

A useful paper, but could be better written for a subject of such importance.

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The Planning and Construction

of the Lick Observatory

1873 - 1888.

by

Neal R. Underwood

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Introduction

The history of the planning and construction of the Lick Observatory from the time of James Lick's announcement of his intentions in 1873, to the completion of the observatory in 1888, is an essential part of the scientific aspect of the cultural history of California. In order to fully understand the events that led Lick to donate \$700,000 for the construction of the observatory and the great telescope, the selection of Mount Hamilton for the observatory site and the announcement of the intended transfer of the observatory to the University of California in 1876, an account of the life of James Lick is necessary and is described in the first part of this essay.

James Lick has been remembered in California history primarily for his founding of the Lick Observatory, his greatest monument to himself, the Santa Clara Valley and California. This recognition of Lick has been somewhat distorted, by his reputation as a wealthy eccentric, and stories that have been told over the years, concerning his motives for founding the observatory. Some aspects of the eccentricity of James Lick was his inclination to speculate upon developments of the future. It is just this type of speculation that resulted in Lick acquiring his fortune in the early American period of California history.

A member of the Lick Trustees, George Shonewald, reported a conversation with Lick, shortly after the announcement of the planned observatory was made, in which Lick said that some day:

We will know the secrets of the spheres and it will be as common for a man to take an interorbital trip into space as it is for you or me to walk down Montgomery Street".*

* Rosemary Lick, The Generous Miser, (1967), p. 62.

It was this type of concern for the future that led Lick to found a great astronomical observatory, as well as providing gifts and donations to charities, scientific and historical organizations.

In the first years following the completion of the Lick Observatory in 1888, there was much scientific and popular interest in the observatory. This resulted in a considerable amount of material written about the construction, early years and personnel of the Lick Observatory and the great refracting telescope. It is the intention of this essay to provide an objective and documented history of the planning and construction of the Lick Observatory, from 1873-1888. The perspective of the essay is to some extent provincial, as much of the information in the essay is drawn from the San Jose Weekly Mercury, printed during the years 1873-1888.

The Lick Observatory has been instrumental in achieving many of the astronomical discoveries of the late nineteenth and *early* twentieth centuries. As the Lick Observatory approaches the centennial of its establishment, the addition of other scientific instruments and telescopes, (especially the one hundred and twenty inch reflecting telescope, completed in 1959), has helped to partially fulfill the prediction made by the pioneer California *51* scientist, George Davidson, when he declared in the first public announcement of James Lick's gift to astronomy, that:

...A thousand years hence, the James Lick Observatory will continue to unfold the mysteries of the cosmos...*

* Daily Alta California, October 21, 1873., p. 1., c. 7.

James Lick

James Lick began his long and diverse life in what is now Fredericksburg, Lebanon County, Pennsylvania. He was born on August 25, 1796.¹ Lick acquired the trade of carpentry in his teenage years and later became an expert piano maker. In 1821 at the age of twenty-five Lick decided to leave the nation of his birth and travel to Buenos Aires, which seemed to offer more opportunities for a talented piano craftsman.²

Lick traveled the long route to South America upon a ship, that sailed first to Africa and then proceeded across the Atlantic Ocean to Buenos Aires. Lick paid for his voyage by constructing a piano for the captain of the ship. In Buenos Aires he became quite successful with a piano shop, despite the fact that he could not speak Spanish, when he first arrived.³

In 1832 Lick decided to sell his business interests in the city of Buenos Aires due to the threat of a violent revolution. In 1833 James Lick sailed to Valpariso, Chile and settled there for three years. When it appeared that the government of Chile would declare war upon the Confederation of Peru and Bolivia, Lick once again sold his investments and moved to the safety of Lima, Peru in 1836.⁴

The Mexican War started in 1846 and newspaper reports told of the American occupation of California. Lick decided to move to California in 1846, business commitments though delayed his departure from Lima until November of 1847. The sale of Lick's lucrative piano shop brought him \$30,000 in gold and he also had six-hundred pounds of chocolate to trade upon his arrival

in California. James Lick sailed into San Francisco only seventeen days before James Marshall's discovery of gold, arriving on January 7, 1848.⁶ Lick saw little potential for his profession in piano making and decided to invest in real estate and gamble on the development of San Francisco. It is believed that James Lick was a visionary, with a practical outlook. For three weeks he walked and rode all over San Francisco, planning and visualizing how the city would develop. During this time Lick also explored down the bay to the Santa Clara Valley and the small town of San Jose.⁷

In February of 1848 Lick began acquiring land in parts of San Francisco, on the basis of how he estimated the city would grow. Lick returned to San Jose in April of 1848 and bought a large tract of land, along with a lumber mill in the Alviso area. The land and mill were purchased from Manuel Miranda, for \$3,000. Two years later Lick bought one-hundred and sixty-seven acres of land bordering the Guadalupe River and the land adjacent to his lumber mill was also obtained.⁸

intrastate News of Marshall's discovery quickly leaked out and the gold rush broke out in May of 1848. Lick had spent about one week in the gold district and found a small bit of gold. It is evident that James Lick realized that his great wealth would result from real estate investments and his farm and mill. During the early part of the gold rush many land owners in the town of San Francisco expected to find a fortune in the gold fields and liquidated their real estate holdings at extremely low prices. Lick was one of the wealthiest men in the area at

double check the detail of this paragraph

that time and he shrewdly purchased some of the best properties in San Francisco, for a fraction of the actual values. Lick invested a little less than \$10,000 in real estate during 1848 and by the end of that year his property holdings were worth an estimated \$2 million.⁹ *analyze this statement*

