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Midwestern Geology and Cornell College: The First 125 Years[1]

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The history of geology at Cornell College can be traced back almost to the college's beginnings. Though not the first to teach geology at Cornell, William Harmon Norton, more than any other person, shaped the Department of Geology and set it on its course of excellence. Born in 1856, the son of a Methodist minister, Norton developed an ardent interest in geology in his boyhood. A graduate of Cornell in Classics, Norton was hired by his alma mater in 1876 to teach Greek, but his avocation was geology. He spent most of his spare time on weekends and during summers studying the rocks and fossils of eastern Iowa. Norton's avocation became his vocation in 1881 when he began teaching geology along with Greek. Nine years later he gave up classics and continued with geology. His skills as a keen observer, mapper, and writer were recognized by Samuel Calvin, director of the new Iowa Geological Survey, and he was hired in 1893 under the title "Special Geology". Norton authored several publications on the geology of eastern Iowa, including reports on the geology of Linn, Scott, Cedar and Bremer Counties. During the course of his research he recognized and described several new Silurian and Devonian formations, the names of which are currently in use. He is best known for his studies on the character and distribution of Iowa's underground water resources, with publications totaling nearly 2,000 pages. His service to the Iowa Geological Survey spanned 40 years and his tenure as a teacher at Cornell 67 years. Norton's legacy includes a college textbook, "Elements of Geology", written in collaboration with William Morris Davis, and 6,000 lantern slides.

Neil A. Miner assumed the chairmanship of the Geology Department at Cornell in 1937. Born in New York in 1898, Miner obtained most of his education in the East. Following the completion of his M.A. in 1934, he entered a doctoral program at the University of Iowa, where he studied Pleistocene geology under G.F. Kay and A.C. Trowbridge. At Cornell Miner continued to build the geology program despite severe budgetary constraints. Believing that field study was an essential component of undergraduate geology training, he and David Delo of Knox College established Camp Norton in the upper Wind River basin of Wyoming. Opened in the summer of 1940, the camp is still currently in operation. Miner became acutely aware of the problem of academic isolation that was endemic to one-person science departments. As a result, he initiated correspondence with other teachers in the Midwest who were similarly isolated. This correspondence led to meetings which culminated in the founding of the Association of College Geology Teachers, which gradually evolved to become, in 1958, the National Association of Geology Teachers (NAGT). Miner's premature death by leukemia in 1947 deprived Cornell and the nation of an excellent teacher. In recognition of his teaching and leadership, NAGT established the Neil Miner Award, a national prize honoring outstanding teachers in the earth sciences.

As Miner's health deteriorated he hired Herbert E. Hendriks, a former student and Cornell graduate who was a PhD candidate at the University of Iowa. Hendriks was born in West Liberty, Iowa in 1918. As a researcher, he is probably known best for his work on the Steelville, Missouri Quadrangle. He was first to describe the Crooked Creek structure as the result of a meteor impact. His interpretation met with stiff opposition until the 1960's, when similar structures were identified in other areas of midcontinent North America. As an able teacher and administrator, Hendriks continued the tradition of excellence in teaching at Cornell. He organized the first chapter of Sigma Gamma Epsilon (an earth science honor society) in the state of Iowa. Anticipating the decline in traditional employment in geology, in 1975 he organized Cornell's environmental studies program, one of the first in the Midwest. Hendriks served as teacher and administrator at Cornell for 40 years.

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The history of geology at Cornell College begins in 1855, just two years after the College opened its doors. As was generally the case in small colleges of that time, a single instructor was responsible for the teaching of all the sciences—physics, chemistry and biology. In 1855 a course in geology was added to the science curriculum, with Stephen Fellows, professor of Mathematics and Natural Science, as the instructor. Though the instructor changed, that single course continued to be taught until the arrival of William Harmon Norton (Fig. 1).

WILLIAM H. NORTON

In actuality, Norton's introduction to Cornell began when he was only ten years old. Born in 1856, in Willoughby, Ohio, the only son of a Methodist minister, Norton came to Cornell in 1866 when his father was assigned a pastorate in Mount Vernon. Public schools in Iowa were barely organized at this time and, because Mount Vernon lacked a public elementary school, young Will was enrolled in the "Primary Department" at Cornell College. His stay was brief, for after one year his father was transferred to Manchester.

