Newton H. Winchell, Pioneer of Science

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IN ITS STRUGGLE to rise above the coarseness of the frontier and the unenlightened materialism of early prairie and urban communities, the Midwest has produced cultural monuments and spiritual and intellectual concepts and ideals of more than passing interest and certainly of more than local value. Although they span the fields of literature, art, architecture, religion, education, and science, in certain cases these contributions are still unappreciated except by specialists within the specified disciplines. An excellent example may be found in the careers of Alexander Winchell, a resident of Michigan, and his brother Newton H. Winchell, who lived in Minnesota during the most productive years of his life. They contributed substantially to Midwest progress and development, and yet for the most part their contributions have been overlooked by historians.[1]

The blood of hardy New England ancestors ran in the veins of Newton Horace Winchell. In 1760 his greatgrandfather moved to Dutchess County, New York, and established his home on a high hill that became known as Winchell Mountain. Nearby, in the village of Northeast, Newton was born in 1839, the son of Horace and Caroline McAllester Winchell. Young Newton attended school in Salisbury, Connecticut, and at the age of sixteen he began teaching in the district school at Northeast. Several years' teaching experience stimulated his desire for a higher education, and in 1858 he entered the University of Michigan. There he began his study of natural science, particularly geology, under the guidance of his brother Alexander, who was chairman of the department of geology, zoology, and botany, organized three years earlier. During the next eight years Newton was enrolled in the university between periods of teaching in the public schools of Ann Arbor, Grass Lake, Flint, Kalamazoo, Colon, and Port Huron.[2] Apparently he taught his way through college.

In 1866 Winchell was graduated from the University of Michigan and

[1] A review of the career of "Alexander Winchell, Michigan Scientist and Educator" was contributed by the present writer to *Michigan History*, 35:185–201 (June, 1951). A full-length study of the Winchell brothers could be based upon their papers in the Minnesota Historical Society and the University of Michigan at Ann Arbor.

[2] Warren Upham, "Newton Horace Winchell, 1839–1914," in Minnesota Academy of Science, *Bulletins*, 5:78 (1911–14); John M. Clarke, "Newton Horace Winchell," in *Science*, 40:127–130 (July–December, 1914).

a year later he received his master's degree there. After a brief experience as superintendent of schools at Adrian, Michigan, he began to devote much of his time to field geology, and between 1869 and 1872 he received sound fundamental training as an assistant on the staff of the Michigan and Ohio geological surveys. In addition, he found time for a side trip to the Southwest, where he studied the geology and mineral deposits of New Mexico.[3]

As assistant to John S. Newberry, chief of the Ohio geological survey, Winchell made a careful and detailed survey of twenty northeastern Ohio counties. Impressed with Newberry's scholarship and stimulated by his imaginative yet thoroughly scientific field work, Winchell produced reports under his guidance that are still among the best originating with this project. From the very beginning of his career his field work showed the ability to make meticulous observations and comparisons — a quality that was to earn him the respect of scientists and laymen alike. In addition to his descriptive reports, he contributed several good maps to the Ohio survey.[4]

In 1872 Winchell was rewarded for his serious efforts when he was invited by President William Watts Folwell to join the staff of the University of Minnesota as professor of mineralogy and geology and as state geologist.[5] After he arrived in Minnesota, however, he discovered that his salary and the funds available for geological work were not in keeping with the pretentiousness of the title. Although the university had been authorized in 1851, it had been in actual operation only three years when Winchell accepted his new post, and he discovered that the state legislature was more interested in developing the industrial and mineral resources of the state than in teaching geology to a handful of university students.

Winchell had no doubts about the need for a thorough natural history survey of Minnesota. The region had attracted early explorers, traders, and adventurers, but many of their records were inaccurate or too general to possess real scientific value. Even Champlain had been aware of copper deposits and other minerals in the vicinity of Lake Superior, but his information was based on hearsay. The *Jesuit Relations* recorded very little pertaining to geography and nothing at all about geology. Hennepin went into some detail when describing rivers and topography, but he was unscientific. Lahontan, who may have traveled in the Minnesota

[3] Warren Upham and Rose B. Dunlap, *Minnesota Biographies*, 870 (*Minnesota Historical Collections*, vol. 14 — St. Paul, 1912).