James Lick was involved in some law suits concerning the land he had purchased in San Francisco, but he was able to maintain the title to his properties with legal costs amounting to about \$10,000.¹⁰ During the next twenty-five years Lick spent most of his time in the Santa Clara Valley, supervising the development of orchards, his farm, a flour mill, his lumber mill and various real estate holdings. He also would commute to San Francisco to supervise the developments relating to his real estate investments, most importantly the Lick House, one of the finest hotels in San Francisco.¹¹

In the year 1873 James Lick at the age of seventy-seven had long been one of the wealthiest men in the state. His lumber mill was one of the finest in California.¹² His real estate holdings in San Francisco and San José had enlarged and he owned land in the town of Los Angeles; on Santa Catalina Island and on the north shore of Lake Tahoe.¹³ Lick's health became poor in 1873 and he left his farm and moved into his hotel, the Lick House. It became evident to Lick that he had only a short time left to live and he began to consider a number of philanthropic plans.¹⁴

There are three individuals who have claimed the honor of convincing James Lick to build a great observatory and powerful telescope. These men were: George Maderia, Joseph Henry and

SP?

George Davidson. The meeting between Lick and Maderia had taken place in San Jose in 1860, at an astronomical lecture. Maderia was a student of astronomy and geology, and Lick was fascinated with both Maderia's telescope and astronomical knowledge. Lick had Maderia stay as a guest at one of his homes in San Jose and Maderia was the first person to suggest to Lick that the most powerful telescope in the world could be constructed with part of Lick's vast wealth.¹⁵

Joseph Henry was the Secretary of the Smithsonian Institute and George Davidson; the Superintendent of the United States Coast Survey for the Pacific Coast, conspired together in 1873 to convince Lick to make additional gifts to science after Lick had unexpectedly^{edly} donated a valuable lot of land to the California Academy of Sciences, in February of 1873. Joseph Henry had met Lick in the summer of 1872, when he had stayed at the Lick House in San Francisco. The meeting and discussion of how the Smithsonian Institution had been founded by the estate of James Smithson[?], had evidently influenced Lick, to make the gift to the Academy of Sciences in San Francisco.¹⁷

George Davidson was the president of the California Academy of Sciences in 1873, and had first met James Lick in February 1873, when he visited the Lick House to thank Lick for the donation of the valuable land to the academy. Davidson soon started an effort to convince Lick to make additional gifts to science and wrote Joseph Henry in Washington, D.C., in a plea to help convince Lick to make further donations to science.¹⁸ Davidson continued to visit Lick and often discussed astronomy, a science that Davidson was

an expert in. ^{By} In 1869 Davidson had begun to search for men who would be interested in establishing a large observatory on the west coast. Davidson had conducted a number of astronomical observations in the Sierra Nevada mountains, in 1872 and became convinced that an observatory built in the Sierras would be superior to any other observatory then in existence, due to the thin clear air at high altitudes. ¹⁹

After many meeting ⁵ between Lick and Davidson, the plan for a great observatory and the most powerful telescope in the world began to emerge ^{evolve?} and James Lick committed himself to constructing the observatory on October 20, 1873, when he ^{permitted} allowed Davidson to announce the plan for the observatory. At the conclusion of a meeting of the California Academy of Science, ^{5,} Davidson, the president of the Academy, said: *reputation*

"...With a telescope of the largest size and most consummate workmanship...properly located ten thousand feet above the sea in the clear skies of the Sierra Nevada...we hope at no distant day to see the mighty problems of creation that are beyond our grasp...such an outfit and such provision have been the life long objects of James Lick; I have obtained his permission to announce to the academy his intentions, which I sketched out in the preceeding sentence...A thousand years hence the James Lick Observatory ...will continue to unfold the mysteries of the cosmos. 20

George Davidson acted as Lick's scientific advisor on the planned observatory until June of 1874, when he departed for a trip around the world. In his time as the chief advisor, Davidson convinced Lick to settle upon constructing the largest refracting telescope in the world, with an objective lens of forty inches. Davidson had also convinced Lick to donate \$1,200,000 for the observatory and to locate the entire plan at ten thousand feet in the Sierra Nevadas. When Davidson returned from his world

wide travels in 1876 he discovered that his meticulous plans had been substantially altered.²¹

Lick had been advised by some astronomers and associates that the severe winters in the Sierra Nevada would cause extreme disadvantages, ~~which~~ ^{that} outweighed the advantages of the excellent observing conditions, ^{during certain periods} at some parts of the year. Some advisors also encouraged Lick to locate the observatory nearer to the San Francisco Bay area, so that it would be more accessible to visitors. This was originally one of Lick's major concerns for the observatory and in the summer of 1875 a search was started for a suitable site. The plan for a Sierra observatory was abandoned.²²

In the summer of 1875 James Lick sent a trusted agent; Thomas E. Fraser to report on the possibilities of an observatory on four mountains in the San Francisco Bay area, these were: Mount Diablo, in Contra Costa County; Mount St. Helena, in Napa County; Mount Loma Prieta and Mount Hamilton, both of which are in Santa Clara County.²³ In August of 1875 Fraser and (D.B.) Murphy, the mayor of San José, rode by horse to the top of Mount Hamilton. Both Fraser and Murphy were impressed with the clear view and the easy access to the mountain, from San José. When Fraser reported to James Lick the results of his mountain expeditions Lick decided in favor of Mount Hamilton.²⁴

After the departure of George Davidson, the scientific advisors for the Lick Trust were; Professor Simon Newcomb and Professor Edward S. Holden, both astronomers at the United States Naval Observatory in Washington, D.C.²⁵ Holden was strongly in favor of

the selection of Mount Hamilton in 1875, and in 1876 he was appointed to be the main scientific advisor to the Lick Trust, during the process of planning and constructing the observatory.²⁶

