# MEMOIR

OF

# ANDREW ATKINSON HUMPHREYS.

## 1810-1883.

BY

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# BIOGRAPHICAL MEMOIR OF ANDREW ATKINSON HUMPHREYS.

MR. PRESIDENT AND GENTLEMEN OF THE ACADEMY:

Another honored name among those of the original fifty corporators of this Academy has been stricken from our membership by death. General Humphreys was eminent both as a scientist and as a soldier, a man of broad and liberal views, of commanding intellect, and of the highest personal honor. Official station and strength of character enabled him to do much to promote American science and to advance the material prosperity of the country.

Under obligations to him of no ordinary nature almost since my boyhood, filled with respect for his character and with admiration for his genius—which intimate professional and personal relations for twenty-nine years only served to enhance—I have shrunk from the duty of preparing this memoir, in the fear that the expression of what is nothing but the truth may seem to be the extravagant eulogy of friendship. I ask you to believe that I shall conscientiously avoid anything like exaggeration, which would be most unworthy of him and of this Academy.

ANDREW ATKINSON HUMPHREYS was born in Philadelphia on November 2, 1810. His great-great-grandfather, emigrating from Wales in 1682, settled in Haverford township, near Philadelphia, where the family still own land which has never passed from their possession. His grandfather and father were both Chief Naval Constructors. The former, the first officer appointed to that grade in our service, was the leading naval architect of his day in this country, and he made the plans upon which were constructed the Constitution and her five sister frigates, which carried the stars and stripes with such distinction in the war of 1812.

As a boy, the subject of this sketch was active, bold, and too full of fun and frolic to devote his attention closely to books. His first serious study was done at the Military Academy at West Point, to which he was appointed in 1827. Even at that age his mind was

not fully developed, and he was graduated in 1831 with the thirteenth place in a class of thirty-three members. Our late colleague, Professor William A. Norton, of Yale College, was his classmate.

Upon leaving the Military Academy Lieutenant Humphreys was assigned to the 2d Artillery. After serving chiefly in South Carolina, Georgia, and Florida, and taking an active part in the Florida war, his health broke down and he resigned his commission on September 30, 1836.

The Topographical Engineers, constituting at that time a distinct bureau of the War Department, were increased in numbers and organized as a corps by the act of July 5, 1838; and the young officer, who, since his resignation, had served as a civil engineer under Major Hartman Bache, was appointed first lieutenant to fill an original vacancy in the new organization on July 7, 1838. For six years he had a varied experience in surveys, harbor improvements and bridge building, and as assistant in the Bureau of Topographical Engineers at Washington. While serving in the latter capacity in 1843 it became his duty to prepare the first project for the extension of the National Capitol, and his design in its essential features much resembles that ultimately adopted and now embodied in brick and marble. In 1844, upon the application of Professor Bache, he was detailed as assistant in charge of the Coast Survey Office. Here he remained until 1849, taking a very active part in organizing the Coast Survey upon its permanent basis. His services were so highly appreciated that Professor Bache not only recommended him for promotion by brevet when they terminated, but also urged the appointment in the following language, quoted from the annual report of the Survey for 1853:

"This officer was placed in charge when the augmentation of the scale of the Coast Survey was begun, and devoted himself with untiring assiduity and most remarkable success to the difficult task imposed upon him. His health suffered so seriously from the accumulated labors which he undertook that he was finally obliged to leave the work. His services were so fully shown by the condition to which he had brought the office during his charge of it that I simply discharged a duty in recommending him for a brevet on retiring. The varied and complicated duties of the several departments of office work require not only professional knowledge of a high order, but intense application and very considerable administrative power.

"The new form of organization to be given to the different parts of the office rendered Captain Humphreys' duty one of even greater than ordinary difficulty, and he discharged it with success, regardless of the gradual undermining of his health. As this duty is imposed by law on the officers of the army, I respectfully submit that for distinguished execution of it he should have the reward appropriate to the officer, a brevet."

It was not until 1850 that Captain Humphreys, after eighteen years of intense application to the duties of his profession, and with judgment ripened by practical experience in many different branches, saw opened before him a field for distinction in original research and independent administration.

