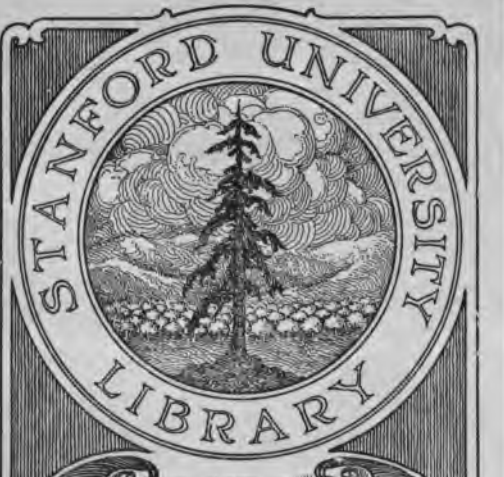
CLARENCE KING

A Memorial

1902



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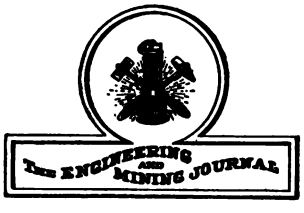

CLARENCE KING.

Clarence King, geologist and mining engineer, died at Phœnix, Arizona, on December 24, 1901. He was born in Newport, Rhode Island, January 6, 1842, so that at the time of his death he had not quite completed his sixtieth year. Immediately after his death his body was brought from Arizona to New York City, where funeral services were held, and later taken to Newport for interment. The funeral services, which were conducted at the Brick Presbyterian Church by the Reverend Henry Van Dyke, were attended by many of his friends in New York, comprising the leading representatives there in science, art, literature and commerce, and a body of some forty prominent members of the Century Club, of which he was a most popular and honored member.

Clarence King stood entirely alone in his world-wide reputation as a mining geologist, and as the pioneer in systematic geological exploration under government control. Just as Hayden was the great master of general reconnaissance work over great areas of the West at a time when they were almost unknown, so King stands out beyond all other explorers for his more quantitative examination of the West's mineral deposits. He was the organizer and the first director of the United States Geological Survey.

In order to express the profound sorrow felt by his co-laborers in the field of geology at the death of Mr. King a meeting was held in the office of the Director of the United States Geological Survey, at Washington, on Saturday, December 28. The meeting was attended by all of the scientific men of the Bureau. Addresses were made by Major J. W. Powell, Hon. Charles D. Walcott and Mr. S. F. Emmons. The following resolutions, offered by Major Powell and seconded by Mr. Hague, were unanimously adopted as an expression of their great loss in the death of so eminent a leader of geological science:

"It is with profound sorrow that we learn of the death of Clarence King, the first director and, in a sense, the founder of the Geological Survey. In him we have lost not only a great scientific leader, but a genial and accomplished gentleman, whose personal qualities endeared him to all who knew him, and whose many acts of loving kindness have left a wide circle of friends in all walks of life to mourn his untimely death.

"As organizer and, during ten years, Chief of the United States Geological Exploration of the Fortieth Parallel, he set higher standards for geological work in the United States and laid the foundation of a systematic survey of the country. He gave practical recognition to the fact that a good topographical map is the essential basis for accurate geological work.

"As first director of the present Geological Survey, he laid down the broad general lines upon which its work should be conducted and which, as followed by his able successors, have led to its present development. He established the principle that a Geological Survey of the United States should be distinguished among similar organizations by the prominence given to the direct application of scientific results to the development of its mineral wealth.

"In that essential quality of an investigator—scientific imagination—no one surpassed King, and his colleagues have all profited by his suggestiveness. He was never content with the study of science as he found it, but always sought to raise the standard of geology as well as to apply known principles to the survey of the country.

"King first introduced microscopical petrography into American geology and, as early as his Fortieth Parallel work, he foreshadowed the application of exact physics to questions of geological dynamics. Early in the history of the present Survey he established a physical laboratory. One result of this step was a paper on the Age of the Earth, which takes very high rank among modern scientific memoirs. Although in his last years circumstances rendered it necessary for him to devote most of his time to other occupations, he had by no means abandoned plans for geological investigation on a scale worthy of his reputation.