James Lick had hoped to live to see the observatory and great telescope completed and grew very impatient with what he considered unnecessary delays. Shortly before his death at the Lick House on October 1, 1876, Lick had expressed his desire to be buried ⁱⁿ at his observatory. His remains were sealed in a vault which had been built in the base of the great telescope, on January 8, 1887.²⁷

The Construction of the Mount Hamilton Road

After the selection of Mount Hamilton had been approved by James Lick and his advisors; Lick made a proposal to the Board of Supervisors of Santa Clara County: he would have the greatest astronomical observatory in the world erected upon Mount Hamilton, if the county would first construct an adequate road, with year round access to the summit. This proposal was accepted by the Supervisors in September 1875.²⁸ The Mayor of San José; D.B. Murphy used his considerable influence in convincing the Supervisors to agree to the building of the road to the observatory site.²⁹

The Supervisors obtained the services of a highly trained engineer; A.T. Herman, ^{Herman} to survey a route for a road to the summit of Mount Hamilton. Herman started the survey in the fall of 1875. On January 15, 1876, two members of the Board of Supervisors; J.M. Batte^e and Abram King inspected the road survey. It was the Supervisors first time upon the summit of the mountain and like

many other visitors to the mountain, they were impressed with the magnificent view of the valleys and the snow covered range of the Sierra Nevada. Batte^e and King found Herman's survey almost finished with a few miles remaining to be completed.³⁰

The twenty mile long road, surveyed by Herman, was ready for construction to begin in February of 1876. A contractor whose last name was Derby had been awarded the contract for the road construction and work was well under way in February 1876. Soon afterwards the social problems of California began to affect the road project. On February 17, 1876 an article appeared in the San Jose Weekly Mercury, which condemned the supervisors and Derby for hiring Chinese laborers on the work teams constructing the road.³¹ In April of 1876 there were over one hundred and fifty workmen building the road. The workers main camp was located to the left of where the Mount Hamilton Road began. The Chinese workers were still employed at that time, although they comprised a minority of the labor force.³² Later in April the Board of Supervisors voted to rename the road, and designated it "Lick Avenue".³³

In May of 1876 Derby, the contractor, had six hundred men employed in constructing the Lick Avenue. The road was nearly all gravel to the area of Smith's Creek, the site of a construction camp, seven road miles from the summit. Derby stated that the road would be completed by May 20, 1876, a date considerably sooner than the Supervisors had estimated.³⁴

On June 1, 1876 an inspection committee of the Board of Supervisors examined the road that Derby claimed was completed.

why no
additional
manpower

Do the left side of the road
up or coming down?
Wouldn't that be a great
idea?

The three committee members were; J.M. Battee, T.F. Ayer and ^{Safe name?} Supervisor Furlong. They initially reported that finishing touches were needed in spots and that a bridge over Smith's Creek was under construction. Later in a formal report to the Supervisors, the inspection committee announced that the road was unfinished and inadequate. Derby the contractor reported that he was unable to complete the construction of the road, that would meet the standards demanded by the Supervisors. The San Jose Weekly Mercury commented:

Nearly everybody appears to have been deceived all around-the contractor on the quality of his rock, the bondsmen and the Board of Supervisors on the quality of the contractor. 35

The construction of an adequate, practical road to the summit of Mount Hamilton was one of the major conditions necessary before the Lick Trustees would start construction of the observatory. The San Jose Weekly Mercury reported in September of 1876 that work needed to be completed on the road to prevent the winter storms from washing away major portions of the road. The Mercury suggested that the Lick Trustees should pay the \$14,000 needed for the completion of the road. The records of the Lick Trust indicate that this course of action was not followed and it is assumed that Santa Clara County raised the necessary funds. 36

In the fall of 1876 the Supervisors hired a new set of contractors to complete the construction of Lick Avenue. Two men whose last names were, Drinkwater and Swall, were entrusted to contract the labor needed to complete the road. The road was fin-

ally completed in December of 1876 and protected from the ravages of the winter storms.³⁷

In January, 1877, the Road Committee of the Board of Supervisors issued a report on the completion of Lick Avenue. During the construction of the road it was reported that 237 kegs of blasting powder, 550 pounds of giant powder, 1,600 pounds of giant caps and 14,000 feet of fuse were used, in carving out the road to the top of Mount Hamilton. The amount of labor involved in the project was revealed to be: 4,448 days for laboring men, 1,443 days for blasters, 112 days for four horse teams, 234 days for two horse teams. The time involved for the contractors was 84 days for Drinkwater, and 56 days for Swall. The time that the unsuccessful contractor; Derby, expended was not mentioned.³⁸ The total cost for the construction of the road to the summit was \$73,455.81.³⁹ * *compare with initial estimate.*

The Construction of the Lick Observatory

On June 7, 1876, the Forty-fourth Congress of the United States of America granted 1,350 acres of Mount Hamilton to the Trustees of the Lick Observatory of the University of California.⁴⁰ A contract for a survey of the site of the observatory was signed in January, 1877, between Thomas Fraser, the agent for the Lick Trustees, and A.T. ^{Herrmann} Herman, the engineer who had surveyed the Mount Hamilton Road. ^{Herrmann} Herman presented the completed survey to the Trustees in March 1877.⁴¹

For the next three years the construction of the observatory buildings was delayed, due to litigation over the Lick Trust in the San Francisco Courts. The claims against the Trust were

* The grade of the road averages $6\frac{1}{2}$ feet per 100 ft. traveled, or approximately 343 ft. to the mile.

compromised in 1880 and work was soon begun on the site of the intended observatory. In the three years before the actual construction of the observatory, extensive planning and consultations were conducted with scientific advisors and the general plans for the buildings and domes were drawn⁴² up.