[4] Geological Survey of Ohio, *Reports*, vol. 1, part 1, p. 593–645; vol. 2, part 2, p. 227–438 (Columbus, 1873, 1874); Clarke, in *Science*, 40:127–130; Upham and Dunlap, *Minnesota Biographies*, 869.

[5] Clarke, in *Science*, 40:127–130.

country in the 1680's, was unable to control his imagination. Nearly a century later Jonathan Carver traveled through the upper Mississippi country and later wrote what was then the best description of the Falls of St. Anthony. In 1805 and 1806 Jefferson's dashing pathfinder, Lieutenant Zebulon M. Pike, gave more particulars concerning the waterfall, and his data enabled Winchell and other geologists to determine with some degree of accuracy the rate of recession of the falls.

Among the numerous explorers and scientists who saw and reported on the Minnesota country during the next half century were Lewis Cass, Henry R. Schoolcraft, Dr. Douglass Houghton, George W. Featherstonhaugh, Charles Whittlesey, and David Dale Owen. The latter's survey of the upper Mississippi Valley, in the years from 1847 to 1850, from the scientific viewpoint was the most productive Minnesota expedition before Winchell's survey was organized in 1872. Unlike earlier expeditions, Owen's survey was made after considerable deliberation and careful planning. It was concerned not only with geological reconnaissance, but with chemical analyses of soils and minerals. The Owen reports seem all the more remarkable when it is remembered that those who wrote them worked under great hardships in a region that was primarily virgin wilderness. There were times when the expedition faced starvation, and some of its members suffered from pleurisy, malaria, or cholera. Quick action on the part of local missionaries saved the lives of some of the scientists who were stricken with disease far from civilized communities.[6]

Owen was fortunate in having a dependable and capable staff of assistants. Chief among them was Joseph G. Norwood, a competent geologist and an able writer. The part of the Owen report dealing with northeastern Minnesota and the Lake Superior area was written by Norwood. His observations on the spectacular basaltic columns on the North Shore of the lake and the crystals of iron pyrites in the Vermilion River rocks are a classic in geological literature. Norwood's descriptive passages were made more vivid by the unique sketches prepared by Owen and others to illustrate the text.[7] In brief, it may be said that the Owen expedition brought to light for the first time some of the essential facts of Minnesota geology, and the published report must have been eagerly read by Winchell when he took over the duties of state geologist in 1872.

From 1852, when the Owen report was published, until 1872 geological

[6] Whittlesey, who explored the Minnesota country both with Owen and later, is the author of a pamphlet entitled *Geology and Minerals: A Report of the Explorations in the Mineral Regions of Minnesota during the Years 1848, 1859 and 1864* (Cleveland, 1866). Owen's findings are recorded in his *Report of a Geological Survey of Wisconsin, Iowa, and Minnesota* (Philadelphia, 1852). See especially the introduction and chapters 1 to 6. For the story of his survey, see Walter B. Hendrickson, "David Dale Owen's Geological Survey of Minnesota," in *Minnesota History*, 26:222–233 (September, 1945).

[7] Owen, *Report*, 84, 213–418. Typical sketches appear on pages 382, 384, 405, and 406.

work in Minnesota was sporadic and, with the exception of Whittlesey's observations, published in 1866, generally unproductive. In 1858 the first state legislature considered a bill to inaugurate a scientific survey of the state, but the plan died in the midst of political debate. Since the project was backed by alert and public-spirited citizens, the second state legislature made another attempt, also unsuccessful, to organize a geological survey. In 1864 Dr. August H. Hanchett was appointed state geologist but, according to Winchell, he was utterly incompetent. He was replaced in 1865 by Henry H. Eames, who also failed, but only after he had started a small-scale gold rush near Vermilion Lake. His report that gold existed on the Vermilion Range caused considerable excitement in the north country wilderness in 1865 and 1866. Gold-seekers rushed to the "diggings" by canoe and dogsled and staked out claims along the range. Optimistic miners sank shafts, tunneled into the hillsides, and dreamed of the day when they would live in luxury. There was so much hope and expectation among the miners that a stamp mill was erected between Trout and Vermilion lakes, and a great deal of money, time, and effort was wasted in a nearly fruitless search for pay dirt in the quartz veins of the hills.[8]