Norton's interest in geology began when his father was assigned a pastorate in Fayette, Iowa. Young Will played along the Volga River, the erosion of which had long before exposed the fossil-rich beds of Devonian limestone. His attraction to the fossils and rocks of the Volga would blossom into a life-long devotion.

Norton returned to Mount Vernon in 1875, now as a student at Cornell College. One of a class of nine, he graduated from the college in the spring of 1876 with a degree in Classics. As often happened with graduates of small colleges of his day, Norton was immediately hired to teach Greek at his alma mater. At that time Alonzo Collin,

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Fig. 1. William Harmon Norton.

instructor of biology, chemistry and physics, also taught the geology class, using Joseph Le Conte's classic book as his text. Norton brought to the college his Greek grammar books and a respectable collection of fossils from the Fayette and Janesville areas.

While teaching Greek, Norton's avocational interest in geology continued to develop. He acquired a copy of Charles White's classic "Geology of Iowa" and was surprised to find that the rocks of eastern Linn County were mapped as Devonian. He perceived correctly that the fossils in eastern Linn County were very different from those he had collected from the Devonian beds at Fayette and Janesville. It was clear to him that Linn County needed to be remapped. In the summer of 1877, coal was discovered at the bottom of a ninety-foot well in Linn County. Because of considerable interest in ascertaining the prospect of commercial mining and because of Norton's desire to correct the error in White's earlier survey, he began his own geological survey of the county. This work was done on Saturdays in the spring and fall with rudimentary tools, which included a riveting hammer, a cold chisel, a 5-foot measuring staff and a homemade clinometer. The clinometer consisted of "a square of walnut in which he set a protractor with a pointed brass pendulum" (Norton 1942). When two-day trips to the northern part of the county were required, he went to the field on Friday, his Latin class left in the care of "advanced students". The results of his survey were published in 1880 in the *Cedar Rapids Republican,* in which he reported that the coal was contained in the Independence Shale (in reality probably Pennsylvanian karst fill) and, therefore, that any illusions of coal mining in Linn County ought to be abandoned. He also delineated the boundary between the Silurian and Devonian in the county, and he named and described the LeClaire, still designated as a member of the Silurian Gower Formation.

In 1881, Alonzo Collin left Cornell, and his science courses were veritably "up for grabs". Norton was tabbed to teach his course in geology along with Greek and so was appointed to a professorship of the unlikely combination of Greek and Geology. By now he had acquired a modest library of books of geology, including early surveys of Wisconsin and Ohio, and he continued to build his cabinet of fossils. According to Norton, "the marriage of Greek and geology was not a happy one, though it lasted nine years" (Norton 1942). He resigned the professorship of Greek, but persuaded the Cornell administration to allow him to continue teaching geology. In 1890, he was appointed Professor of Geology, even though he was teaching but a single class. He gradually built a multi-course department, with most courses including field excursions to sites he had mapped in his survey of Linn County, as well as to the local cemetery and brickyard. Geology at Cornell grew in popularity under Norton's inspired leadership. His favorite course was Evolution. It is an interesting fact that during his senior year at Cornell he gave an oration at King Chapel, entitled "The Genesis of Mind", in which he branded evolution as a "callow cackling hypothesis" and Darwinism as:

> "A bridge across ten million years
> Without a prop to save it from sneers
> Not even a couple of rotten piers
> A thing for laughter, fleers and jeers"

He excused his early ignorance as a result of "having been brought up on the Methodist Quarterly Review" (Norton 1942). Despite his conversion, throughout his teaching career he maintained that he found nothing in evolution to be incompatible with a belief in God.

While still teaching Classics, Norton developed a friendship with Samuel Calvin, of the State University of Iowa, who gave him valuable advice regarding his Linn County survey and assisted him in identifying his fossils. This connection opened a door for Norton, because when the Iowa Geological Survey was permanently established in 1892 with Calvin as Director and State Geologist, Norton was hired under the heading "Special Geology". Expanding his earlier work he produced his "Geology of Linn County", which was published in an Annual Report of the Iowa Geological Survey (Norton 1895c). Similar reports for Scott County (Norton 1899), Cedar County (Norton 1901) and Bremer County (Norton, 1906) followed. Field work was done during summers, and report writing was sandwiched in with teaching during the academic year. He was commissioned to investigate Devonian strata beneath the Cedar Valley limestones, and in this effort he named and described the Bertram, Coggan, Otis and Kenwood units, the names of which are still in use (Norton 1894, 1895a).