"In Clarence King geological science in America will miss a pioneer and a leader; the Geological Survey loses its broad-minded founder and adviser, and its older members a beloved friend."

The following tribute to the memory of Mr. King was prepared by Mr. S. F. Emmons, his intimate friend and associate, and was published in connection with the foregoing resolutions in the *Engineering and Mining Journal* of January 4, 1902:

The Life and Scientific Work of Clarence King.

Among the many who have met Clarence King, there were few but have borne away from their meeting a delightful impression of the subtle charm of his personality. Of those in the most varied walks of life, scientific, literary and artistic, who have been counted his friends, each has recognized in him, in addition to this charming personality, a wonderful grasp of mind and a clear insight into the essential principles of his own particular profession. To the members of his small circle of intimates alone has it been sometimes permitted to gain a knowledge of the great and tender heart which accompanied this remarkable intellectual development, but the recipients of his beneficence, whether of mind or purse, alone can realize with what grace and freedom he gave.

No man could ever do justice to all his varied accomplishments, for there was nothing that he touched, whether in art, literature or science, that he did not adorn. Doubtless many casual acquaintances have reasoned that one who could be brilliant in so many different lines could not have been thorough in all, and probably few, even among mining engineers, realized to what extent the present remarkable development of our mining industry is due, directly or indirectly, to the labors or influence of Clarence King. Since, therefore, in a hasty sketch like the present, it would be manifestly impossible to do justice to all the phases of his many sided life, it will only be attempted to trace that which had to do with mining industry.

According to the standards of the present day, King did not receive a very elaborate professional training; but, together with an instinctive faculty of grasping at once the keynote of any subect he was studying, which is generally considered characteristic of genius, he possessed the more unusual power of concentration of mind that enabled him in comparatively brief time to master all the essential details of his subject.

In his early life the bent of his mind toward the study of nature was greatly influenced by his mother, a woman of most remarkable intellectual gifts, who, left a widow when scarcely out of her teens, had devoted her life to the education of this, her only son. His professional education was completed at the Sheffield Scientific School of Yale, which he left in 1862, a member of the first class that received a degree from that institution. At college he was devoted to athletic sports, and throughout all his life was distinguished for remarkable physical vigor and energy; even up to the time of his last illness he was in the habit of enduring fatigues that would have worn out men of half his years.

The year following his graduation he set out on a horseback trip across the continent in order to study the then practically unknown Rocky Mountains, or Cordilleran System. This trip, which he and his friend, James T. Gardiner, made with an emigrant train, starting from St. Joe, Missouri, occupied several months, during which he first conceived the idea of the importance and feasibility of making a geological section across this, the longest mountain system in the world, at its widest point, an idea which he succeeded in putting into practical execution five years later.

Such a trip in those days was necessarily full of incident, but space will only admit of the mention of a single one: The young explorers had left their emigrant train and stopped over at Virginia City to study the already famous Comstock Lode. The night after their arrival the boarding house in which they were sleeping caught fire, and King, who was a sound sleeper, barely escaped with his life, losing everything he had with him. His loss included not only his clothing, but all his letters of credit and recommendation, and he was, therefore, obliged to go to work as an ordinary hand in one of the mills in order to earn money enough to continue his journey, for in those days it was a question of months, rather than days, before replies could be had to mail communications with the East.

When he finally reached California, after crossing the Sierras on foot, he attached himself as volunteer assistant to the Geological Survey of the State of California, under Prof. J. D. Whitney. Among his scientific services on this Survey were the first determination of the age of the auriferous slates, the exploration of the Mt. Whitney group of the Southern Sierras, then the highest known mountain mass in the United States, and the recognition of the glaciation of the Sierras, which his chief had, up to that time, not believed in. He was also associated in the examination of the mines of the Mariposa Grant and took part in an exploration of Arizona under General McDowell. During the latter, he and his companion were once captured by the Apaches, but were fortunately rescued just as the fires were being prepared for their torture.