The failure of the Vermilion gold rush was the main cause of the collapse of the Eames survey. The legislature, of course, was disappointed in Eames, but it was not discouraged to the point of abandoning scientific surveys. In 1865 N. C. D. Taylor was authorized to search for copper in the St. Croix Valley, and in 1870 Alexander Winchell was engaged by the state to examine the salt springs at Belle Plaine. Then on March 1, 1872, the state created the geological and natural history survey. Meanwhile, in 1866, Whittlesey's report of observations made at various times in Minnesota under private and federal auspices was published. Although not as important as the Owen report, Whittlesey's notes were regarded as valuable background material by Newton Winchell and the other members of the Minnesota survey.

The act providing for the geological and natural history survey of Minnesota was an unusual document in several respects.[9] In the first place, the legislature entrusted the administration of the survey to the University of Minnesota. This plan, which was both unique and wise, was motivated by the fact that the governor had burned his fingers on several previous occasions by appointing incompetent geologists to investigate the mineral resources of the state. Since the state university was the local center of

[8] Newton H. Winchell, *History of Geological Surveys in Minnesota*, 3 (Geological and Natural History Survey of Minnesota, *Bulletins*, no. 1 — St. Paul, 1889); Winchell, *Iron Ores of Minnesota*, 176 (Geological and Natural History Survey of Minnesota, *Bulletins*, no. 6 — Minneapolis, 1891).

[9] For the text of the law, see Minnesota, *General Laws*, 1872, p. 86–88.

scientific wisdom, it seemed logical that its president would choose better men. The subsequent history of the survey indicates that he made an excellent choice when he named Newton Winchell state geologist.

The detailed statement of the purpose of the survey was another unusual feature of the law. According to Section 2, the geological project was promoted "with a view to a complete account of the mineral kingdom as represented in the state, including the number, order, dip, and magnitude of the several geological strata, their richness in ores, corals, clays, peats, salines and mineral waters, marls, cements, building stones and other useful materials, the value of said substances for economical purposes and their accessibility." Furthermore, the law called for an accurate chemical analysis of the various rocks, soils, ores, and other similar substances in the state. Complete and exact records of chemical tests were to be made and kept on file for future use.

Equally specific directions were given for botanical and zoological studies. According to Section 3 of the law, the state geologist was to direct a complete examination of the plant life of Minnesota, including all trees, shrubs, herbs, and grasses. The legislature was interested in animal life, too, requesting a complete scientific inventory of all mammals, fish, reptiles, birds, and insects. Since weather phenomena is always of fundamental interest in an agricultural society, it was natural that the Minnesota lawmakers asked the director of the survey to compile meterological statistics and data on variations in precipitation and temperature. He was also instructed to prepare an accurate map of the state.

The act also provided for a natural history museum. This was to be established on the university campus for the display of properly prepared specimens of rocks, soils, ores, coals, fossils, cements, building stones, plants, and woods, as well as skins and skeletons of animals, birds, insects, and fish. Whenever possible, duplicate specimens were to be sent to the Smithsonian Institution.[10] The wealth of detail in a law of this type was commendable, but the fact that the state legislators remembered the needs of the Smithsonian Institution was indeed uncommon.

The plan of the survey, as outlined in the law, was admirable. The legislators, however, apparently expected a large share of the work to be done by good fairies, since they provided an annual appropriation of only a thousand dollars. A few months in the field convinced Winchell that the survey could not be conducted on this inadequate sum. He therefore suggested that the legislature should sell certain state-owned salt lands to subsidize the scientific projects. This plan was supported by prominent citizens in and out of politics, and at their suggestion Winchell drafted his ideas into a bill that was quickly passed by both houses and signed

[10] Winchell, *History of Geological Surveys*, 5–7.

by the governor on March 10, 1873. Under its provisions the salt lands were transferred to the custody of the University of Minnesota board of regents, which was given authority to sell the lands in order to provide funds for the survey. In the meantime, the state increased the appropriation to two thousand dollars annually, until the proceeds from the sale of the salt lands should equal that sum. This was a fortunate provision, for difficulties arose that delayed the transfer of the lands to the regents, and it was not until 1885 that all this property was placed in the custody of the university.[11]