His county studies led to investigations of Silurian biohermal reef and interreef beds, and the Wapsipinicon or "Fayette" breccias (Norton 1920). The report contained numerous photographs and detailed descriptions, which led him, regrettably, to erroneous conclusions about their origin. He also identified old river channels buried beneath Pleistocene glacial and fluviatile sediment, and he did pioneering work on the Iowan surface.

To the citizens of Iowa, Norton is undoubtedly known best for his studies of Iowa groundwater. Growing population and the expanding agricultural industry near the turn of the century resulted in increasing contamination of municipal and household water supplies. Of particular concern was typhoid fever, which reached epidemic proportions in Waterloo in 1904. There was a growing need to identify deeper sources of uncontaminated water. Prior to the organization of the Iowa Geological Survey, Norton had collected and analyzed the cuttings of 20 deep wells in northeastern Iowa. This information was published in the third volume of the Survey Annual Reports under the title "Thickness of the Paleozoic Strata in Northeastern Iowa" (Norton 1895b). Because of his familiarity with lower Paleozoic stratigraphy, in 1894 he was given charge of the research on Iowa's deep wells and its artesian waters. He chose to begin the research by making a thorough historical study of the classic region of artesian wells–Artois, France. During his survey of old French literature he found the term "aquifer" used to define the water-bearing stratum of an artesian system. Said Norton, ". . .(I) ventured to revive it, under the impression that he who makes one word grow where two or three grew before is a benefactor" (Norton 1942).

The first report "Artesian Wells of Iowa", over 300 pages in length, appeared 1897 in volume 6 of the Annual Reports (Norton 1897). In 1912, he authored a more prodigious volume, numbering nearly 1200 pages, which described the underground water resources of the entire state (Norton et al. 1912a). It was also published as a USGS Water Supply Paper (Norton et al. 1912b). Assisting him in

this monumental undertaking were young "apprentices", including Howard Simpson, Oscar Meinzer, and W.J. Miller, all of whom went on to distinguished careers in the field of water research. His report guided the drilling of water wells in the state for many years, and resulted in great savings of time, effort, and money. In a recent issue of *Iowa Geology* (Libra 1995), he was quoted in reference to Jumbo, the famous artesian well that "erupted" at Belle Plaine in 1886.

Norton continued his teaching at Cornell and his research at the Iowa Geological Survey until 1924. A severe attack of arthritis threatened to leave him bedridden, and he felt it necessary to resign his professorship at Cornell College and his position at the Survey at the age of 68. G.F. Kay, director of the Survey, refused to accept his resignation, and so Norton continued his work, arthritis notwithstanding. In 1927 he issued a supplemental report on the deep wells of Iowa, a mere 365 pages (Norton 1928). He retired from the Survey in 1932 after 40 years of service. In describing his departure, Norton said, "I cleaned up my laboratory with a report of 48 pages on Deep Wells Drilled in Iowa, 1928–32. I sent over to the University of Iowa two truck loads of sample drillings accumulated during more than 40 years, together with my letter files, dismantled my laboratory, burned my scores of large scale profiles criss-crossing the state, on which I had based my forecasts, and dismissed from my mind Iowa's deep wells and ground waters and its geologic structure, even as I had earlier cleaned out my mental attics of Latin and Greek and the geology I had taught" (Norton 1942). His report on the deep wells was published by the Survey in 1935 (Norton 1935). His Iowa Geological Survey reports alone total well over 2500 printed pages. Impressive indeed, considering that his field research was limited to summers, that the writing was squeezed in during the academic year, and that he lacked a degree in geology!

After his official retirement from the Cornell professorship, Norton continued to teach his favorite course in evolution, determined to continue as long as health and student interest maintained. Eighteen years later, in the fall of 1941, he taught the last class, announcing that his class in evolution was "canceled for the duration". He was finally granted emeritus status in 1942, after a teaching career that spanned 66 years!