By an act approved September 28, 1850, the General Government granted to the several States bordering upon the Mississippi river the swamp and overflowed lands within their limits, to provide a fund for reclaiming the districts liable to inundation. Vigorous action was at once started throughout the entire region. The people of Louisiana, alarmed lest the embanking of the vast lowland districts above them should so concentrate the floods as to overwhelm their own fertile fields in a common destruction, invoked the aid of the Government to conduct surveys and investigations looking to a system for their protection. From this movement the Delta Survey had its origin. Congress made two appropriations, $50,000 in 1850 and $50,000 in 1852; and with these, in modern estimation, most inadequate means Captain Humphreys conducted for ten years a series of researches which accomplished their object, and which have placed his name high on the list of the distinguished hydraulic engineers of the world.

The problems presented to Captain Humphreys for solution were most intricate. Even the fundamental laws governing the flow of water in natural channels, as laid down by the best authorities, were not based upon experiments sufficiently extended to warrant confidence. The data as to cross-sections, slope, volume of discharge, matter in suspension, etc., for this particular river were all unknown. The extent to which the great bottom lands acted as reservoirs to reduce the volume of the maximum flood wave as it traversed the unleveed districts was in dispute even upon theoretical grounds, while of the actual facts nothing was established. The topography of the district was based upon rude surveys unworthy of confidence where precise information was essential to a proper

discussion. The records of previous floods were meagre, and many of them were only to be collected by personal inquiry throughout a region vast in extent, and much of it sparsely settled by a population wedded to absurd hydraulic theories which colored their statements and compelled the investigator to adopt a system of cross-examination more akin to that in the courts than to questions in ordinary practical engineering. The river itself, the resultant of immense forces whose laws of action were unknown, flowed through the country, eroding the banks on one side and reconstructing them on the other, in defiance of the puny efforts of the riparian proprietors, and sometimes in ways apparently so contradictory as almost to justify the sufferers in personifying the river as an evil spirit, which periodically reared his tawny front from the chasm where he writhed in uneasy slumber at low water to work malicious mischief upon their homes and fertile fields. In addition to this great problem of protection against floods, the investigation of another question —that of improving the channels over the bars at the mouths of the river—was soon added to Captain Humphreys' labors.

After a hurried reconnaissance of the region he organized three parties—one to make a minute topographical survey of the river banks between New Orleans and Red river, including accurate lines of level; another to make a hydrographic survey of the river in the same region, including the measurement of cross-sections, the gauging of discharges, and the study (original with Captain Humphreys) of the character and quantity of the material pushed along the bottom, and a third to perform systematic hydrometric work near New Orleans daily for a couple of years. Gauge rods for measuring the oscillations of the water surface were also established throughout the entire extent of the delta. The amount of sedimentary matter carried in solution was observed daily for a couple of years. The discharge of several crevasses was determined by measurement. Like investigations were inaugurated at the several passes to determine the laws governing bar formation where the river water enters the Gulf.

Captain Humphreys gave the closest personal attention to the work of these several parties, passing from one to the other continually and correcting all omissions or misapprehensions. His written instructions, which have never appeared in print, are most minute, and might well serve as models in conducting similar work. They cannot fail to impress the reader with his firm grasp of the subject

and his care to include every element which might enter into the ultimate discussion of the results. These arduous labors performed under a burning sun, for which his sedentary life in Washington had ill prepared him, were suddenly terminated by a *coup de soleil* in the summer of 1851. This shock completely prostrated him and compelled his temporary relinquishment of the direction of the work. After the loss of the master spirit the operations soon fell into confusion, and the field work was brought to an end, leaving much which had been projected unperformed.

For a time Captain Humphreys' physical condition was distressing. His nervous system, overtaxed by continuous mental labor for several years, demanded absolute rest; and all the loving ministrations of home were needed to prevent the ambitious spirit from chafing itself to death under so unwonted a check. When at length reaction commenced, and returning strength made idleness no longer endurable, he sought and received permission to visit Europe, with instructions to examine its delta rivers and to learn what the experience of centuries had taught as to the immediate and ultimate effects of different methods of protection against inundation. Thus the investigations committed to his charge profited in the end by what at first seemed to be a fatal interruption.

In the summer of 1854 Captain Humphreys returned with health restored and eager to resume operations on the Mississippi. This was not to be. The great question of a Pacific railroad had excited popular enthusiasm, and the Secretary of War had been charged with making the surveys and investigations needful to determine the comparative merits of the different routes and the probable cost of each. He knew and appreciated Captain Humphreys' ability, and insisted that he should assume direction of the work as his own confidential adviser—retaining, however, charge of the Delta Survey, which was thus temporarily restricted to the reduction and discussion of data already collected.

It was at this time (October, 1854) that my good fortune placed me, a recent graduate from West Point, under the orders of Captain Humpheys. General Warren, then a second lieutenant, and myself were the only officers at that time on duty with him in the office of Pacific Railroad Surveys, but the work was pushed forward by him with great energy.

