

FERDINAND VANDERVEER HAYDEN.

BY M. B.

Of the great surveys of the United States prior to the creation of the present United States Geological Survey, that established in 1869, under the direction of the distinguished scientist whose name stands at the head of this sketch, was undoubtedly the best known, most important, and longest in point of duration.

Ferdinand Vanderveer Hayden was born in Westfield, Mass., on September 7, 1829. He early moved with his parents to Ohio, and settled on the Western Reserve, where he was brought up on a farm and studied at common school, but he received an excellent education, for he was graduated at Oberlin College in 1850, and then turning his attention to medicine, received his degree in that science at the Albany Medical College in 1853.

During the same year he began his career as a geologist, and was sent by James Hall, then and still State geologist of New York, to the Bad Lands of Dakota, where he explored one of the remarkable ancient deposits of extinct animals, and returned to Albany with a large and valuable collection of fossil vertebrates. In 1854 he again went West under the auspices of the American Fur Company, but at his own expense, and after spending two years in exploring the basin of the Upper Missouri River, returned with a large number of fossils, part of which he deposited in the St. Louis Academy of Sciences and the remainder in the Academy of Natural Sciences in Philadelphia. On his return, in February, 1856, he was employed by Lieut. Gouverneur K. Warren, of the U. S. Topographical Engineers, to make a report on the district he had just explored, and so secured to the government the results of his three years' work.

His collections attracted the attention of the authorities of the Smithsonian Institution, and in May, 1856, he received the appointment of geologist on the staff of Lieut. Warren, who was engaged during 1855-57 in making a reconnaissance of the Northwest, principally in what is now known as Dakota.

Dr. Hayden continued so occupied until May, 1859, when he was appointed naturalist and surgeon to the expedition sent out for the exploration of the Yellowstone and Missouri Rivers, under Captain William F. Reynolds, of the United States Engineers. He was engaged in this work until May, 1862, when the civil war having broken out, he was appointed acting assistant surgeon, and assigned to duty at the Satterlee Hospital, in Philadelphia. On February 19, 1863, he was confirmed assistant surgeon and full surgeon by the United States Senate, and sent to Beaufort, S. C., in the capacity of chief medical officer. This place he filled until February, 1864, when he returned North, and was made assistant medical inspector in the department of Washington. In September, 1864, he was ordered to Winchester, Va., as chief medical officer of the Army of the Shenandoah, then commanded by General Philip H. Sheridan. He remained with this command until May, 1865, when he resigned from the army and was given the brevet of lieutenant-colonel for "meritorious services." In 1865 he was elected professor of mineralogy and geology in the University of Pennsylvania, in Philadelphia, and continued in the active administration of this chair until 1872, when the increasing duties of the geological survey compelled his resignation. Meanwhile, in 1865-66, he was unofficially connected with the Smithsonian Institution, and during the summer of 1866 he again visited the valley of the Upper Missouri, for the Philadelphia Academy of Natural Sciences, gathering for that society a valuable collection of vertebrate fossils. In 1867, when Nebraska was admitted as a State, Congress provided for a geological survey of the new State. The direction of this work was given to Dr. Hayden, who in 1868 extended his work westward into the Territory of Wyoming, and made two annual reports to the Commissioner of the General Land Office. For this work, the small sum of \$5,000 was annually appropriated, and the present national survey is the direct continuance and outgrowth of this small beginning.

In April, 1869, this work was reorganized under the title of "The Geological Survey of the Territories of the United States," and for the first year's work \$10,000 was appropriated. During the subsequent years until 1872, Dr. Hayden conducted a series of geological explorations in Dakota, Wyoming, Utah, and Colorado, the scope of investigation including besides geology, the natural history, climatology, resources, and ethnology of the region. The grants of money were likewise steadily increased from year to year, until, in 1873, they reached \$75,000, and \$20,000 for engraving. In 1886, the year in which Dr. Hayden severed his connection with the survey, it received \$503,240, or over one hundred times the sum originally granted to the sur-

vey, nearly twenty years previously. In 1869, the work of the survey included a reconnaissance along the eastern edge of the Rocky Mountains from Cheyenne, Wyoming Territory, to Santa Fe, New Mexico, with reports of the geology and mining and agricultural resources of the country passed over; and in 1870 the area explored comprised a belt of country in Wyoming Territory along the line of the Union Pacific Railroad, and the annual report for that year contained papers on the geology, natural history, meteorology, agricultural and material resources of the Territory, besides special reports on its fossils, plants, fish, and reptiles.

A portion of the country at the sources of the Yellowstone and Missouri Rivers was explored in 1871, including the Yellowstone Lake, and the geysers and hot springs of the Fire Hole or Upper Madison River. Descriptions of the wonders of this region soon found their way into print and were translated into foreign languages. Public interest was developed to such an extent that during the sessions of Congress that winter an act, approved on March 1, 1872, was passed, by which the district now known as the Yellowstone National Park was "reserved and withdrawn from settlement, occupancy, or sale under the laws of the United States, and dedicated and set apart as a public park or pleasuring ground for the benefit and enjoyment of the people," and placed under the exclusive control of the Secretary of the Interior.