In 1879 Sherburne W. Burnham, a professor of astronomy at the University of Chicago, came to Mount Hamilton to test the conditions of the atmosphere and settle the question of the suitability of the site, in comparison ^{with} to a site at a greater elevation. Thomas Fraser had a temporary observatory constructed for Professor Burnham's studies. This was the first observatory on Mount Hamilton and was seven feet high and twelve feet in diameter. There will be further elaboration on Burnham's report in the section of this essay which concerns the telescopes of the Lick Observatory.⁴³

Work was commenced on the Lick Observatory on July 23, 1880. Thomas Fraser, superintendent of construction for the observatory, was confronted with the massive task of organizing the preparations for the construction work. Everything that was needed by the workmen, including their water, had to be hauled to the summit by horse and wagon.⁴⁴ At first water was hauled from Smith's Creek, a seven mile one way trip. Later during the summer of 1880 springs were discovered about 4,300 feet from the observatory site and 340 feet below the summit. Plans were made to construct a pump and reservoir system. The leveling of the summit for the foundation of the observatory, was begun on October 21, 1880.⁴⁵

In 1881 the work that had been done in leveling the summit was completed, up to thirty feet had been blasted away from the summit and approximately 40,000 tons of blasted rock was moved from the summit of Mount Hamilton by that summer. A base of solid rock was thus provided for the foundation of the observatory and buildings. The bricks that were used in the construction of the observatory came from a clay deposit two and one half miles from the summit.⁴⁶ During the winter of 1881 between eight and ten men were at work, preparing the foundation, under Fraser's supervision. Telegraph and telephone lines were built to the mountain top in 1881, linking the observatory site with San José.⁴⁷ The work on the water supply and reservoir was also begun. The circular room for the twelve-inch refracting telescope was completed, utilizing about 32,000 bricks, which had been baked at the brick kilns on the mountain.⁴⁸

In 1882 the major work of the year was the extension and brick laying of the main building, for a length of ninety feet from the circular room of the small dome. The water supply was greatly improved, after a road had been built to a reservoir site and a major reservoir was constructed out of brick and cement. This reservoir was 2,390 feet away from the observatory and had a capacity of 85,000 gallons.⁴⁹

In 1883 an additional reservoir was built. This reservoir was designed to catch rain water and can contain 65,000 gallons. The walls of the main building were constructed an additional ninety feet, reaching the north wall of the uncompleted dome for the thirty six inch refracting telescope.⁵⁰

In 1884 the unique difficulties of the mountain top observatory had been solved, only the plans needed completion. The main building was completed, although the interior of the building needed completion. The library room was made ready for books and the astronomers room near the summit was built. The Meridian Circle House and the Transit House were also completed. The water works also continued to be improved and expanded.⁵¹

In the year 1885 the bricks and other materials needed for the construction of the large dome were hauled to the summit. A stone retaining wall was built around the summit to prevent erosion. The meteorological instruments were installed, along with hundreds of smaller arrangements to make the observatory complete.⁵²

During the summer of 1886 the brick work for the large dome was completed along with the interior of the main building. There were about 2,600,000 red bricks used in the entire building. The exterior of the main building had a special paint applied, to preserve the building from the severe climatic changes upon the mountain. A third major reservoir was also constructed. It held about 30,000 gallons and is located 4,000 feet away from the observatory and is 170 feet higher than the observatory floor. A steam pump and windmill drew the water through pipes laid to the observatory, and the water was used to turn the large dome and elevate the hydraulic cylinders which raise the floor under the large dome.⁵³

On January 8, 1887 the remains of James Lick were sealed in a vault at the bottom of the thirty eight foot tall foundation pier of the uncompleted great telescope. A memorial eulogy that

was written by George Davidson was placed in the lead lined oak casket which contained Lick's remains, along with the signatures of the Lick Trustees. A plaque stating, "Here Lies The Body of James Lick", was placed on the front of the vault.⁵⁴ In October 1887 the large dome and telescope column were finished. The main building contained the library, offices, workshops and the domes. The finished domes were painted with a highly reflective white paint. The small dome housing the twelve inch refracting telescope is twenty four feet in diameter, and is located at the northwest angle of the building. The large dome is seventy feet, six inches in diameter, on the inside, and is located at the south end of the building. Overall the main building and domes are two hundred and seventy feet long.⁵⁵

The Telescopes of the Lick Observatory

Mount Hamilton was chosen as the site for the Lick Observatory for the following reasons: The site was close to the population centers of San Francisco and San José, the Supervisors of Santa Clara County agreed to build the road to the summit, favorable atmospheric conditions were present, the observatory was higher in elevation and closer to the equator than any other North American observatory at that time, enabling the astronomers to view a zone 20° wider than any of the contemporary American observatories. Another reason for the choice of Mount Hamilton is the speculation that Lick favored the site because it overlooked the Santa Clara Valley and his farm and mills.⁵⁶

In 1879 Professor S.W. Burnham made a series of astronomical and atmospheric observations upon the summit of Mount Hamilton,

from August 17, 1879, to October 16, 1879. During his stay on the mountain, Burnham discovered forty-two double stars, with a six inch refracting telescope. Burnham also established that the medium elevation site had excellent atmospheric conditions for astronomical research. The summit often had dry and clear skies, while fog shrouded the valleys below.⁵⁷ In his report to the Lick Trustees Burnham wrote:

Mt. Hamilton would be much more desirable, and more could be accomplished there with a large telescope than at any other place where an observatory has yet been established. 58

The twelve inch refractor was the first major telescope to be placed in the Lick Observatory. This instrument was made by Alvan Clark and Sons, a famous telescope firm in Cambridgeport, Massachusetts, in 1876. The lens for this telescope was cast by Feil and Company in Paris, France. Dr. Henry Draper originally purchased the telescope for his private observatory in New York, and finding it too large for his purposes he resold it to Alvan Clark in 1879. The twelve inch instrument was purchased by the Lick Trustees in September 1880, and mounted in the north dome of the observatory in October, 1881. This telescope has six eye lens, which range in magnification power from 160X to 1,400X. The twelve inch refractor is a total of fifteen feet, four inches long.⁵⁹