One of the legacies of Norton's teaching is a collection of lantern slides that he assembled, and which numbers in excess of 6000. The majority were homemade and developed in Norton's darkroom, which doubled as the family bathroom. These slides feature not only local geology but also famous geologic localities in other parts of the United States and Europe, places which Norton visited later in his life. The collection currently is housed in the Norton Geology Center at Cornell College.

Another legacy is his textbook, "Elements of Geology", which was published in 1905 and revised in 1929 (Norton, 1905, 1929). Written in consultation with William Morris Davis, the book was originally intended for high school use, but quickly became popular as a college textbook and was widely used for several years. The book emphasized a global view of geology, and it contained numerous photographic illustrations from classic sites across the United States, the British Isles, Europe, Asia, Africa, Alaska and Greenland.

NEIL A. MINER

The teachers of geology who succeeded Norton continued the strong geologic tradition at Cornell. Two in this succession merit inclusion in this presentation. The first was Neil A. Miner (Fig. 2). Born at Saranac Lake, New York in 1898, he moved with his family to Barre, Vermont, where he completed his primary education. Miner completed his primary schooling in 1917, and matriculated at Syracuse University that fall. During his sophomore year, he fell victim to the great flu epidemic, which left him in fragile health throughout

Fig. 2. Neil Alden Miner.

the remainder of his life. By the spring of 1919, he had recovered sufficiently to return to school. To pay for his college expenses, Miner worked as a taxidermist on the staff of the Syracuse Museum of Natural Science.

As it happened, his supervisor at the museum was Charles Richardson, a well-known mineralogist who took Miner under his wing. This association led to his enrollment in several introductory geology courses and his subsequent appointment as Richardson's field assistant for a mapping project with the Vermont Geological Survey. The combination of his enthusiasm for the outdoors and his experiences on the mapping project led to his election of geology as his major. Unfortunately, his studies were interrupted by the death of his father in 1920. Miner returned home to operate the family's taxidermy and furrier business. He sold the business after ten years and returned to college at Syracuse. Despite his late return and his nearly full-time duties as taxidermist with the museum, he managed to receive his B.A. degree in the spring of 1932. That summer he served the Gaspe Expedition as geologist, photographer and taxidermist. During this expedition he developed a special interest in Pleistocene geology (Fryxell 1950).

Following the completion of his M.A. in 1934, Miner entered the University of Iowa geology doctoral program to continue his study of Pleistocene geology under G.F. Kay and A.C. Trowbridge, two world-renowned experts at that time. Shortly after he began his doctoral studies, he married Gertrude Shell of Sibley, Iowa. In his work on Pleistocene Glaciation of the Gardiner, Mammoth, Hot Springs, and Lava Creek Regions of Yellowstone National Park, Miner clearly established multiple glaciation in the region of the park (Miner 1937). In order to finance his field work, he took a summer position as Ranger-Naturalist in the Park. This experience left him with a great affection for the region, and he spent five summers as a ranger-naturalist in Yellowstone, where his campfire talks were highly regarded.

In the spring of 1937 Miner was appointed as Instructor of Geology and Chairman of the Department of Geology at Cornell College. His universal curiosity, enthusiasm, and dedication to teaching resulted in growth in the department. Miner arrived at Cornell with high hopes but very limited resources. Despite cramped budgets, Miner managed to increase the teaching collection of rocks, minerals, and fossils. Early in life he developed interest and skill in photography, which was a source of pleasure and also a valuable tool in his teaching. Visual aids were an important part of his teaching, and while in the field he took photographs for use in the class room. Characteristically, his dark room, including his enlarger, was home made. He utilized his mechanical and photographic capabilities to produce a "geologic time clock" which he constructed from photo-

graphs, diagrams, and parts from an old phonograph. This teaching aid illustrated each geologic period and its characteristic life forms and physical events (Fryxell 1950).

According to those who knew him, Miner's mechanical skills and his wide-ranging interests, although recognized and appreciated by his students, were considered as secondary attributes. His rapport with his students and his sincere desire to teach and help them were the characteristics that were most appreciated. Students felt that they were special to Dr. Miner and they responded by doing their best. His interest in his students extended beyond their undergraduate experience. He took special pains to see that his graduates got the right jobs or enrolled in the right graduate schools.