After the close of the Civil War, when Congress, as a measure of wise public policy, had voted to subsidize the Trans-Continental railroads, King recognized that the time had come for carrying out his scheme of connecting the geology of the East with that of the West, and making a cross-section of the entire Cordilleran System. In the winter of 1866-7 he went to Washington, and in spite of the disadvantage of his youth, and still more youthful appearance, he was so successful in impressing Congress with the importance of ascertaining the character of the mineral resources

of the country about to be opened up by these railroads and affording a scientific basis for their development, that, not only was a generous annual appropriation voted for the geological exploration he had planned, but King himself was placed in absolute charge of it, subject only to the administrative control of General A. A. Humphreys, Chief of Engineers.

It was characteristic of the scientific thoroughness of the man that, while all similar works under government auspices were called *surveys,* this, the only one which formed a systematic whole and constructed complete topographic maps of the area examined, was designated by him simply an *exploration.*

The most important result of this work, in its relation to mining, was the publication in 1870 of the economic bearing of its results in the volume of King and Hague, entitled " Mining Industry," a work which marked a new departure in geological reports. It was well characterized in these columns as " by itself a scientific manual of American precious metal mining and metallurgy, and an invaluable work of reference concerning the mode of occurrence of gold and silver." It was mainly devoted to an exhaustive study of the Comstock Lode, the mining regions farther east having reached at that time but a very limited development. In the Comstock mines alone had mining methods and machinery made any distinct advance over European precedents. These advances were all illustrated by drawings made to scale with such accuracy that it is said that the well-known firm of Frazer & Chalmers later used them as working drawings in the construction of their early stamp mills and hoisting machinery.

The original plan of the exploration had contemplated only three years' field work, and it was a striking tribute to King's ability as its chief that Congress, in the summer of 1870, without any solicitation on his part and, indeed, without his knowledge, made an appropriation for its continuance, which extended its field work for another three years.

In consequence of this extension and the time required by various specialists to work up the vast amount of material gathered, ten years had elapsed ere the six quarto volumes, which embodies its results, were completed, and King was able to undertake the final summing up of the whole. This work was published in 1878 as a volume of 803 pages, entitled " Systematic Geology." Probably no more masterly summary of the great truths of geology had been made since the publication of Lyell's " Principles," and it differs from the latter in that it is not a compilation, but based on personal, or personally directed, observations. It was well characterized by one of its more careful reviewers in the following terms: " The most satisfactory part of Mr. King's work, next to its scientific thoroughness, is the breadth of view which

embraces in one field the correlation of such extended forces and the vigor of grasp with which the author handles so large a subject without allowing himself to be crushed by details. Hitherto every geological report has been a geological itinerary without generalization or arrangement. This volume is much more; it is, indeed, almost a systematic geology in itself and might be printed in cheaper form and used as a text-book in the technological schools."

King's crowning service to geological science in this country, and through it, to the development of mining industry, followed shortly after the completion of the Fortieth Parallel work in the conciliation of the warring elements in existing government surveys, which seriously threatened to put a stop to all government aid to scientific work. Probably few realize that it was mainly through his influence among the leading scientific men of the country, and his tactful management of affairs in Congress, that this crisis was averted. The question was referred to the National Academy of Sciences, and their recommendations, which were on lines laid down by him, were finally adopted by Congress, and early in 1879 a law was passed establishing the United States Geological Survey as a Bureau of the Interior Department. King was appointed Director of the Survey by President Hayes, with the approval of the chiefs of all the organizations which it displaced.