In order to fulfill James Lick's Deed of Trust, the Lick Trustees were directed to have built:

...a powerful telescope, superior to and more powerful than any telescope yet made,... 60

George Davidson appears to have convinced Lick of the advantages

of a forty inch refracting telescope, although Lick at one time was reported to have wanted a reflecting telescope, up to six feet in diameter.⁶¹ Upon the transfer of the observatory to the Regents of the University of California, Richard S. Floyd, the President of the Lick Trustees wrote:

Whether a great refracting telescope or a great reflecting telescope-the most eminent astronomers of the world were divided upon this question, a practical consideration of our exposed site determined the Trustees to decide in favor of a great refractor. It is doubtful if a large reflector could have its power practically realized at a sitelike Mount Hamilton. ⁶²

In 1873 when Lick and his advisors were making the initial plans for a great refractor, the largest refractor then in use was a twenty six inch telescope at the Naval Observatory in Washington D.C. Professors Holden, Newcomb and Trustee Fraser consulted all of the established telescope and lens companies in the United States, Great Britain, and Europe, before awarding the contract for the great telescope to Alvan Clark and Sons in 1880. The size of the great refractor was to be thirty six inches, the largest lens size believed to be technically possible. The glass blocks for the thirty six inch objective and thirty-three inch corrective lens were cast by Feil and Company of Paris, requiring many test castings, and suffering cracks in the original objective lens in 1882. A perfected objective lens was shipped across the Atlantic Ocean, to Alvan Clark in 1885.⁶³

The Clarks required one year to shape the lens to perfection. The finished lens cost \$50,000 exclusive of mounting and was shipped across the continent in a special railroad car in

December of 1886, arriving at the observatory on December 27, 1886, where it was placed in a special vault, until it could be mount-

ed over a year later, in January of 1888.⁶⁴ The mounting for the great telescope was built by the firm of Warner and Swazey of Cleveland, Ohio and was assembled at the observatory. The total cost for the great telescope and all its accessories was about \$200,000.⁶⁵

The thirty six inch refractor was also unique because the dome building it had been mounted in is equipped with an elevating floor, that can rise a vertical distance of seventeen feet and is lifted by the hydraulic cylinders mentioned previously. The thirty-three inch correcting lens converted the telescope into a photographic instrument, and the telescope has a magnification power of 270X to 3,000X. The great telescope is fifty-eight feet long and until the completion of the Yerkes Observatory of Wisconsin in 1895, with a forty inch refractor, the great refractor of the Lick Observatory was the largest in the world. The thirty-six inch refractor remains the second largest refractor in use.⁶⁶

There are five smaller telescopes that were set up at the Lick Observatory in the years prior to the transfer of the institution to the University of California in 1888. There is a six and one half inch equatorial telescope, that is used in the Meridian Circle House, The four-inch comet seeker was ordered on the recommendation of Simon Newcomb in 1880 and was delivered in 1881. An additional six inch meridian circle telescope was ordered in 1882 and delivered in 1884. The four inch transit and zenith telescope was ordered in 1880, mounted in 1881 and remodelled in 1885. All of the above mentioned telescopes are refractors.⁶⁷

The Lick Observatory of the University of California

When the great thirty-six inch refractor was mounted in January 1888, in the large dome, that had been constructed by the Union Iron Works of San Francisco, preparations began for the transfer of the observatory to the University of California. In May, 1888, the Regents of the University of California requested and received the valuable and voluminous correspondence regarding the planning and building of the Lick Observatory. That same month the Regents voted to spend \$20,000 annually, for the maintenance of the observatory.⁶⁸

On June 1, 1888, at the Lick Observatory, the Lick Trustees, represented by Trustees Edwin B. Mastick and Charles M. Plummer, presented a special deed to the Regents of the University of California, and thereby transferred ownership of the observatory to the Regents. Richard Floyd, the President of the Lick Trust, was unable to be at the ceremony due to a prolonged illness. Floyd sent a written statement that announced that the Trustees had fulfilled the will of James Lick and additionally transferred to the Regents \$90,000 in gold, the money left over from James Lick's original bequest of \$700,000. Edward Holden was officially appointed Director of the Lick Observatory on that day. Holden had previously been the President of the University of California since 1885.⁶⁹ A ceremony for the public transfer of the Lick Observatory to the University of California was made at the Commencement Day Ceremonies at the Berkeley campus on June 27, 1888.⁷⁰

Appendix

Deed of Trust of James Lick, Esq., of San Francisco, California.
Dated September 21, 1875. Recorded in the Office of the Records
of the County of San Francisco, State of California.
In Liber 810, of Deeds. 1875.

"Third- To expend the sum of seven hundred thousand dollars (\$700,000), for the purpose of purchasing land, and constructing and putting up on such land as shall be designated by party of the first part, a powerful telescope, superior to and more powerful than any telescope yet made, with all the machinery appertaining thereto and appropriately connected therewith, or that is necessary and convenient to the most powerful telescope now in use, or suited to one more powerful than any yet constructed; and a suitable observatory connected therewith. The parties of the second part hereto, and their successors, shall as soon as said telescope and observatory are constructed, convey the land whereupon the same may be situated, and the telescope and the observatory, and all the machinery and apparatus connected therewith, to the corporation known as the 'Regents of the University of California;' and if, after the construction of said telescope and observatory, there shall remain of said seven hundred thousand dollars in gold coin any surplus, the said parties of the second part shall turn over such surplus to said corporation, to be invested by it in bonds of the United States or of the City and County of San Francisco, of other good and safe interest-bearing bonds, and the said telescope and observatory are to be known as 'the Lick Astronomical Department of the University of California'."