While the proceeds from the sale of the salt lands formed an important financial backlog, it became increasingly difficult to meet the rising costs of the survey without appropriations from the legislature. This was especially true after 1887, when expensive tests, including drilling, were made for oil, gas, iron, and copper. In 1887 and 1888 special annual appropriations of five thousand dollars were made to cover the cost of mineral and petroleum prospecting.[12]

The unique organization of the Minnesota survey, with the administration centered in the state university, probably reduced to a minimum the usual trials and tribulations of the state geologist. Winchell, however, was often forced to curtail his activities and to limit his staff's work for lack of funds, especially in the early years of the survey. Furthermore, he had to find other employment during part of the year in order to meet his normal living expenses. He taught in the university, lectured, and prepared scientific reports for private interests who sometimes did not wish to pay for his services.[13] It was his need of cash, as well as his love of science, that prompted him to accept a position with General George A. Custer's expedition to the Black Hills in the summer of 1874.

Its purpose was to disprove rumors of gold in the Black Hills, for it was desirable to curb a prospectors' rush to this area, which was occupied by the warlike Sioux. The scientists attached to the expedition had wider interests and under the leadership of William Ludlow, chief engineer for the military Department of Dakota, they examined the major geological formations, fossils, and flora and fauna of the region. Contrary to expectations, the geologists discovered gold in commercial quantities throughout the district, and when this news leaked out, bright-eyed prospectors descended in droves on French Creek and Deadwood Gulch. By the end of the summer the last of the western gold-mining frontiers was in full development.[14]

[11] Winchell, *History of Geological Surveys*, 10, 21–23.

[12] Minnesota, *General Laws*, 1887, p. 353.

[13] For an example of such a situation, see George F. Whitcomb to Winchell, April 8, 1900, Winchell Papers owned by the Minnesota Historical Society.

[14] For an account of Custer's expedition, see William Ludlow, *Report of a Reconnaissance*

Meanwhile Winchell, Ludlow, George Bird Grinnel, and other scientists attached to Custer's column enjoyed the primitive beauty of the Black Hills. Protected by Custer's military units, the men felt a sense of security that could not be provided by small arms alone. As might be expected they did not spend all their time in scientific pursuits, but enjoyed the cool air and fresh vegetation of the forest slopes, and hunted deer, bear, and birds, which they found in abundance. Work was pleasantly synchronized with pleasure, and Winchell made his botanical and topographical observations under the most enjoyable conditions. By the end of the summer he had completed a colored geological map showing the location of eleven strata in the area from the forty-third to the forty-fifth parallel lying between the one-hundred-and-third and one-hundred-and-fifth meridians. Acting on Ludlow's suggestion, he wrote a report on the flora of the region, and it was included in the official report of the expedition.[15]

On his return to Minnesota, Winchell again took active charge of the geological and natural history survey, now in its third year. Perhaps his experience in the Black Hills prompted him to begin in earnest a botanical survey of Minnesota. At any rate, when the university board of regents assembled in December, 1875, it ordered the inauguration of a thorough and systematic examination of the plant life of the state—a project which Winchell supported wholeheartedly.

In the following spring he addressed a circular letter to the botanists of the state, asking for their assistance and recommending a four-point program for fieldworkers. First, they were urged to make full notes on the flora in their locality, taking special care to indicate species, peculiarities, structure, habitat, color, and relative abundance. Winchell urged repeated verification before reporting any observation as a fact. Second, the botanists were requested to collect and preserve as many specimens as possible. The third point emphasized the desirability of collecting fine specimens for exhibition purposes. Finally, Winchell suggested that certain reference books be used to assist the botanists with the technical work of classification. The study of timberlands, which had been started the year before, was to be continued, and more attention was to be given to animal life in Minnesota.[16]

As the survey continued year after year it became evident that the

of the Black Hills of Dakota (Washington, 1875). Accounts of the gold rush are given in Estelline Bennett, *Old Deadwood Days* (New York, 1935), and G. W. Stokes and Howard Driggs, *Deadwood Gold* (New York, 1926).

