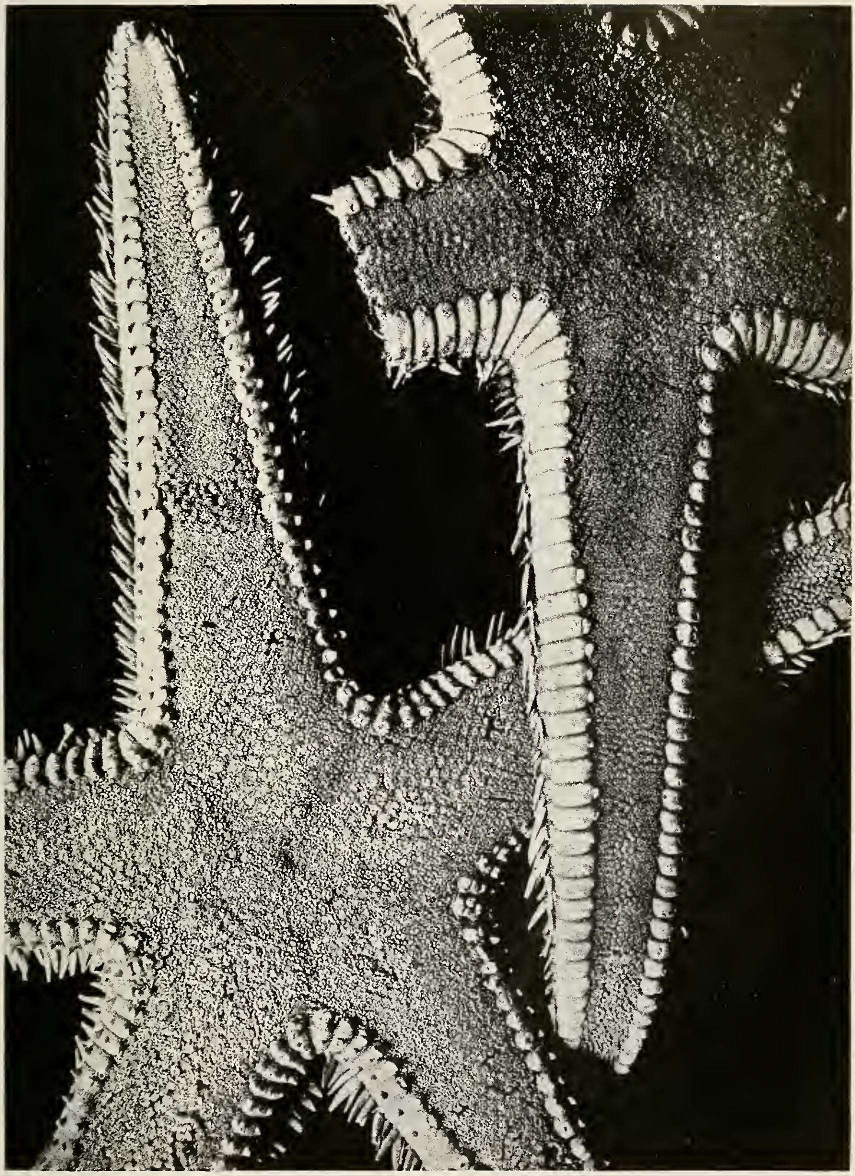
ASTERINA MINIATA.
DORSAL AND VENTRAL VIEW.

Linckia columbiae.
Dorsal, Ventral and Side Views.
Regeneration; "Comet" Forms.



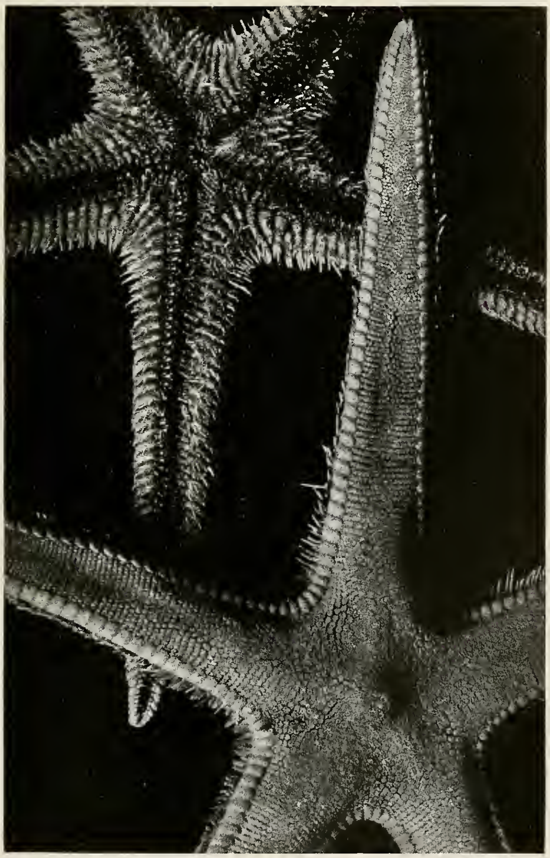


MEDIASTER EQUALIS.
DORSAL AND VENTRAL VIEW.



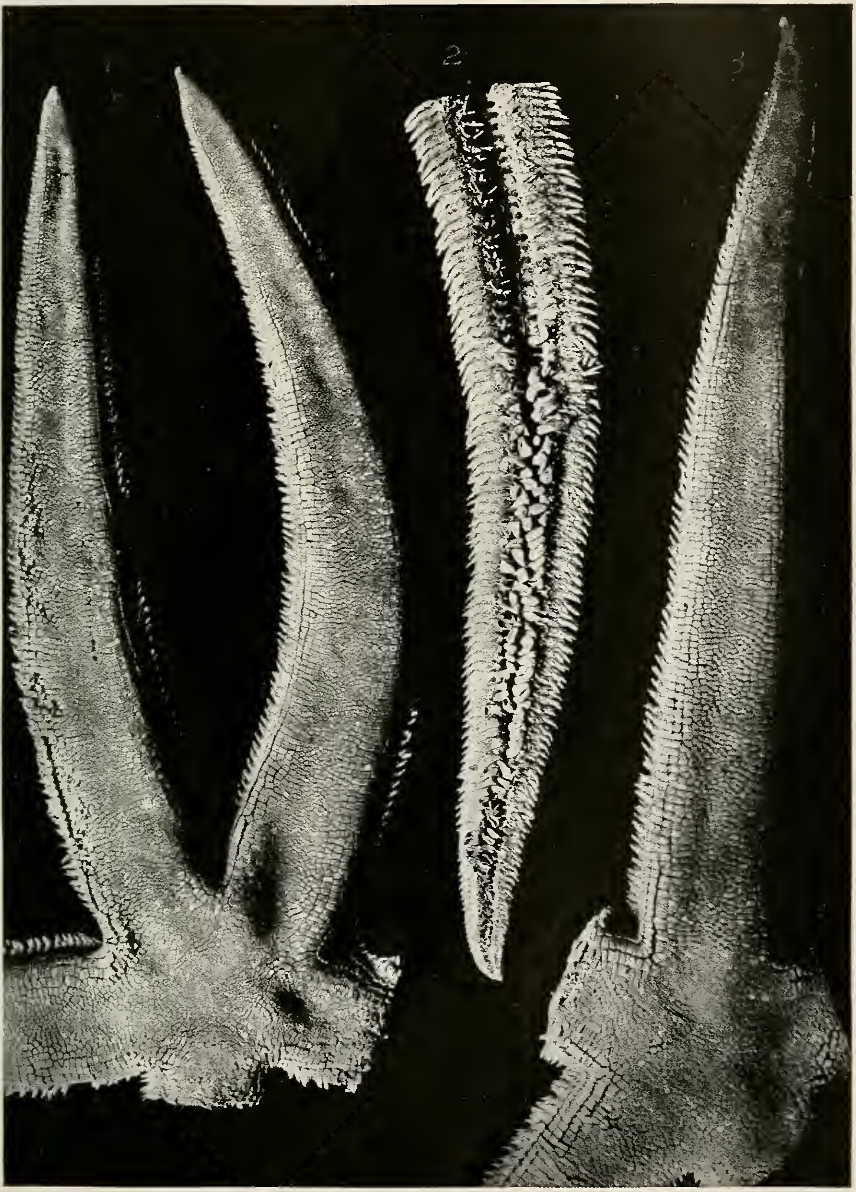
Astropecten armatus.
Dorsal View of Two Specimens.

Plate IX.

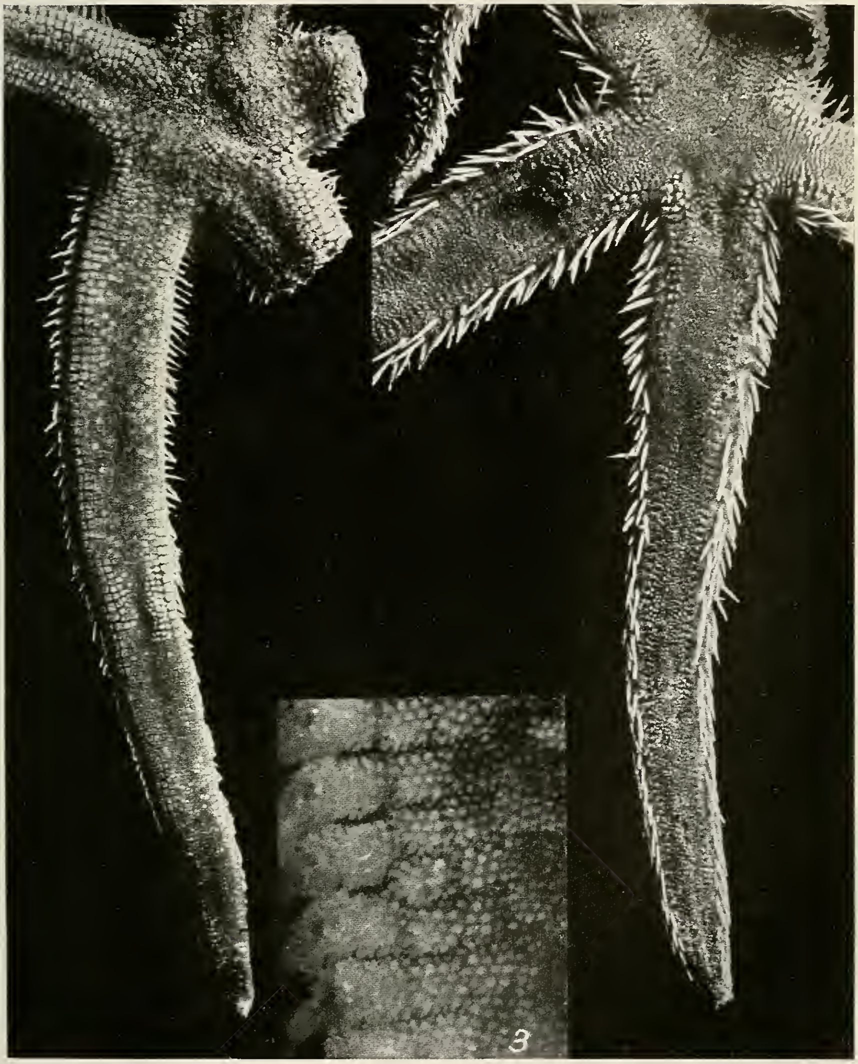


Astropecten californicus.
Dorsal and Ventral View.

PLATE X.



LUIDIA FOLIATA.
DORSAL AND VENTRAL VIEW.



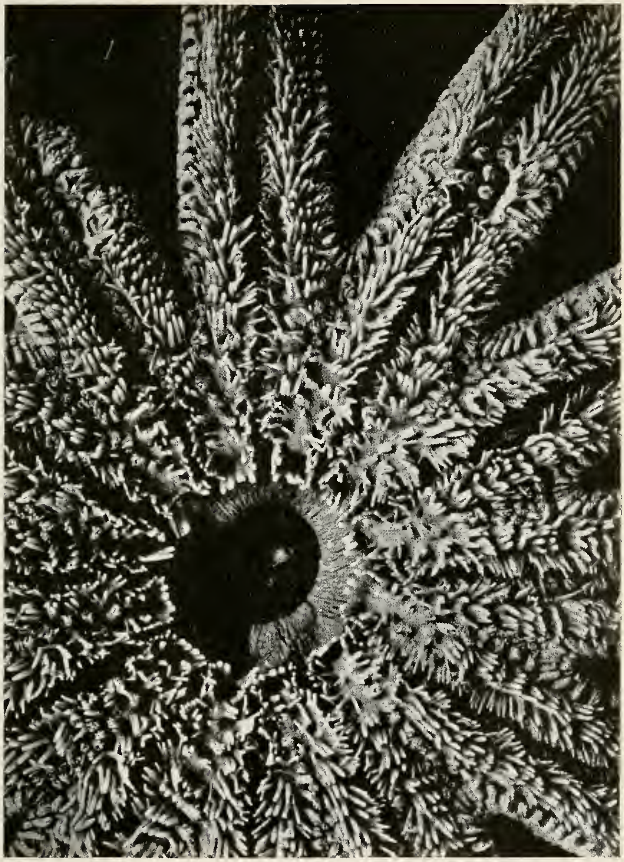
Luidia ludwigi. (Left Figure and 3)
Dorsal View.

Luidia asthenosoma. (Right Figure)
Dorsal View.

PLATE XII.

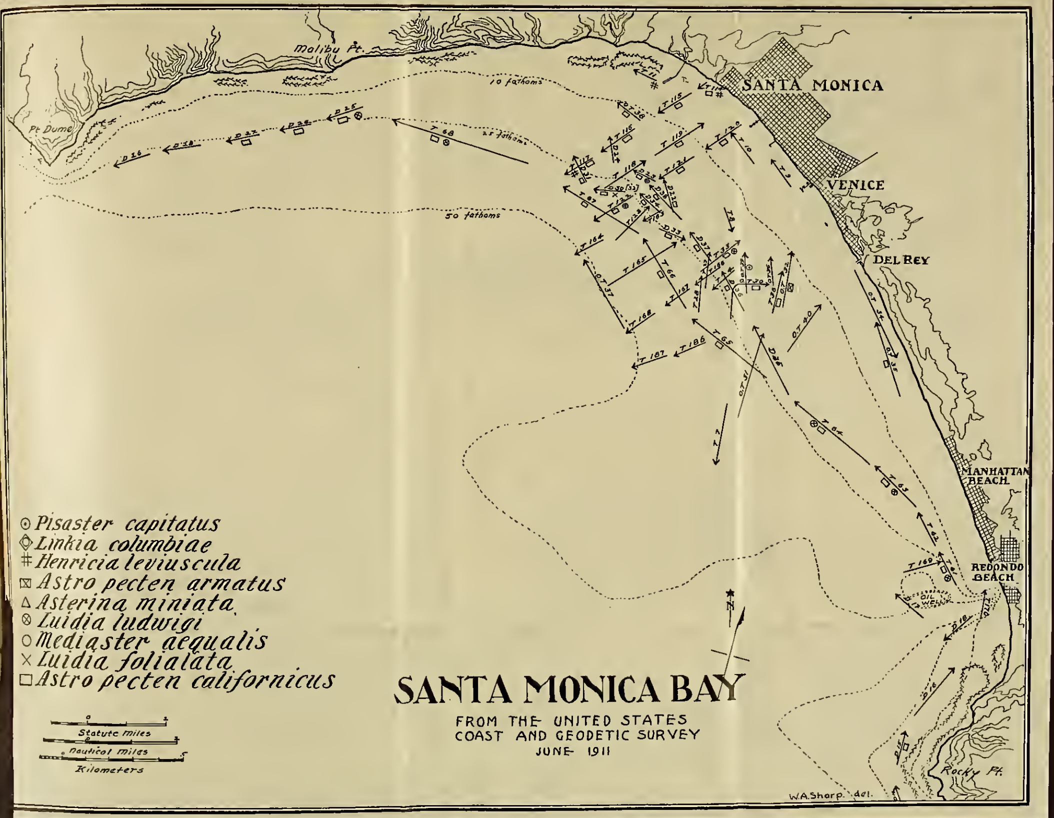
SOLASTER DAWSONI.
DORSAL VIEW.

Plate XIII.



Solaster dawsoni.
Ventral View.


LOS ANGELES HARBOR
AND VICINITY
FROM THE UNITED STATES
COAST & GEODETIC SURVEY
JUNE 1911
LONG BEACH
WILMINGTON
SAN PEDRO
San Pedro Hill
Rocky Point
Portuguese Bend
BAY CITY
SUNSET BCH
HUNTINGTON BCH.
NEWPORT
San Gabriel R.
Santa Ana R.
⊙ Pisaster capitatus
⊕ Linkia columbiae
Henricia leviuscula
⊠ Astro pecten armatus
△ Asterina miniata
⊗ Luidia ludwigi
○ Mediaster aequalis
× Luidia foliolata
□ Astro pecten californicus
Statute miles
Nautical miles
Kilometers



SANTA MONICA BAY

FROM THE UNITED STATES
COAST AND GEODETIC SURVEY
JUNE 1911

ECLIPSE SUPERSTITIONS OF THE INDIANS

By Hector Alliot

CIVILIZED man looks upon an eclipse with keen interest, but he is no longer awed by that fascinating phenomenon.

Modern science has long since made clear the causes of eclipses of the moon and sun, and the household almanac gives us the exact course of their progress as well as the very second on which they will occur and the various regions in which they will be visible to the naked eye.

In many parts of the world, however, even today, savage tribes and nomadic peoples hold to the superstitions of centuries past and regard eclipses of moon or sun with fear and awe.

To the natives of the Malay peninsula, for instance, the eclipse of the sun is one of the world's greatest recurring tragedies. According to their belief the Sun and Moon are two goddesses and the stars are their children. Once upon a time the Sun had as many children as the Moon. The inhabitants of the Earth, however, were unable to stand the insufferable light and heat from the innumerable little suns, so they incited the Sun and Moon to devour their offspring.

It seems that a long time ago, the Sun carried out her part of the bargain and the day-stars disappeared, while the Moon managed to hide her own children and they escaped.

When the Sun found out the deception that had been practiced upon her, she swore vengeance, and has been chasing the Moon through the heavens ever since. Sometimes she succeeds in coming so close to her victim that she is able to bite her. That is what we call an eclipse.

According to that very ancient myth the Sun has retained a ravenous appetite for devouring stars. Every morning upon awakening she breakfasts upon a multitude of little stars, while every evening the Moon, knowing that the Sun is asleep, brings forth her own children from the hiding caves of the sky to play in the cerulean blue fields until the morrow.

To the native Peruvians, as well as our own Algonkins, Creeks, Iroquois and Esquimaux, night is symbolized by a monster dog which devours the sun. Time has long since demonstrated that this operation is harmless since the sun rises brightly every day, but the eclipse is the extraordinary occurrence unexpected and inexplicable to the native tribes. They remember that in their most ancient myths it was said that some day the great night hound would really swallow the sun, and that the end of all things would then surely come.

In an attempt to distract the attention of the great dog and induce him to abandon his purpose, the medicine men of ancient days devised what seemed to them a most logical method of procedure. The clans were assembled upon the appearance of an eclipse, and all the little dogs among the tribe were brought forth and beaten unmercifully during its entire period. The explanation given by the Iroquois for this course was that the Big Dog who was pursuing the Moon would be arrested by the cries of his unhappy fellows and would desist from his chase, the harder they were whipped and the louder they yelped, the sooner would the eclipse pass. The purpose has always been accomplished, as we all know.

It is not impossible that this myth of the Big Dog was a belief imported from the Mongols many centuries ago. In the ancient mythology of China the dragon was the emblem of the moon, as may be seen illustrated on antique carved temple doors and royal embroideries. Its darting posture symbolized the progress of the great luminary. The conventional shape of these portrayals was probably a poetical illustration of the encircling form of the penumbra at the time of an eclipse.

Among the Chinese, tom-toms were—and are yet—beaten incessantly, guns fired, and a variety of noises made with all sorts of instruments to frighten away the Dragon that it might not devour the Sun.

Many American Indian tribes entertain the belief that when an eclipse occurs a great dragon or snake is attempting to swallow the sun. This superstition is so general that one finds it even in the Aztec literature of Mexico wherein the woman—serpent—symbol of the moon, is depicted as devouring the sun.

This is not unlike the Egyptian myth of Typhon and Osiris in which it is related that the body of Osiris was cut to pieces by Typhon. Plutarch gives us an explanation of this, a scholarly deduction from mathematical and astronomical comparisons, showing that Typhon was originally the orb of the sun and Osiris that of the moon, "mother of our flesh" as it was called in Egypt, and "mother of the world," as it was denoted in Mexico.

Since with the advent of an eclipse one or the other of the great astral bodies was consumed, with the direst results to mankind, the Toltees displayed the greatest and most genuine grief on their recurrence. In hope of arresting the combat they gathered in large numbers, discharged their arrows heavenward, and sought to attract the attention of the conflicting luminaries by the cries of animals and men. Since they were supposed to be especially concerned in the welfare of mankind, the Tarascans beat their dogs and their servants that the planets might be diverted from their struggle.

All primitive peoples have held the belief that the Moon was particularly the protector of dogs. If therefore these proteges of hers were abused until they barked noisily, she would come to their rescue and desist from her conflict with the sun. That the moon never failed to show pity for the dogs' cries was proven by the fact that within a very short time she would abandon her struggle with the sun, and the eclipse would pass. That this was a most logical conclusion is demonstrated by the fact that since man has studied eclipses, they have—in their totality—been of but a few minutes' duration. Was there ever a better proof of the efficacy of the beating of dogs at the beginning of the phenomenon?

Whether the moon is swallowed by the sun or the reverse, eclipses have been for untold centuries considered omens of impending calamity by countless numbers of inhabitants of our planet.

More cultured primitives, or such as held more advanced ideas—like the Araucanians—believed that an eclipse indicated a sickness of either the moon or sun. It was their custom, as in the case of the illness of their fellows, to make hideous noises and clamor of musical instruments, and assemble in great gatherings chanting and uttering loud cries in order to frighten the angel—or devil—of death away from their "mother of the world."

The beating of tom-toms, playing of cymbals and rattles, flogging of dogs and of slaves, was practically universal among primitive tribes of Asia and Africa, and from Canada to Patagonia. And this general practice is readily explained by the fact that these peoples, unacquainted with the causes of disease and death, were gradually led—by cunning and self-interested necromancers and shamanas—to believe in potions, charms and incantations as the sole means of salvation from those afflictions.

Among the Navaho it was the belief, which still obtains, that disease was a demon which possessed the body of the afflicted. The only successful means of ridding the victim of his presence was by wierd incantations and incessant beating of tom-toms, the health or even the life of the patient being quite a secondary consideration. If this remedy was good for human beings it was evidently equally efficient to cure the illness of the Moon, mother of us all.

The Pomos, since 1856, tell a wonderful story of how the white man cured the Moon of her sickness.

It seems that Lieutenant Whipple in his westward voyage of exploration, knowing that an eclipse would occur had brought with him a portable telescope. This instrument was of course unknown to the aborigines and they gathered in great numbers to look at it.

"What are you going to do with this new gun?" asked one of the Pomo chiefs of the officer.

"Shoot the moon, of course," was the traveller's unthinking answer.