The Third Board of Trustees

The third board of Trustees was appointed by James Lick on September 2, 1876; ratified by action of the Trustees in session of the Board, November 29, 1876, and confirmed by action of the Courts during the settlement of compromises with heirs of James Lick after his disease.

Richard S. Floyd, President.

William Sherman, Vice President, (died September 12, 1884).

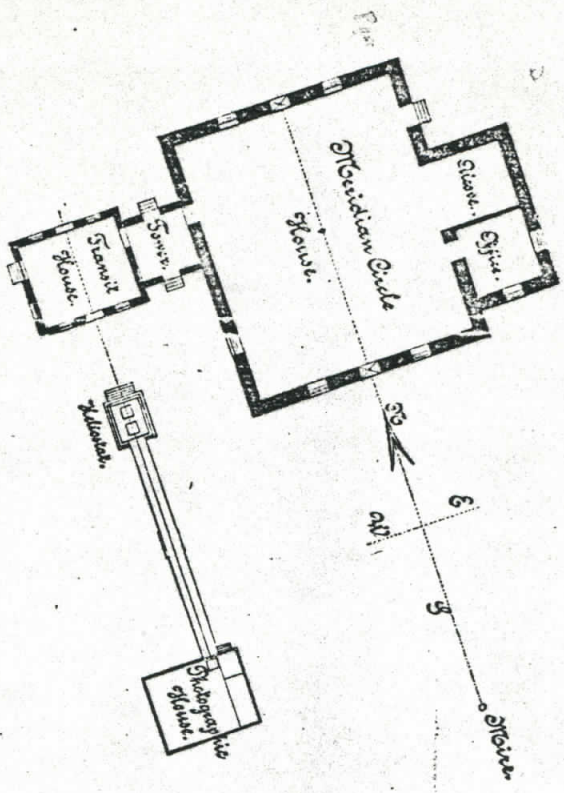
George Schoenwald, Attorney.

Charles M. Plum.

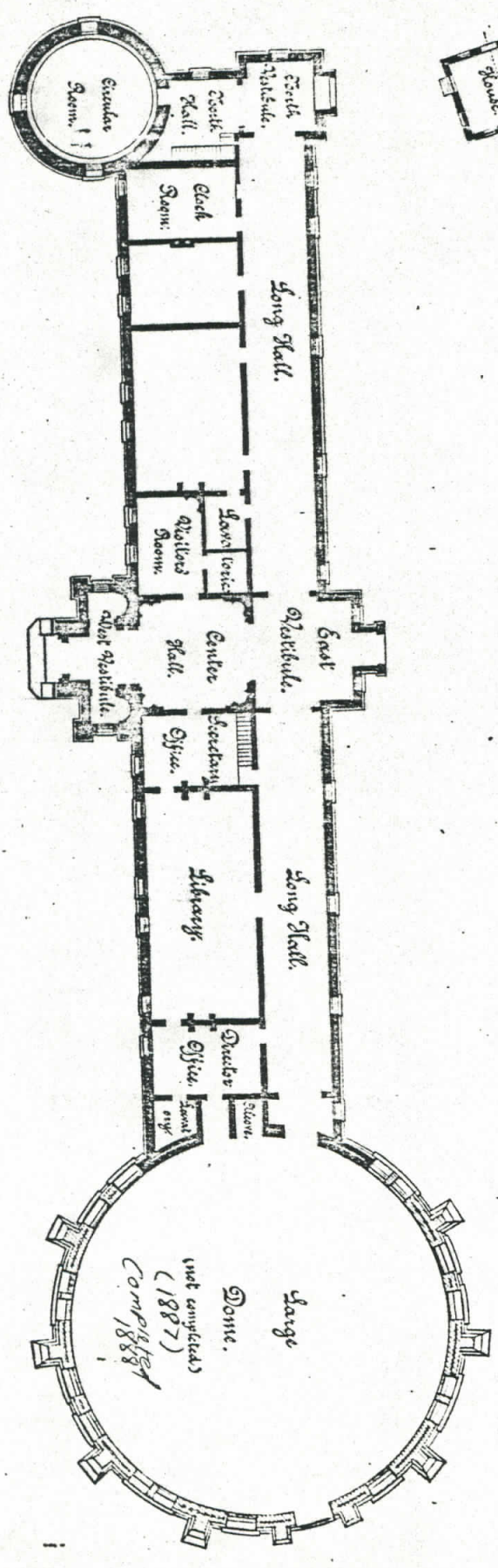
The Mount Hamilton Stage Company

"Visitors to Mount Hamilton leave San Francisco at 4:30 p.m. for San Jose. Stages of the Mount Hamilton Stage Company call at the various hotels and leave the office of Wells-Fargo, San Jose, daily at 7:30 a.m. : arrive at Smiths Creek at 11 o'clock: thirty minutes for lunch: arrive at observatory at 12:30 : time at observatory, two hours. Return to San Jose at 6 o'clock. Elegant coaches, beautiful drive, fast time. Secure your seats and tickets of Samuel Miller, agent under Grand Hotel.

From: Daily Alta California, (San Francisco)
May 28, 1888., p. 1., c. 3.