[15] Ludlow, *Reconnaissance of the Black Hills*, 8, 66–68.

[16] A copy of the circular, which is dated May 1, 1876, is in the Winchell Papers. See also Winchell's notes on the Big Woods, dated January 16, 1875, and a letter to the university board of regents, May 8, 1876, in the same collection; as well as Geological and Natural History Survey of Minnesota, *Sixth Annual Report*, 54, 154 (Minneapolis, 1878).

results would represent one of the most complete and carefully detailed projects of the kind in American scientific history. The state was surveyed county by county, and attention was given to all rock and mineral formations, to glacial drift, to all types of soils and subsoils, and to the nature and commercial value of building stone. All topographical features, including the elevation of lakes and hills, were carefully mapped. All species of mammals, birds, and plants found in the region received attention. Even the water in the lakes and rivers was tested and its quality recorded. Paleontology was not overlooked. For example, eighty-one species of crustaceans, of which twenty-seven were new to science, were credited to the state. As the survey progressed numerous fossil mollusks, invertebrates, fungi, and plants were discovered in various parts of the state.[17]

The administration of the field work was entirely in Winchell's hands. Acting on his authority as state geologist, he made his plans in accordance with available appropriations and other considerations, and then, after securing the approval of the regents, he carried them out to the best of his ability. Although he was primarily interested in the scientific aspects of the survey, he kept economic objectives constantly in mind and achieved a judicious balance between science and economics in the finished reports. He exhibited wisdom, too, when he insisted that the published reports be couched in semiscientific language that could be understood readily by the average citizen. From the beginning he emphasized the utilitarian features of the project in order to win and to maintain public support. He worked on the principle that a well-satisfied public would mean a co-operative legislature, and generally speaking his diplomacy was successful. Having once firmly secured the good will of the people and the state legislature, it was possible for him and his colleagues to do more advanced scientific work without fear of criticism.[18]

The scientific results of the survey are difficult to evaluate. Perhaps it will suffice to say that much was added to the stock pile of information gleaned from tabulated reports of state and federal surveys elsewhere, and that the sum total helped scientists deduce general principles which have led to a better understanding of the American environment. Some of the scientific contributions were of such prime importance that they deserve special mention. For example, the existence of the prehistoric glacial Lake Agassiz in the Red River Valley was definitely established. By a study of the recession of the Falls of St. Anthony an approximate date for the second glacial epoch was determined, and Winchell's tech-

[17] The Geological and Natural History Survey of Minnesota, *Fourteenth Annual Report* (Minneapolis, 1885), is largely devoted to paleontology.

[18] Winchell, *History of Geological Surveys*, 24, 25.

nique with respect to glacial geology attracted international attention.[19] While working on the survey, Winchell became interested in the archaeological remains of ancient Indian civilizations, and he was so fascinated by the culture of the prehistoric tribes that he decided to make a special study of their way of life. The result was a folio volume on the *Aborigines of Minnesota*, which was published by the Minnesota Historical Society in 1911.

Of greater scientific, and certainly of greater economic importance, was Winchell's unraveling of the complex geological formations in northern Minnesota. This was especially true of his detailed study of the Mesabi and Vermilion iron regions. While all his field work in the ore area was valuable, one discovery in particular was revolutionary, scientifically speaking. It had been a general belief among geologists and others interested in iron mining that all the iron-bearing rocks of the Lake Superior region were in the same formation. Winchell discovered that there were two formations rich in valuable ore, thus revealing a far greater iron potential for the state and stimulating a new search for ore. When found, it contributed to the growing industrial might of the nation.[20]

Although the demands of the survey were great, Winchell found time to participate in state and national affairs relating to science and education. He was one of the organizers of the Minnesota Academy of Science, and he took an active part in its programs and administration. He was elected its president in 1879, and the same honor was again bestowed on him in 1897. He helped establish the *American Geologist* and assumed the duties of managing editor. All these responsibilities, however, did not prevent him from being a prominent member of the International Congress of Geologists and from lecturing as far away from home as Bologna, Italy. The natural history museum of the University of Minnesota was another project which reflected his enthusiasm and competency. By 1888, although moderate in size, the museum was "full to overflowing" with well-prepared and attractively mounted specimens and exhibits.[21]

[19] Geological and Natural History Survey of Minnesota, *Tenth Annual Report*, 5, 141 (St. Paul, 1881); F. W. Sardeson, "Glacial Geology Work of Professor N. H. Winchell," in Minnesota Academy of Science, *Bulletins*, 5:89–92. Winchell prepared a paper on glacial geology for the Geological Society of London in 1878.