Captain Humphreys was absorbed in the preparation of his general report, collecting his materials from the manuscript reports,

incomplete maps and profiles, and verbal explanations of the several chiefs of the different routes, and from a voluminous correspondence with the chief engineers of the important railroads east of the Mississippi, and with leading merchants and business men. Congress soon assembled in short session, and the throng of Senators and Representatives eager for the latest information rendered close application during the day well nigh impossible. Our real work was largely done at night, and under pressure which can hardly be overstated. The precise advantages and disadvantages of the several routes, the estimates of their relative cost and relative working expenses, the questions of water and fuel, and more generally the demands and probable traffic to be accommodated, all had to be studied; and hasty penciled "memoranda" of points to be investigated came at all hours from Captain Humphreys, whose grasp of the subject and admirable judgment produced an impression on me which thirty years have only deepened. His mind worked like a beautiful machine, neglecting nothing, forgetting nothing, and so rapidly bringing order out of chaos that the work took shape visibly from day to day. The preliminary report was completed before Congress adjourned; and subsequent experience has amply confirmed the correctness of its conclusions and the wisdom of its recommendations.

New parties (to one of which I was attached) were soon sent into the field under the direction of Captain Humphreys, who shortly found himself at the head of a sub-bureau of the War Department charged with all the numerous explorations and surveys west of the Mississippi. Other important matters were often referred to him for special reports by the Secretary of War, who highly appreciated his knowledge and ability. In 1856 he was also appointed a member of the Light-house Board, which largely added to his labors.

In 1857, upon his application, I was ordered to report as his assistant upon the Delta Survey. He had provided himself with a little private room to which he could escape occasionally from his office in the War Department to study the old records, and he was bitterly chafing at the constant interruptions to investigations which he still regarded as the great scientific work of his life. After he had been struck down in 1851 the field work had not been carried out in all respects according to his plans, and the subsequent office reductions had shown that links were missing in the chain of evidence which could not be supplied without resuming operations

upon the river. Fortunately his economical management of the appropriations had left sufficient funds available, and he soon drew up a project for me to carry out in the field. This project was a marvel of forethought that left no gap to be regretted in the subsequent elaborate discussion of the problem, of which the general scope could only be inferred at that date.

The project contemplated daily measurements of the discharge of the Mississippi river near the mouth of the Ohio, and at a point between the influx of the Yazoo and Red rivers; lines of levels across the great Yazoo and Tensas bottom lands, to determine their reservoir capacity; the erection of numerous gauge rods throughout the alluvial region, for recording the daily changes of level of the river; full information as to the daily contributions of the tributary streams; accurate measurements of any crevasses which might occur during the approaching high water; numerous cross-sections of the river at points distributed throughout the entire alluvial region; resurveys at important localities, to learn precisely what changes had occurred since the date of the old measurements; the collection of all possible data as to former floods, and full records of the actual condition of the levees from Cairo to the Gulf, with the dates and history of their construction and the local systems upon which they had been built. In a word the finger was to be firmly placed on the pulse of the great river, and every symptom of its annual paroxysm was to be noted. Very fortunately one of the greatest floods on record occurred, and the observations thus became invaluable for the purpose for which they had been planned. Simultaneous observations at the passes were carried on by Mr. C. A. Fuller, under the immediate direction of Captain Humphreys.

The reduction of these records, augmented by authentic information from every available source, was a work of immense labor and of profound study. The results are now known to the world in the published report, of which two complete and one abridged edition have been printed in this county, while translations into most of the principal languages of Europe have appeared abroad. Respecting this report I have only one word to say. Captain Humphreys had earned the reputation which led to his being entrusted with and continued in the direction of so responsible a work by long years of intense and exhausting mental labor. He had nearly sacrificed his life in its prosecution while I was yet a young cadet beginning my course at West Point. As his assistant during

the last for years of the work, I had simply performed my duty to the best of my ability. Most men would have considered a complimentary allusion to these services in the introductory letter an ample reward. This was not his way of thinking, and he placed my name with his own on the title page. Is it wonderful that a man who to the highest professional attainments united so generous and noble a nature should have bound his associates to him with respect and love stronger than links of steel?