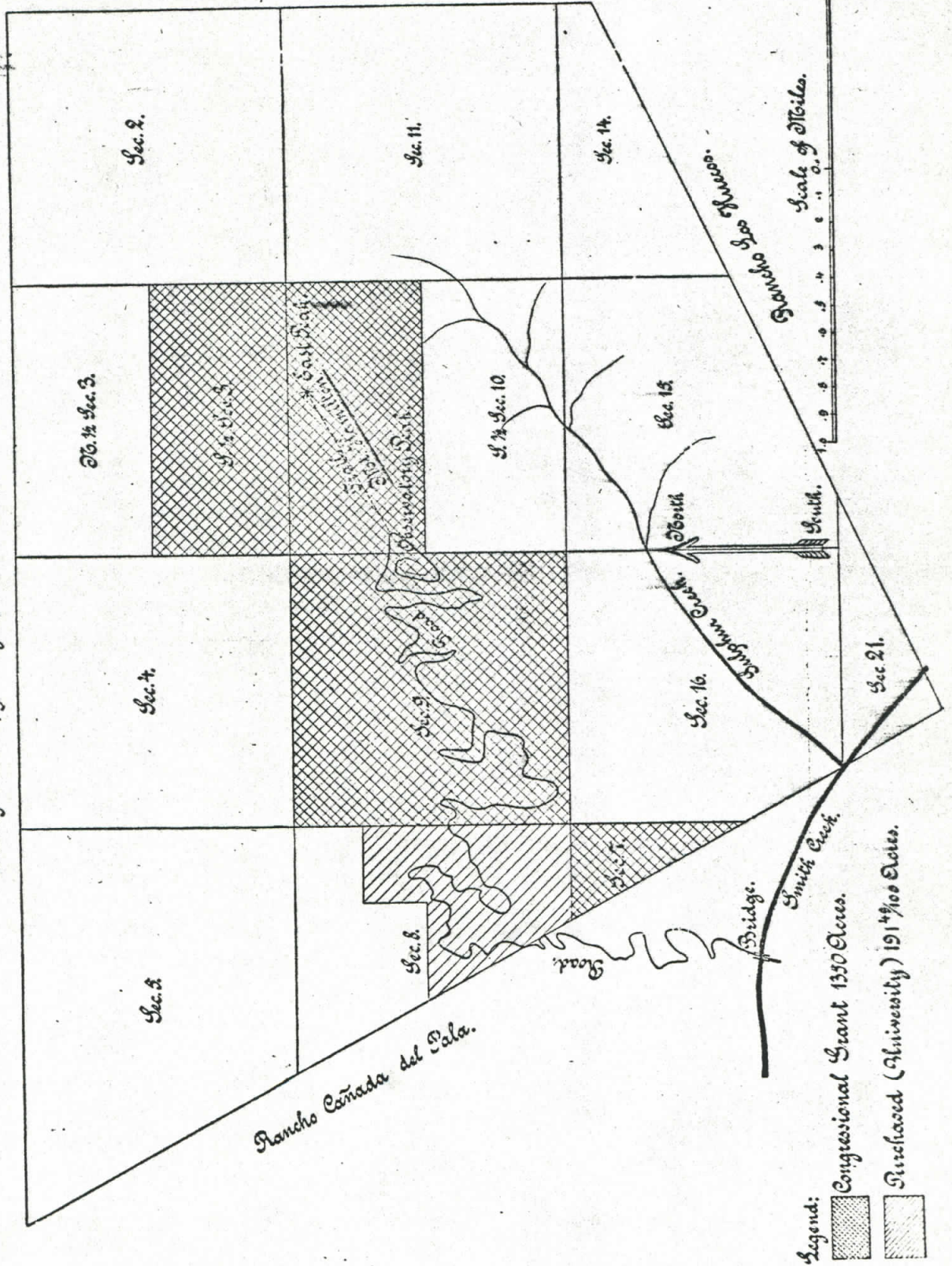


Ground Plan
of the
Lick Observatory.
Scale.



Map
of
Mt. Hamilton Reservation.
From
Official Surveys.
1876.

Township 7. South, of Range 3, East, Monte Diablo Base & Meridian.



Footnotes

1. Rosemary Lick, The Generous Miser: The Story of James Lick of California, (Los Angeles, The Ward Ritchie Press, 1967), pp. 3.
2. Ibid., pp. 4, 9-11.
3. James Lick sailed from New York on August 14, 1821 upon the ship "Seneca". The long voyage would take Lick to Buenos Aires which was then an independent city, and not part of Argentina. an account of the voyage is found in: ibid., pp. 11-15.
4. Ibid., pp. 29-30.
5. Ibid., p. 32.
6. William H. WorriLOW, James Lick: 1796-1876; His Role In California History, (New York, The Newcomber Society of England, American Branch, 1949), p. 14.
7. Lick, op. cit., p. 33.
8. Ibid., p. 35.
9. WorriLOW, op. cit., p. 14.
10. In 1853 Lick paid \$10,000 to Jose Y. Limantour who was thought to possess the legal title to much of the land in San Francisco, due to what appeared to be a valid Mexican Land Grant, which the United States was pledged to recognize, when it acquired California. Limantour had collected money from many owners of real estate in the city. In exchange for the money Limantour settled the property claims, and the owners would now have the legal title. Lick's involvement is covered in: Lick, op. cit., p. 40.
The documents which Limantour based his claims upon were proven to be fraudulent, after microscopic examination of the Mexican Government Seal on the documents were proven to be forgeries. The examination of the Mexican seals was done by George Davidson, who later was instrumental in helping to found the Lick Observatory. This is detailed in: Oscar Lewis, George Davidson, : Pioneer West Coast Scientist, (Berkeley and Los Angeles, The University of California Press, 1954), pp. 30-33.
11. F.J. Neubauer, "A Short History of the Lick Observatory", Popular Astronomy, LVII, (May 1950), p. 204
12. Lick, op. cit., p. 51
13. A complete list of James Lick's property holdings is found in the third Deed of Trust of James Lick Esq., of San Francisco, September 21, 1875.