Miner became acutely aware of the problem of academic isolation that was endemic to one-person, small-school science departments. He set about to reduce this problem by initiating correspondence with other isolated teachers of geology in the Upper Midwest. This correspondence led to discussions during a Tri-state Geological Field Conference, held in 1937 in southeastern Wisconsin. The participants of those discussions included Miner, Dave Delo of Knox College, Fritioff Fryxell of Augustana, Monta Wing of Beloit, and Leonard Wilson of Coe. Before parting, those five teachers agreed to meet again the following spring. That meeting, held at Augustana College, brought together eleven geology teachers from one-person departments throughout the Upper Midwest. It provided an opportunity for them to become acquainted with one another, to "pick each other's brains," to share observations and experiences and to arrange trades of specimens. The culmination of the meeting was the founding of the Association of College Geology Teachers. Officers were elected and a committee was formed to prepare a statement of purposes and a constitution. At the 1939 meeting, held at Cornell College, these were adopted. Miner went on to serve as the second president of the Association of College Geology Teachers (Fryxell 1950).

After a hiatus during World War II, the Association resumed its annual meetings in 1946 with a gathering at Knox College. This meeting was an important one because the Association announced its decision to open its membership to all concerned with geological education and, accordingly, changed the organization's name to "Association of Geology Teachers." Since the 1951 meeting, the national meetings of the Association have been held concurrently with the Geological Society of America Annual Meeting. In April of that year, the first issue of the *Journal of Geological Education* appeared. The healthy growth of the organization, and the formation of sections at the 1958 meeting caused the Association to change its name to the "National Association of Geology Teachers".

Miner believed that field study was an essential component of undergraduate geologic training (Fig. 3). His graduate field work in the Yellowstone Park region impressed him with the potential of that region as a site for a summer geology field station. He was joined in this enterprise by Dr. Dave Delo of Knox College, who also was familiar with the Yellowstone Park area (Miner and Delo 1942a, b). Together they chose the "Timberline Ranch" in the upper Wind River basin as the site for the field station. In the summer of 1940, they conducted the first session of "Camp Norton" with about 30 students in attendance. In 1946, Syracuse University joined Knox and Cornell, and in 1947, Miami University of Ohio was added to the list of participating institutions. Despite World War II and later global conflicts, several crises in the mineral and petroleum industries, and cutbacks in many geology departments, Camp Norton is still open for business, currently under the direction of the Geology Department at Miami University of Ohio.

The beginnings of World War II saw a great decrease in the number of male students at Cornell. To compensate for this decline the school solicited a military contract and opened a Naval Flight Preparatory School. Miner served as an instructor of navigation in the program and later as the civilian coordinator. The end of the war brought an increased enrollment of returning veterans and the accompanying strains of resources and time. Miner's struggle to implement some of his long-deferred departmental plans and to cope with the reinstallment of the geology equipment and specimens in the space temporarily taken over by the navy program resulted in his near physical collapse. His health steadily deteriorated and in the fall of 1947, ten short years after he earned his Ph.D., Miner died of leukemia. The National Association of Geology Teachers, saddened by the loss of one of their founders and cognizant of his great teaching, established the Neil Miner Award, a national prize honoring outstanding teachers in the Earth Sciences (Fryxell 1950).

Fig. 3. Neil Miner in the field.

Fig. 4. Herbert E. Hendriks supervising students.

HERBERT E. HENDRIKS

As his health failed, Miner turned to a former student to take his place at Cornell, Herbert E. Hendriks, then a Ph.D. candidate at the University of Iowa (Fig. 4). Hendriks was born in West Liberty, Iowa in January of 1918, where he attended both elementary and high school. In the fall of 1936, he enrolled at Cornell College. His love of the out-doors led to his selection of a major in geology and a minor in biology. As a student of Neil Miner, he was exposed to the widest possible spectrum of geologic phenomena. Even as an undergraduate, Hendriks excelled in field work and developed a special interest in structural geology. His special ability to see things in three dimensions enabled him to synthesize scattered data into coherent images.