In 1872, two parties were in the field. One division explored the headwaters of the Yellowstone, Gallatin, and Madison Rivers more in detail than in the previous



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year, while the other division visited the Snake River or Lewis Fork of the Columbia, in Idaho and Wyoming Territories—a region which before that time was only partially known; and in 1873 the work in Colorado was begun on the eastern front of the Rocky Mountains, and then carried westward, being completed in 1876.

Meanwhile, in 1873, geography was added, not as primary object, but for the sake of furnishing a topographical base on which the geological formation could be shown, and the name of the organization again changed, becoming "The Geological and Geographical Survey of the Territories." Thereafter the work progressed more systematically, and on the completion of the labors of the survey in Colorado, in 1876, the seat of action was again transferred to Wyoming.

In this manner the active direction of this important national undertaking was continued until 1879, during which year the existing surveys, including, besides that of Dr. Hayden, those under the supervision of Major John W. Powell, Clarence King, and Lieut. George M. Wheeler, were consolidated, forming the United States Geological Survey. This action was the result of considerable legislation, owing to the rivalry of the heads of the interior and war departments, each of which contended that the survey should be under his direction. In this movement, Dr. Hayden advocated the placing of the survey under the charge of the department of the interior, and was an active candidate for the directorship, but the choice fell upon Clarence King, who received his appointment from President Hayes.

* Died in Philadelphia, Dec. 22, 1887.

Dr. Hayden was at once made assistant geologist, and given charge of the work in the region of the sources of the Mississippi or the division of Montana. He continued in this capacity until failing health caused his resignation, to take effect on December 31, 1886.

He was a member of scientific societies both in the United States and in Europe, and in 1873 was elected a member of the National Academy of Sciences. In 1876 the honorary degree of LL.D. was conferred on him by the University of Rochester, and in June, 1887, he received a similar degree from the University of Pennsylvania. On his receipt of the latter, the *Public Ledger* said: "It is a praiseworthy act for the University to honor with the highest distinction in her gift her justly distinguished son, and, as far as the recognition of his skill can do, to console his dying hours."

Dr. Hayden's scientific papers were about fifty in number, and were contributed to the *American Journal of Science*, to the *Proceedings* of the Philadelphia Academy of Sciences, and to the transactions of other learned societies of which he was a member. His principal publications were issued by the government, and included annual reports from 1867 to 1879, which give the general and geological descriptions of the region surveyed each year, together with special reports on the paleontology, natural history, and similar subjects, with catalogues of the specimens, also so-called miscellaneous publications designed to give information on various subjects of interest connected with the West, written by authorities in the specialties of which they treat, and finally a series of quarto volumes entitled "Reports of the United States Geological Survey of the Territories." To most of these volumes he was a contributor, and as United States geologist in charge of the survey, their editor.

In 1886 Dr. Hayden was stricken with progressive locomotor ataxia. This soon prostrated him, until he was confined to his room, and although he rallied slightly during the spring and summer of 1887, he continued to sink until death relieved him of his sufferings, in Philadelphia, on December 22, 1887.

The Dependence on Invention.

In the December number of the *Popular Science Monthly* appears a leading article on inventions at Panama. Nothing is truer than that all great undertakings are accompanied by inventions equal to their necessities. Especially is this true when anything of a great public benefit is in the balance. Inventions may not always be equal to the emergency immediately upon its development, but their evolution is sure till they are capable of overcoming the difficulty. The immense dredging apparatus and excavators at Panama have done wonderful execution, and have been greatly instrumental in sustaining the hope in the eventual success of the enterprise under its present management. But it would seem, from the reports coming from that quarter, that inventions have not been multiplied or developed enough to meet the urgency of the undertaking.

That a canal will eventually be cut through from ocean to ocean on the line laid out by De Lesseps is an event of as much certainty as that which followed the conception of the Suez Canal, if it is thought that the requirements of commerce will be advanced thereby. Physical obstacles have thus far been subdued by the engineering skill of man, in cases where they have at first appeared insurmountable. "Every great undertaking, properly conducted, brings about improvements in the processes of execution." This is exemplified in the tunneling of Mont Cenis and St. Gothard. To facilitate the progress of the work and make it more of a possibility, the invention of a machine for the compression of atmospheric air and its utilization as a motor became a matter of vital necessity. It aided in the prosecution of the work by keeping the air comparatively pure, while acting as a power in the operation of the drills. Had it not been for this contrivance, that the exigencies of the situation called into demand, workmen would have found it impossible of laboring in the vitiated air, or a great expense would have had to be incurred to accomplish several purposes, all of which this invention effected. This Alpine air pressure engine has not been used at Panama, as it is adapted only to tunneling or mining, but it serves to show that what man undertakes to do, that appeals to public necessity, he is sure to have the aid of invention to help in its final achievement. The great dredges at Panama were inspired by the difficulty of procuring labor. —*Boston Journal*.

To restore faded ink on parchment, etc., the Bodleian Library, at Oxford, has long employed solution of hydrosulphide of ammonia, which is spread in a thin layer over the writing with a camel's hair pencil.