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Contents

The Life of Johan August Udden, Geologist, Teacher, Inventor: Through the Kansas Years
James R. Underwood, Jr.

The Geologic Work of J. A. Udden
Richard C. Anderson

"More's the Pity": The Short Archeological Career of J. A. Udden
Marlin F. Hawley

Topics, Themes, and Theories in Little River Focus Archeology: Research After Udden
Susan C. Vehik

Memories of My Sojourn in Lindsborg
Johan A. Udden

List of Papers by Johan A. Udden
Marlin F. Hawley

An Old Indian Village
Johan A. Udden

The
KANSAS Anthropologist
Journal of the Kansas Anthropological Association

Kansas Anthropological Association

The Kansas Anthropological Association is the oldest amateur archeological organization in the state. Its membership is made up of individuals and institutions interested in the prehistoric and historic peoples of the area. The objectives and goals of the Association are the preservation and interpretation of archeological and ethnographic remains within the state; the scientific study, investigation, and interpretation of archeological remains and ethnographical materials; the publication and distribution of information concerning Kansas archeology and ethnology; and the development and promotion of a greater public interest and appreciation for the heritage of the state.

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Each year members receive four issues of the *Kansas Anthropological Association Newsletter* (ISSN 1069-0360) and one journal, *The Kansas Anthropologist* (ISSN 1069-0379). They also receive six issues of *Kansas Preservation*, the newsletter of the Cultural Resources Division of the Kansas State Historical Society. All members and interested individuals, professional or amateur, are invited to submit material to the editors for use in these publications. Back issues of the journal or newsletter, if available, may be ordered from the Historian-Recorder at the address listed above. Prices will be furnished upon request.

JOHAN AUGUST UDDEN AND *AN OLD INDIAN VILLAGE*, REVISITED

Marlin F. Hawley, Volume 23 Editor
Virginia A. Wulfkuhle, Editor

CONTENTS

Preface ..... Laurel M. Udden 1

Introduction ..... Marlin F. Hawley 3

The Life of Johan August Udden, Geologist, Teacher, Inventor:
Through the Kansas Years ..... James R. Underwood, Jr. 5

The Geologic Work of J. A. Udden ..... Richard C. Anderson 15

"More's the Pity": The Short Archeological Career of J. A. Udden ..... Marlin F. Hawley 23

Topics, Themes, and Theories in Little River Focus Archeology:
Research After Udden ..... Susan C. Vehik 35

Memories of My Sojourn in Lindsborg ..... Johan A. Udden 45

List of Papers by Johan A. Udden ..... Marlin F. Hawley 51

An Old Indian Village ..... Johan A. Udden 57

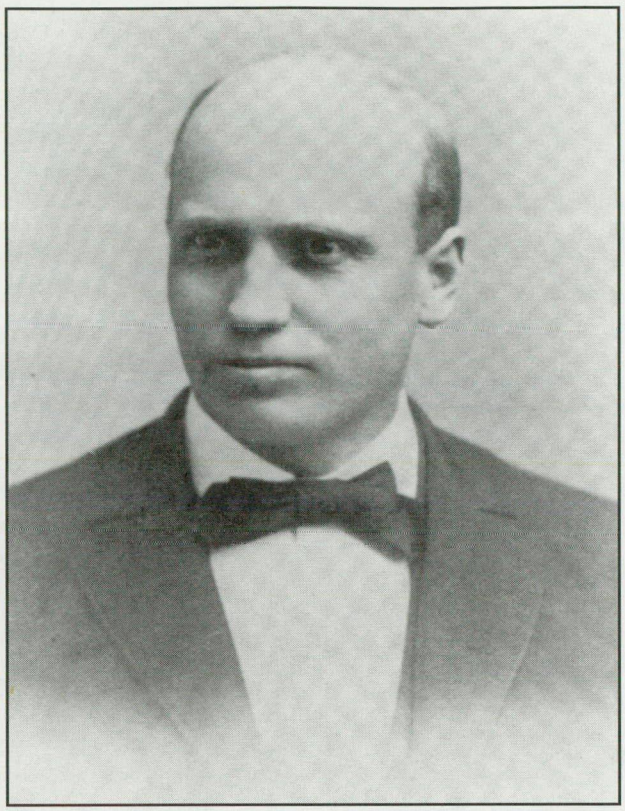
Book Review 139

About the Authors 141

2002 Kansas Anthropological Association Members 143



Clouds over the Paint Creek site as seen by the Nebraska State Historical Society field crew in 1934.