This remark came near turning into a tragedy the harmless observation of the eclipse, for the angry savages crowded about the Lieutenant and his scant guard threatening to wreck the instrument. One of the scouts quickly sensing the meaning of the turmoil, explained to the Indians that the intention of his chief was so skillfully to shoot with his gun that the sun would be compelled to let go the moon, begging them to wait a few minutes to see the marvellous result of his chief's fine marksmanship. Instead of destroying the instrument the Pomos were awestruck at the result of their white brother's superior skill.

A most curious and unusual myth concerning the sun's eclipse was common to the tribes of Northern Yucatan, who believed that the phenomenon was due to the illness of the moon, suffering from fever and experiencing the first stages of jaundice. The women would wail and weep and the men smite themselves on the mouth. In latter days they fired off muskets, "To prove," as a sarcastic writer puts it, "that they were not strangers to the beneficent progress of civilization."

In earliest days, however, the occasion was one of gruesome and barbaric celebration. It was thought that the eclipse, once becoming permanent, the evil spirits of darkness would come and devour the inhabitants of the earth. To avert such a catastrophe a hunt was immediately instituted for white-haired and white-skinned people, and these were sacrificed amidst the din of musical instruments and noisy incantations.

In Tlaxcallan this ceremony took a different form. To soothe the ruffled spirits of the sun, angered at some misdeed of his wife, the moon, a sacrifice was made of victims of a ruddy complexion; when, however, it was the moon whose domestic happiness had been disturbed by her husband, the sun, albinos—specially kept for that purpose—were sacrificed.

Alegre and Sahagun, the famous Hispanic historians, agree that both in Sinaloa and Southern California eclipses were thought to be caused by the dust of celestial battles, and to aid the luminary in her conflict arrows were shot up into the sky to distract and confuse her adversary.

The moon has, for obvious reasons, ever been associated with the birth of children. Among our own Indians, as well as with the Aztecs and Toltecs, "Metzli" (under which name the Toltecs worshipped the moon) was the deity presiding over human destinies. It may have been because the mood-god was identical with Joaltecutli, the god of night, that the glossy black obsidian, "iztli," was dedicated to his worship. It was the custom for women with child at the time of an eclipse to place a piece of iztli in their mouths, and a crescent-shaped ornament of the same material in their girdles, lest the unborn child become a mouse, or be born without lips or nose, through the temporary anger or lack of attention of the protecting god.

There lived on this continent, however, one ancient nation which looked upon an eclipse without fear and with deep scientific interest.

Upon the monolithic monuments of Copan and Quirigua in Honduras and Guatemala, the majestic procession of the planets has been recorded for twenty centuries. From the recent discoveries of Sylvanus G. Morley, who has been able after years of research partially to decipher the intricate glyphs of the Mayas, it is scientifically proven that these ancient inhabitants of Yucatan had so perfect a knowledge of astronomy that their records compare with our most modern calculations with but a negligible fraction of variation.

The superstitions of the past, while curious and interesting, are often disturbingly similar to our own ignorance. How much more wonderful it is to find that our advanced knowledge in astronomical lore, as in other things, is but a step beyond that of the ancient, little known, and less appreciated "barbarians," who dwelt in the tropical forests of Central America many centuries ago. Long before us they possessed positive and definite astronomical and mathematical knowledge of the highest order, and this was finally recorded by them in granite, for the benefit of history and the glory of science, about the time the Christian era dawned upon Europe.

LUPINUS MOLLISIFOLIUS spec. nov.

By Anstruther Davidson, C. M., M. D.

Shrubby perennial 3-4 ft. high branching freely, stems pubescent and fistulous petioles 1-2 in. long; leaflets oblanceolate, obtuse and mucronulate, 2 in. long, softly pubescent on both sides, midrib prominent beneath; racemes rather dense 10-15 in. long, stipules linear setaceous, flowers dark blue 6-8 lines long becoming subverticillate, standard with white spot changing to red, pedicels 2 lines long; upper calyx with open notch 1 line deep, lower slightly longer, entire, bracts fugacious ovate acute two-thirds the length of the sepal at falling; keel ciliate from above the middle to near tip with a few scattered cilia on lower half; pods softly pubescent 6-8 seeded; seeds black.

Sierra Madre Los Angeles. Collected by T. Payne in sandy wash near that town. May 20, 1918. Type No. 3310. Also found at Crescenta, Los Angeles Co.

LUPINUS PAYNEI spec. nov.

By Anstruther Davidson, C. M., M. D.

An old plant of Lupinus Paynei, with seed pods.
This specimen measured 13½ feet across the crown.

Shrub 4-8 ft. high from a trunk-like base 3, 4 and sometimes 8 inches in diameter; sikly pubescent throughout; petioles 2-4 inches long, twice the length of the leaflets; stipules firm 6 lines long, linear-lanceolate; leaflets oblanceolate, rather thinly pubescent silvery on both sides, apex acute; racemes 8-15 inches long, rather dense, subverticillate, flowers very fragrant, 6-8 lines long, varying from white through lilac and lavender to purple, pedicels 3 lines long; standard with yellow spot changing to red or reddish purple; keel ciliate above the middle to near the tip- upper calyx cleft one-third of its length, lower entire, pod canescent (silvery, silky on drying) 2 inches long, 6-8 seeded; seeds varying from grey to brown with various markings.

California: Canyons of the Tapo Ranch, Santa Susana, May, 1918, Theodore Payne, No. 3305 Type in authors herbarium.

This plant has been under observation by Mr. Payne for some years. It grows on hillsides of a reddish clay with occasional outcroppings of gravel. Those with long lavender blooms are quite like a Wisteria in appearance and are altogether the most showy of all our southern lupines.

This plant has been grouped with *L. longifolius* (Wats) Abrams, from which it differs in being silvery-pubescent, having proportionally longer petioles, narrower lanceolate leaflets, longer and stronger semi-persistent stipules, yellow spotted standard, and canescent pod, the latter in *L.longifolius* is markedly hirsute or pubescent. *L.longifolius* flowers continuously throughout the season; L. Paynei flowers in spring only all blooming simultaneously.

A young plant of Lupinus Paynei in full bloom.

ADDITIONS TO THE LOCAL FLORA

By Anstruther Davidson, C.M., M.D.

Sitanion minus Smith. Telegraph Peak.
Sitanion glabrum. Smith. Baldy Lookout.
Agropyron tenerum, Vasey. N. Fork San Gabriel.
Agropyron Vaseyi S. & S. Brown's Flat.
Stipa occidentalis Thurb. North slope Baldy Mt.
Stipa Parishii Vasey. Upper San Antonio.
Bromus grandis Shear. N. Fork San Gabriel.
Bromus subvelutinus Shear. S. Antonio Canyon.
Bromus unioloides HBK. Los Angeles Streets. (Davidson.)
Agrostis Rossae Vasey. N. Fork San Antonio Canyon.
Agrostis exarata Trin. N. Fork San Antonio Canyon.
Agrostis Idahoensis Nash. Kelly's Cabin.
Agrostis alba L. City streets. (Davidson.)
Poa scabrella Thurb. Baldy Lookout.
Poa compressa L. City Streets. (Davidson.)
Avena fatua glabrescens Coss. City Streets. (Davidson.)
Muhlenbergia squarrosa Ryd. Upper San Antonio Canyon.
Pucinellia nuttalliana Hitch. Common around Hynes. (Davidson.)
Paspalum dilatatum Poir. Roadsides Whittier and Santa Ana. Common. (Davidson.)
Selaginella Watsoni Underwd. San Antonio Canyon.
Luzula comosa Meyer. Prairie Fork.
Juncus Mertensianus Bong. Kelly's cabin.
Juncus rugulosus Engel. Dry Canon.
Carex aurea celsa Bailey. San Antonio Canyon.
Carex aurea teneraeformis McKay. Kelly's Cabin.
Coralorhiza multiflora Nutt. Ontario Peak.
Limnorchis sparsifloris Wats. Camp Baldy.
Phoradendron juniperum libocedri Engl. Prairie Fork.
Arabis platysperma Gray. Ontario Peak. Mt. San Antonio.
Prunus emarginata Walp. San Antonio Canyon.
Cneordum dumosum Hook. Laguna Beach. (Miss Thecla Mohr.)
Lotus lathyroides Greene. Pasadena.
Euphorbia lathyrus L. San Antonio Canyon.
Epilobium glaberrimum Barb. San Antonio Canyon.
Gilia tenuiflora altissima Parish. San Gabriel Mts.
Gilia pungens tenuiflora Brand. San Antonio Canyon.
Monardella macrantha Gray. Barley Flats. (Grinnell.)
Phacelia californica f. Balli Macbride. Brown's Flat.
Collinsia tinctoria Hartw. Brown's Flat.
Quercus Kelloggi Newb. Prairie Flat, 6500 ft.
Helenium Bigelovii Gray. N. Fork San Antonio.
Senecio triangularis Hook. Prairie Fork.

Senecio horridus Fries. Ontario Peak.
Wyethia ovata T.&G. Pine Flats. (Grinnell.)
Chicorium intybus L. Simi Marsh. (Davidson.)
Carduus Benedicta L. 85th St. (Payne.)
Bidens frondosa L. L. A. River. (Moxeley.) Alvarado St.

The numerous additions that have been made to our local flora by the Botanical section of the Academy are mainly due to the energy of Mr. Ivan M. Johnston of Upland in thoroughly exploring the San Gabriel Mts. in his neighborhood. All the additions to which no name is attached are his records. Many plants in the list are not infrequent in the San Bernardino Mts., but have not hitherto been accredited to our mountains.

Senecio triangularis and *Arabis platysperma* natives of the Sierras are here far out of range. *Cneordium dumosum* at Laguna has extended its northern limit. Among alien immigrants *Paspalum dilatatum* is new to the state, and *Euphorbia lathyrus* and *Bidens frondosa* are new to So. California.

ADDITIONS TO THE LICHEN FLORA OF SOUTHERN CALIFORNIA

By George L. Moxley.

NOT many years ago I collected a few of the more striking Lichens and sent them with some other plants to the U. S. National Museum. I was informed that the Museum had no specialists in the Mosses or Lichens and that my specimens had been sent to certain others for determination. The Lichens were sent to Mr. G. K. Merrill, of Rockland, Maine, who, in subsequent correspondence, asked me to continue collecting for him, "particularly in such places as are outside the district represented by the Hasse list."

On Sept. 3rd, 1917, I collected three specimens in Eaton Canyon which, to my surprise, Mr. Merrill said were heretofore unreported from this region.

"*Parmelia dubia* (Wulf.) Schaer. The specimens are poor and without fruit, but the determination seems satisfactory. The name does not appear in the Hasse or Herre lists, and perforce the plant is new to California. Hasse may have enumerated it under the name of P. olivetorum, but I have never seen the thing that he called olivetorum. It (meaning my specimen) is not P. olivetorum, that is certain." I have quoted from Mr. Merrill's letter thus far. Referring to Dr. Hasse's Lichen Flora of Southern California I find that his specimen of Parmelia olivetorum (Ach.) Nyl. was determined by Dr. W. Nylander himself. Therefore it would not seem likely that the plant in question would be mistakenly determined as P. olivetorum by Dr. Hasse. Mc-Clatchie, in his Seedless Plants of Southern California mentions P. olivetorum but makes no reference to P. dubia.

Physcia obscura v. virella (Ach.) Leight. "new to your region."

Physcia caesia (Hoffm.) Nyl. "new to your region."

I hope this accidental addition to our local Lichen flora will stimulate the collection and study of this class of plants.

SOME UNDESCRIBED PLANTS FROM SOUTHERN CALIFORNIA.

By I. M. Johnston.

Lupinus elatus Johnston, sp. nov.

Perennial; plant consisting of a cluster of several erect, slender, herbaceous stems; stems striated, covered with a minute appressed silvery-silk pubescence, well branched above the middle, 6-9 dm. high; leaves silvery-sericeous, the under surface not so densely so as the upper; leaflets 5-8, narrowly oblanceolate, acute, 3-8 cm. long, 2½-8 mm. wide; petioles 1½-4 cm. long; stipules 5 mm. long, deciduous, setaceous; racemes loose, few flowered, less than a dm. long; peduncles usually shorter than the racemes; flowers rather small, verticellate or scattered; pedicels 2-3 mm. long; bracts 4 mm. long, early deciduous; calyx sericeous, gibbose, its upper lip notched, 6-7 mm. long, the lower lip nearly entire, 4-5 mm. long; corolla light blue, 8-10 mm. long; banner, wing and keel of equal length, glabrous; pods pubescent, 2-3 cm. long, 6-8 mm. wide, 2-5 seeded, obliquely sharp pointed; seeds mottled with dark brown, 3-4 mm. in diameter.

In habits and gross characters this plant is nearest to *Lupinus laxiflorus* Doug. It can be separated from that species by its pubescence, its glabrous flower-parts, its longer leaflets, its shorter pedicels and peduncles, its taller growth and by it more branching habit.

The only Southern California lupine which could be confused with *Lupinus elatus*, is *L. formosus* Greene. It is readily separated from that species by its erect and taller growth, its different pubescence and by its much larger leaves.

The type of this species, our No. 1627, was collected July 30, 1917, at 8,000 ft. alt., Upper Transition Zone, near the head of Icehouse Canon, San Antonio Mts. The type is in the authors herbarium. Cotypes are to be found in the Gray Herbarium and in the Pomona College and Stanford University herbariums.

Hosackia argophylla Gray var. **decora** Johnston, var. nov.

Stems more slender and shorter than in the species. Pubescence conspicuously less dense, softer and more appressed, in herbarium specimens distinctly silvery, never golden in color.

This variety is constant and readily recognizable and appears to have a distinct range from the typical plant. *H. argophylla,* readily recognized by its dense, almost woolly, pubescence, ranges on the dry hot interior area of San Diego and Riverside Counties. Our proposed variety grows in the chaparral and pine belts of the San Jaciento, San Bernardino and San Gabriel Mountains and may extend farther north, since, in some respects, it seems rather close to *H. argentea* Kell.

The type, our No 1278, collected July 15, 1917 in Cascade

Canon Fork of San Antonio Canon, is deposited in the Pomona College Herbarium.

Eriogonum umbellatum Torr. var. **minus** Johnston, var. nov.

A low subalpine perennial; peduncles 1-2½ cm. high, bearing simple 1-3 rayed umbels; rays 4-9 mm. long; leaf blade broadly ovate, 2-6 mm. long; petioles very short, never over 4mm. long; a dense permanent yellowish tomentum on leaves, stems and bracts.

The plant here described is an extreme and noteworthy variation of *E. umbellatum* resulting from great exposure. It is very abundant at the type station on the summit of Mt. San Antonio (Old Baldy), and is found in a somewhat larger form on the other high peaks of the San Antonio Mts. In the San Antonio Mts. it ranges throughout the Canadian Zone and is usually found on exposed ridges above 8000 ft. alt. The typical plant on the other hand is confined to the Transition Zone ranging from 6000-8000 ft. alt. and always growing in unexposed situations.

The type, our No. 1692, collected on the exact summit of Mt. San Antonio, alt. 10.080 ft., on Aug. 22, 1917, is deposited in the author's herbarium.

A FEW NOTES ON THE BOTANY OF SOUTHERN CALIFORNIA.

By I. M. Johnston.

Gymnogramme triangularis Kaulf, var. *viscosa* Eaton.—Growing with the typical form on shaded slopes in the San Joaquin Hills, back of Laguna Beach, May 4, 1918, *Johnston 1926,*

Notholaena californica Maxon.—Quite common in dry rocky ground in Temescal Canyon (between Corona and Elsinore), April 27 and May 30, 1918, *Johnston 1864, 1993.*

Potamogeton crispus L.—Very abundant in still and running water along the Santa Ana River northwest of Corona. Dec. 1, 1917, *Johnston.*

Andropogon glomeratus (Walt.) B. S. P.—In a swamp on the San Joaquin Ranch, Orange County, *Mrs. C. B. Bradshaw.*

Chaetochloa verticillata (L.) Scrib.—A roadside weed near Upland, Aug. 2, 1917, *Johnston 1639.* Identified by Mrs. Agnes Chase.

Bromus arenarius Labill.—Well established and abundant at Red Hill, a mesa near Upland, May 5, 1917, *Johnston 1211.*

Arenaria serpyllifolia L.—Well established in a lawn at Claremont, April 25, 1918, *Johnston 1978.*

Spergularia rubra, J. & C. Presl.—At roadsides and especially along the railroads at Upland, Ontario, Claremont, Pomona and La Verne. Very common and well established. *Johnston 117, 2006.*

Spergularia Clevelandii (Greene) Robin.—Dooryards and roadsides about Claremont. Very abundant on the Pomona College campus, where it grows with *S. rubra*. Easily told from that species by its white flowers and its winged seeds. *Johnston 1976*.

Fumaria officinalis L.—In orchards at Upland and Ontario, Dec. 25, 1916, *Johnston*.

Lepidium Draba L.—Well established and very annoying in the grain fields south of Chino, April 18, 1918, *Johnston 1849*.

Sisymbrium Irio L.—Well established in local areas at both Upland and Ontario. Feb. 1, 1918, *Johnston 1966*.

Conringia orientalis (L.) Dum.—A few plants in an orchard at Upland, Jan. 31, 1918, *Johnston*.

Hasseanthus variegatus (Wats) Rose var. **elongatus** (Rose) comb. nov. *H. elongatus* Rose.—Differs from the species in having elongate instead of globose corms and in having much longer stem leaves, these being 3-4 cm. long.

We have seen this form in the San Joaquin Hills (the type region) and in the San Jose, San Juan and Puente Hills; also at Lone Hill south of Glendora, at Johnson's pastures on the base of the San Antonio mountains above Claremont, and at Red Hill northeast of Upland. It is rather common at all these stations. Growing in rocky situations below 2000 ft. alt.

Lupinus longifolius (Wats.) Abrams.—This species, or at least the form placed under it by Abrams, is by no means a coastal form. Away from the coast we have collected the shrub in the San Gabriel Wash north of El Monte, at Lone Hill, near Glendora, in the Puente Hills back of Whittier, at 4500 ft. alt. in the chaparral belt of the San Antonio mountains, and at its probable inland limit, Cucamonga. Farther inland it is replaced by *L. Hallii*.

Astralagus nigrescens Nutt.—In the foothills north of Claremont, April 8, 1900, *W. R. Shaw 31*. Abundant on the grassy summit of Red Hill, a mesa northeast of Upland, April 28, 1917, *Johnston 1187*.

Hypericum formosum H. B. K. var. *Scouleri* Coulter.—Low ground, alt. 1200 ft., at Claremont, June 23, 1897, *Mary Parker*. Abundant in marshy ground, alt. 1300 ft., at Red Hill, northeast of Upland, July 22, 1917, *Johnston 1732*.

Elatine californica Gray.—Quite common in the mud on the shore of the lake in Laguna Canon, San Joaquin Hills, Orange County, May 4, 1918, *Johnston*.

Viola lobata Benth.—Moist shaded slopes in the Upper Chaparral Belt of the San Antonio mountains. Fern Fork, San Dimas Canon and Charcoal Fork, Cucamonga Canon, July 1, 1917, and May 20, 1917, *Johnston 1759, 1303*.

Opuntia basilaris Engelm. var. *ramosa* Parish.—Scattered colonies of this plant are found in the San Antonio Canon Wash, at about 1200 ft. alt., between the towns of Upland and Claremont. Identified by Dr. J. N. Rose.

Tamarix gallica L.—In low ground this is often found as an escape. Chino, Gardena, Murrieta, Riverside, Temescal Canon and Wilmington.

Fraxinus coriacea Wats.—Several trees on the Santa Ana River bottom at a point northwest of Corona, Dec. 1, 1917, *Johnston 1804*.

Amsinckia Douglasiana DC. var. **Eastwoodae** (Macbride) comb. nov. *A. Eastwoodae* Macbride.—Differs from the species chiefly in its much larger corolla and in its intense orange color. It appears to be usually less branched and to have a softer pubescence.

In the plant as we know it, the limb of the corolla averages between 7 and 9 mm. in diameter and the tube ranges between 12 and 15 mm. in length. The color of this form is so intensely orange that in comparison with it the flowers of typical *A. Douglasiana* have a faded, greenish-yellow appearance. At all the stations at which we know the plant it is found growing with *A. Douglasiana*, but in all cases it remains distinct and by its color easily recognizable, even from a distance.

In our district the plant has been collected in the foothill above Claremont, at Red Hill northeast of Upland, and at several stations in the vicinity of Corona. *Crawford 1001, Johnston 1175, 1836, 1872.*

Amsinckia parviflora Heller.—Lone Hill near Glendora, Claremont, near Upland and Corona. Common at all these stations and in all cases growing with *A. Douglasiana*. *Johnston 1834, 1835, 1870.*

Linaria vulgaris Mill.—Established along the railroad tracks near Upland, August, 1916, *Johnston*.

PEARL FISHERIES OF TENNESSEE*

By W. E. Myer, Carthage, Tenn.

THAT you may more fully appreciate Tennessee pearls and the fascination of the pearl fishery in this State allow me to call your attention to the fact that fine, perfect, Tennessee pearls are worth more than the highest grade diamonds of same size. The chance of finding a pearl worth anywhere from one hundred dollars to two thousand dollars in the very next mussel opened draws men to the river and holds them there, even after weeks of poor success, or even absolute failure. I knew one farmer who went to the river to water his horse at noon, and, while the horse was drinking, idly picked up a mussel lying in easy reach. He opened the mussel and found a pearl for which I paid him $190.00. This started him to putting in all his spare time. For a year he worked at pearling whenever his farm work would permit and never found another pearl of any value. This, of course, is an exceptional case and is given only to show how the eternal hope of good luck abides in man's breast.

In these later days the pearlers find it is safer and more businesslike to work in partnership with four or five others. This body of, say, five men put all their findings together and divide the proceeds equally. By saving and selling both the shells and pearls they are reasonably sure of making some two dollars each per day, if they work not less than two weeks at it.

Cumberland and Clinch Pearls.

While all the rivers in the State produce more or less pearls, the Cumberland and Clinch are amongst the great pearl-producing waters of the world. I say "are," but, unless some sane restraint be speedily thrown around the heedless total working out and total destruction of every mussel in each mussel bed and leaving no living mussels to reproduce the race, we are going soon to have to say "were." Already the production has fallen off to nothing in many formerly rich pearling grounds, because no mussels were left to reproduce.

The reason so few Tennessee people know much about these beautiful gems from their own rivers is because the great majority of the pearls are sent direct to New York for sale, as New York is the great pearl market of the United States.

The Beauty of Pearls from Our Clear Streams.

The beauty, and therefore value, of a pearl is greatly increased by being produced by mussels in clear water. For this reason the pearls from the clear streams of our Tennessee Highlands are famous for their beauty and value.

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* By the kind permission of the Tennessee Academy of Sciences, these extracts are reprinted from Volume Two of its Transactions, January 1, 1914 to May 5, 1917.

The waters of each section of the United States contain different elements in solution. These elements give a different appearanc to the pearls from those sections. Pearls from our clear, pure, highland streams are a beautiful white; those from Wisconsin, whose waters have a slight impregnation of copper, are a beautiful green, those from red, sandy streams being rusty-reddish, or sometimes a beautiful bronze. An expert can look at an unknown pearl and tell from what section it came.

History of Pearl Industry in Tennessee.