14. For a complete list of the beneficiaries in Lick's will see ibid., pp. 16-23.
15. Lick, op. cit., pp. 61-62.
16. Ibid., pp. 87-95.
17. Ibid., p. 87.
18. Ibid., An account of Davidson's first meeting with Lick and the subsequent planning for the telescope and observatory is also found in, Lewis, op. cit., pp. 77-83.
19. Lewis, op. cit., pp. 78-80.
20. Daily Alta California, (San Francisco), October 21, 1873, p. 1., c. 7.
21. Lewis, op. cit., pp. 80-82.
22. Publications of the Lick Observatory of the University of California, vol. I., (Sacramento, 1887), p. 10.
23. All of the mountains in the San Francisco Bay area that Lick considered for his observatory are of medium elevation. Mt. Diablo: 3,848 ft., Mt. St. Helena: 4,343 ft., Mt. Loma Prieta: 3,806 ft. and Mt. Hamilton: 4,302 ft. at the observatory site. Lick had personally visited Mt. St. Helena and had rejected it as a site. Lick never visited the top of Mount Hamilton during his life and trusted Fraser's judgment in deciding on the observatory site. This is detailed in; Lick, op. cit., pp. 70-72.
24. Neubauer, op. cit., p. 209.
25. Millicent Shinn, "The University of California. II. The Lick Astronomical Department," Overland Monthly, 2nd. Ser., XX, (November, 1892.), p. 486.
26. Taliesin Evans, "A Californian's Gift to Science," The Century XXXII., (May 1886.), p. 64.
27. Lick, op. cit., pp. 78, 83.
28. The San Jose Weekly Mercury, September 30, 1875, p. 1.
29. Neubauer, op. cit., p. 209.
30. San Jose Weekly Mercury, January 20, 1876, p. 3., c. 4.

31. Ibid., February 17, 1876, p. 1., c. 9.
32. Ibid., April 6, 1876, p. 3., c. 4.
33. Ibid., April 13, 1876, p. 3., c. 9.
34. Ibid., May 11, 1876, p. 3., c.3.
35. Ibid., June 15, 1876, p.1., c. 8.
36. Upon the transfer of the observatory to the University of California, a detailed account of the funds in the Lick Trust was published in the Daily Alta California, (San Francisco), June 2, 1888, p. 1., c. 2.
37. San Jose Weekly Mercury, January 18, 1877, p. 2., c. 8.
38. Ibid.
39. Ibid., April 12, 1877, p. 3., c. 1.
40. Aaron A. Sargent, the United States Senator from California used his influence to secure for the observatory site an area of Federal land on Mt. Hamilton, amounting to 1350 acres in 1876. In 1876 James Lick purchased an additional 149 acres of land on Mt. Hamilton, that had been in private ownership. In 1886 R. Morrow who owned a vast amount of ranch land on the east side of the observatory lands, donated another 40 acres, protecting the observatory against the construction of buildings in close proximity to it. Information and a map of the observatory reservation are found in Publications of the Lick Observatory of the University of California, vol. I., (1887), pp. 11-13.
41. San Jose Weekly Mercury, January 25, 1877, p. 8., c. 4.
42. Shinn, op. cit., p. 486.
43. The arrival of S.W. Burnham in San Francisco on August 16, 1879, and his two months of observations upon Mount Hamilton, were extensively reported in the San Jose Weekly Mercury. The report that Burnham delivered to the Lick Trustees is printed in Publications of the Lick Observatory of the University of California, vol. I., (1887), pp. 13-33.
44. Evans, op. cit., p. 66.
45. San Jose Weekly Mercury, October 21, 1880, p. 1.
46. A considerable amount of money and effort was saved by having the bricks made upon the mountain, this is mentioned in Publications of the Lick Observatory of the University of The University of California, vol. I., (1887), p. 42.

47. San Jose Weekly Mercury, November 17, 1881, p. 2.
48. Ibid., September 15, 1881
49. Publications of the Lick Observatory of the University of California, vol. I, (1887), pp. 41-42.
50. Ibid., pp. 41-43.
51. Ibid., p. 43.
52. Ibid.
53. Ibid., p. 34.
54. Edward S. Holden, Handbook of the Lick Observatory, (1888), pp. 14-15.
55. Publications of the Lick Observatory of the University of California, vol. I., (1887), p. 34.
56. San Jose Weekly Mercury, September 22, 1880, p. 3.
57. Publications of the Lick Observatory of the University of California, vol. I., (1887), pp. 13-33.
58. Ibid., p. 23.
59. Ibid., p. 65.
60. Deed of Trust of James Lick Esq. of San Francisco, op. cit., p. 16.
61. In the University of California Magazine for April 1899 an article by George Davidson was published, in which Davidson gave his account of the founding of the Lick Observatory. It appears that Davidson exaggerated his importance to the observatory project and maintained that James Lick had "never looked through a telescope or read a work on astronomy", until 1873. This inaccurate statement about Lick and Davidson's original disdain of the choice of Mount Hamilton for the observatory tends to make Davidson's recollections somewhat questionable. A summary of Davidson's article is found in, Oscar Lewis, George Davidson: Pioneer West Coast Scientist, (1954), pp. 76-83.
62. San Jose Weekly Mercury, June 7, 1888, p. 1.
63. Shinn, op. cit., pp. 488-489.
64. G. Edward Pendray, Men, Mirrors, And Stars, (1935), p. 249.
65. Shinn, op. cit., pp. 488-489.

66. Pendray, op. cit., pp. 223-225.
67. Publications of the Lick Observatory of the University of California, vol. I., (1887), pp. 65-69.
68. Daily Alta California, (San Francisco), May 9, 1888, p. 1., c. 3., May 22, 1888., p. 1., c. 5.
69. Ibid., June 2, 1888., p. 1., c. 2.
70. Lick, op. cit., p. 84.

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San Jose Weekly Mercury, 1873-1888.