[20] Undated manuscript on the "Structure of the Mesabi Iron Ore," in the Winchell Papers; Geological and Natural History Survey of Minnesota, *Final Report*, 4:358 (St. Paul, 1899); Winchell, "The Discovery and Development of the Iron Ores of Minnesota," in *Minnesota Historical Collections*, 8:25–40 (St. Paul, 1898); W. H. Emmons, "Contributions of N. H. Winchell to the Geology of the Iron Ranges of Minnesota," in Minnesota Academy of Science, *Bulletins*, 5:83–88.

[21] T. B. Walker, "Professor Winchell's Relations with the Academy of Science," in Minnesota Academy of Science, *Bulletins*, 5:73–77; *American Geologist*, 1:86–100 (January–June, 1888); Winchell, *History of Geological Surveys*, 4, 20; Geological and Natural History Survey of Minnesota, *Seventeenth Annual Report*, 3 (St. Paul, 1889).

In educational circles, Winchell was often the center of controversy. He was especially critical of church colleges, and he was very frank if not objective in expressing his opinions on this question. He believed that the church college was often unrealistic, smug, and afraid to face a world of changing ideas and changing values. In the course of an address on education delivered before the Minnesota Academy of Science in 1881, he declared that church colleges drew themselves "within their shells, affrighted, like snails" when modern science and civilization "began to buzz about their doors." [22]

Many late nineteenth-century scientists, conscious of newly found power and importance, became arrogant. At times Winchell's vituperative attitude was typical of his profession. Science, however, did not have a monopoly on invective, which had long characterized the churches. Furthermore, the presidents of church colleges rarely displayed immunity to its charms. There is some evidence for believing that Winchell's attack on church-related schools was stimulated by a campaign, conducted by the administration of Hamline University, against state-supported schools in Minnesota. A strong supporter of state education, Winchell declared that it was "the right and duty of the state itself to look after its own interests, and especially its highest interests, and to take measures to qualify citizens not only to read their ballots but to discharge all the duties of high citizenship." [23] Although Winchell exerted considerable influence on the steady growth of the university from 1880 to 1900, it is obvious that church colleges also continued to grow, and some of the nation's best institutions of this type are located in Minnesota today.

Winchell's interest in state education did not extend to the federal government. Although he championed state-supported schools and scientific surveys in Minnesota, he became a severe critic of federal-supported surveys in the fields of geology and anthropology. In this opposition he doubtless was inconsistent. Americans, it is true, have tended to favor locally controlled projects as against federal programs, even though in the last analysis each type of activity is supported by taxes paid by the people. It must be kept in mind, however, that Winchell's antagonism had a special motivation, both personal and professional, for it was based on his disapproval of John Wesley Powell, director of the United States Geological Survey.

Powell, a product of the Midwest, was one of the most widely known scientists in the United States in the 1880's. He was still riding the wave of popularity which started to roll in 1869, when he made his pioneering

[22] Winchell, "The State of Higher Education," in Minnesota Academy of Science, *Bulletins*, 2:52 (1880–82).
[23] Winchell, in Minnesota Academy of Science, *Bulletins*, 2:45, 62.

and spectacular trip through the Grand Canyon. Whenever he spoke or wrote, American scientists were alerted to look for some new and "profound" truth or theory. In the closing decades of the nineteenth century, Powell was known as the high priest of American science. There is reason to believe that his influence was not quite as widespread as historians have claimed. At least one group of scientists did not fully appreciate him. These men were suspicious of the hero of the Grand Canyon, and they considered him an opportunist and a politician who was not sincere in serving the interests of American geologists. In short, from their point of view, he was a scientific bureaucrat who was not acting in a strictly professional manner. The leader of the anti-Powell group was Newton Winchell, who referred to Powell as "a smooth politician and ambitious operator, rather than a candid earnest working geologist." [24]