Pearls had been found now and then in our rivers since the white men first came here. No one appeared to realize their value or possibilities. Nothing was done to develop the industry until about 1876. About this year a fisherman on Caney Fork River, near Lancaster, found a magnificent pearl which, after going from one less posted man to another a little better posted, and so on through several hands, is said to have brought in New York about $2,000.00, and was probably worth, from the best descriptions I have been able to get of it, not less than $10,000.00. This set the people to looking for pearls and soon hundreds were making good money in the then unworked mussel beds of that section.

At the beginning of the pearl industry no one dreamed the shells had any value. But later there came to this country a big, tall, raw-boned, bespectacled German named Boeple. He, with German thoroughness, made a personal investigation of many of our pearl rivers. On the Cumberland he did not content himself with beginning where pearls were then being found. Neither did he content himself with beginning at the head of navigation as the most determined Americans would have done. Dressed in a uniform of serviceable khaki, at a time when khaki was unknown in this country, he started from up in the feud country of the Pine Mountains of Kentucky, where the Cumberland was about the size of a large spring branch. He walked down it to the falls in Whitley Country; there built a rough plank canoe and continued down to the mouth of the Cumberland near Paducah, something near a thousand-mile exploration trip. Boeple came to see me at Carthage. He told me that he had found eighty different species of mussels in Cumberland River, and that there was a fortune in working up the shells in pearl buttons. He urged me to go in with him and start a button factory. No! Not I! I was too smart to be drawn into the iridescent meshes of a dreamer! He went on to Muscatine, Iowa. Finally, finding he could get no one to go in with him and furnish the needed capital he began making buttons out of mussel shells in a little tumbledown shanty in Muscatine. They laughed at him but watched him. Boeple failed because of lack of money. One of the shrewd business men of Muscatine saw the possibilities and established a factory that made him a fortune. Soon prosperous factories sprang up in many places. Boeple remained poor. But, when he died, Iowa erected a splendid monument in his memory.

The Origin of the Pearl.

The cause or origin of the pearl is always a question of great interest. The great majority of pearls has been caused, either by some irritating substance like a grain of sand getting imbedded in the mussel and becoming a source of irritation, or by the egg of a small parasite, which preys upon mussels, becoming a source of irritation. In either case, nature gives the mussel the automatic power to secrete this smooth pearly substance around the irritating object and thus reduce the trouble. The vast majority of pearls is caused by the egg of the parasite.

Japanese Culture Pearls.

The Japanese learned this secret of the origin of the pearl many hundreds of years ago. They have ingeniously taken advantage of it to cause the formation of immense quantities of "culture pearls," as they are called. They insert into the shell of the pearl oyster small, half-round, smooth objects and fasten them to the shell with cement. In the course of five or six years these are so coated with pearl as to have all the outward appearance of genuine pearl. Only an expert can detect the difference.

Pearls have been found and admired and worn by savage man in every age and every part of the world where mollusks are found.

The World's Greatest Find of Pearls.

De Soto, in his celebrated and ill-fated march through Georgia, gave the Indians a very creditable imitation of what Sherman's later march through Georgia was to be. You know what Sherman called war. It is said that the Indians entertained for De Soto the same tender affection that the later Georgians entertain for Sherman.

Be that as it may, or as it most likely was, De Soto found in one of the temple houses of a Georgia Indian town the enormous quantity of two bushels of pearls. Never before or since in the history of the world has such enormous booty been found. The value of this booty must have amounted, at present prices, to hundreds of millions of dollars. To relieve the Indians of the care and worry of this enormous treasure, he kindly took it with him. He also very considerately opened many of the graves of their great men and took the gems buried there. This is probably the pot calling the kettle black, as the speaker has done a great deal of this same grave work, as you will see later on. De Soto was never able to get his pearls to market. As the trials of De Soto's men increased, they threw away all useless impedimenta. Then De Soto, hoping to get a better spirit into his men, divided this immense pearl booty and gave to each his share, which was about one pint. This was enough to make each man rich, if he could only get them home; but, as their troubles increased, they gradually threw away their pearls.

Pearls from Castalian Springs Mound.

Several beautiful pearls were taken by me from the grave of an Indian in a great burial mound at Castalian Springs, Tennessee. These pearls were fitted around the edge of a beautiful sacred gorget, which he wore suspended from his neck. Imagine this beautiful, engraved shell gorget, with its rich roseate pink edge studded with these lustrous pearls. This pearl-studded gorget is probably the finest article or adornment ever taken from the grave of a mound builder.

I spent two summers exploring this old mound-builder town at Castalian Springs. Its story is very interesting. No scientist ever had the good fortune to discover and explore more interesting remains of the unknown past, situated in one of the most beautiful sections of the South, inhabited by such splendidly hospitable people.

The Imperial Pearl Set of Empress Eugenie.

I have in my possession one of the most beautiful specimens of artistic pearl jewelry human ingenuity has ever produced. It is the Imperial Pearl Set of Empress Eugenie. It contains over one thousand oriental pearls. Its value is about $20,000.00. The mounting and arrangement of these pearls required all the time of one man for over three months. This historic pearl set of the Empress Eugenie is the property of my brother, Mr. Herman Myer, of New York City.

Another quaint pearl set, which I have, in its old and worn case, has a history in which is interwoven some of the brightest and some of the saddest things of the last hundred years. Eugenie, whose mother was a citizen of the United Staes and whose father was a blue-blooded grandee of old Spain, married the Emperor Napoleon III. It was one of the few royal marriages for love. Great pressure was brought on Napoleon not to marry her, but to marry a woman of a reigning house who could help him politically. Napoleon, to his credit, told them he preferred love to increase in power. This pearl set, consisting of tiara, brooch, ear drops, necklace and bracelets, was one of the emperor's gifts to his wife. At the fall of the empire, in 1870, it was part of the jewelry the unfortunate empress was able to bring away. She gave it to one of her loyal friends, who, at the risk of his own life, helped her to escape to England.

REPORT OF THE SECRETARY

SINCE the last report of the Secretary was rendered to this Academy, the attention of our members has been so called to the great visitation of sorrow imposed upon the whole civilized world, and the demands upon us for a strenuous and material support for the warfare now being waged on behalf of humanity and righteousnes, that we have been compelled, in a measure, to forego some of the activities appertaining to the more peaceful avocations of our responsibilities.

Our Directors, however, have carefully conserved the stability of the Academy and, though at times embarrassed by the disturbed condition of public affairs, they have conducted our proceedings in such a manner that all have felt that though our ship of intellectual progress may have been buffeted by the storms of timidity and disquiet, it is safely anchored in a harbor of peace and safety.

This may be evidenced by the statement that, by successive elections, they have been retained as our executive officers, there having been but one change. Nearly a year ago, Mr. Thomas L. O'Brien devoted himself to the service of our Country and now he is in France, a soldier of the Engineer Corps of the United States Army. At our last annual meeting, Mr. Mars F. Baumgardt was elected to the position in which Mr. O'Brien had theretofore so ably officiated.

Our meetings have been attractive, not only to our members but to the public who have always been cordialy welcomed, and the discourses which have been delivered were not only educational and instructive but eminently popular and interesting. As showing the broad field of discussion embraced, I give their subjects, to-wit:

The Economic Results of Explosions in Agriculture.

The Volcanos of Aetna and Vesuvius and their Environments:

The Illumination of the Panama-Pacific International Exposition:

The Collecting of Butterflies.

Visual Education in Museums.

The Hawaiian Kingdom and the Islands of the South Pacific.

The Early Days of California and the Misions.

The Historic Background of the Great War.

One of our meetings was devoted to the social amenities and the banquet table, at which, with pleasing descriptions, were exhibited upon the screen photographs of flowers, plants, mountains, valleys, water falls, cañons and lakes in California, Oregon, Wyoming, Arizona, the Yellowstone Park and the Grand

Cañon of the Colorado, taken by the Lamere process in their natural colors.

A Special Meeting of the Academy was held on April 13, 1918, at Exposition Park, at which Mr. William A. Spalding, in front of the Museum, planted a California Live-Oak tree, and erected at its base a tablet of stone and bronze bearing the date and institution of the tree by our Academy of Sciences.

The Report of the Treasurer, which has been approved by the Board of Directors, shows that we have publicly manifested our loyalty to the Country by a generous subscription to the Liberty Loan; that safe investments have been made of the Beeman and Bulletin endowment funds; that all curent expenses have been paid and that we commence this new Academic year with a balance to our credit in the Treasury.

Holdridge O. Collins, *Secretary.*

Rejoyce Collins Edwards

Los Angeles, California

July 12, 1918

I have a kind soul that would give you thanks,
And knows not how to do it but with tears.

TREASURER'S REPORT, FISCAL YEAR ENDING JUNE 1st, 1918

Balance in Bank, June 1st, 1917		$ 176.69
Receipts—		
Dues from Members		277.50
Interest from Loans		700.02
		$1,154.21
Disbursements—		
Bulletin Account	$ 238.32	
Lecture Account	141.03	
Office Expenses	140.30	
Sundries	24.70	
Purchase of Bonds, Mortgage Guarantee Co.	200.00	
Purchase of Stock, Fidelity Savings & Loan Asso.	200.00	
Purchase of Liberty Bonds	150.00	
	$1,094.35	
Balance in First National Bank	59.86	
	$1,154.21	
Interest Bearing Investments—		
Mortgage Guarantee Co., Bonds @ 5½%	$ 5,200.00	
Fidelity Savings & Loan Asso., Stock @ 6%	3,300.00	
Liberty Loan, Bonds @ 4¼%	2,650.00	
	$11,150.00	

S. J. Keese,
Treasurer.

We the undersigned, a Committee appointed to audit the accounts of the Treasurer of the Southern California Academy of Sciences, report that we have examined the books, vouchers and accounts of said Treasurer and we find that the funds of the Bulletin and Beeman Endowments have been invested in interest drawing securities; that all the financial obligations of said Academy have been paid and that there is a balance on hand of $59.86 from the current income.

Holdridge O. Collins,
Geo. W. Parsons,
Committee.

Directors' Meeting

A regularly called meeting of the Directors was held in the Academy office on Saturday, February 16, 1918. Present, Messrs. Beeman, Benton, Collins, Keese, Parsons and Spalding.

President Benton presented for consideration an Agreement, dated January 7, 1918, between the Southern California Academy of Sciences and others, and the County of Los Angeles, modifying and supplementing the Agreement dated February 7, 1910, between the same parties.

The said supplementary Contract provides that the Board of Governors, created by the said Agreement of February 7, 1910, shall have the care, control, management and improvement of the Brea Beds, donated by Mr. G. Allen Hancock, and the property donated by General Harrison Gray Otis, for a period of fifty years, but subject however to the supervision and approval of the Board of Supervisors of Los Angeles County.

The unanimous consent of the Directors was voted to the terms of said supplementary Contract, and the same was ratified and confirmed, and the President and Secretary were authorized to execute the same on behalf of this Corporation.

Board adjourned.

Academy Meeting

One of the most interesting assemblies of this Academy during the many years last past, was convened on Friday, March 29, 1918, in the Friday Morning Club House.

The Honorable Grant Jackson, Judge of the Superior Court, a Native Son of the Golden West, presented to us a most graphic and valuable history of the early days of California and the trials and hardships of the American immigrants which have placed this great State in the front rank of those of our Nation, the most prosperous, most advanced in intellectual pursuits and scientific attainments.

His discourse was illustrated by a large collection of views, showing the Mission structures, their patron saints, the early pueblas and presidios and the valleys and mountains of our coast environment.

Special Meeting of the Academy

Saturday, April 13, 1918, was celebrated as Arbor Day, at Exposition Park, Los Angeles, by patriotic exercises and tree-planting in commemoration of various public bodies and organizations that have identified themselves with the development of the Park.

A formal notice of this event was transmitted to our members and a generous attendance responded.

At the north end of the sunken quadrangle and immediately fronting the Museum building our ex-President, William A. Spalding, with the assistance of Directors Samuel J. Keese and George W. Parsons, planted a California live oak tree, and erected at its side a tablet in stone and bronze, with a legend of the date and its institution by this Academy of Sciences, and Mr. Spalding delivered to the assembly a most interesting historical address relating to the activities of this Academy.

Academy Meeting

The Annual Meeting of the Academy was held Tuesday evening, May 28, 1918, in the Auditorium of the Friday Morning Club House.

The following named gentlemen were unanimously elected Directors for the ensuing year, to-wit:

Hector Alliot
Mars F. Baumgardt
George H. Beeman
Holdridge O. Collins
Anstruther Davidson
Samuel J. Keese
George W. Parsons
William A. Spalding
Albert B. Ulrey
William L. Watts

The discourse for the evening was given by Mr. Bernhard R. Baumgardt to a large and intensely interested audience. His topic was "The Historic Background of the Great War," in which he related the inherent fundamental principles of savagery which controlled the deeds of the conquering Goths, Vandals, the Huns and other tribes which swarmed from the fens and gloomy forests of ancient Germany, and the Atavism of their descendants of the present day.

Directors' Meeting

The Directors elected for the Academic year of 1918-1919 held a legally called meeting on Friday, May 31, 1918, in the office of the Academy, at which all were present except Messrs. Beeman, Ulrey and Watts.

In calling the meeting to order Mr. Benton expressed his great appreciation for the cordial support he had received from the Directors during the five years he had held the office of President and he declined a re-election. A hearty vote of thanks was tendered him for his faithful and very effective services during his incumbency as President.

The election of officers resulted as follows, viz.:

President—Hector Alliot
First Vice-President—Mars F. Baumgardt
Second Vice-President—Anstruther Davidson
Third Vice-President—Arthur B. Benton
Treasurer—Samuel J. Keese
Secretary—Holdridge O. Collins

The Treasurer made a verbal statement of the financial condition of the Academy and asked for an Auditing Committee to examine his accounts. Messrs. Collins and Parsons were appointed such committee with instructions to report at the next meeting of the Directors.

Miss Theckla T. Mohr, George H. Grinnell and Dr. F. C. Clark were elected members of the Academy.

The President appointed the following Committees, viz.:

COMMITTEE ON PUBLICATION

Holdridge Ozro Collins, LL.D., Chairman
Anstruther Davidson, C. M., M. D.
Samuel J. Keese

COMMITTEE ON FINANCES

Samuel J. Keese, Chairman
Arthur B. Benton
George H. Beeman

COMMITTEE ON PROGRAM

William A. Spalding, Chairman
George W. Parsons
Mars F. Baumgardt

The following named gentlemen are respectively the Chairmen and Secretaries of the Sections, viz.:

ASTRONOMICAL SECTION

Mars F. Baumgardt, Chairman; Samuel J. Keese, Secretary

BIOLOGICAL SECTION

Albert B. Ulrey, Chairman; C. H. Phinney, Secretary

BOTANICAL SECTION

Dr. Anstruther Davidson, Chairman; Theodore Payne, Secretary

ZOOLOGICAL SECTION

Dr. F. C. Clark, Chairman; Raymond D. Jewett, Secretary

GEOLOGICAL SECTION

William L. Watts, Chairman; George W. Parsons, Secretary

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*Directors' Meeting

A Meeting of the Directors was held on Thursday, August 1, 1918, in the Office of the Academy at which all were present, except Benton, Spalding, Ulrey and Watts.

The Committee appointed to audit the Annual Report of the Treasurer, reported as follows, viz:

We, the undersigned, a Committee appointed to audit the accounts of the Treasurer of the Southern California Academy of Sciences, report that we have examined the books, vouchers, and accounts of said Treasurer and we find that the funds of the Bulletin and Beeman Endowments have been invested in interest-drawing securities; that all the financial obligations of said Academy have been paid and that there is a balance on hand of $59.86 from the current income.

Holdridge O. Collins,
Geo. W. Parsons,
Committee.

The Report of said Committee was approved, ratified and confirmed and the Committee discharged.

There was an earnest discussion relating to the activities of the Sections of the Academy, resulting in the unanimous adoption of the following Resolution, to-wit:

Resolved, The Board of Directors recommend that Sections of the Academy meet at least six times a year; preferably once a month, when possible and desirable;

Further, That cost of membership in said Sections to all not members of the Academy be one dollar per year, including subscription to Bulletin and free admission to one or more Sections of the Academy.

Dr. Ralph Benton was elected to membership.

Board adjourned.

Holdridge O. Collins,
Secretary.

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*The unusual volume of matter in this number of the Bulletin has delayed its going to press and impeded its issue upon the usual date.

The earnest desire of the Directors to increase the usefulness of the Sections, by extending encouragement and all possible aid for their prosperity and success in their good work, induced the action at the last meeting of the Board, and the record of the proceedings of that meeting is included herein for the information of all who may desire to become associated with the work of Sections, although not members of the Academy.

Botanical Section

The sessions of the Botanical Section have been held monthly since the opening of the season in September. The meetings have been well attended, and have been devoted to examination of specimens collected during the summer and to informal discussion thereon.

We have thus been enabled to add a creditable number of species new to science and have recorded a comparatively large number of species new to our immediate neighborhood. These additions may be found detailed in the pages of the Bulletin.

Theodore Payne, Secretary.

BULLETIN

OF THE

SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

LOS ANGELES

JANUARY, 1919

HECTOR ALLIOT

Gone to the Great Unknown

Los Angeles, California

February 15, 1919

The Moving Finger writes; and having writ,
Moves on; nor all your Piety nor Wit
Shall lure it back to cancel half a line,
Nor all your Tears wash out a Word of it.

HOLDRIDGE O. COLLINS,
Secretary

HECTOR ALLIOT, Sc. D.

PRESIDENT 1918-1919

BULLETIN

OF THE

Southern California Academy of Sciences

LOS ANGELES

JANUARY, 1919

Volume XVIII, Part 1.

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Office of the Academy, Room 719 San Fernando Building
Telephone 65741

Southern California Academy of Sciences

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MARS F. BAUMGARDT .... First Vice-President
ANSTRUTHER DAVIDSON .... Second Vice-President
ARTHUR B. BENTON .... Third Vice-President
SAMUEL J. KEESE .... Treasurer
HOLDRIDGE O. COLLINS .... Secretary

George H. Beeman — George W. Parsons
Albert B. Ulrey — William A. Spalding
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Committee on Finance

Samuel J. Keese — Arthur B. Benton — George H. Beeman

Committee on Program

William A. Spalding — George W. Parsons — Mars F. Baumgardt

Sections of the Academy

Astronomical Section

Mars F. Baumgardt, Chairman — Samuel J. Keese, Secretary

Geological Section

William L. Watts, Chairman — George W. Parsons, Secretary

Biological Section

Prof. Albert B. Ulrey, Chairman — C. H. Phinney, Secretary

Zoological Section

Dr. F. C. Clark, Chairman — Raymond D. Jewett, Secretary

Botanical Section

Anstruther Davidson, Chairman — Theodore Payne, Secretary

EDITORIAL

SIR ISAAC NEWTON'S discovery of the Attraction of Gravitation was the inevitable Evolution of his research in centripetal forces, and the then opaque subject of the motions of the Moon connected with the tides of the ocean.

In 1687 he published his *Philosophia Naturalis Principia Mathematica* and for years thereafter scientists generally, and astronomers in particular, combatted each other with acrimonions discussions pro and contra the forces of attraction, until Newton's dicta was proved scientifically orthodox in the catholic assent to the Procrustean law of the revolution of the planets in our system; for were this attraction annihilated, not only our Sun, which undoubtedly is traveling in an inconceivably immense orbit around some huge central body, but all our planets and their satellites would fly off at a tangent and travel through all eternity in a straight path, like that wonderful Sun, Groombridge, 1830, rushing *a-muck* through space at the rate of 200 miles each second.

Johann Kepler's Law of Gravitation—"Every particle of matter in the universe attracts every other particle with a force varying directly as the masses, and inversely as the square of their distances"; and the first of what are known as Kepler's Three Laws—"Every planet moves in an elliptical orbit, in one of the foci of which the Sun is situated," are the imperishable enactments which control in all investigations of that most ancient, most wonderful and most entrancing branch of the Sciences, Astronomy; and that universal genius, Shakespeare, enlists under the banner of Kepler when he says

"But the strong base and building of my love
Is the very center of the Earth
Drawing all things to it."

Allied with Astronomy are the two co-ordinate branches, Seismology and Atmospheric Phenomena, to whose study have resulted the erection by nearly all our great universities and astronomical observatories of the most elaborate and delicate seismic annunciators, and by our Government at Washington, the establishment of the Weather Bureau, which has been of incalculable benefit to our country

Students of Seismology have announced that, eliminating from consideration the contraction of our earth in its cooling process, the great factor for producing earthquakes, is the powerful and united attraction of the planets when in conjunction or opposition with the earth

On December 22, 1892, and before he became President of this Academy of Sciences, Mr. William A. Spalding, in a lecture before The Teachers' Institute at Los Angeles, predicted that in 1906, the equinox of Saturn would be almost exactly superimposed upon that of Jupiter, and the other planets Mars, the Earth, Venus and Mercury dropping into line and their disturbing influences being united, if there were anything in the belief that their united forces of attraction were of a measurable estimate, terrestrial convulsions would occur, or, as he put it, "Then, if there is anything in this system, look out for something to pop."

None of us in Californa have forgotten how terribly that announcement was verified

About the first of September, 1910, Professor Simon Sarasola, President of the Colegio De Belen, at Havana, Cuba, who, during many years, had studied the atmospheric phenomena of the Gulf of Mexico, sent a communication to the Weather Bureau at Washington, announcing that on, or about September 8 of that year, a tornado of unusual violence would sweep the Atlantic Coast from Mexico to South Carolina, and we remember the loss of lives, of vessels and the total destruction of the city of Galveston by the cataclysm on that date

Mr. Spalding and Professor Sarasola have favored us with most interesting papers upon these subjects, which have been published in our Bulletins, and others have, from time to time, entered into these fields of investigation, some from an abstract position, others in a more concrete manner, confining their efforts to an individual or single line of study.

Of the latter class is Mr. W. T. Foster of Washington, D. C., who has been an investigator in Astronomy, Astro-physics and Meterology. For many years he has regularly published a Bulletin upon "Weatherology," as he calls it, which is devoted more partcularly for the benefit of the agriculturists, with prognostications as to weather conditions and advice as to what should be sown and planted for a successful harvest. His predictions generally have been astonishingly verified, and acceding to our request, he prepared for us the article which we have the pleasure of presenting to the attention of our readers in this Bulletin.

By the death of Theodore Roosevelt, Science has lost from her ranks a Paladin, a strenuous champion for the investigation of many paradoxical and enigmatical problems in Biology which had been an element of acrimonious controversy, many of which received from him an accepted interpretation.

As an explorer, he discovered and placed upon the World's maps, mountains, valleys and rivers heretofore unknown, and in the more restricted field of Zoology, he gave new interest to old and young by his relations of the habits and customs of the wild life of man and beast in their heterogeneous acclimatization.

His battles against the conscienceless trapper and hunter, have prevented the extermination of the milder denizens of the field and forest and the rare and beautiful bird-life which is such a joy to us in the episodes of our existence.

But first, and infinitely in advance of the leading of all others in this world, he was the perfect and practical model for us in the inculcation of justice, honor and purity in our children and implanting in them that zeal for devout patriotism and invincible love of country which were the predominent and adamantine principles of his being.

He outranked all in that class of grand Exemplars who make their own abilities the sole measure of what is fit.

As the profound Academician, the successful Rancher, the Legislator and Champion for uprightness in political contests, the Leader who demanded honest citizenship from those who fled to us from foreign oppression, the Police Commissioner, the valiant Soldier, the Governor and the President who gave his country an assertive dignity, prestige, influence and might such as it never before had occupied, he finds no peer in the history of the past.