The report was completed at the last moment before the outbreak of hostilities in 1861. Of General Humphreys' war record this is not the place to speak. To courage of the highest order, both moral and physical, he united the energy, decision, and intellectual power which characterized him in civil administration. These traits, joined to a thorough knowledge and appreciation of the principles of strategy and grand tactics, fitted him for the highest military responsibilities; and when peace was proclaimed he had few equals, and no superiors, among the generals developed by the war. His service throughout was with the Army of the Potomac, in which he rose to the command of an army corps. If fortune had favored him with independent command, it is certain that the country would have been the gainer.

In the winter of 1865-66, with his full rank as major general of volunteers, he was sent to the alluvial region of the Mississippi to determine what could best be done to repair the ravages of the war in that region, where the levees had suffered much from neglect as well as from the great flood of 1862. His report, although brief, is a valuable historical document.

He had now risen by regular promotion to the grade of lieutenant colonel, the two corps of engineers having been consolidated during the war. On August 8, 1866, he was appointed brigadier general and chief of engineers, *vice* General Delafield, retired. He discharged the duties of this responsible position for a period of thirteen years, until he was placed on the retired list at his own request on June 30, 1879.

It is a matter of importance to American science that the office of chief of engineers shall be held by a man of broad views, who appreciates its needs and is interested to promote its progress. I am sure that the members of this Academy interested in geology, zoölogy, and botany appreciate the assistance which General Humphreys was both able and willing to render in advancing their sev-

eral specialities. During the twenty-five years in which the exploration of the vast region west of the Mississippi was most active, including the Pacific railroad and other surveys before the war and the King and Wheeler surveys since its close, no man had more power to aid or was more interested in aiding these branches of research than General Humphreys. In the field of hydraulic engineering as applied to the improvement of our rivers, harbors, and internal routes of communication, in which the material interests of the country have so much at stake, he was equally active. During much of this time the burden of his great responsibilities deprived him of the leisure needful for individual research, but it is no small matter to have a scientific man and a friend of science in a position so influential and so important.

In the system of sea-coast fortification General Humphreys' administration marks an important era. Our late colleague, General Barnard, in his eulogy of General Totten, printed in the first volume of our Biographical Memoirs, has admirably outlined the life work of that distinguished engineer, to whom the country owed a system of fortification more nearly perfect and comprehensive than any adopted in Europe in his day. But the advance of science respects neither man nor his works. General Totten's massive masonry towers served their purpose and protected our seaboard from insult while he lived, but their efficiency died with him. Improved processes in metallurgy and a better understanding of the principles of gun construction and of the chemistry of explosives have placed under the control of modern fleets—

> "Such implements of mischief as shall dash
> To pieces, and o'erwhelm whoever stands
> Adverse, that we shall fear they have disarm'd
> The Thunderer of his only dreaded bolt."

The duel of the *Monitor* and *Merrimac* off Newport News in 1862 marked an epoch no less decisive than that which stripped the coats of mail from the horsemen of the middle ages and created the infantry of to-day.

General Humphreys met the changed conditions with good judgment. He convened a board of eminent engineers, with General Barnard at its head, to investigate the subject in the most thorough manner, both theoretically and by experiment. The result was the present system, which consists in obstructing the channel by electric torpedoes flanked by the old guns in the old casemates, but defended

by modern ordnance mounted in barbette on depressing gun-carriages and covered by mounds of earth. This system was never designed as a finality, but only as a temporary expedient to give protection to the seaboard until the struggle between guns and armor had reached a more definite stage. General Humphreys approved and carried it out, so far as the insufficient appropriations of Congress would allow. He also organized an efficient submarine mining system and a school of application for research in professional matters and for supplementing the West Point course in points where engineering science was treated too briefly from want of time.

General Humphreys' administration of the civil branch of the duties of the Corps of Engineers was confronted with peculiar difficulties growing out of the war. The two organizations which had existed since 1838 had been consolidated into a single corps during its progress, and casualties among the personnel had been severe. Many young officers had joined during the war, and had risen to high rank with little or no experience except with armies in the field. But Congress immediately inaugurated works of internal improvement upon a larger scale than ever before, and of a character to demand high professional skill in their inception and execution. The corps was thus suddenly called upon to bear the responsibility of projecting and constructing a system of water communications and of river and harbor improvements over an area but little less than that of the whole continent of Europe, while the surveys of the Great Lakes and of the Western Territories were still actively prosecuted. This responsibility was met by the chief in a manner which illustrated his good judgment and knowledge of men, and which produced excellent results.