J. A. Udden

Preface

J. A. Udden was my grandfather's brother. The brothers graduated together in 1881 from Augustana College in Rock Island, Illinois. During the summer after graduation, J. A. attended an annual Augustana Lutheran Church Convention in Lindsborg, Kansas. While there, the pastor of the local church told J. A. that he was planning to start an academy and asked if he would agree to teach in it. The pastor taught the religion classes, and J. A. taught everything else. J. A. stayed there for seven years. This academy became Bethany College, which is still in Lindsborg, and is perhaps best known for its annual Easter presentation of "The Messiah," a tradition for 125 years.

From Bethany College J. A. returned to Augustana in Illinois and taught there for some years. A stone marker on that campus bears the name "Udden" in his memory.

He left there and went to the University of Texas in Austin, where he stayed for many years. When I asked the secretary at the geology building in Austin what materials they had by J. A. Udden, she checked and asked me, "How much do you want?" She showed me an abundance of materials that he had written. It is told that on one trip into the panhandle of Texas, J. A. discovered oil on land owned by the University of Texas. So if the University of Texas has a good football team (as they usually do), maybe it is in part because J. A.'s discovery contributed to the program.

I have met children, grandchildren, and great-grandchildren of J. A.'s on visits to the Houston area. Some of his children and grandchildren are in the field of geology, continuing in J. A.'s tradition.

Laurel M. Udden
Minneapolis, Minnesota

NOTES

INTRODUCTION

Marlin F. Hawley
Wisconsin Historical Society

This volume reprints Johan August Udden's classic monograph, *An Old Indian Village*, originally published in 1900 by Augustana College in Rock Island, Illinois. Its author, Johan Udden, although a noted geologist, is arguably the "father" of Great Bend aspect/ Wichita archeology, as well as of "historic sites" archeology in the central Great Plains. While not the first to take an interest in the enigmatic mounds found on Native American sites in central and south-central Kansas, with the publication of *An Old Indian Village*, Udden established the foundations for a century of research.

Of immigrant origins, Udden was born in 1859 in the village of Udd, Sweden, and came to America with his parents, Andreas and Inge Larsson, and his three siblings in 1861. Settling in Minnesota, the Larssons soon adopted the name of their home in Sweden. When Udden was 10 years old, his father died. His mother, he noted years later, sacrificed to provide for her children's education. Udden ultimately attended Augustana College in Rock Island, Illinois, where he studied under the natural scientist Joshua Lindahl. Lindahl and his pupil developed a close relationship. The elder man continued to mentor Udden through his years of teaching at Bethany College in Lindsborg from 1881 into 1888. Ever practical, Lindahl urged Udden to pursue areas of science in which he could make a contribution. It is perhaps to Lindahl's influence that we owe Udden's only foray into archeology (Anderson 1992; Hansen 1985; Underwood 1992, herein).

It is no reflection upon Udden that the book had so little impact upon his contemporaries in Kansas. His hope that, "Should this paper come into the hands of collectors or students of this class ... it may whet their appetite for more and better literature of the same kind" (Udden 1900, herein), certainly was not immediately fulfilled.

Udden and his growing family left Lindsborg in 1888, when he accepted a position at Augustana College. From 1888 until 1911, he taught natural history and geology. He was a special assistant for the Iowa Geological Survey during the years 1897-1903 and worked for the University of Texas Mineral Survey in 1903-1904 and the Illinois Geological Survey from 1906 to 1911. He was a contributor to the United States Geological Survey in the years 1908-1914. In 1911 he began a long association with the Bureau of Economic Geology at the University of Texas and in 1915 was appointed director. He held the post until his death on January 5, 1932.

Udden received four honorary degrees, including Doctor of Laws from Augustana College in 1929, in recognition of his work. In 1911 the King of Sweden knighted him for distinguished contributions to science (Heiman 1963).