His genius, like the nobility of Washington, will gleam a beacon of honor, hope and safety through all the ages.

"He was a man, take him for all in all,
I shall not look upon his like again."

The danger of contagion and the visitation of sorrow with which this city has been afflicted during the last six months by reason of the dreadful epidemic so generally prevailing, induced our municipal authorities to impose a prohibition of all public assemblies, and neither this Academy nor any one of its Sections has been in session since the last annual meeting, until January.

Our first monthly assembly of the Academy session for this season was held on the third of this month, and a large and attentive audience listened to a most eloquent and instructive address by Mr. B. R. Baumgardt.

At the close of the meeting the auditors were presented with an exhibition by Mr. Mars F. Baumgardt, the accomplished Chairman of our Astronomical section which undoubtedly is unique in the entire history of scientific discovery and practical demonstration.

He had prepared a chart, upon a graduated and exact scale, of the winter sky as seen by us, and each of the constellations, with all its predominant suns was shown in all its beauty.

The river Eridanus with its streams of stars, near which

"Stands great Orion, who so kens not him in cloudless night
Gleaming aloft, shall cast his eyes in vain
To find a brighter sign in all the heaven."

Glowing with the brilliance of eternal fires are seen the great suns Bellatrix and Betelgeuse in his shoulders, beautiful Regel in his foot, Saiph in his knee, the little group of stars in his head, the three bright stars in his belt and the downward hanging row in his sword, in the center of which is that great nebula. With his upraised club and his shield of lion's skin that sparkles with a curved row of little stars, he awaits the attack of the angry Taurus, with blazing Aldebaran in the Hyades of his head, its curving horns each tipped with a brilliant sun and the silvery twinkling of the Pleiades in the shoulder.

Canis major, Canis minor, Castor and Pallux appear in all their glorious brilliancy.

All the great suns and the multitudes of smaller stars, which are indicated in their nomenclature by Greek letters, were shown upon the chart by an application of radium, and when the lights were turned off and Stygian darkness prevailed in the auditorium, the details of this chart shone with brilliancy of the flashing diamond.

In October last, Mr. Baumgardt had prepared a lecture upon Radium, the history of its discovery and production, with a practical demonstration of its properties, which was intended for the Astronimical Section, but, owing to the orders forbidding public assemblies, it had to be deferred. It is probable that notice will be given in a near future of a meeting of the Astronomical Section, at which all members of this Academy will be welcomed.

Holdridge Ozro Collins.

ANTHROPOGENY.

By Hector Alliot, *Sc. D.*

OF the many scientific branches into which the study of Man has been divided, Anthropogeny, dealing especially with inquiries into the origin and development of the human species, holds for us a very particular interest.

While we have, for many years, known a great deal about shells, plants, reptiles and giant mammals of prehistoric times, we have—until almost yesterday—had little or no knowledge concerning our own race.

Sixty-five years ago no evidence whatsover could have been offered which would enable us to fix the approximate date of Man's appearance on this planet, or of the beginning of his slow, but ever progressive achievement.

If we look at modern man and compare him with his earliest known prototype, we find but very insignificant physical changes, chief of these being the fact that his bones are smaller and of lighter structure. The real difference—the only important one—is indicated by the measurement of his skull, which is generally associated with brain development. The progress from the extremely primitive mind of the earliest known human type has gradually and laboriously advanced from the use of a stone implement of warfare, hunt and industry, to the present highly developed electrical age; this is demonstrated entirely by the measurement of skulls.

That this method is logical and efficient is confirmed by its application to modern types; a cultivated, highly civilized specimen has a cranial measurement greatly in excess of that of a savage bushman. The skull of the modern thinking man gives an average of 90 to 76, that of the bronze age man from 74 to 70, the Neanderthal man 70 to 57, and the Trinil man—the most primitive of all known ancient members of our family records only 52.

From our own generation back to the iron, bronze and copper ages—some 25,000 years—so many skulls and other human remains have been found, studied, compared and classified that no doubt now exists as to the complete and well determined sequence of human progress for two hundred fifty centuries. The marvelous fact remains from that survey that for a period—so long that we have difficulty in grasping its duration except by some comparison like that of one foot in length to a distance of almost five miles—we progressed intellectually only some eighteen per cent as general average, and with none other than very superficial changes in our bony structure.

In other words our ancestor, the Stone age man, was quite as intelligent as we are but applied that intelligence in different direction than we do today. The demands of his time called for the best woodcraft, finer knowledge in the domestic arts and in those of the chase and combat.

Invasions, conquests and introductions of new industries have profoundly affected Man, in historical times; future studies will clarify much of the complicated influences of the cultures to which they gave birth and which have grown side by side and often overlapped one another.

Anthropogeny just now is still a very incomplete mosaic, many of the parts of which, however, are clearly cut and definite. Until such time as the prehistory of Asia and of Africa has received the serious consideration of students it deserves, it will not be possible to progress much beyond present knowledge.

Outside of the epoch-making discovery of the Trinil man in Java, the anthropogenist has been obliged to limit his researches to the field of Western Europe.

It is self evident that most of the discoveries of the past, as well as those of the future, must be largely accidental.

The further back research is extended, the rarer the dependable specimens become, owing to great changes that have destroyed or buried deeply the osseous remains of primitive men. The increasing certainty that our race was very sparingly represented on the whole surface of the globe, until recent centuries, is another feature which must greatly retard future inquiry, beyond the present knowledge of our invasion of Europe from Asia and our cultural advancement in that region of the earth.

For the last ten thousand years or so, Europe seems to have been inhabited by four dominant races: the Mediterranean long heads, of dark hair and complexion, with brown eyes, the Alpine broad heads with dark hair and grey or blue eyes, the Teutonic long heads with fair skin, blonde hair and blue eyes, with the Cro-Magnon race as a background.

While much comparative material has been secured and examined, the relations of these races with one another and the influence of reaction upon one another have not yet been established in a definite scientific manner. The survey of the whole period furnishes the evidence, soon to be confirmed, that from the east, northeast and south, alternating invasions brought new peoples and their cultures, at that time.

The area of these invasions covered modern Europe and the coast of northern Africa. The anatomical study of the considerable skeletal material discovered, shows no evidence of negroid affinity (except in two Grimaldi skeletons), and indicates the dominance of races of, or related to, the Caucasian stock.

From this point, anthropogeny treads more certain ground, because the evidence is clearly defined. The copper and bronze age, while merging into the stone age, offers no uncertain demarcations, ethno-geography, geology, archaeology and paleontology assist and confirm the evidence from different scientific points of view.

The Cro-Magnon seems to be the oldest race of historical times, the other existing now being comparatively recent modifications of ancient human types, not yet established.

Beyond them, the Brunn race, once important, has disappeared, centuries before the Neanderthal, Piltdown, Heidelberg and the Trinil held sway in turn, but long since have also been obliterated by causes that have not yet been determined. It may be that the stock ran out, that epidemics, wars or climatic changes may have had the same destructive influences upon primitive man as we see now at work before our very eyes.

Superficial study of Australia and Polynesia, will show the fast progressing disappearance of native races, which were numerous and strong a hundred years ago. The more rapid elimination of typical aboriginal culture, however, is to be observed in the brief period of the last fifty years from the Atlantic to the Pacific Coast of the United States.

Excepting in the case of the Navajos, which is unique, our whole Indian population is decreasing and in many cases certain tribes have absolutely disappeared. It is but logical to assume that the same conditions prevailed in the misty past of prehistory.

The two features common to all the prehistoric races are their stature and their brain capacity. The average height of modern man is five feet, seven inches. While the Cro-Magnon reached, in many cases, five feet ten, and six feet, all his primitive ancestors were of about the same height as our own, ranging from five feet three inches to five feet ten inches. In brain capacity we find the dominant feature. Man's bony structure has gradually become much lighter and less ponderous, the lower jaw has very materially changed in size and weight; the skull capacity has been affected by the muscular changes associated with that metamorphosis, producing a brain capacity of 1400 to 1500 C.C.M. in modern man which rapidly recedes to 1350 for the Brunn race, 1250 for the Neanderthal, 1000 for the Trinil.

Such a very brief survey of the subject as this, does not permit dwelling on the progress of culture adn its aesthetic phases, like the so-called Magdalenian and Aurignacian cultures of the Cro-Magnon races, which were the fore-runners of our graphic and plastic arts in the Reindeer period. We desire, at this time, to limit ourselves to a survey of modern knowledge of the more essential human skeletal evidence, places and dates of discovery.

In 1891, a skeleton was discovered at Brunn, Morovia, deeply embedded along with bones of the woolly mammoth. It was first described by Makowsky, who himself had discovered in the same neighborhood, a fragmentary skull known under the name of Brunn II. Interest which this find created, at the time, established the similarity of form with another skullcap, discovered in 1871, in the course of coal mining at Brux, Bohemia, which was in the collection of the Royal Museum of Vienna.

Since then a burial place has been discovered at Predmost, Moravia, from which fragments of over fourteen skeletons have been gathered. The chief distinction of the skulls is that they are extremely elongated, the forehead quite modern and the contours of the face more harmonious than in the preceding races: the artifects discovered in the burial places indicate also an advanced knowledge of bone and stone implements; an idol carved out of ivory, found at Predmost, suggests a well developed religious sense.

THE CRO-MAGNONS.

Through the anthropological ignorance of the Mayor of Aurignac, in the Pyrennees, a precious collection of some seventeen skeletons was lost to science in 1852, when they were discovered in a limestone cave by a laborer, but the archaelogist Lartet, who was able to study only the stone implements that were left, was fortunate enough to discover in the grotto of Cro-Magnon, near Les Eyzies, which has since become historical in scientific importance, five skeletons, which have been recognized as the type of the great Cro-Magnon race.

The skull is not harmonious in proportion, being large and very distinctly long, the face quite broad in relation to its height, the brain capacity large, the forehead convex, the bones of the limbs robust, the stature far above the average, showing altogether a high type of the Homo Sapiens.

The data collected concerning this interesting race, are very definite, as nearly fifty skeletons have been found from 1823 to 1909, in various localities and classed as belonging to the Cro-Magnons; the range of the habitat of that race has also been established thereby: it covers a vast field in southwestern Europe, extending from a populous center in the Dordogne region of France extending as far north as western Wales, south to Santander, Spain, east to Italy, northeast to Austria and Syria.

Whether the much discussed so-called Grimaldi and Aurignacian are subspecies of the Cro-Magnon or distinct races is still being studied and may be determined later; their exact location in the series is, however, of secondary importance in the greater divisions of human races.

NEANDERTHAL RACES.

The preservation of the remains of more recent races was largely due to the fact that their representatives dwelt in caves and rock shelters. With the Neanderthal we find practically the last of the prehistoric humans who practised ceremonial burials and laid out their dead in the floor of their protected caverns.

The first Nenderthal discovered, was found in a quarry on the north face of the rock of Gibraltar in 1842 and is now in the Museum of the Royal College of Surgeons, in London.

The type skull, however, was found in the Feldhofner grotto in the valley of Neanderthal, near Dusseldorf in 1856. Since then a number of fragments, especially of lower jaws, have been identified from Gibraltar to Belgium, through western France, Germany, Croatia, Austria, Hungary, from 1848 to 1911, showing a very large distribution.

For the first time a very marked difference from all the preceding races is clearly established. The stature is low, the supraorbital ridges are prominent, the lower jaw is massive as well as the teeth, the forehead receding, the cranial profile inferior to that of the lowest existing modern races, the skull narrow and long.

THE PILTDOWN MAN.

By the merest accident C. Dawson, in the autumn of 1911, chanced to pick up a piece of unusually thick human parietal bone in a gravel pit which was being dug out for road making near Piltdown, England. Realizing that his find was possibly of importance, he enlisted the co-operation of Professor Arthur Smith Woodward, eminent paleontologist, with the result that systematic search made the following year brought to light other parts of the skull of the "dawn-man", constituting the most important and significant discovery in the whole of man's history.

The association together of an eminent geologist like Dawson and a paleontologist like Woodward enabled science to acquire the first geologic records which determined the age of Eonanthropus—the "dawn-man", so called because of his limited intellectual development.

That first known inhabitant of the Sussex valley on the banks of the river Ouse, was of the normal size of any of us today; his limbs were more powerful than ours and he had a much heavier bony structure. He had a thick neck, very large jaw, protruding lips, broad, flat nose, beetling brow and a receding forehead; a man of powerful physique and of very primitive intelligence.

He used a natural cavern for his home, protecting his young from depredation by rolling a huge stone to close the entrance against the intrusions of the giant cave bear, the striped hyena, and the great common enemy—the savage sabre-tooth tiger.

Armed with the most primitive of stone lances rudely fashioned from a piece of flint, and the clumsiest of stone axes, he sallied forth to give battle to the many enemies of his race, or hunt the stag and bison upon which he fed. It is difficult to imagine greater physical valor than that possessed by these man-beasts, whose minds were but little developed beyond mere animal instincts. But what marvelous instinct they displayed, and what courage, else they must have perished off the earth!

We all bow in reverence before the devotion and self sacrifice of modern motherhood, but the student of anthropology is overwhelmed with admiration of the deeds of the Piltdown's mate, the mother of a large brood, who for ten—twenty years—daily, hourly struggled for the survival of her growing family. By the side of Eonanthropus, —but often alone,—against almost insurmountable odds of hunger, physical dangers, and the appalling dread of attack by giant beasts of prey at all times, the first woman defended her off-spring and preserved the race.

THE HEIDELBERG RACE.

In 1907 was discovered a human jaw in a sand pit at Mauer, near Heidelberg, at the depth of 79 feet from the upper surface of a high bluff in river sands which had yielded many specimens of ancient mammals.

This is the earliest specimen of human skeleton recorded in Europe and the most unique lower jaw ever before found.

It had drifted down from a great distance, yet fortunately for science, it had retained the teeth which, though primitive, are essentially human, as well as the lower jaw, which is of greater massiveness than that of the Neanderthal type, and lacks any chin formation. When other discoveries are made to confirm the indications offered by the Heidelberg jaw, it will be demonstrated that the Mauer sands type was of extreme primitiveness and one of the earliest progenitors of our race.

THE TRINIL RACE.

By far the most sensational anthropological discovery was made by Eugen Dubois, a Dutch army surgeon, on the Bangawan River of Central Java in 1891. A portion of the skull, two teeth and a thigh bone (later supplemented with a molar by the Selenska expedition of 1907-1908) were discovered near Trinil.

These remains, incomplete though they are, unique as they remain, constitute specimen of the earliest known race of men. In fact Pithecanthropus, as has been called the Trinil man, sets back the appearance of our race to the Pleistocene age, as evidenced by the specimens of fauna discovered about his remains and confirmed also by geology.

While the scant material found by Dubois is of priceless importance, it may be soon confirmed by some new discovery which will establish the Trinil race on a more definite base. Meanwhile, Pithecanthropus, the last known link in the chain of our ancestry, remains the fertile ground of speculation of scientific and psychic research in attempting to decide whether the being discovered in Java was really a man or a creature just below, and a progenitor of our own race.

Theory is not exact science, and with the lack of more definite information one must pause on the misty shores of the past and patiently wait for more scientific enlightenment.

What seems definitely acquired is that human mind, art and industry dawned upon the world with the first stages of the Pleistocene or ice age of the quaternary, and laboriously but steadily moved onward for four hundred and fifty centuries, toward the conquest of the stone, copper, bronze and iron idustries leading to the rise of present world civilization.

From the average geological calculations, that triumphal march has lasted 450,000 years, the last 25,000 representing our more rapid intellectual advance from the Cro-Magnon and Brunn cultures of the stone age to the present.

A NEW PLANT RECORD FOR CALIFORNIA

By Roxana Stinchfield Ferris

AS far as I am able to discover *Holacantha emoryi* has not been listed from a California locality. It was my good fortune to collect this curious shrub in a sandy wash on the highway, between Needles and Barstow, eight miles from Ludlow in San Bernardino county, where it was associated with *Cassia armata*. The characteristic arborescent habit was not evident in the shrubs here, due presumably to the fact that the low, interlaced branches served as a windbrake to catch the sand and to pile it in mounds in much the same fashion as the branches of the mesquite tree.

The type locally of *Holacantha* is on the desert between the Gila river and Tuscon. It is not rare in this region and in adjacent Mexico, though it is never locally abundant. The natural habitat appears to be shallow arroyos and drainage areas near the low desert hills. I have also collected it on the Harquahala plains between Hassayampa river and Parker in the northern part of Yuma county, Arizona.

SOME CALIFORNIA LIGHTNING

By Charles Maclay Booth.

ABOUT fourteen years ago when the writer first came to California he was told that one of the charms of the country was that it never rained in summer and that the thunder storms of the East were unknown in Los Angeles.

It was an interesting but not vital bit of information for neither rain nor thunder showers in summer had previously been considered other than natural.

This meterological information was received, let us say, in June and was found to be entirely accurate until the middle of August. On that day a cloud rose above Mt. Wilson piling its masses across the sky and there descended a cloudburst with most terrific lightning and thunder.

Pasadena Avenue north of Sycamore Grove rapidly became a roaring river and the Pacific Electric tracks at the foot of the hill were covered a couple of feet deep with gravel and boulders.

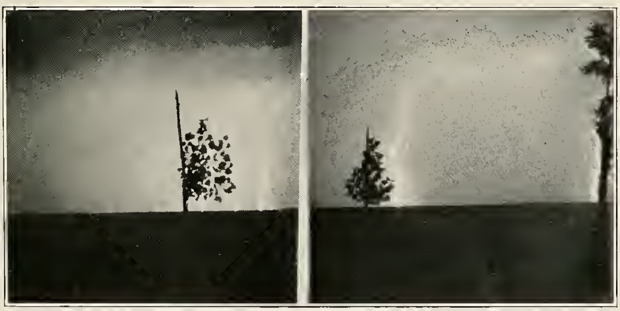
There went another perfectly good California weather rule. However as applied to that part of the State west of the Sierra Madra ranges, the rule has since been found to be good and the storm mentioned was "unusual weather".

On the so-called desert, east of the mountains, summer showers and thunder storms are of not infrequent occurrence and while the precipitation is sometimes a cloudburst it generally is a light shower that scarcely moistens the surface of the ground. The electrical features of these storms usually leave nothing to be desired for brilliancy, but often the thunder is faint. With the clear air and far horizon, a storm ten or twenty miles away looks very close and the distance is realized only from the long interval between the flash and the thunder.

These remarks are based on my personal observations and apply to the country adjacent to the Mojave river.

It has been noticed that the center of the storms generally follows the low hills either west or east of the river, the rain which falls in the river valley coming from the edge of the storm. Most of the rainfall comes from the southeast.

In this connection it may be said that the west and southwest wind storms of this region seem to accompany foggy or rainy weather on the coast.



The accompanying pictures were made with a small hand camera during a distant storm on June 30, 1918. The display lasted for several hours and though the lightning was brilliant over a full quarter of the horizon from W.S.W. to N.N.W., the center seemed to remain slightly north of west of the observation point which was twelve miles north of Victorville.

The flashes were almost incessant and at last after a series of unusually brilliant ones the camera was brought out and set with open shutter pointing as nearly as possible toward the heart of the storm. It was a busy few minutes closing the shutter and winding the film and one can not be certain that the double flashes shown were simultaneous but at least the interval must be measured in fractions of seconds for the effort was made to close the shutter with the flash.

The small trees shown in the various pictures indicate how little the center of the storm moved,—at least in a northerly or southerly direction.

Several times before the camera was brought out and during the intervals of resetting, flashes were seen having a complete loop in their line and it was with deep regret that the camera was put away with all the films exposed and no record of the looped lightning. However when the roll was developed, the plate marked No. 1 showed a looped flash which had been caught by the camera and not by the eye.

Of all the thunder storms and pictures of lightning which the writer has seen this storm was the first to show the loops and the record of the camera confirms the impression of the eye. The great regret is that though several such flashes were witnessed only one was recorded.

The remaining pictures while not unique are at least accurate records of a most remarkable electrical display. Plates Nos. 2 and 3 show in the horizontal flashes lines closely approximating loops formed by the branching and uniting of the main flash but an examination of Plate No. 1 shows the loop in the direct line of discharge and as much a part of the flash as a loop in a rope.

The above half-tone is from a photograph taken by Mr. Samuel J. Keese on June 30, 1918, when the most pronounced electrical storm during the last twenty years, was raging in this vicinity.

The view is from Valencia and Sixth Streets, facing the East, in the City of Los Angeles. —EDITOR.

CONTRIBUTIONS ON SOUTHERN CALIFORNIA BOTANY

By I. M. Johnston

Carex globosa Bott, Proc. Linn. Soc. 1:259 (1845).

Very abundant on the moist shaded side of Fern Canon just north of Brown's Fats, alt. 4000-4500 ft., Upper Chaparral Belt, San Antonio Mts. *Johnston 2132*. Determination verified by Mr. K. K. Mackenzie. We have also noted the plant at the Charcoal Camp, alt. 4500 ft., in Cucamonga Canon. Immature specimens in the Pomona College herbarium collected by Professor Crawford (No. 725) on Sept. 1, 1916 in the "mountains north of Claremont" are also referable here. All these stations are on the south slope of the San Antonio Mts.

Smilacina sessilifolia Nutt; Wats. Proc. Amer. Acad. 14:245 (1879).

A large dense pure colony in marshy ground at Red Hill east of Upland, alt. 1300 ft., Upper Sonoran Zone, July 4, 1918, *Johnston.*

This species and *Hypericum formosum,* with which it grows, are strangely out of place in this valley marsh. Their presence can not be accounted for by the supposition that the seeds have washed down from these mountains, while the Smilacina is known only from their far side. It is a curious fact that the only known cismontane station for the two rare Lower Sonoran desert species, *Cladium mariscus* and *Muhlenbergia repens,* is the same small marsh. A strange mingling of boreal and austral elements.

Cakile americana Nutt., Gen. 2:62 (1918).

A single plant found growing in the sand at Abalone Point, near Laguna Beach, July 28, 1916, *Crawford.*

Sedum spathulifolium Hook, Fl. Bor. Amer. 1:227 (1834).

The following stations have been noted in the San Antonio Mts., where it is found trailing over mossy cliffs in shaded canons in the Upper Chaparral Belt.

1, Near Weber's Camp, alt. 3000 ft., Coldwater Fk. of Cattle Canon; 2, Day Canon, 3500 ft.; 3, Fern Canon Fk. of San Dimas Canon, 4000 ft; 4, "Lytle Creek near falls, *Abrams.*"

All the plants seen by me have very pale yellow or white petals, but they do not seem to be otherwise different from the typical flowered northern plant. Due, perhaps, to their pale color Dr. J. N. Rose refered our Day Canon specimens (No. 1644) to *S. californicum* Britt; but, like all the other collections, they agree very poorly with the original description of that species.

Lupinus elatus Johnston, Bull. So. Cal. Acad. 17:63 (1918).

This species has been collected by Mr. F. Grinnel on Mt. Islip, San Gabriel Mts., where he reports it to be very common; also recently found by the writer (No. 2063) on the south spur of Cucamonga Pk., San Antonio Mts., where it grew with *L. formosus* in the Upper Transition Zone, alt. 6500 ft.