Although, owing to failing health, consequent upon the severe strain, both mental and physical, of nearly 20 years' strenuous work, he felt obliged to retire to private life in the second year of his directorship, he maintained the liveliest interest in the work and organization of the Survey up to the very last. In the short period of his administration he outlined the broad general principles upon which its work should be conducted, and its subsequent successes have been in great measure dependent upon the faithfulness by which these principles have been followed by his successors. His belief was that a geological survey of a great industrial country, while not neglecting the more purely scientific side of its work, should occupy itself primarily with the direct application of geological results to the development of the mineral resources of the country.

Under his direction were carried on the examinations of the Comstock, Eureka, Leadville and other mining districts, whose importance is to be measured not solely by the accurate information which they afforded of these particular regions, but in far greater degree by their influence upon the whole body of mining engineers, in teaching them the practical importance of a study of the geological relations of ore deposits.

He also planned and supervised the collection of statistics of the precious metals for the Tenth Census, a work which has never been equaled in detail or scientific accuracy, and whose logical result was the annual collection of statistics of all the mineral resources of the United States, which has been carried on by the Geological Survey ever since the completion of the work of the Tenth Census.

While it was his work as an organizer and administrator that will have the most far reaching results, results that will endure when the memory of him shall have become dim, his personal influence in maintaining high standards of scientific accuracy and personal integrity in the mining profession was always most potent.

In the case of the exposure of the diamond fraud of 1872, the credit of the discovery of its long concealed location was due to his assistants, who happened to have surveyed during the previous summer the region within which it was included. It was in the interest of pure science, and in the hope of discovering the true matrix of the diamond, that he undertook its investigation. When it was discovered that the ground had been salted, it was King's prompt action that averted the financial catastrophe that threatened to involve Europe, as well as this country. By traveling day and night he outstripped all other possible means of information, and on reaching San Francisco made a peremptory demand upon the directors of the company that they should at once stop all issue and transfer of stock. To a suggestion that the announcement should be temporarily delayed, he replied: "There is not money enough in the Bank of California to induce me to delay this announcement a single hour." It was in San Francisco, where the company had started, and its stock was mainly held, that the importance of this discovery was best appreciated. With regard to it the Reverend Horatio Stebbins made the following significant utterance: "One scientific man, whose untarnished fame alone is worth all the diamonds in the world, has found occasion to prove to the world the value of science and his own great moral worth; and that result alone compensates for all the shame of this great fraud. This man, in response to the promptings of duty and responsibility as the geologist-in-charge of the territory where the diamond field was alleged to be located, sought out the scene of the fraud in the service of science alone and hastened with his undeniable proofs to those engaged in forwarding the scheme and put an end to the projected robbery of the people. To have learned that we have one such man is enough to make us look upon the whole stupendous wrong and its results as a cause of thankfulness."

In the course of his long and varied career King served as expert in many famous mining law suits, such as the Richmond-Eureka case in Nevada, the Dives-Pelican case in Colorado, the Center Star-Iron Mask in British Columbia, and the Anaconda and other mines, in Butte, Montana, but he was never willing to accept a retainer in such service until he had satisfied himself by personal observation that the contention of the side that desired his services was in accord with his reading of the geological structure and such as he could conscientiously subscribe to. There have been cases where the entire line of argument has been changed after the inception of the case in deference to his opinion of its geological untenability.

He possessed not only a keen insight into geological structure, as developed in the underground workings of mines, that is rare, even among the best and most experienced geologists, but also a remarkable grasp of its legal bearing, so that to him was commonly allotted the general conduct of the case and the determination of the line of attack or defense to be followed. This, however, did not satisfy his conception of his duty toward his client, for he was never willing to trust to the observations of another, but always verified every fact in detail by his own personal inspection. He thus obtained such thorough knowledge of his subject that the most skillful lawyers in the profession were unable to shake his testimony by their cross-examinations, which often extended over several days' time.

This class of work was, however, to King a matter of necessity rather than of predilection, although he took pleasure in it, as he did in everything that involved a contest of wits and intellect. His first preference was for investigation in pure science, and to contribute in this line permanent and substantial additions to the foundations of human knowledge was his highest ambition; in literature and art he delighted, as a mental recreation and pastime, but money-making was to him merely a means to an end; necessary, but of relatively subordinate importance. That circumstances necessitated the devotion of so much of his time to the latter occupation has been a material loss to the world of science and art.