Hendriks demonstrated his geologic acumen early in his graduate school career. His specialty was structural geology and he chose a particularly complex region in southeast Missouri for his thesis area. He quickly discovered that the area, selected for him by the Missouri Geological Survey, was far more complex than the usual layer-cake geology that is typical of most of the Midwest. He was presented with a new quadrangle later that spring and was able to complete the mapping and his thesis, despite the late start. However, the complex structure of the Steelville area piqued his curiosity and he asked for permission to use that area for his doctoral dissertation. After the interruption by World War II, Herb returned to graduate school and the Steelville Quadrangle. He found what looked like a highly faulted dome, the Crooked Creek structure, in the center of quadrangle. Earlier investigators, influenced by the work of Walter Bucher, had termed such features "cryptovolcanic" (Bucher 1921). Bucher proposed that they were caused when subterranean explosive forces were not sufficient to break through to the surface. The result was intense brecciation and severe faulting of the country rock and folding of the strata near its margins.

The area had been explored intensively for mineralization and the Missouri Survey had an extensive library of cores. Hendriks investigated them all and discovered some puzzling information. First, the brecciation, that was so intense at the surface, decreased downward. Second, he saw no evidence of the thermal alteration, which should have accompanied any cryptovolcanic activity. Movement along two intersecting faults (Palmer Fault, and Cuba Fault) had also been suggested as a cause for the brecciation. Hendriks obtained some displacement data and discovered that displacement was greatest at the center of the region and decreased away along both faults. He had heard that Claude Albritten, working in the 1930's on "cryptovolcanic" features, had interpreted them to be meteor impact structures, an idea that was considered nonsense by the general geological community. Hendriks visited Albritten who proposed that the Crooked Creek structure might be a meteor crater. He suggested that Hendriks look for shatter cones in the strata at the center of the structure. His discovery of shatter-cones at Crooked Creek convinced him that Albritten was right, and he declared it emphatically in his dissertation (Hendriks 1949). Although backed by his thesis advisor and a member of the astronomy faculty at the University of Iowa, he faced very strong opposition from members of his dissertation committee. At this time uniformitarianism (gradualism) was a ruling paradigm, and Meteor Crater in Arizona was still a controversial structure. Hendriks prevailed and was awarded his Ph.D. in 1949. The Missouri Geological Survey, which underwrote his research, refused to accept his interpretation of the Crooked Creek structure, and it withheld permission to publish his conclusions. Not until the 1960's when Dietz rekindled the old uniformitarian vs. catastrophism controversy with a series of publications on meteor impact structures, was Hendrik's hypothesis published. (Hendriks 1965, Dietz 1968). As a result of Alvarez's K-T boundary paper (Alvarez 1980) and the years of controversy that have followed, meteorite impacts are now widely accepted, with Iowa claiming its own impact crater at Manson.

In the spring of 1941, Hendriks married Luretta Tipton, his childhood sweetheart. This marriage resulted in a son, Herbert Hendriks, Jr., and a life-long partnership dedicated to learning, teaching, and the nurturing of students. He taught all his courses with thoroughness and dedication. Hendriks believed that effective communication was an essential skill for his students, and he taught writing skills as a part of his courses. Research papers were required in all his upper-level courses. He claimed that he learned his paper-writing skills by studying the classics as an undergraduate. He and his red pencil could convert the most turgid and convoluted paper into a clear, concise and logical document.

Fig. 5. Herbert Hendriks with students at the plane table.

Despite the long hours of teaching, Hendirks made time to get to know his students outside of class. He planned and led week-end field trips to sites in Illinois, Wisconsin, and Missouri. These trips were coeducational, something rather controversial even in the late 1940's, and they were attended by geology majors and non-majors alike. Such trips led to many converts to geology. Who could fail to get excited about geology when it was studied in the field and explained so well and with such enthusiasm by "Herb"? It is noteworthy that many of these converts were women who, at this time, were not always welcome in undergraduate science departments and were treated with disdain by most graduate schools. During the 1950's, there were two major field trips each year; the first was the freshman trip to northeast Iowa, ending at Pike's Peak State Park. This trip gave his students first-hand exposure to glacial geology, stratigraphy, paleontology, and structure. The trip culminated in a hike through the Ordovician section in the cliffs above the Mississippi. After lunch, which was taken on the bluffs that overlooked the confluence of the Wisconsin and Mississippi Rivers, Hendriks described the evolution of the Mississippi valley in the region. The second trip, usually in the spring, was to his thesis area in Missouri. This trip was for the majors and allowed time for a field reconnaissance of the stratigraphy, determination of the structural attitude of these units, and the use of stratigraphic principles. His Socratic teaching method encouraged each student to bring together what he/she had seen and to integrate it into a comprehensive picture of the geology of the area. To facilitate the taking of structural data, Hendriks developed and patented a device to simplify the measurement of strikes and dips. It consisted of a square base about 12 cm (5 in) in diameter, upon which was mounted a circular rotatable disk with two ridges which crossed it, intersecting at 90 degrees. The device was laid on the surface to be measured and a Brunton pocket transit was placed on one set of ridges with the level bubble set at zero. The circular disk was rotated until the bubble leveled. The ridge on the disk was then a "line of strike" and its bearing could be read using the Brunton. The other ridge pointed in the direction of dip and by placing the Brunton parallel to this ridge the dip angle could be measured (Fig. 5).