The following errors have been detected in the original description: The measurements of the calyx lobes were reversed, the upper lip is 4-5 mm. long (not 6-7 mm.) while the lower lip is 6-7 mm. (not 4-5 mm.). The floral bracts average 8mm. in length, not 4mm. as given.

Astragalus trichopodus Gray, Proc. Amer. Acad. 6:218 (1865).

Frequent on the low grassy hillsides from Carbon Canon, in the hills south of Pomona, thru the Puente Hills to Turnbull Canon, which is north of Whittier. Most abundant in the upper part of Brea Canon. *Munz 2095, Johnston 1964.* Determination by Professor M. E. Jones.

Angelica tomentosa Wats., Proc. Amer. Acad. 11:141 (1876).

Abundant in scattered sations in the San Antonio Mts. In the Upper Chaparral Belt in the San Dimas Canon Watershed in the vicinity of Brown's Fats, alt. 4000-5000 ft. and in the Cucamonga Canon Watershed in West Fork and about Charcoal Camp, alt. 3000-4750 ft. A very small colony was noted on the canon floor of Cow Canon, alt. 3000 ft., Lower Chaparral Belt. The species is usually found in moist open places in the chaparral, not infrequently with Pteris. *Johnston 2106, 2141.*

Monardella **saxicola** Johnston, sp. nov.

Perennial from a suffrutescent base; stems erect, 1½-3½ dm. high, stiffly branching from near the base, covered with a retrorse pubescence; leaves elliptical to broadly lanceolate, obtusish, with slightly revolute margins; blades 1½-4 cm. long, narrowed to a petiole seldom over 5mm. long; under surface of leaves very pale, densely puberulent, abundantly minutely punctate, with 2 or 3 pairs of lateral veins evident; upper surface of leaves light green, only sparsely pubescent, midrib and laterals faintly descernable; heads 1½-2½ cm. wide; floral bracts strongly veined, membraneous, ovate to ovate-lanceolate, 6-12 mm. long, acute to short acuminate, villous; calyx 9 mm. long, villous on ribs and sparsely punctate in the intercostal spaces; calyx teeth subulate, 1-1½ mm. long, densely villous on the inner surface; corolla lavender, the pubescent tube surpassing the calyx by at least 1 mm., lobes 3-4 mm. long; stamens pubescent only at bases, very unequal, the upper about equalling the upper corolla lip, the lower ones exceeding the lower corrolla lip by 2 or 3 mm.

Relationship: Nearest to *M. hypoleuca* Gray which it closely approaches in habit of growth and in its similarly shaped, revolute margined, bicolored leaves. In the character of the pubescence, however, the plants are conspiciously different. *M. hypoleuca* has tomentose stems and has a very dense tomentum on the under surface of the leaves which completely hides the venation. The color of the upper surface is deeper green and the veins are more impressed than in *M. saxicola*. The flower heads seems slightly smaller and the flowers much paler in color.

Certain robust specimens of *M. epilobioides stricta* Abrams, from the north side of the San Antonio Mts. resemble *M. saxicola* slightly, in the shape of the lowest leaves and their punctuation. These plants, however, are very different as they lack bicolored, conspicuously nerved leaves and have smaller heads, narrower floral bracts, taller and more slender stems and have their leaves reduced in size as they grow upward along the stem.

Type: Near Brown's Flats, Upper Sonoran Zone, alt. 5000 ft., San Anonio Mts., *Johnston 2133*, Sept. 1, 1918. Type in Pomona College herbarium. Cotype material in Stanford University and University of California herbaria.

Distribution and habitat: Locally abundant in exposed rocky ground in the Upper Chaparral Belt along the south slope of the San Antonio Mts. The following are the only places where the plant has been seen by me: South slope of Cucamonga Peak, alt. 4500-6500 ft; along the Sunset Trail near Brown's Flats, alt. 4500-5400 ft.; A single plant in Evey Canon in the Lower Chapparral Belt, alt. 250 ft. (*Johnston 1440, 2050* both belong to this species.).

V *Monardella lanceolata* Gray, var. **glandulifera** Johnston, var. nov.

Stems pubescent, upper parts covered with numerous stalked glands, $1\frac{1}{2}$-$3\frac{1}{2}$ dm. high, much branched above the middle; leaf blades lanceolate to oblong-lanceolate, 1-$2\frac{1}{2}$ cm. long, dark green; heads 5-12 mm. wide, on short glandular pedicels; floral bracts ovate to oblong-ovate, 4-6 mm. long, sparingly glandular, minutely scabrous; calyx 6-7 mm. long, very sparsely glandular and pubescent, teeth triangular-subulate; corolla (in dried specimens) very dark purple, lobes 3-5 mm. long.

Relationship: In the size of the heads this plant is similar to *M. lanceolata microcephala* Gray. It does not have, however, the sinuses of the calyces naked nor is the inflorescence strongly spreading and open. I feel that the small size can be attributed to ecological causes. The stalked glands which covers the plant distinguishes it at once from all other species of the genus as found in Southern California.

Type: Brown's Flats, Upper Sonoran Zone (?), alt. 4300 ft., San Antonio Mts. *Johnston 2139*, Sept. 1, 1918. Type in Pomona College herbarium. Cotype in Stanford University and University of California herbaria.

Distribution and habitat: Known from Brown's Flats where it grows very abundantly on a small, grassy, pine cover flat in the Upper Chaparral Belt. The zonal position of Brown's Flats is uncertain as there are some reasons for considering it a Transition Zone "island" in the chaparral.

Corethrogyne filaginifolia (H. & A.) Nutt. var. **pinetorum** Johnston, var. nov.

Stems slender, usually less than 6 dm. high; tomentum present only on the bases of the stems and on about the lowest ten leaves; stems, excepting the basal decimeter, and the leaves, excepting the lowest, densely covered with stipitate glands; heads about 8 mm. high (usually less than ten to a stem and not infrequently solitary), born on long divaricate branches of a raceme or simple corymbose-panicle.

Relationship: Nearest to var. *bernardina* (Abrams) Hall, from which it differs in having most of the stem and leaves, as well as the inflorescence, permanently and from the beginning densely stipitate-glandular. In *bernardina* the stems and inflorescence, with the exception only of the pedicels and involucres, are heavily tomentose. In age this tomentum may be partially deciduous but in such cases the exposed portions of the stem or leaf is smooth and shining, not glandular. In *pinetorum* the inflorescence is fewer flowered and the stems average somewhat lower in height. Type: Brown's Flats, Upper Sonoran Zone (??) alt. 4300 ft., San Antonio Mts., *Johnston 2137*, Sept. 1, 1918. Type in Pomona College herbarium. Cotype in Stanford University herbarium.

Distribution and habitat: Frequent in dry rocky ground in the Lower Transition Zone, alt. 4300-650 ft., of the San Antonio Mts. (Here also belongs *Johnston 1644*).

WANTED

Copies of Volumes III, IV, V, VI of the Bulletins to complete files. Address the Secretary.

WEATHEROLOGY

By W. T. Foster, Washington, D. C.

WASHINGTON, Jefferson, Franklin, Adams and other scientists of their time believed that we may know of future weather by its past and therefore, on their recommendations, many academic and other educational institutions made careful records of temperatures, rainfall and other weather events. About 1840 the Smithsonian Institution gave that idea a great impetus and under its management a large number of new weather records were started in various American localities and the older records, made at numerous places were collected and preserved by binding. In 1871 the U. S. Weather Bureau was organized and it continued and extended the weather records recommended by our early American scientists. As a result we now have a number of good records, including every day for more than one hundred years and a large number covering less time.

Those records are potentially of immense value and only by their use may we know future weather more than a week in advance. In all weather investigations the hypotheses, or theories, as to the causes of weather changes in America must be compared with and tested by these records. When a system for forecasting weather events is formulated those old and new records must be used and the forecasts mathematically worked out from their numbers.

To solve this most difficult and most important problem has been the larger part of the writer's life work. About half time was given to it from December, 1875, to August, 1890, and since the latter date whole time, with no other business. In March, 1903, the writer came to Washington in order better to secure and use the weather records, old and new, now on deposit in the U. S. Welather Bureau, and the astronomical records of the solar system, open to all investigators at the U. S. Naval Observatory. Besides the work of this investigator he has paid out more than $20,000 for records and experiments.

The hypothesis used, now advanced by the writer to a theory and the Golden Rule of Planetary Weatherology is stated thus: "Similar relative positions of Sun, Moon, Earth and major planets cause similar weather."

Perfect weather forecasts never have been, never will be made. Some, who have pretended to investigate the writer's crop-weather forecasts formulated rules of verification requiring perfect forecasts. Tested by such rules all forecasts must fail. Prof. H. H. Clayton, meteorologist of Blue Hill, Mass., meteorological observatory near Boston, wrote a complete set of rules for testing crop-weather forecasts in 1904, and these rules were included in the Bard Bill, No. 5277, introduced in the Senate March 26, 1904, and referred to the Committee on Agriculture. The bill offered compensation to anyone who would work out, for the Government's use, a practical, useful system of forecasting crop-weather. Officials of the U. S. Weather Bureau opposed the bill and it was thot best not to call it up. Senator Bard was, at that time, representing California in the U. S. Senate.

Evidently the real test of long range, or crop-weather forecasts is in determining whether the forces are better than guessing. The Clayton rules required the forecaster to say whether the average of consecutive three-day temperatures will be above, about or below normal, and whether they will rise, fall, or be stationary. A rise or fall of not more than two degrees is not considered a change. In 1905 Prof. Clayton tested a forecast for St. Paul, Minn., made by the writer, to cover three months. The Clayton rules were used for that verification, the forecasts proved to be 70 per cent good, 30 per cent bad, and were published. Important improvements have been made since. The forecasts were in possession of Prof. Clayton two months in advance. The Clayton rules for testing rainfall forecasts are similar to the rules for temperatures.

In December, 1916, the writer predicted an extensive drouth to occur during crop season of 1917 to cover the country south of the Missouri river and between the lower Mississippi river and the crest of the Rockies. In midsummer of 1917 he advised to sow Winter wheat that Fall, or Spring grain early in 1918; that early maturing crops of 1918 would be best; to avoid planting corn and cotton for 1918, in the predicted drouth sections. Early in 1918 he predicted a severe drouth to begin about June 15, 1918, in about same country over which the 1917 drouth extended—the 1918 drouth to continue thru the crop season of 1918. These forecasts were 90 per cent good. Approximately correct forecasts of most of the severe storms of 1917-18 were published one to six months' in advance. These forecasts are published every week in many newspapers and magazines, having a circulation of about 1,500,000 copies.

The theories upon which Planetary Weatherology is based are that the members of the solar system, thru electro-magnetism, affect each other; that these effects vary as magnets having orbital revolutions and axial rotations; their effects also vary as to whether the planetary effects are reckoned from heliocentric or geocentric positions. Normal temperatures and precipitation constitute the base lines for weather forecasts. I call these normals the Sun lines. They are caused by the Sun as it progresses north from March 21 to September 22, and South from September 22 to March 21. Beginning with Jan. 1, the daily temperatures for 40 or more years are added and their sums divided by the number of years. The results give the normal temperature line for every day. Precipitation normals are similarly obtained.

These being the base lines, which I call the Sun lines, the records, covering from 60 to 100 years, are compared with these normals and new records are thus produced, showing the days of the month on which the temperatures and precipitation were above or below normal, those above normal being written in red ink and those below in black. Temperature and precipitation records are made separately.

All experiments and forecasts are mathematically worked out from these daily plus and minus records by comparing the positions of the Moon and planets with the records, taking out of the records at least seven periods of 30 days each, when these solar system bodies occupied similar positions. Relative to the Earth, Venus is in similar position every eight years, Mars about 15 years, Jupiter near 12 years, Saturn 29½ years, Uranus and Neptune a little more than one year each.

The Moon and Mercury are passive, negative, or neutral. The forces of the planets come to Earth thru the Moon and pass to Sun thru Mercury. Very seldom more than half the planets are in electro-magnetic touch with the earth on any one date, and therefore two to four of the positive planets, including Earth, connected with the Moon are sufficient to give good forecasts.

Each of the planets and the Moon in relation to each other have two strong and two weak positions. The form of force, acting between, is electro-magnetism, the purpose of which is to condense and carry matter to the central body, the Sun being the ultimate reservoir. Force is matter in motion and the force we are dealing with in Weatherology is attenuated matter from outer space moving inward to planets and Sun, building them. They are all growing bodies. These facts can be demonstrated by using the weather records. Precipitation results from these operations.

The solar system is a very great and complicated piece of machinery and above statements give only an outline of the true system of Weatherology. The subject will furnish many years' work for scientific investigators who are strong enough to cast aside old and mistaken theories of the universe.

George Whitwell Parsons

THE GREAT DESERTS OF CALIFORNIA AND NEVADA

By

Holdridge Ozro Collins, LL.D.

PLATE 1.
Two desert scenes near the border between Nevada and California —Colorado river basin.

THE so-called desert regions of the United States lie in South-Eastern California, Southern Nevada and about 350 miles of the Southern portion of Arizona adjoining the Mexican boundary line. They embrace areas whose totality is about 570,000 square miles, of which 40,000 square miles lie within the two wastes called the Colorado desert and the Mojave desert, in the Eastern section of

California. Their dimensions include lofty mountain ranges, deep and gloomy cañons, level plains stretching to the horizon and depressions like Death valley in California which is 337 feet below the sea level.

PLATE 2.
Sand Hills near Sandy. "The Devil's Playground."

However, these immense tracts have no Oases similar to those in the great Sahara of Africa, although they contain, separated by long distances one from the other, small springs and water-holes which lie concealed by surrounding scant brush-growth, reedy vegetation and quiete or desert grass.

Comparatively small portions of these great areas are composed exclusively of the ravaging and annihilating sand, the larger portion producing innumerable varieties of the cactus family, such as the Joshuas or yucca palms, prickly-pear, and the savage cholla and Spanish dagger, sage brush, mesquite, grease-wood and other plants indigenous to arid surroundings where a water supply from streams or rain-fall is almost unknown.

We present herewith some half-tone views made from photographs of various localities. Plates 1, 2 and 3 show areas of sand which nature has not blessed with vegetation.

The sparse growth of the productive soil is seen in plates, 4, 5, 6 and 7.

The bountiful and rich crops which have been produced from ground of similar chemical combinations in Arizona, that have been watered by great irrigation systems, most assuredly indicate that when a future shall see these lands lying under water brought to them by private enterprise or government appropriation, an enormous life supporting area will be added to the agricultural interests of our country.

PLATE 3.

DEATH VALLEY—THE MOST ARID SECTION IN THE WEST.

A miner was rescued recently at point marked "A" and the skeletons of two other men were found within a radius of a few miles.

At point "B" 60 people died from thirst, with water within six miles in one direction and fourteen miles across the valley, where is located the Keane Wonder Mine. Many other deaths have been reported during the last ten years.

A catalogue of the fauna of this "great and terrible wilderness wherein were fiery serpents and scorpions and thirsty ground" can be written in a very few lines: the jack-rabbit, the horned toad, the scorpion and lizard, the kangaroo rat, the desert turtle and that rattling subtil enemy of man which "stingeth like an adder," and of which it is written, "it shall bruise they heel and thou shalt bruise his head," and his more deadly but silent brother, the side-winder, and the coyote whose cry alone breaks the profound silence of these regions, embrace the list of those that are generally known.

The voice of the mocking-bird and the sweet carols of our feathered loves ever are mute, the only denizen of the sky being the vulture whose shadow falls upon the desolate land as he sails in search of his carrion food.

The only aboriginal inhabitants are the remnants of the Piute and Mojave Indian tribes whose day of total extermination is rapidly approaching.

But even the worst and most unpromising of these regions are not without their material wealth. Zinc is found in paying quantities, and large saline deposits have been discovered mixed with borax and nitre. Nitre claims are controlled by the mining laws of the

United States. It is found in strata four or five feet in thickness and it possesses 45 per centum efficiency as a high explosive. An exhaustive search for potash has revealed several rich deposits in various localities in such quantities, which, with the production from the kelp of the Pacific Coast, will at an early future free us from the necessity of foreign importation.

PLATE 4.
Yuccas, nicknamed "Joshuas," and skyline of Needle Pointed Mountains marking the California and Nevada State Line.

George Whitwell Parsons, during his younger days, lived in Arizona where he had the exacting experience of prospector and where he participated in the lively activities against the Apache ferocities under Geronimo and of the Vigilante Committees in their work of establishing order and decency among the lawless and "bad-man" element which infested the Territory in its early age. He threw the lariat, rode the bronco, loaded his burro and in traversing the desert plains, and crossing the great mountain ranges he became an expert in mining development and familiar with the necessities for an explorer of uninhabited sections. The experience he gained in those primitive times made him an authority after coming to Southern California, and the reports made by him from the knowledge he gained in the thousands of miles he traversed in exploring the mineral deposits in California and Nevada, were received with absolute trust and faith as to their verity.

In his long and wearisome journeyings he frequently encountered the shocking evidences of the many ghastly tragedies of these trackless wilds, in the bleaching skeletons of those who had perished, some at miles away, and others but a short distance from the life-preserving water.

Most profoundly impressed by the death toll presented to him on every side, he instituted a campaign for the erection of durable signs directing to the location of water-manna in this wilderness.

PLATE 5.
The festering Cholla.

His propositions in this behalf were emphatically and materially seconded in Los Angeles by the Chamber of Mines and Oil and the Chamber of Commerce, by the local press generally and the Los Angeles Daily Times published a most valuable map indicating the valleys, mountain ranges and sources of water supplies throughout these arid regions.

The matter was presented to the California Legislature and an appropriation of $5000.00 was granted for the construction of signs indicating the position of springs and water-holes.

Bills for an appropriation for this purpose were repeatedly rejected by the Congress of the United States, in many sessions, but finally, after years of taxing labor, urgent petitions and the presentation of such facts, concerning which there could be no doubt, an Act was passed and became a law, whereby the Secretary of the Interior was authorized "to discover, develop, protect and render more accessible for the benefit of the general public, springs, streams and water-holes on desert and public lands of the United States and in connection therewith to erect and maintain suitable and durable monuments and sign-boards at proper places and intervals along and near the ac-

PLATE 7.

A Thirst Tragedy. One of two bodies found within half a mile from water. Perished less than two days after leaving camp.

customed lines of travel and over the general area of said desert lands, containing information and directions as to the location and nature of said springs, streams and water-holes, to the end that the same may be more readily traced and found; also to provide convenient and ready means, apparatus and appliances by which water may be brought to the earth's surface at said water-holes for the use of such persons; also to prepare and distribute suitable maps, reports and general information relative to said springs and water-holes and their specific location."

The work thus commenced, no doubt, will result in a not distant future, in the placing of guides to every source of water in these great deserts and perhaps in the discovery and development of additional water supplies.

Mr. Parsons has served as Chairman of the Committees of Mines and Mining and of Transportation, of the Los Angeles Chamber of Commerce, and he is now, and he has been for many years a Director of this Academy of Sciences.

He has lately published an illustrated pamphlet entitled "A Thousand Mile Desert Trip and Story of the Desert Sign Post," in which he gives a graphic and interesting history of the inception and

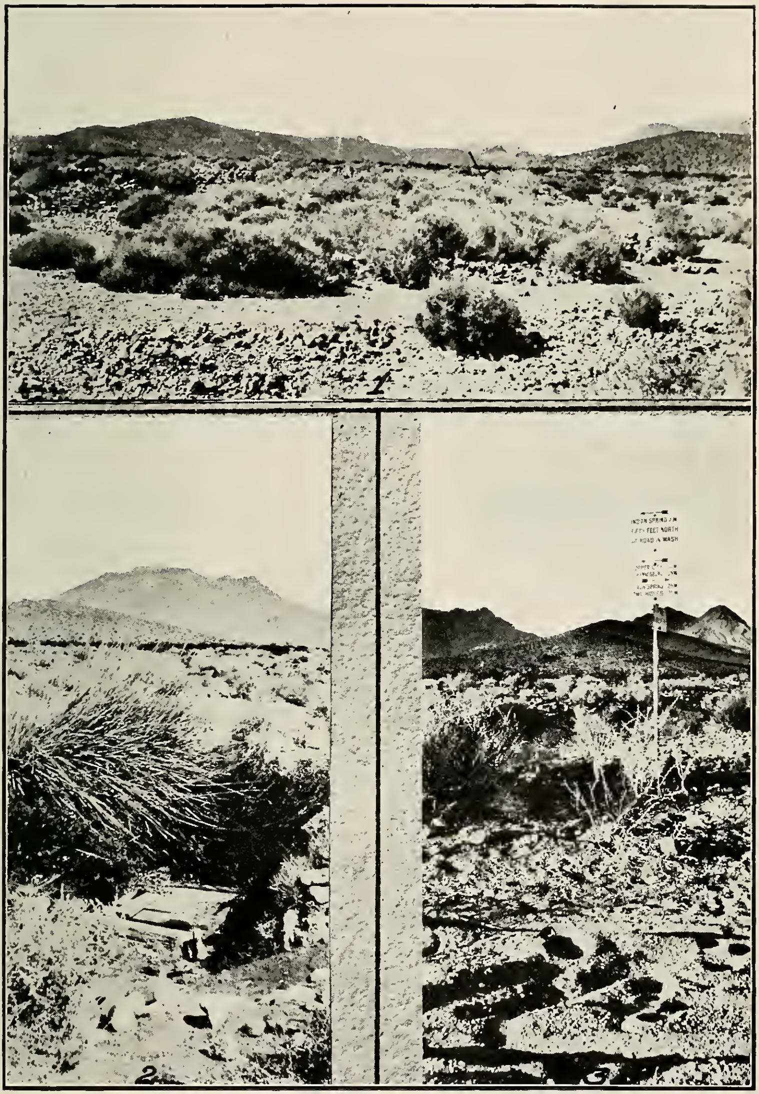


PLATE 6.

One. View in Mojave Desert.

Two. A hidden Spring.

Three. Sign-post directing to hidden spring.

success of his gratutious proceedings for the welfare of the travelers of these deserts.

His strenuous labors in securing this great work for humanity have received most laudatory recognition and commendation from the leaders of economic, religious, scientific and commercial bodies of our entire country from Ocean to Ocean.

In our Bulletin of January, 1917, we wrote a few words relating to the work of Mr. Parsons, in which was quoted a paragraph from "The World's Work." We do not think that statement is inappropriate for a re-reading, viz:

"Mr. Parsons' public spirit and unselfish persistence have achieved a humanitarian purpose that will be gratefully acknowledged by thousands of men and beasts."

TRANSACTIONS OF THE ACADEMY

A regular meeting of the Directors was held on Wednesday, October 9, 1918, in the office of the Academy, at which all were present except Benton, Davidson, Ulrey and Watts.

The record of proceedings of the previous meetings was approved.

The Treasurer presented a statement of the finances of the Academy, and in view of the unusually large indebtedness incurred by the publication of the July Bulletin and other necessities of the Academy, he was authorized to borrow the sum of $200.00 and to pledge for the repayment thereof, any of the securities of this Academy, and with the Secretary, to execute the necessary obligation therefor and any other papers that may be necessary in the premises.

Mr. Everett R. Perry, residing at 720 Kingsley Drive, was elected a member of the Academy.