Opposition to Powell and dissatisfaction with the service he was giving geologists were among the major reasons for the establishment of the *American Geologist* in 1888. The need for a strictly professional journal for American geologists that could make new information and scientific data easily and quickly accessible and serve as a clearinghouse for ideas free of all political influence was recognized by a group which included both Winchells. It was hoped, too, that through the medium of such a periodical, geology would become more widely appreciated, and once fully appreciated, would receive better support as a profession and as a respectable course of study in the college and university curriculum. Finally, since the *American Geologist* was to be an organ of opposition to Powell, no geologist affiliated with the federal survey was appointed to the editorial board. As the first issues of the new journal came off the press, Winchell declared that it would amply support the federal survey whenever it deserved support. He added, however, that the editors reserved the right "to criticise it and its mistakes." Under Powell, he continued, the survey had "overgrown all reasonable dimensions" and had become too "dictatorial and opinionated." [25]

Fortunately for the *American Geologist*, for Winchell, and perhaps for Powell, its editorial policy and contents were on a relatively high level of scholarship, and controversial matters were soft-pedalled. Up until his death in 1891, Alexander's close co-operation with his brother as managing editor was in constant evidence; thus the journal was almost a Winchell magazine. Two more capable men to guide the periodical would

[24] Ralph H. Gabriel, *The Course of American Democratic Thought*, 168–172 (New York, 1940); N. H. Winchell to A. Winchell, February 21, 1888, Winchell Papers, University of Michigan.

[25] H. Foster Bain, "N. H. Winchell and the American Geologist," in *Economic Geology*, 11:51–62 (January, 1916); N. H. Winchell to A. Winchell, February 21, 1888, Winchell Papers, University of Michigan. For the personnel of its editorial board, see any issue of the *American Geologist* for the first six months of 1888.

have been difficult to find. That for eighteen years the *American Geologist* was the leading publication in its field speaks well for its management and its editorial policy.[26] Certainly, it greatly enhanced the reputation of Newton Winchell, and the geology department of the University of Minnesota basked in the reflected glory. It also increased the popularity of geology, and added to its professional respectability in the United States. Newton and Alexander Winchell were important human factors in the development of geology from a marginal study of doubtful value into a first-class science.

Any estimate of Newton Winchell's scholarship and any attempt to evaluate his contributions in his chosen field must rest first of all on the fact that he was among the last of the field-trained general geologists. In many respects he was a transitional figure — a member of the old school of geologists and a pioneer in the new. He never considered himself a specialist, and by the standards of his day he was competent to work in all fields related to geology, including paleontology, mineralogy, ethnology, and archaeology. In paleontology, he was perhaps least efficient. As director of the Minnesota survey for twenty-eight years, he accomplished a vast amount of pioneering work in an area covering eighty thousand square miles of terraine. The twenty-four annual reports, ten bulletins, and six final volumes published by the Minnesota survey are a lasting monument to the state geologist and his assistants. The high caliber of the *American Geologist* is another indication of Winchell's intelligence, capacity for work, and ingenuity. The publication has a permanent place in the history of American scientific journalism. Winchell's entire career was devoted to science, education, and society. Although he was not always accurate in his scientific deductions, and not always generous when dealing with his contemporaries, he had original ideas and he dared to do new things. Thus he was a pioneer on the frontier of science.

[26] N. H. Winchell to A. Winchell, January 26, February 4, 21, May 31, 1888, December 12, 1889; A. Winchell Manuscripts, 15:518, Winchell Papers, University of Michigan. The *American Geologist* was succeeded by *Economic Geology* in 1905.

THE AUTHOR of the article published above has contributed to *Michigan History* for June a study of his present subject's brother, which appears under the title "Alexander Winchell: Michigan Scientist and Educator." Like Newton, Alexander Winchell pioneered in field geology. His "work in Alabama, Michigan, and Minnesota added new data to the growing stockpile of geological knowledge," according to Professor Davenport. The articles on the Winchell brothers dovetail at many points, and together they provide a significant chapter in the history of an important Midwest family.