Hendriks took a personal interest in his students. His door was always open for anyone who needed advice, help, or an understanding listener. His rapport with students was recognized by the administration when he was named acting Student Personnel Dean in 1957. His administrative skills were also recognized when he was selected to serve as acting Academic Dean in 1962.

The Cornell Geology club grew out of student get-togethers in the Hendriks' home. Under his leadership it became the first chapter of Sigma Gamma Epsilon, an Earth Science honor society, in the

state. The Cornell Chapter officiated in the installation of a chapter at the University of Iowa. His efforts also resulted in increased student enrollments. As a result, Cornell's president authorized the addition of a second full-time position in the Department. The additional person freed up enough time so that individual student research projects could be undertaken. There followed a number of National Science Foundation grants for student research and research equipment. Cornell led the state schools with the introduction of undergraduate optical mineralogy and the use of thin-sections in petrography courses. Hendriks knew that the expansion of specialties and increasing complexity in the science of geology made adequate presentation of an undergraduate geology major impossible with a two-person department. He was able to convince the administration of this need, and in 1966 the Geology Department was increased to three full-time faculty.

In the early 1970's, Hendriks noted a general decline in traditional geological employment and foresaw the benefits of expansion into the area of environmental science. In cooperation with the Biology and Politics Departments, he developed Cornell's Environmental Studies Program. Approved in 1975, the program involved a flexible major, with elective courses in biology, chemistry, and politics and a course called "Earth's Dynamic Systems" as its introduction. Hendriks taught the introductory course and served as the program's first director. Environmental Studies has since grown to become a significant segment of Cornell's science enrollment with many new courses introduced to serve this multidisciplinary major. This pioneering effort merits even greater appreciation in light of an article in March 1996 issue of *GSA Today* (Stein 1996). He described the initiation of what he considers an innovative introduction of such a major at Northwestern University in 1992, some 17 years after it was introduced at Cornell. It is also instructive in that he also describes opposition by other university departments during the efforts to develop the program, but its quick acceptance by students.

Hendriks served Cornell as teacher and administrator for 40 years. His tenure coincided with dramatic changes in the college, the sciences, and the Department of Geology. His leadership during these times resulted in the modernization of the curriculum, upgrading of the department's equipment, and expansion of its staff, and rock, fossil, and mineral collections. Hendriks also served his community, working as a member of the City Planning and Zoning Commission. In addition, he found time to serve as President of the National Association of Geology Teachers, Central Section in 1953. He served the Geological Society of Iowa first as Secretary, 1961, then as President, 1970. Hendriks was named fellow of the American Associaton for the Advancement of Science and the Geological Society of America. He was elected President of the Iowa Academy of Science in 1971, and in 1975, he was a recipient of that society's Centennial Award.

The Geology Department at Cornell College continues with the same spirit as that of Norton, Miner, and Hendriks. It has just completed a major revision of its course offerings with an even greater emphasis on field work and student research projects. The One-Course-At-A-Time format of the college allows for extensive field trips. Depending on the year, students may visit recent environments of carbonate deposition in the Bahamas, learn the stratigraphy and taphonomy of dinosaur deposits in Montana, or study the complexities of the geology of the Big Bend area of Texas. In addition, student internships at various governmental and industrial institutions allow students to get first hand experiences in geologic investigations. It is hoped that by looking to the future, the department can keep faith with its past.

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