The Secretary reported that he had secured for the fourth Tuesday of every month, the large Hall on the tenth floor of the Metropolitan Building, for the meeting of the Astronomical Section, and that Mr. Mars F. Baumgardt, Chairman thereof, will deliver the first lecture therein on October 22, 1918, for which a printed notice for distribution had been prepared.

Board adjourned.

ACADEMY MEETING.

The regular monthly meeting of the Academy was held on Friday evening, January 3, 1919, in the Friday Morning Club House.

Mr. B. R. Baumgardt entertained our members and guests in his usual happy and graphic diction, by a description of the two cities, Paris and Versailles and an augury of the results of the forth-coming Peace Conference.

He verbally pictured the two cities, their majestic Temples of worship, historic Palaces, magnificent Museums, the unsurpassed beauty of their interiors and many of their world-renowned art treasures, views of which were presented upon the screen.

His remarks relating to the Peace Conference and the terms of restitution and reparation which shall be imposed upon the defeated central, savage oligarchy, were greeted with a mighty applause.

At the close of the lecture, the lights were turned off and Mr. Mars F. Baumgardt exhibited a chart of the Winter heavens, with the principal suns of the Constellations glowing by an application of radium.

HOLDRIDGE O. COLLINS, Secretary.

BULLETIN

OF THE

SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

LOS ANGELES

JULY, 1919

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Volume XVIII, Part 2.

COMMITTEE ON PUBLICATION

William A. Spalding, Chairman

Anstruther Davidson, C. M., M. D. Samuel J. Keese

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Botanical Section

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Holdridge Ozro Collins, LL. D.
Secretary 1908-1919.
President 1919-1920.

Nostra tuebimur ipsi

AVANT PROPOS
BY THE PRESIDENT

Difficile est proprie communia dicere

I should be wanting in one of the distinctive characteristics of our minds and hearts—that leaven which induces a gentle and affectionate association of worth—did I not gratefully appreciate the honor conferred in my election as the Presiding Officer of this Academy of Sciences.

This distinction has come to me at a time when we are saddened by the loss of my predecessor whose remarkable endowments had placed him in the front rank of the intellectual and scientific following of this community.

Lacking the executive ability and profound erudition in those branches of science which Hector Alliot had made his life's study, I may, at least, presume to have the confidence that I can follow his lead in the conduct of the affairs entrusted to me.

This Academy of Sciences was founded on November 6, 1891 as "The Southern California Science Association." In 1895 that designation was changed to its present name, and on May 17, 1907, it was incorporated under the laws of this Great Commonwealth.

Commencing immediately after its organization, it issued from time to time, under its imprint, monographs upon various subjects until 1897, when our first regular series of Bulletins was commenced. This series continued through 15 numbers down to 1905. But in July, 1896, the first number of a series of Monographs, entitled "Proceedings" was issued. These were of great value and interest and their publication extended from that date down to 1902 when number one of Volume I, of the present series of Bulletins, now embracing 18 Volumes, was published, and this Academy has the proud distinction of being the first and only Scientific Body on the Pacific coast to edit and disseminate a regular and continued series of Bulletins, which series has extended by a linked chain through twenty-eight years.

During the twelve years I was Secretary, the large correspondence I had with Scientific Bodies in most of the civilized portions of the world, and a personal visitation I made to some of them while on a protracted tour of two years around the globe, disclosed to me the very great interest taken in our Bulletin and the value placed on such articles therein relating particularly to the fauna and flora of this Pacific coast and the ethnology of its primitive inhabitants. My experience has convinced me that the habitude of our home environment affords not only an ample, but the proper field for investigation, analysis and exposition for the function of our Bulletin.

The last fifty years have been productive of most wonderful discoveries in all branches of Science, which have conduced to the comfort and happiness of mankind, but it may be said with confidence that Science is yet in its infancy and another half-century will disclose to the human race secrets of nature of which we now have no conception, for no thoughtful scientist now accepts the word "impossible" in his vocabulary. A time will certainly come when through the portals opened by scientific investigation will be seen

"Tongues in trees, books in the running brooks,
Sermons in stones and good in everything."

The noblest words of Shakespeare, and perhaps in the highest apprehension of the human intellect, are these:

"Ignorance is the curse of God,
Knowledge the wing wherewith we fly to heaven."

The gospel of truth is the verity of material entity.

We accept in our studies nothing upon faith, for there is no Apostolic succession in Science.

The one great question now before the student of material nature is, What is matter?

The materialist asserts, as against ecclesiastical dogma, that it is no more inconsistent to say that matter is eternal, than to affirm that there is a sole eternal creator: No compelling *proof* has been presented of the existence of a primordial intelligent cause, but the materialist has on his behalf the positive and practical scientific evidence of the existence of matter, and that matter cannot be annihilated, and he quotes the words of Byron, who was a poetic philosopher as well as a philosophical poet, "Matter is eternal, always changing but reproduced and, so far as we can comprehend eternity, eternal."

All of us, at some period of our life, have had certain so-called religious beliefs, the result of early education, which may have become modified or entirely eliminated by later study and reflection. Who of us in his search for cause and effect has not been impressed with Nature's great Procrustian law,

"So careful of the type she seems,
So careless of the single life.

In presence of the *Magnalia naturae* can we be anathematized if we adhere in belief to the saying of the ancient Greek poet, "These things are not of to-day, nor yesterday, but evermore and no man knoweth whence they came."*

John Burroughs has written—"In discussing these questions our plumb-line does not touch bottom, because there is no bottom."

Our work is in the evidence of things seen. Any discussion in the domain of Faith, which is said to be "the substance of things hoped for, the evidence of things *not* seen," is entirely without the limits of our province.

Our Bulletins in the future, as they have been in the past, and, as a general rule, our public lectures, will be devoted to exemplifications and explanations of conditions in scientific knowledge which now, in a great measure are "caviare to the general," so that a greater interest may be taken in matters which are of vital importance to humanity.

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*Ού γάρ τι νῦν γε κἀχθες ἀλλ' ἀεί ποτε
Ζύ ταυτα κοὐδείς οἶδεν εξ ὅτου φάνη.

Holdridge Ozro Collins.

The Clark Observatory.

THE CLARK OBSERVATORY

By Mars F. Baumgardt.

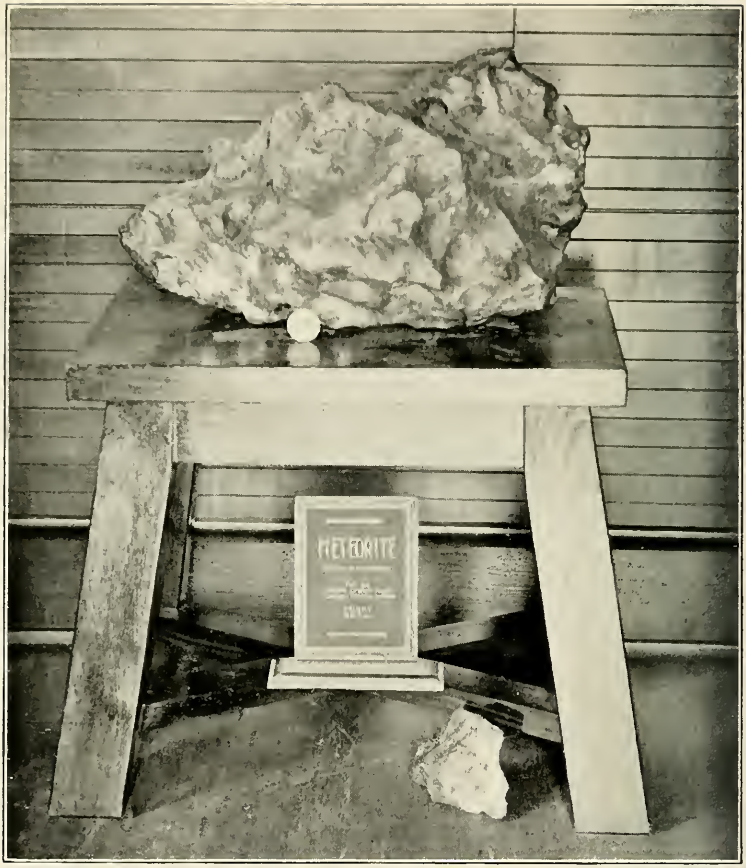
A Corner in the Laboratory.

In the center of his spacious residence grounds upon the Adams street elevation, Mr. W. A. Clark, Jr., has erected an Astronomical Observatory and supplied an equipment which, in many features, are unique in the endowment of star-gazing structures established by private munificence and enterprise.

The building surmounts the ground 65 feet, and, running around its summit, under the Dome, is a graceful iron platform from which an unobstructed view can be had of this beautiful quarter of Los Angeles and of the great arch of the skies.

The Observatory is octagonal in shape, constructed of red brick and, rising in two stories, is super-posed by the copper Dome thirteen feet in diameter, easily revolved upon a series of roller bearing wheels.

Deep below the surface of the ground, lies a great concrete block, twelve feet in thickness, in which is anchored the steel frame which rises to the level of the third floor, through the center of the tower, but entirely isolated and disjoined from the surrounding structure. Upon this stands the Brashear six-inch equatorially mounted telescope with its driving clock. This steel tower within its disconnected



THE METEORITES FROM CANON DIABLO, ARIZONA. THE SILVER DOLLAR SEEN AT THE BASE OF THE LARGER METEOR SHOWS THE COMPARATIVE SIZES.

veneer of brick wall, has proved so rigid and immovable that not the slightest vibration has been perceived when using the telescope with the highest optical powers, although the heavy cars of the West Adams Street railway line pass the tower within two hundred feet.

Immediately above the concrete foundation of the steel tower is a basement divided into two sections, one of which is used as a special room for a brilliant exhibit of Radium, composed of a number of highly active radioscopes showing the action of the Alpha rays of Radium.

A display of 155 star-maps, of which several have been completed, is being prepared. These represent stars from the first to the fifth magnitude and the Milky Way. The stars are rendered luminous by the action of the Alpha particles of Radium upon a responsive base of sulphide of zinc. The prepared material is cemented to small celluloid disks of varying diameters, mounted in their respective places on black mats. With little study of these maps the well known stars and the Constellations can be readily located in the heavens.

The other section contains a large collection of photographic transparences, the finest results of the Mt. Wilson Observatory. They are framed and illuminated by electric lights prepared with special dies and reflectors. The photographs of the Moon are shown with white light; those of the Sun have a yellow tint and those of the nebulae, stars, clusters, spirals and comets have a soft blue light, giving them the exact appearance seen through a large telescope.

There is also in this underground vault a cabinet upon which are mounted three stereoscopes presenting beautiful astronomical stereoscopic photographs of the Moon, comets, meteors and other bodies of the heavens.

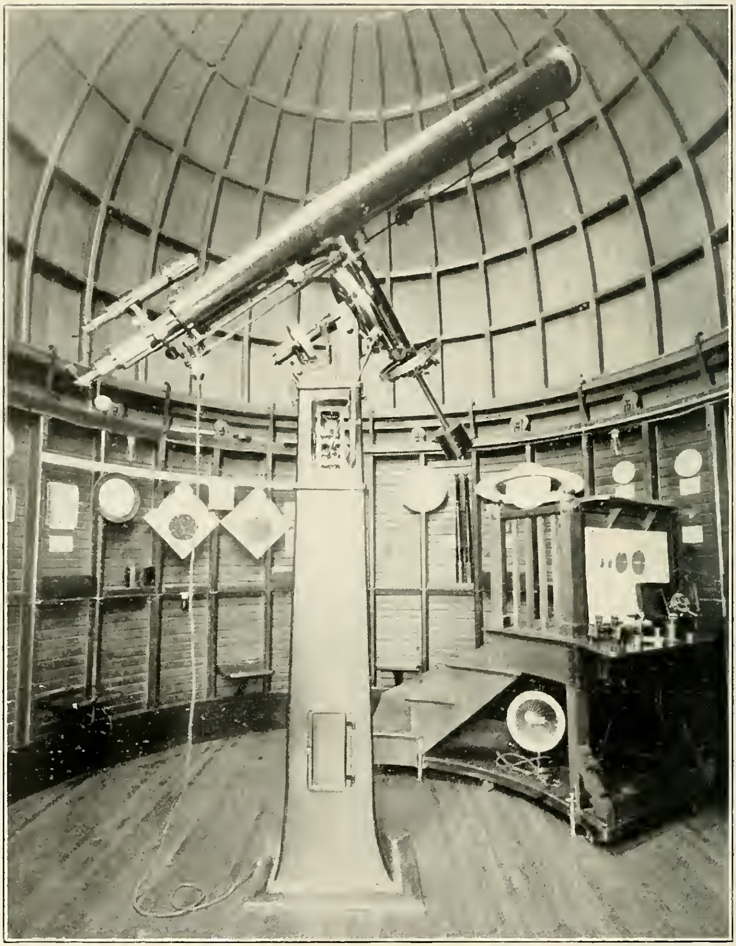
Upon the ground floor is neatly shelved a large and valuable geological library, and upon exhibit, a collection of siderites or iron meteors. The largest weighs 357 pounds and another turns down the scales at seven and one-half pounds. These were obtained at Meteor crater near Canon Diabolo, Arizona. The others are fragments from that greatest known meteor, brought by Admiral Robert E. Perry from Cape York, Greenland, and now deposited in the National History Museum, New York City.

Upon the second floor are the Astronomical library of about 100 bound values of recent publications, perhaps 200 pamphlets and magazines, maps and atlasses, over 500 photographic prints covering many departments of astronomical work and more than 1100 lantern slides, the finest results from the Mt. Wilson, Yerkes, Lick, Lowell and Harvard Observatories.

Suspended from the ceiling are models of the planets of our Solar system made to a scale with a circular ring upon the floor, almost 41 feet in circumference, representing the Sun. Mercury appears by a small globe less than half an inch in diameter and the distance across the rings of Saturn is more than 30 inches. The model of the Earth is less than an inch in diameter and that of the Moon less than a quarter of an inch. The models are painted in colors and they appear as realistic as the planets themselves, seen through a good telescope.

A planetarium, showing the weekly positions of the planets and demonstrating many astronomical facts relating to the Earth, Sun and Moon, their positions and motions, and models of the double-star systems, are seen on the floor. The walls, as well as those of the other floors are covered with the very finest of astronomical photographs and apparatus for demonstration.

The third floor supports the observing room and the Dome. Upon



The Six-Inch Refracting Telescope.

its walls are suspended many beautiful photographs, Radium star-maps, mechanical star and planet finders and interesting apparatus, chief of which is one which shows, not only the causes of the phases of the Moon, but produces them when set in motion.

There is also another set of planet models in color, to scale, but made flat so as to occupy less room. The visitor cannot fail to be impressed when he realizes that the little disk, scarcely an inch in diameter, indicates the size of our Earth as compared with the great Dome overhead which represents our Sun.

The six-inch euqatorial objective is equipped with the Hour circle or Right Ascension, divided into minutes and the Declination circle, which has divisions reading as fine as five seconds. Both circles have powerful magnifying lenses, illuminated by small electric bulbs and so mounted that these fine divisions of time—and distance—can be distinctly read by the observer. It has also a photographic attachment.

The accurate and beautiful mounting of the telescope can be easily operated from the eye-end. It is provided with rods and toggle joints leading to clamps and slow motion gears, permitting a close adjustment in both co-ordinates. Within easy reach are the electric switches which control the lights on the circles, those of the room and the red lights during photographic work.

The magnifying power of this telescope may be changed in a manner similar to that of a microscope, by the use of different eye-pieces. The powers range from 75 to 500 diameters and, when used, they depend upon the objects observed and the condition of the atmosphere.

Models of Jupiter, the Earth and Saturn.

The driving clock is located within the steel pier and is driven by a fifty pound weight. It is regulated by a centrifugal governor, and by it the telescope will follow a star during the entire rotation of the Earth.

Accessories to this telescope include a finder with an unusually large field of view, eight eye-pieces, a diagonal reflecting prism for use when observing objects in the zenith, and two polarizing eye-pieces for gazing directly at the Sun without smoke-glass eye-pieces.

The Observatory is supplied with many other instruments among which will be found the following, to-wit:

One eight-inch Brashear reflecting telescope;

Two four-inch Zeiss equatorial refracting telescopes mounted on heavy tripods affording a very firm base. They are equipped with circles and driving gears and each is supplied with a full set of eyepieces;

A binocular telescope with a pair of two-inch objectives, mounted upon a heavy tripod and having a set of one-hundred diameter eyepieces;

An unusual telescope in the Observatory is a two-inch refractor. Its objective lens is ground from quartz. It is intended primarily for photographic work in connection with spectrum analysis but it may also be used for visual purposes:

Two Bausch and Lomb prism binocular field glasses. One has a pair of two-inch objectives and a magnifying power of twelve diameters. It has brilliant illumination and affords a beautifully distinct view when used on objects such as the Pleiades or Hyades. The other has twenty-five millimeter objectives and gives a magnifying power of six diameters. It affords the greatest field of view possible and is excellent for embracing extensive regions of the skies. Both instruments may be used in the hands or upon tripods:

A coelostat with a ten-inch plane mirror rotated on an equatorial mounting by clockwork, at such a rate that it will keep a beam of sunlight, reflected from its silvered surface, on a second stationary plane mirror. This instrument is used in connection with the spectroscope;

A Bausch and Lomb spectroscope;

Apparatus for projection purposes in illustrating lectures and demonstration work at the Observatory consisting of the following, viz:

1. Three stereopticans with electric arc and nitrogen incandescent lamps, with a full set of objectives for different forms of projection work;
2. A scientific lantern for experimental work;
3. A moving picture machine.

Thirty mechanical lantern slides which illustrate the cause and show the effects of many of the celestial phenomena such as eclipses, tides, time, transits, variable stars, revolution of the Earth around the Sun and the Moon around the Earth, the Solar system with the revolutions of all the planets and the orbits of comets with the development and action of their tails;

A siderial clock, two eighteen-inch globes, one of the Earth, the other of the heavens, a set of weather instruments and an illuminator for perforated star maps.

Important among the exhibit material is a model of the Moon made of plaster-of-paris, forty inches in diameter. Its detail is copied from direct observation with the telescope. By illuminating the globe with a powerful electric light, the phases of the Moon can be produced with much of the wonderful shadow detail seen through the telescope.

Designs are being perfected for the construction of a pavilion, adjacent to the Observatory, of dimensions adequate to include an Assembly Hall, lecture rooms; a Museum and an extensive library.

Mr. Clark has, most generously, granted to members of this Academy of Sciences, permission to make use of this Observatory and its appliances for investigation and study, and I shall be pleased to welcome visitors at any "good seeing" night.

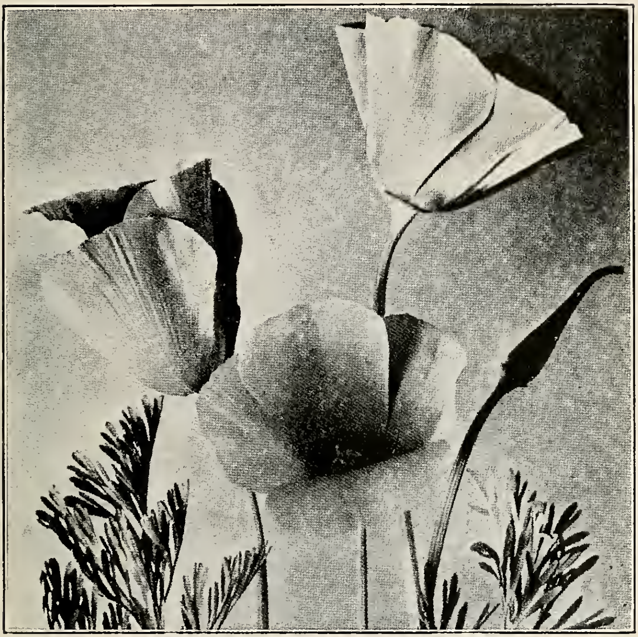
THE FORTY-INCH MODEL OF THE MOON.

Scene in California Wild Garden Exposition Park, Los Angeles taken just three years after planting.

Some of the flowers in the foreground are Tidy Tips (Layia elegans), Dwarf Blue Lupine (Lupinus nanus), California Poppy (Eschscholtzia californica) and Blue Gilia (Gilia achillaefolia). The young lady is gathering flowers of Collinsia bicolor from beside a large Elderberry tree. The grey foliaged shrub is the Desert Salt Bush (Atriplex lentiformis) and the larger trees in the background are California Sycamores (Platanus

THE CALIFORNIA WILD GARDEN IN EXPOSITION PARK ITS HISTORY AND OBJECTS

By Theodore Payne



ESCHSCHOLTZIA CALIFORNICA
"California Poppy"

Coming to California in 1893, having previously spent five years in the horticultural profession in Englan,d what impressed me perhaps more than anything else was the wonderful native flora of this state. But as the years went by it was with deep regret that I saw the wild flowers so rapidly disappearing from the landscape. I made up my mind then that if I were ever able to embark in business on my own account, I would try and do something to awaken a greater interest in our native plants and endeavor to persuade people to use them more frequently in planting gardens, parks and public grounds; and also, to conserve those growing in the wild state wherever possible. Thus it was that I came to specialize in the growing of California wild flowers and native plants.

For years I had dreamed of planting a California wild garden; a garden in which there should be nothing but plants native to California; a garden planted after nature's own fashion. In the fall of

MALACOTHRIX CALIFORNICA

1913 I conceived the idea of making such a garden at one or both of the great expositions to be held in 1915 at San Francisco and San Diego. I soon abandoned the idea of San Francisco, it being too far away. Then after some negotiations with the authorities in charge of the Panama-California Exposition at San Diego, I gave this up also, not being able to make such arrangements as would warrant the undertaking.

In a letter of Feb. 9, 1914, from Mr. Frank B. Davison of the State building in Exposition Park, the suggestion was made that I should obtain a permit from the Park Board to make and maintain at my own expense a small growing exhibit of California native plants in the park, somewhere near the Exposition building. A few weeks later I appeared before the Board of Park Commissionesr and asked permission to make a California wild garden in this park. On the proposal of Mr. H. W. O'Melveny a resolution was passed giving me permission to plant such a garden and appointing Mr. Frank Shearer, Park Superintendent, a committee of one to decide with me upon a suitable location.

Shortly after this the 1915 General Committee was appointed for the purpose of preparing for the visitors expected during the Exposition year. I found myself upon this committee and also upon the sub-committee known as the Floral Display Committee of which Mr. Frank Wiggins was chairman. The duties of this sub-committee were to provide for floral displays in the city during 1915. One of the first undertakings to come before us was the beautification of the Figueroa Street frontage of Exposition Park, which at that time was totally unimproved. As there had been some talk of holding a Horticultural Exposition in Los Angeles during the fair year, the idea originating with the Los Angeles County Horticultural Society, it seemed to us that this Figueroa frontage would be an ideal location for such an exhimit. Mr. Wiggins sent out letters to a number of horticulturalists and nurserymen asking them to attend a meeting to formulate plans for carrying out this project; the response however, was so discouraging that we decided to go no further with the matter. The committee then resolved to find some scheme for beautifying the park along the Figueroa Street frontage. A number of methods were suggested, my own being to make a California native garden. A garden planted entirely with native trees, shrubs and flowers, something that would be typical of California. Thus it was, that I abandoned my own project of a small garden, and was entrusted by the committee with the work of making plans and specifications for a wild garden to cover the southeast corner of the park; it being decided to improve the remainder of the Figueroa Street frontage in a more formal way.