During his directorship of the Geological Survey he established a laboratory of experimental physics, defraying the expense of its costly apparatus out of his own pocket, and securing for its conduct the services of the most prominent young physicists of the day. Here were carried on under him a series of investigations into the Constants of Nature, with a view of testing experimentally, and, if necessary, revising the existing theories upon the constitution of the earth. The results of these investigations have already constituted important contributions to the science

of terrestrial physics; King's paper on the "Age of the Earth," in the *American Journal,* has been characterized by such men as Kelvin and Helmholtz as a most important contribution to the study of the earth. The final summing up of a new theory of the earth, though it had been formulated in his mind, was still awaiting the long-hoped-for moment of leisure when it was cut short by death. In literature he had published but little, his principal work being "Mountaineering in the Sierra Nevada," a combination of scientific descriptions and genre-painting which possesses literary merit equal to that of the best literary writers of the day.

In the spring of 1901, after an unusually arduous mining campaign, he had a severe attack of pneumonia and whooping cough, and during convalescence it was discovered that he had contracted tuberculosis, the seeds of which were supposed to have been sown during a visit to the Klondike in the previous summer. From this disease he died at Phœnix, Arizona, on the 24th of December, 1901, in the 60th year of his age.

S. F. EMMONS.

Besides the publications mentioned above, the following scientific papers are credited to Clarence King:

"On the Discovery of Actual Glaziers on the Mountains of the Pacific Slope."—*American Journal of Science*, 3d Ser. Vol. I, pp. 157-161, 1871.

"Paleozoic Subdivisions of the Fortieth Parallel."—*American Journal of Science,* 3d Series, Vol. II, pages 475-482, 1876.

"Notes on the Uinta and Wahsatch Ranges."—*American Journal of Science,* 3d Series, Vol. XI, page 494, 1876.

"Catastrophism and Evolution."—*American Naturalist,* Vol. XI, pages 449-470, 1877.

"Report on Physical Constants of Rocks."—United States Geological Survey, *Third Annual Report,* pages 3-9, 1883.

"The Age of the Earth."—*American Journal of Science,* third series, Vol. XLV, pages 1-20, 1893. *Smithsonian Institution Annual Report,* 1892-93, pages 338-352.

The following letter was published in the *Engineering and Mining Journal* of January 18, 1902:

SIR:—It is far more fitting that honor be done Clarence King in some masterpiece of poetry, music or art, but, powerless to do this, I can only offer my tribute to his memory in a few halting phrases.

The news of his death reached me just a year from the day we became acquainted, and in thought I live over again that and the few succeeding days during which I had the privilege of intercourse with one of the rare souls which make this earth happier and better for their presence. During these days the disease which ultimately proved fatal was slowly fastening upon him, yet even in his suffering his cheerful and kindly smile, and his fascinating conversation made the lonely mining camp a radiant spot. His constant courtesy to the most humble miner or servant, his unfailing humor, which neither sickness nor disappointment could check, his sympathetic interest in the perplexities of his associates, and the rare charm and polish of his conversation marked him as a perfect gentleman and an unselfish soul.

Men such as Clarence King are few indeed. His interests were as broad as civilization and his sympathies as catholic as humanity. Merely to be in his company was in very truth a liberal education, and I feel that I cannot estimate the great value to myself of that month of daily intercourse with him. Only too clearly I realize the impossibility of expressing in these feeble and commonplace sentences the great privilege of an acquaintance with Clarence King. But I could not do less than try.

With the ending of his life it seems as though the sun had set on a glorious day. But in the darkened firmament the brilliant star of his memory will remain a constant reminder of the goal he reached and toward which we all may strive in perfect faith that it is worthy of every high thought and noble purpose.

HENRY M. ADKINSON.

CHICAGO, Jan. 8, 1902.