The more experienced officers were placed on boards to project works at important localities, and in their individual capacities to supervise the constructions and disbursements throughout extensive districts. The younger officers were assigned as assistants to exercise local supervision and make themselves familiar with both theory and practice by special reading and experience in the field. Very soon the whole force was organized and working together as a unit to carry into effect the legislation of Congress. Whatever success may have attended the operations of the corps at this important period of its history deserves to be associated with the chief who directed its labors with a skill for which his own studies had been so admirable a preparation.

Upon his own application, at the ripe age of 68 years, General Humphreys' name was transferred to the retired list of the army. Fifty-two of these years had been devoted to the service of his country. He had performed an amount of mental labor of which few men are capable, but his eye was undimmed and his brain was as clear as ever. Repose was far from his thoughts. He was an enthusiastic soldier, and the responsible positions he had held as Chief of Staff and Corps Commander in the Army of the Potomac had made him more familiar with its campaigns than any other man then living. It was his purpose to prepare a history covering the period after he became Chief of Staff in the summer of 1863. The Scribner's Series, to which he was invited to contribute, afforded him the opportunity, and he at once undertook the labor. It would have been easy for him to prepare a volume of personal recollections, but that was not his method of doing work. The official records of both armies had been so classified and arranged in the War Department as to afford authentic material for history in the true sense of the word, and he applied himself to the task of its analysis with the energy of youth and the ripened judgment of a man familiar with affairs. The condensed form of the publication hampered and restricted him, but the result in two small volumes is worthy of a place by the side of Cæsar's Commentaries and of Zenophon's Anabasis. They will remain with military men the touchstone for judging of the accuracy of more extended histories of these campaigns.

General Humphreys' individual contributions to science were appreciated both in this country and in Europe. In 1857 he was elected a member of the American Philosophical Society; in 1862, an honorary member of the Imperial Royal Geological Institute of Vienna; in 1863, a fellow of the American Academy of Arts and Sciences. In the same year he became one of the original corporators of the National Academy of Sciences. In 1864 he was elected an honorary member of the Royal Institute of Science and Arts of Lombardy. The degree of LL. D. was conferred upon him by Harvard College in 1868. He was also a corresponding member of the Geographical Society of Paris, of the Austrian Society of Engineer Architects, and of the New Orleans Academy of Sciences. In 1880 he was elected an honorary member of the Italian Geological Society. In March, 1885 (after his decease), notification of his election as a corresponding member of the Geographical Society of Hungary was received.

His military honors were equally distinguished. He received the brevet of colonel in the regular army for gallant and meritorious services in the battle of Fredericksburg, Virginia, of brigadier general for gallant and meritorious services in the battle of Gettysburg, Pennsylvania, and of major general for gallant and meritorious services in the battle of Sailor's creek, Virginia, in which he commanded the Second Army Corps.

In contemplating such a career it is natural to search for the secret of its success. A little incident which occurred before the war goes far to reveal it. One day, when studying a report that bore evident marks of neglect and ignorance of its subject, he suddenly brought his clenched fist heavily upon the table, exclaiming: "I cannot understand how any man can be willing to assume charge of a work without making it his business to know everything about it from A to Izzard." These words unconsciously sounded the keynote of his whole life.

In official relations General Humphreys was dignified, self-possessed, and courteous. His decisions were based on full consideration of the subject, and once rendered were final. He had a profound contempt for everything which resembled double-dealing or cowardice. He scorned the arts of time servers and demagogues, and when confronted with meanness took no pains to conceal his indignation, no matter what might be the rank or position of the offender. He felt the warmest personal interest in the success of his young associates, and often did acts of kindness of which they learned the results but not the source.

In his social relations General Humphreys exerted a personal magnetism which can hardly be expressed in words. His manners were marked by all the graceful courtesy of the old school, while the unaffected simplicity and modesty of his character and the force and vigor of his ideas left an impression not easily effaced. He was a gentleman by nature, not merely by artificial polish, and no one could be thrown much in his society without recognizing the fact.

Friends privileged to meet him intimately in his own house could not fail to be charmed with the atmosphere of love and happiness which pervaded the home circle. In 1839 he married his cousin, Miss Rebecca Hollingsworth; and in her society, surrounded by his sons and daughters, he threw off the burden of care and became the genial companion and kind-hearted friend.

He was fond of music and literature, and all his tastes were cultivated and refined.

On the evening of December 27, 1883, General Humphreys passed from life as he would have wished, seated alone at his table. The family had retired, bidding him good night apparently in his usual health. Full of years and honors, his life work well done, most admired and beloved by those who knew him best, one of the great men of our age and country there rested from his labors, leaving in many hearts a void which will never be filled.