The site selected for this garden was a stretch of ground covering nearly five acres, commencing at the old fan palm on Figueroa Street and running south along this street to the southern boundary of the park, then west to the grand stand, then north to the race track and from there following the circular fence of the latter back to the old fan palm. It was rather an odd shaped piece of ground to develop, and in many ways not an ideal setting for a gild garden, having around it so many formal objects. However, there were some advantages in its location, also. The History and Art building, containing the relics from the famous Brea beds, and the Exposition building were near by. The accessibility of the location was also an advantage, being only an 18 minute ride from the heart of the city with a three minute car service. Thus many people could visit it who would have been unable to do so had it been in some more remote place.

My plans provided for a thick planting of trees following the race track thus in time shutting out this objectionable feature; a grove of pines to hide the grand stand, and a more or less thick planting of shrubs along the street frontage with here and there a vista of the flowers within. These plans were endorsed by the Board of Park Commissioners and accepted by the 1915 committee. I was very anxious to start the work early in June so as to be able to get it all planted and have a grand display of wild flowers by early spring 1915, but I was disappointed in this as the County Board of Supervisors, which was to provide the necessary funds held the matter up for many months, and it was not until nearly the end of the year that the necessary arrangements were made for carrying out the work. As the County authorities decided to do the grading, to install the sprinkling system and to lay out the walks, it was nearly the end of

COLLINSIA BICOLOR
"Innocence"

March, 1915, before it was turned over to me to plant and also to maintain until the end of the year. I found on commencing my work that the grading had not been completed, the sprinkling system had to be changed in many places and the walks had not been made at all. It was necessary to complete this work so that it was sometime in May when the actual planting of the garden commenced.

In the plan, I had provided for a sycamore grove, an oak grove, a redwood grove, a big tree grove and a grove each of Monterey and Torrey pines. These were the first to be located, the trees being planted in such a manner as to form a natural group. The planting of the other trees followed; then the shrubs, perennial plants and bulbs and last of all the sowing of the annual wild flower seeds. Every species had its zone, so to speak, growing in thick masses then thinning out with scattered specimens and gradually merging or intermixing with other kinds. The wild roses drifted across the path following through a portion of the ground just as they would in the wild state. The bracken ferns grew in clusters under the redwoods, and the sticky monkey flowers came up from beside the wild cherries. The main groups of trees were planted about the intersections of the walks and many open spaces were used for masses of wild flowers, thus giving much the appearance of a piece of natural landscape thru which walks had been cut.

The sprinkling system which I recommended for this garden was an underground automatic disappearing sprinkler. This is like the ordinary lawn system except that when the water is turned on the sprinklers rise up about 18 inches above the surface of the ground and drop back again when the water is turned off. This is an ideal sprinkler for such a garden because when in use the sprinklers are well up above the flowers and out of sight again when not in use. For some reason the County authorities had this only installed in one section of the grounds, the remainder being an ordinary underground lawn system. In the summer of 1917 the Park Department changed to an over-head Skinner system, which to my mind was not as desirable, and which detracted greatly from the beauty of the park.

The ground for many years previous had been uncultivated land and was full of weed seeds. During the summer and early fall months the sprinklers were kept going, thus starting the weeds to grow. The ground was then cultivated and a little later again watered, starting a new crop and then cultivated again. In this way eight crops of weeds were destroyed before the wild flower seeds were sown.

By the end of 1915 the laying out of the garden was completed and it was then turned over to the City Park Department.

In order that the best results should be obtained it was necessary to do some hand weeding and this was made possible by the generosity of some public spirited citizens who furnished the necessary funds for this work.

In the spring of 1916 the wild flowers commenced to bloom and in a few weeks the whole garden was a mass of yellow and orange and blue and purple shades. Thousands of people visited it daily and on Sundays the walks could hardly accommodate the crowds. There were species of trees, shrubs and flowers collected from all parts of the state. To see these growing and to study them in their natural habitats, it would be necessary for the student to travel many hundreds of miles besides spending much money and time. A label was provided for each species in the garden giving first the botanical name and below it the common name of the plant. This label was placed in front of one specimen of each kind somewhere near the walk so that it could be easily read by the public. In the case of

LUPINUS NANUS
"Dwarf Blue Lupine"

DELPHINIUM CARDINALE
"Scarlet Larkspur"

SAYIA ELEGANS
"Tidy Tips"

MENTZELIA LINDLEYI
"Blazing Star"

masses of wild flowers, it was placed where the flowers were the thickest. Thus the garden became valuable from the student's standpoint. All the schools of the city used it for their botanical classes. Students also came from Pasadena, Long Beach and other nearby towns.

Entering the garden from the north entrance on Figueroa street the general color scheme was yellow. One of the first flowers to be noticed was the little Sunshine (Baeria gracilis) covering the ground with a perfect carpet of yellow, broken here and there with the large cream-colored blossoms of the Malacothrix californica, opening to the early morning sun. Then came masses of yellow mountain daisies, and beyond these a perfect sea of tidy-tips with here and there a patch of cream-cups, while large bushes of yellow lupine, sticky monkey flower and other shrubby plants rose above the smaller flowers. A few stray plants of blue lupine, blue gilia and baby-blue-eyes added greatly to the color effect. Further down the walk and near the sycamore grove the color scheme changed to blues, lavenders and purples, produced by masses of wild heliotropes, blue gilias, pentstemons and large blue bush lupines. Beyond this was a field of orange poppies enhanced by splashes of blue and lavender from lupines, gilias and thistle sage, while in the southeast corner was billow upon billow of blue and white lupines. Then to the west were golden blazing stars, lilac gilias, violet canterbury bells and many

PLATYSTEMON CALIFORNICUS
"Cream-Cups"

others. In the oak grove the baby-blue-eyes seemed perfectly at home while the collinsias peeped out from beneath the shade of elderberries. There were mariposa lilies too and brodiaes scattered among the other flowers; floral firecrackers and tiger lilies mingled with the brake ferns under the redwoods. Artists painted pictures of it, every day students and nature lovers visited it, birds, bees and butterflies made it their home. As visitors came down the main path they felt the breath of the wild and forgot they were almost in the heart of a big city. "Why its just wild" they would exclaim. This spontaneous expression of their feelings was very gratifying to me for I felt that I had really achieved *MY WILD GARDEN*. Several newspapers and magazines wrote descriptions of the garden, and I received many very complimentary letters concerning it; two of these letters I am reproducing here.

Los Angeles, Calif., June 7, 1916.

Dear Sir:

I feel that there rests upon me a moral obligation which is not discharged until I have thanked you for the hours of unalloyed pleasure your garden of wild flowers has afforded me and the members of my family. As far as I know the park is unique. In all my travels over this world I cannot recall having seen anything like it. I hope that your work

VIOLA PEDUNCULATA
"Yellow Violet"

and interest in beautifying Los Angeles is being properly recognized and encouraged.

Most sincerely yours,

B. R. Baumgardt.

Berkeley, Calif., June 24, 1918.

My Dear Mr. Payne:

I have just returned from Santa Barbara where I finished up with my students in Landscape Gardening our summer traveling course of instruction, and I want to take this opportunity of thanking you for the four kodak pictures of our party in your wild flower exhibit at Exposition Park, and for the time and attention you so kindly gave us on that day.

I would like to have you know that of all the landscape compositions we saw and studied during the six weeks trip there was not one of more interest or one of more landscape value than your well selected and well arranged exhibit at the Exposition Park. It is something that I shall always want my students in Landscape Design to see and

ORTHOCARPUS PURPURASCENS
"Owl's Clover" or "Pink Paint Brush"

study because it is a wonderful example of what can be done with our native plants. It also brings out the landscape values of such native materials, which I believe we should become more familiar with. I certainly wish we had such an extensive exhibit here in the North because it would certainly be a mecca for landscape gardeners, botanists and the people at large. I sincerely hope that your wild flower garden may continue to be properly maintained in order that it may teach great lessons in the use of our native materials, especially here in this state where so much exotic material predominates in our landscape work.

Wish best wishes for your continued success, I am

Yours very truly,

J. M. Gregg,

Professor of Landscape Gardening and Floriculture, University of California.

In all there were planted 262 species of native plants as given at the end of this article. Some of these have died from improper soil conditions, others from too much water and other causes, still in a general way the greater number of them have succeeded well, and I believe it possible with a little care to have a far greater number growing within this garden. Many of the trees and shrubs have done admirably and increased in beauty each year. At the time of this writing, just four years after planting, there are sycamores, redwoods and pines 25 feet in height, oaks 15 feet or more, while numbers of shrubs have attained a large size.

This then is the history of the Wild Garden and how it came to be. Of its objects, one of them was not fulfilled, it was not completed for the Exposition year. Of the others, I believe it has served its purpose well. Through it many people of our own state have obtained a closer knowledge and greater appreciation of the wild flowers and trees of California.

SALVIA CARDUACEA
"Thistle Sage"

CALOCHORTUS PLUMMERAE
"Late Flowering Mariposa Lily"

PINACEAE. Pine Family.

Pinus L.

- **lambertiana** Dougl. Sugar Pine.
- **flexilis** James. Limber Pine.
- **ponderosa** Dougl. Yellow Pine.
- **ponderosa var. jeffreyi** Vasey. Jeffrey Pine.
- **contorta** Dougl. Beach Pine.
- **murrayana** Balf. Tamrac Pine.
- **coulteri** Don. Big-cone Pine.
- **sabiniana** Dougl. Digger Pine.
- **torreyana** Parry. Torrey Pine.
- **parryana** Engelm.. (P. quadrifolia Sudw.) Parry's Nut Pine.
- **monophylla** Torr. One-leaf Pine.

muricata Don. Bishop Pine.
radiata Don. (P. insignis Dougl.) Monterey Pine.
tuberculata Gord. (P. attenuata Lemm.) Knob-cone Pine.

Pseudotsuga Carr.
douglasii Carr. (P. taxifolia Britt) Douglas Fir.
macrocarpa Mayr. Big-cone Spruce.

Picea Link.
sitchensis Carr. Tideland Spruce.

Tsuga Carr.
heterophylla Sarg. (T. mertensiana Carr) Coast Hemlock.

Abies Link.
concolor Lindl and Gord. White Fir.
grandis Lindl. Lowland Fir.
magnifica Murr. Red Fir.
nobilis Lindl. Noble Fir.
venusta Koch. Santa Lucia Fir.

TAXODIACEAE. Redwood Family.

Sequoia Endl.
gigantea Dec. Big Tree.
sempervirens Endl. Redwood.

CUPRESSACEAE. Cypress Family.

Libocedrus Endl.
decurrens Torr. Incense Cedar.

Thuja L.
plicata Don. Canoe Cedar.

Chamaecyparis Spach.
lawsoniana Murr. Lawson Cypress.

Cupressus L.
goveniana Gord. Goven Cypress.
macrocarpa Hartw. Monterey Cypress.
macnabiana Murr. Mac Nab Cypress.

Juniperus L.
californica Carr. California Juniper.
occidentalis Hook. Sierra Juniper.

TAXACEAE. Yew Family.

Torreya Arn.
californica Torr. (Tumium californicum Greene) California Nutmeg.

LILIACEAE. Lily Family.

Yucca L.
whipplei Torr. Spanish Bayonet.

Fritillaria L.
lanceolata Pursh. Mission Bells.

Lilium L.
pardalinum Kell. Leopard Lily.
humboldti Roezl. and Leicht. Humboldt Lily.
parryi Wats. Lemon Lily.

Calochortus Pursh.
catalinae Wats.
plummerae Greene.
venustus Dougl. White Mariposa Lily.
splendens Dougl. Lilac Mariposa Lily.
luteus Dougl. Yellow Mariposa Lily.
clavatus Wats. Large Yellow Mariposa Lily.
maweanus Leicht. Pussy's Ears.
benthami Baker. Yellow Star Tulip.
albus Dougl. White Globe Tulip.
amabilis Purdy. Yellow Globe Tulip.

Brodiaea Smith.
capitata Benth. Cluster Lily. Wild Hyacinth.
laxa Wats. Ithuriel's Spear.
grandiflora Smith. Harvest Brodiaea.
ixioides Wats. Golden Brodiaea.
lactea Wats. White Brodiaea.
coccinea Gray. Floral Firecracker.
volubris Baker. Twining Brodiaea.

Bloomeria Kell.
aurea Kell. Golden Stars.

Camassia Lindl.
leichtlinii Baker. Camass.

Trillium L.
sessile L. var. californicum Wats. Common Wake Robin.
ovatum Pursh. Coast Trillium.

IRIDACEAE. Iris Family.

Sisyrinchium L.
bellum Wats. Blue-eyed Grass.

SALICACEAE. Willow Family.

Salix L.
lasiandra Benth. Yellow Willow.
argophylla Nutt. Bush Willow.

Populus L.
fremonti Wats. Common Cottonwood.
trichocarpa Hook. Black Cottonwood.

BETULACEAE. Birch Family.

Alnus L.
rhombifolium Nutt. White Alder.

FAGACEAE. Oak Family.

Quercus L.
lobata Née. Valley Oak.
garryana Hook. Post Oak.
douglasii H. & A. Blue Oak.
dumosa Nutt. Scrub Oak.
chrysolepis Liebmann. Golden Cup Oak. Maul Oak.
agrifolia Née. Live Oak.

SILENE LACINIATA
"Indian Pink"

wislizenii A. DC. Interior Live Oak.
sadleriana R. Br. Campst. Deer Oak.
engelmanni Greene. Mesa Oak.
kelloggi Newb. Black Oak.

Pasania Orst.
densiflora H. & A. Tan Oak.

JUGLANDACEAE. Walnut Family.

Juglans L.
californica Wats. California Wild Walnut.

POLYGONACEAE. Buckwheat Family.

Eriogonum Michx.
fasciculatum Benth. Wild Buckwheat.

CARYOPHYLLACEAE. Pink Family.

Silene L.
laciniata Cav. Indian Pink.

CHENOPODIACEAE. Goosefoot Family.

Atriplex L.
lentiformis (Torr.) Wats. Desert Salt Bush.

hymenelytra (Torr.) Wats. Desert Holly.

NYCTAGINACEAE. Four-O'clock Family.

Abronia Juss.

umbellata Lam. Sand Verbena.

villosa Wats. Desert Sand Verbena.

Mirabilis L.

californica Gray. California Four-O'clock.

CALYCANTHACEAE. Sweet-Shrub Family.

Calycanthus L.

occidentalis H. & A. Western Sweet-scented Shrub.

LAURACEAE. Laurel Family.

Umbellularia Nutt.

californica Nutt. California Laurel or Bay.

RANUNCULACEAE. Buttercup Family.

Aquilegia L.

truncata F. & M. Columbine.

Delphinium L.

parryi Gray. Blue Larkspur.

cardinale Hook. Scarlet Larkspur.

Clematis L.

lasiantha Nutt. Wild Clematis.

Thalictrum L.

polycarpum Wats. Meadow Rue.

BERBERIDACEAE. Barberry Family.

Berberis L.

aquifolium Pursh. Barberry.

PAPAVERACEAE. Poppy Family.

Platystemon Benth.

californicus Benth. Cream-cups.

Romneya Harv.

coulteri Harv. Matilija Poppy.

Platystemon Benth.

rigidum Benth. Tree Poppy.

Eschscholtzia Cham.

californica Cham. California Poppy.

Meconopsis. Vigner.

heterophylla Benth. Flaming Poppy.

Argemone L.

platyceras hispida (Gray) Prain. Prickly Poppy.

FUMARIACEAE. Fumitory Family.

Dicentra Bernh.

chrysantha H. & A. California Bleeding Heart. Golden Ear Drops.

formosa DC. Pink Bleeding Heart.

CRUCIFERAE. Mustard Family.

Erysimum L.

asperum DC. Wild Wallflower.

grandiflorum Nutt. Coast Wallflower.

BRODIAEA LAXA
"Ithuriel's Spear"

CAPPARIDACEAE. Caper Family.

Isomeris Nutt.
  arborea Nutt. Bladder-pod.

VIOLACEAE. Violet Family.

Viola L.
  pedunculata T. & G. Yellow Violet.

STERCULIACEAE. Sterculia Family.

Fremontia Torr.
  californica Torr. California Slippery Elm.

MALVACEAE. Mallow Family.

Lavatera L.
  assurgentiflora Kell. Tree Mallow.

Sidalcea Gray.
  parviflora Greene. Wild Hollyhock.

Malvastrum Gray.
  fasciculatum (Nutt) Greene. False Mallow.
  davidsonii Robinson.

GERANIACEAE. Geranium Family.

Geranium L.
  richardsoni F. & M. Mountain Geranium.

Floerkia Willd.
........**douglasii** Baill. Meadow Foam.

ANACARDIACEAE. Sumach Family.

Rhus L.
- **laurina** Nutt. Sumach.
- **integrifolia** (Nutt) B. & H. Lemonade-Berry.
- **ovata** Wats. Lemonade and Sugar Tree.
- **trilobata** Nutt. Squaw Berry.

SAPINDACEAE. Buckeye Family.

Aesculus L.
- **californica** (Spach) Nutt. California Buckeye.

ACERACEAE. Maple Family.

Acer L.
- **macrophyllum** Pursh. Big-leaf Maple.

RHAMNACEAE. Buckthorn Family.

Rhamnus L.
- **californica** Esch. Wild Coffee.
- **californica var. tomentella.** Brew & Wats.
- **crocea** Nutt.
- **ilicifolia** Kell.

Ceanothus L. California Lilac.
- **integerrimus** H. & A.
- **thyrsiflorus** Esch.
- **spinosus** Nutt.
- **divaricatus** Nutt.
- **oliganthus** Nutt.
- **megacarpus** Nutt.
- **crassifolius** Torr.
- **verrucosus** Nutt.
- **rigidus** Nutt.

VITACEAE. Grape Family.

Vitis L.
- **girdiana** Munson. Wild Grape.

CRASSULACEAE. Stone-crop Family

Stylophyllum Britton & Rose.
- **densiflorum** Rose.

Dudleya Britton & Rose. Hen-and-Chickens.
- **pulverulenta** (Nutt) B. & R.
- **brauntoni** Rose.
- **lurida** Rose.
- **sheldoni** Rose.

SAXIFRAGACEAE. Saxifrage Family.

Saxifraga L.
- **peltata** Torr. Indian Rhubarb.

Heuchera L.
- **elegans** Abrams.

Carpenteria. Torr.
- **californica.** Torr.

NEMOPHILA INSIGNIS
"Baby-Blue-Eyes"

Ribes L.
- **tenuiflorum** Lindl. Yellow Flowering Currant.
- **glutinosum** Benth. Pink Flowering Currant.
- **malvaceum viridifolium** Abrams. Pink Flowering Currant.
- **divaricatum** Dougl. Wild Gooseberry.
- **speciosum** Pursh. Fuchsia-Flowered Gooseberry.

PLATANACEAE. Plane-tree Family.

Platanus L.
- **racemosa** Nutt. Sycamore.

ROSACEAE. Rose Family.

Holodiscus Maxim.
- **discolor** (Pursh) Maxim. Wild Spiraea.

Fragaria L.
- **californica** C. & S. Wood Strawberry.

Potentilla L.
- **glandulosa** Lindl.

Cercocarpus H. B. K.
- **betulaefolius** Nutt. Mountain Mahogany.
- **traskiae** Eastw.

Adenostoma H. & A.
- **fasciculatum** H. & A. Greasewood. Chamiso.

Rosa L.
- **californica** C. & S. Wild Rose.

Osmaronia Greene.
- **cerasiformis** (T. & G.) Greene. Oso Berry.

Prunus L.
    demisa (Nutt) Walp. California Choke Cherry.
    ilicifolia (Nutt) Walp. California Wild Cherry. Islay.
    integrifolia Sarg. Catalina Cherry.
Heteromeles Roem.
    arbutifolia Roem. California Holly. Christmas Berry. Toyon.
Lyonothamnus Gray.
    floribundus var. asplenifolius Brandegee. Catalina Ironwood.
Amelanchier Medic.
    alnifolia Nutt. Service Berry.

LEGUMINOSAE. Pea Family.

Cercis L.
    occidentalis Torr. Western Red-bud.
Lathyrus L.
    laetiflorus Greene. Wild Pea.
    alfeldi White. Wild Pea.
    splendens Torr. Pride of California.
Lupinus L.
    arboreus Sims. Yellow Tree Lupine.
    chamissonis Esch. Coast Lupine.
    longifolius (Wats.) Blue Bush Lupine.
    cytisoides Agardh. Canyon Lupine.
    affinis Agardh. Blue Lupine.
    nanus Dougl. Dwarf Blue Lupine.
    hirsutissimus Benth. Hairy Lupine.
Prosopis L.
    juliflora (Swartz) DC. Mesquit. Algaroba.
    pubescens Benth. Screw-bean. Tornilla.
Cercidium Tulasne.
    torreyanum Wats. Palo Verde.
Parkinsonia L.
    aculeata L. Retama. Horse Bean.

LOASACEAE. Loasa Family.

Mentzelia L.
    lindleyi T. & G. Blazing Star.
    laevicaulis (Dougl.) T. & G. Blazing Star.

ONAGRACEAE. Evening Primrose Family.

Zauschneria Presl. California Fuchsia.
    californica microphylla Gray.
    californica latifolia Hook.
Clarkia Pursh.
    elegans Dougl. Clarkia.
    concinna (F. & M.) Greene. Beautiful Clarkia.
Godetia Spach. Farewell to Spring.
    bottae Spach.

amoena Lilja.
grandiflora Lindl.
Oenothera L.
californica Wats. White Evening Primrose.
biennis hirsutissima Gray. Yellow Evening Primrose.

ARALIACEAE. Aralia Family.

Aralia L.
californica Wats. Ginseng. Wild Aralia.

CORNACEAE. Dogwood Family.

Cornus L.
nuttallii Aud. Large Flowered Dogwood.

GARRYACEAE. Silk-tassel Family.

Garrya Dougl. Silk-tassel Tree.
elliptica Dougl.
veatchii palmeri (Wats). Eastwood.

ERICACEAE. Heath Family.

Rhododendron L.
occidentale Gray. Western Azalea.
californicum Hook. California Rose Bay.
Arctostaphylos Adans. Manzanita.
tomentosa Dougl.
glauca Lindl.
Arbutus L.
menziesii Hook. Madrone.

PRIMULACEAE. Primrose Family.

Dodecatheon L.
clevelandi Greene. Shooting Star.

OLEACEAE. Ash Family.

Fraxinus L.
dipetala H. & A. Flowering Ash.

SOLANACEAE. Nightshade Family.

Solanum L.
xanti Gray. Violet Nightshade.
Lycium L.
richii Gray. Catalina Box-thorn.

SCROPHULARIACEAE. Figwort Family.

Verbascum L.
virgatum With. Mullein.
Antirrhinum L.
coulterianum Benth. White Snapdragon.
Collinsia Nutt.
bicolor Benth. Innocence. Chinese Houses.
Pentstemon Mitch.
cordifolius Benth. Scarlet Honeysuckle.
labrosus Hook. f. Scarlet Pentstemon.
centranthifolius Benth. Scarlet Bugler.

spectabilis Thurber. Blue Pentstemon.
parishii Gray. Parish's Pentstemon.
palmeri Gray. White Pentstemon.
antirrhinoides Benth. Yellow Pentstemon.
heterophyllus Lindl. Violet Beard's-tongue.

Diplacus Nutt.
glutinosus Nutt. Sticky Monkey Flower.
puniceus Nutt. Red Sticky Monkey Flower.

Mimulus L.
brevipes Benth. Yellow Monkey Flower.
cardinalis Dougl. Scarlet Monkey Flower.
luteus L. Common Monkey Flower.

Orthocarpus Nutt.
purpurascens Benth. Owl's Clover. Pink Paint Brush.

POLEMONIACEAE. Gilia Family.

Gilia R. & P.
achillaefolia Benth. Blue Gilia.
abrotanifolia Nutt.
capitata Dougl. Large Blue Gilia.
tricolor Benth. Bird's Eyes.
dianthoides Endl. Fringed Gilia. Ground Pink.
californica Benth. Prickly Phlox.

Linanthus Benth.
densiflorus Benth. California Phlox.

HYDROPHYLLACEAE. Water-leaf Family

Nemophila Nutt.
insignis Dougl. Baby Blue Eyes.
maculata Benth. Spotted Nemophila.

Phacelia Juss.
tanacetifolia Benth. Wild Heliotrope.
grandiflora (Benth) Gray. Large Flowered Phacelia.
whitlavia Gray. Wild Canterbury Bell.
parryi Torr. Parry's Phacelia.

Emmenanthe Benth.
penduliflora Benth. Whispering Bells.

Eriodictyon Benth.
tomentosum Benth. Yerba Santa.

LABIATAE. Mint Family.

Trichostema L.
lanatum Benth. Romero. Woolly Blue-curls.

Scutellaria L.
angustifolia Pursh. Skullcap.

Stachys L.
californica Benth. Hedge-nettle.

Salvia L.
carduacea Benth. Thistle Sage.

Audibertia Benth.

grandiflora Benth. Humming Bird Sage.
nivea Benth. Button Sage.
stachyoides Benth. Black Sage.
polystachya Benth. White Sage.

BIGNONIACEAE. Bignonia Family.

Chilopsis Don.
saligna Don. Desert Willow.

CAPRIFOLIACEAE. Honeysuckle Family.

Sambucus L.
glauca Nutt. California Elder.
Symphoricarpus Juss.
racemosus Michx. Snowberry.
mollis Nutt. Dwarf Snowberry.
Lonicera L.
subspicata H. & A. Wild Honeysuckle.

LOBELIACEAE. Lobelia Family.

Palmerella Gray.
debilis serrata Gray. Blue Lobelia.

COMPOSITAE. Sunflower Family.

Malacothrix DC.
californica DC.
Senecio L.
donglasii DC. Bush Groundsel.
Baeria F. & M.
gracilis (DC.) Gray. Sunshine.
Eriophyllum Lag.
confertiflorum (DC.) Gray. Golden Yarrow.
Helianthus L.
annuus L. Sunflower.
parishii Gray. Perennial Sunflower.
Encelia Adans.
californica Nutt. Bush Sunflower.
farinosa Gray. Incienso.
Leptosyne DC.
stillmani Gray. Yellow Daisy.
douglasii DC. Yellow Daisy.
maritima Gray. Sea Dahlia.
gigantea Kell.
Layia Hook & Arn.
elegans (Nutt) Torr. & Gray. Tidy Tips.
glandulosa (Hook) H. & A. White Daisy.
Solidago L.
occidentalis Nutt. Western Golden Rod.
Aster L.
greatae Parish. Wild Aster.
hesperius Gray. Wild Aster.

HERBERT M. BISHOP

By

Holdridge O. Collins, L.L.D.

A chivalric Patriot has surrendered the life which, in unquenchable love for his native land, he tendered for her preservation and integrity during our terrible internecine war.

Herbert M. Bishop, descended through a long and distinguished line of Colonial and Revolutionary ancestors, whose names are emblazoned in the historic pages of our Country, was born in New London, Connecticut, in the year 1844.

Graduating from Yale University in 1865, he chose the Medical Profession for his life's work and in this became noted both for his initiative talents and the adaptation of the best of old ideas to improved methods.

He was Surgeon of the First Regiment of Connecticut Cavalry during the War of the Rebellion, and, upon the organization of the Grand Army of the Republic, he was elected its Grand Commander in Connecticut, and after coming to California, he affiliated with a Post in Los Angeles. In virtue of his rank as an Officer, he was elected a member of the California Commandery of the Military Order of the Loyal Legion.

He was a member of the American Institute of Homoeopathy and President of the California Homoeopathic Society. Together with the Order of Knights Templar, he belonged to the Shrine and he received the 32d Degree of the Scottish Rite.

In 1892 he came to California and established a new home in Los Angeles for his family and here, he devoted his energies to his profession with exceptional success.

His master-passion was to learn the Why, the How, and the Where of all creation, material as well as spiritual, and, being gifted in his intellectual endowment with great analytic efficiency and relentless energy, he resorted to several of the branches of Science for a thread which would lead him forth from the labyrinth of his uncertatinties.

Upon his dwelling he constructed an Astronomical Observatory with which he gave years of study to the systems of the Universe, and the result of his investigations were imparted in most interesting discussions at meetings of the Sotuhern California Academy of Sciences of which he was a most zealous member.

To him was granted compliance with that beautiful prayer of Tobias,—"Mercifully ordain that we may grow aged together," for his life's love and companion preceded him but a short time to the Great Unknown.

He died at his home in Los Angeles on Wednesday, April 24, 1919, and we inscribe this Memorial upon the pages of our Records as a tribute to our affection for his memory; a testimonial to his gentle and loving character and our affliction for the loss of him whom, no more we shall see.

PETALODY OF THE STAMENS IN ESCHSCHOLTZIA

By George L. Moxley

Normally, Eschscholtzia has four petals and numerous stamens. Occasionally, I have noticed one or two stamens metamorphosed into petal-like forms, not flabelliform like the normal petals, but usually more or less oblanceolate or spatulate, and frequently twisted. And it seemed very unusual for more than two to appear in a single flower. On the 21st of May, however, I noticed a very "double" flower along the sidewalk and picked it for a closer examination. Each petal of what should have been the normal flower had two or three of the attached stamens metamorphosed into petal-like forms. They were not uniform in shape or size, some being almost of the normal outline and others broadly spatulate, the margin in some entire and in others more or less deeply lobed or incised. Another abnormality of this flower was that one of the styles was divided almost to the base and one of these segments again divided about half its length. I returned later to see if other abnormal flowers might be found in the plant but it had been cut down with the grass along the walk.

On June 23rd I again passed that way and found that the plant had thrown out new growth and there were three doubled flowers, two of which were regularly so, in that there were within the four normal flabelliform petals, and alternating with them, four cuneate-oblong and somewhat lobed petals. The third flower had the four normal petals and three very much incised ones, and the fourth petaloid stamen narrowly linear-oblong and much twisted. The petals of this last flower had fallen when I returned in the evening. I have preserved the other two flowers and have removed the plant to my yard for further observation, and in hope of obtaining seed from it.

LUPINUS SUBHIRSUTUS N. SP.

By Anstruther Davidson, M. D., C. M.

Annual, stem erect, 2-3 dm. high, villous throughout with long white hairs; branches few; petioles hairy, 2-3 times as long as the leaves; leaflets 8, light green, 2 cm. long, oblanceolate, acute or apiculate at the apex, glabrate above, sparsely long haired beneath, more so on the margins; flowers somewhat verticillate; peduncles 3-4 mm. long; bracts linear, threadlike, persistent, very hairy, 6-8 mm. long; flowers 10 mm. long, light blue, banner with central yellow spot, flecked with dark dots, sides reflexed; keel naked; upper calyx deeply and openly cleft, the uniting base scarious and of a light blue color, lower calyx densely haired, entire; pod short, erect, 10-12 mm. long, 4-seeded.

Palm Springs, Colorado Desert; April, 1919. Type No. 3333 author's harbarium. This plant grows in the sand both at Palm Springs and Thermal and was first seen by the author at the latter place in 1908, but was not again collected until this season, when Mr. M. S. Gordon found it at Palm Springs. At my request Mr. Daggett in a collecting trip for the Museum sought for and found a few specimens from which the type has been taken.

Lupinus hirsutus in general appearance resembles *L. sparsiflorus,* but differs from that plant in having larger flowers and these semi-verticillate; *L. sparsiflorus* has the flowers notably alternate and somewhat distant, and the hairs on all parts show under the microscope numerous tiny nodes arranged in somewhat irregular whorls. The hairs on *L. subhirsutus* are smooth except those on the lower calyx, which show a few nodes.

Lupinus nanus, with which *L. subhirsutus* might be confounded, has somewhat similar flowers, but these are verticillate; the hairs are smooth except on the lower calyx and the bracts are not persistent.

FOSSILS OF LA BREA RANCHO.

By The President.

Our Academy is the owner of an aggregation of mounted Fossils which is unique among the collections of the world's Scientific Bodies and this, with a large portion of our Library, numbering about 3000 bound volumes and pamphlets, is now upon exhibition in the Museum at Exposition Park.

It is generally known that the original excavations of these fossils were carried on under concessions made by Mrs. Erskine M. Ross to this Academy of Sciences, to the University of California and to the Los Angeles High Schools and that the work proceeded thereunder during a period of about two years.

So many inquiries have been made as to the discovery and exhumation of said fossils, and such a desire manifested to learn the conditions under which they were placed in the Museum, owing to certain articles heretofore published in our Bulletins, that I have thought it not only expedient but opportune, at this time, again to place upon record a statement of the the position of this Academy as the legal owners thereof.

These fossils were excavated from the Brea pits adjoining the City, and mounted at an expense of about $3500.00 paid from the Treasury of this Academy. Our Bulletin of January, 1910, contains an elaborately illustrated account of our labors in this behalf.

*On February 7, 1910, with two other corporations and a private association, we entered into a contract with the County of Los Angeles, whereby we agreed to place these fossils upon exhibition in a Building about to be erected by the County. After the construction of said Building we caused them to be transported and erected in the wing assigned for our sphere of activities, and there they have remained to the present day. In addition to what is there shown, we have in the basement under said wing, a very large number of boxes filled with fossil remains of the fauna of the quaternary age, which can be assembled and mounted, producing many numbers of exact fac-similies of those upon exhibition.

We have at no time parted with the ownership thereof, nor have we done anything to induce a belief that we have permanently disposed of them by gift or otherwise. On the contrary, the records of our Academy show that we have been careful to perpetuate the fact of our ownership, and that we parted with the physical possession thereof only as a loan.

On July 3, 1912, at a meeting of our Board of Directors, a Communication was unanimously adopted, addressed to the Board of Governors of the Los Angeles County Museum of History, Science and Art of which the following is a copy, to-wit:

*See copy thereof on page 83.

Los Angeles, July 3, 1912.

"To the Board of Governors of the Los Angeles County Museum of History, Science and Art:

You are hereby notified that all of the fossils excavated from La Brea Rancho, which are now in the Museum Building at Exposition Park, are the property of the Southern California Academy of Sciences, and that this Academy claims to be, and is the sole and exclusive owner of said fossils:

That said fossils were excavated under the direction of this Academy of Sciences which paid all the expenses thereof from its individual treasury, amounting to over $2000.00, under a concession to it by Mrs. Erskine M. Ross.

In signing the contract with the Historical Society of Southern California, The Fine Arts League, The Southern Division of the Cooper Ornithological Club and the County of Los Angeles, this Academy of Sciences did, in no respect, relinquish its title to said fossils, and it has at no time consented to any proposition relating to the waiving of its title to said fossils.

It is not the intention, at this time, to remove said fossils from said Museum, or to take them from the supervision of your Board of Goxernors, but we make this statement, that you may understand our claims in the premises, and we ask that this communication be incorporated in the record of the meeting at which it shall be presented to you, so that in the future,—perhaps a very distant future—there may be no misunderstanding, should this Academy of Sciences demand possession of said fossils for the purpose of depositing the same in its own Building.

The Board of Directors of the Southern California Academy of Sciences, at a meeting held on July 3, 1912, ordered this Communication to be presented to you by its Representatives upon your Board, with the request that it be made a matter of record in your proceedings. I have the honor to subscribe myself

Yours very sincerely,

HOLDRIDGE O. COLLINS,

Secretary of the Southern California Academy of Sciences."

Vide Pages 108-109 of Volume I of the Records of this Academy, and Page 88, Volume XI of our Bulletin, July 1912.

This Communication was duly presented to said Board of Governors by Mr. William A. Spalding, at that time President of this Academy, and our Representative upon said Board of Governors.

I am not an Utopian, and therefore I cannot hope to remain long enough to see this Academy the owner of its own Building in which these precious remains may be housed, but I believe a distant future will see such an object achieved. We have had an endowment of a generous amount, and a member of this Academy, without wife, child or a known relative in the world, has executed his Will and Testament in such form that, upon his decease, his entire estate, real and personal will be vested in this Academy. It is hoped that the example of these two donors will incite others to a similar course so that a fund may be obtained wherewith can be erected a Temple of Science in which we shall have a Home as well as a Name.

CONTRACT BETWEEN THE COUNTY OF LOS ANGELES AND THE SOUTHERN CALIFORNIA ACADEMY OF SCIENCES, ET AL.*

THIS AGREEMENT Made and entered into this 7th day of February, 1910, by and between the County of Los Angeles, party of the first part, and the HISTORICAL SOCIETY OF SOUTHERN CALIFORNIA, a corporation, THE FINE ARTS LEAGUE, a corporation, SOUTHERN DIVISION OF THE COOPER ORNITHOLOGICAL CLUB, and SOUTHERN CALIFORNIA ACADEMY OF SCIENCES, a corporation, parties of the second part, WITNESSETH:

THAT WHEREAS, the party of the first part is about to erect at Agricultural Park a Historical Museum and Art Gallery for the purpose of collecting and exhibiting therein a collection of fine arts, specimens, and data of biology and zoology, and historical matter relative to the Pacific Coast, more particularly Southern California, with a view of promoting and encouraging scientific art and historical education and investigation;

AND WREAEAS, said second parties possess exceptionable ability based upon long experience, in the collection, installation and maintenance of exhibits in their respective lines;

AND WHEREAS, said first party is desirous of obtaining the co-operation and assistance of the said second parties, in the collection, installation and maintenance of the exhibits aforesaid, and the management thereof as hereinafter set forth:

NOW THEREFORE IT IS HEREBY MUTUALLY AGREED by and between the parties hereto, that the said second parties shall have the care, supervision, control and management of said building and the collection, installation and supervision of said exhibits therein, for a period of fifty years, from and after the 7th day of February, 1910, through a Board of Governors, to be created as hereinafter provided, IT BEING EXPRESSLY UNDERSTOOD that the intent and purpose of establishing the relation between said parties hereto is for the specific purpose of securing the experience and ability of the said second parties, to the end that said building and its contents may be used and enjoyed by the people of Southern California to the fullest extent for educational purposes.

That for the purpose of controlling and managing said building and the exhibits therein, there shall be created a Board of Governors to consist of nine members to be selected in the following manner, to-wit:

The Chairman of the Board of Supervisors;

Two persons to be selected by the Fine Arts League;

Two persons to be selected by the Historical Society of Southern California;

Two persons to be selected by the Southern California Academy of Sciences;

One person to be selected from Southern Division of the Cooper Ornithological Club;

One person to be selected at large by the parties hereinabove named; and said nine persons shall constitute a Board of Governors who shall hold office at the pleasure of the power appointing the same, and said Board shall have full power and authority in the management and control of said building and the exhibits therein, subject to the supervision of the first party.

IT IS FURTHER AGREED that said first party as soon as said building shall have been completed, shall cause the same to me furnished with the necessary furnishings therein for the installation and care and custody of the exhibits which shall be furnished by the second parties, and that from time to time first party will appoint sufficient employees as may be necessary to care for and manage the said exhibits and said building and pay their salaries for said service, PROVIDED HOWEVER, that said employees shall be recommended by and serve at the pleasure of the Board of Governors, and shall be under the direct supervision and management of said Board of Governors and said first party will from time to time make provision for all the exhibits furnished by said second party until the building is filled to its full capacity; all expense in connection with said building and exhibits and in the maintenance and operation thereof is to be borne and paid by said first party, PROVIDED, HOWEVER, that the same shall be first agreed upon by said first party and PROVIDED FURTHER, that neither said second parties nor said Governing Board shall make any charge for their work or services done or performed in connection with the same. The object and intention of this agreement on behalf of said first party to secure the valuable services of said second parties in the collection and installation of said exhibits without any cost therefor.

Said Board of Control shall immediately after their appointment meet and organize by electing one of their number president; a secretary and such other officers as they deem expedient and shall make such rules and regulations for the maintenance and handling of said exhibits as they deem wise and expedient from time to time, said rules to be approved by the first party.

IN WITNESS WHEREOF the parties hereto have caused these presents to be executed by their respective representatives duly authorized by resolution, the day and year first above written.

COUNTY OF LOS ANGELES,
By C. J. Nellis,
CHAIRMAN BOARD OF SUPERVISORS.

Attest: C. G. Keys,
Clerk. By A. M. McPherron, Deputy.

HISTORICAL SOCIETY OF SOUTHERN CALIFORNIA,
By ...., President.
And ...., Secretary.

THE FINE ARTS LEAGUE,
By ...., President.
And ...., Secretary.

SOUTHERN DIVISION OF THE COOPER
ORNITHOLOGICAL CLUB,
By ...., President.
And ...., Secretary.

SOUTHERN CALIFORNIA
ACADEMY OF SCIENCES,
By W. A. Spalding, President.
And Holdridge O. Collins, Secretary.

*See page 81.

TREASURER'S ANNUAL REPORT.

Ending June 30, 1919.

RECEIPTS:		
Balance in Bank, June 1, 1918	$ 59.86	$
Received % Dues	351.50	351.50
" % Interest	537.94	537.94
" % Telephone rebate	3.50	3.50
" % Redemption Fidelity Savings Stock	200.00	
" % Loan from First National Bank	200.00	
Total Receipts	$ 1,352.80	
TOTAL REVENUE		$ 892.94
DISBURSEMENTS:		
Bulletin Expense	$ 513.77	$ 513.77
Lecture "	70.00	70.00
Rent "	97.50	97.50
Telephone "	88.00	88.00
Printing "	45.01	45.01
Postage "	23.15	23.15
Interest "	3.40	3.40
Sundry "	44.25	44.25
Paid First National Bank loan	200.00	
Purchase of Liberty Bonds	200.00	
Total Disbursements	$ 1,285.08	
Balance per Bank, June 30, 1919	$ 67.72	
TOTAL EXPENSE		$ 885.08
Excess of Revenue		$ 7.86
Bank Balance, June 1, 1918	$ 59.86	
Bank Balance, June 30, 1919	67.72	7.86

INVESTMENT ACCOUNT BALANCES—June 30, 1919.

Mortgage Guarantee Co., Bonds @ 5½%	$ 5,200.00
Fidelity Savings & Loan Association Stock @ 6%	3,100.00
3rd Liberty Loan Bands, @ 4¼%	2,650.00
4th Liberty Loan Bonds, @ 4¼%	200.00
	$11,150.00

S. J. KEESE, Treasurer.

So. Cal. Academy of Sciences.
Los Angeles, Cal.

Gentlemen:

We the undersigned, a Committee appointed to audit the accounts of the Treasurer of the Southern California Academy of Sciences, report that we have examined the books, vouchers and accounts of said Treasurer and we find that the funds of the Bulletin and Beeman Endowments have been invested in interest drawing securities; thta all the financial obligations of said Academy have been paid and that there is a balance on hand of $67.72 from the current income.

GEORGE H. BEEMAN,
W. A. SPALDING,
Committee.

TRANSACTIONS OF THE ACADEMY.

Directors' Meeting.

A meeting of the Directors was held on February 18, 1919, at which were present Messrs. Benton, Collins, Keese, Parsons, Spalding and Watts.

Vice-President Benton presided.

A record is hereby made of the death of President Hector Alliot at Los Angeles, on February 15, 1919, and it was resolved that the Directors, in a body, attend the funeral services.

Mr. William A. Spalding was appointed a Committee to prepare a Memorial Address to be presented to members of the Academy.

As a testimonial to the memory of our departed President, it was resolved that the office be not filled for the unexpired term.

Dr. S. Stillman Berry of Redlands, California, was elected a member of the Academy.

Board adjourned.

Academy Meeting.

The April, 1919, meeting of the Academy was held in the Friday Morning Club House on Wednesday, the 16th day of the month. Vice-President Benton presiding.

The evening was devoted to Astronomy.

Mr. William Tyler Olcott spoke upon Variable Stars and Mr Mars F. Baumgardt exhibited upon the screen various systems of the universe, some of them as moving demonstrations by means of wonderful and unique mechanical appliances devised by himself.

Academy Meeting.

The annual meeting was held on Friday evening, June 6, 1919, in the auditorium of the Friday Morning Club House, Vice-President Benton presiding.

The following named gentlemen were unanimously elected Directors for the ensuing year, viz: George H. Beeman, Arthur B. Benton, Holdridge O Collins, Anstruther Davidson, Mars F. Baumgardt, Triumph C. Low, Samuel J. Keese, George W. Parsons, William A. Spalding, William L. Watts.

The address was by B. R. Baumgardt, whose subject was "The Building of the Temple," in which he forecasted Germany's future interpretated the awakening of England, portrayed the French problem of reconstruction, analyzed the Russian enigma and epitomized America's national and international responsibility.

Directors' Meeting.

The first meeting of the Directors, elected for the ensuing year, was held on Monday, June 23, 1919, Vice-President Baumgardt presiding.

All were present except Benton and Watts.

The Secretary made a report of the general condition of the

Academy, and the Treasurer presented a statement of the receipts and disbursements during the last year, asking for a Committee to audit his accounts. Messrs. Spalding and Low were appointed such Committee, with instructions to report at the next meeting of the Directors.

The Secretary was authorized to purchase such book-cases as he may think necessary for the proper arrangement of the large accumulation of literature which has made such a congestion in the Academy office that access to any particular volume is practically impossible.

Whereas, at the Annual Meeting on June 6, 1919, only ten Directors were elected, now under the provisions of Article VII of the By-Laws, Mr. Theodore Payne was unanimously elected to the vacancy.

The election of Officers for the ensuing year resulted in the unanimous choice of the following named gentlemen, viz:

Holdridge O. Collins, President.
Mars F. Baumgardt, First Vice-President.
Anstruther Davidson, Second Vice-President.
Arthur B. Benton, Third Vice President.
Samuel J. Keese, Treasurer.
George W. Parsons, Secretary.

The President-elect appointed the following committees, to-wit:

COMMITTEE ON PUBLICATION.

William A. Spalding,
Anstruther Davidson, C. M., M. D., Samuel J. Keese.

COMMITTEE ON FINANCE.

Samuel J. Keese, George H. Beeman, Arthur B. Benton.

COMMITTEE ON PROGRAM.

Mars F. Baumgardt, Samuel J. Keese, Triumph C. Low.

The following named applicants were elected members of the Academy, viz: W. F. Alder, Mrs. N. Irene Beebe, John Comstock, Maurice Gradwohl, Mrs. O. G. Jones.

It was unanimously resolved to abolish and discontinue the Zoological Section, as all discussions in that branch of the Sciences can be embraced in the broader Section of Biology.

There being no further business, the Board adjourned.

HOLDRIDGE O. COLLINS,
Secretary.