In addition to reprinting *An Old Indian Village*, several introductory papers have been commissioned or reprinted from other sources to provide the reader with the details of Udden's life, scientific achievements, and work in Little River focus archeology following his explorations at the Paint Creek site.

James Underwood, retired chairman of the Department of Geology, Kansas State University, and Dr. Dan Merriam, editor of the *Transactions of the Kansas Academy of Science*, granted permission to reprint Underwood's article, "The Life of Johan August Udden, Geologist, Teacher, Inventor: Through the Kansas Years," from the *Transactions of the Kansas Academy of Science* 95(3-4):177-191, 1992. The text of this article has been reproduced without changes except for corrections of several typographical errors. Dr. Underwood kindly shared with me his sizeable collection of Udden-related materials. This material has been of inestimable value to my own understanding of Udden's life and career. Dr. Underwood also contributed the photograph of Udden and his wife, which has been added to the article as Figure 2.

Richard Anderson, emeritus professor of geology at Augustana College in Rock Island, generously consented to write a brief overview of Udden's geological career, "The Geologic Work of J. A. Udden." The roots of Udden's geological work extend to his years at

Bethany and developed alongside his archeological interests.

In "'More's the Pity': The Short Archeological Career of J. A. Udden," I discuss Udden's archeological pursuits. Regrettably, there is only limited contemporaneous documentation on Udden's excavations. The meager sources at hand, supplemented with his monograph and other secondary sources, serve to show the same keen intelligence at work in *An Old Indian Village* that Udden would apply to his geological endeavors. It is clear that, while he never again pursued archeology after leaving Bethany College in 1888, he maintained an interest in archeology.

Susan Vehik in "Topics, Themes, and Theories in Little River Focus Archeology: Research After Udden," discusses the archeological work conducted in sites of the Little River focus of the Great Bend aspect from Udden's founding excavations at Paint Creek (14MP1) onward. Based upon a close reading of its sources, this is an important paper for charting the development of Little River focus archeology in particular and Great Bend aspect archeology in general.

Udden himself contemplated his years at Bethany. In his reminiscence of those years, he reflected on the people, events, and discoveries that turned a budding naturalist into a world-renowned geologist. Originally this reminiscence was published in Swedish in *Lindsborg Efter Femtio Ar*, edited by Alfred Bergin in 1919. It was translated and reprinted in 1969 as *The Smoky Valley in the After Years*, edited by Ruth Bergin Billdt and Elizabeth Jaderborg. I would like to thank Elizabeth Jaderborg of Lindsborg, Kansas, for encouragement in reprinting this reminiscence.

Rounding out the collection is a bibliography of Udden's scientific and technical papers. Based on Udden's own privately printed "List of Papers Published by J. A. Udden," I added items post-dating that 1925 document. Included as well are a few items omitted from it but included in Baker's (1933) memorial, published by the Geological Society of America, and in Monica Heiman's (1963) biography of Udden.

Jonathon Miller, director of the library at Augustana College, granted permission to reprint the monograph. Republication was made possible by a grant from the Kansas Anthropological Association. Digital reproduction of *An Old Indian Village*, a first step to reprinting in paper form, was done by Northern Micrographics in LaCrosse, Wisconsin. Northern Micrographics specializes in digital reproduction and printing of books and other documents that, because of age or other factors, are too fragile for general use. Many libraries, including the Kansas State Historical Society, employ them to reprint scarce historical volumes. To complete the process, it was first necessary to find a clean, bright copy of Udden's monograph, which could then be dismantled and scanned. After months of searching on the Internet, I found a reasonably priced copy for sale by an out-of-print book dealer in New Zealand! The copy was sacrificed for this reprint edition.

As editor of this volume, I am, of course, grateful to the authors for their contributions. I owe a particular debt of gratitude to James Underwood and Richard Anderson, both scholars with a long-time interest in Udden, for encouragement throughout this endeavor and also for reading through the draft manuscript of the introductory papers. I would also like to thank Vance Holliday of the Department of Geography at the University of Wisconsin-Madison (now at the University of Arizona) for reading over the draft. Laurel Udden offered words of encouragement and contributed the short preface.

References Cited

Anderson, Richard C.
1992 The First 75 Years of Geology at Augustana College. In *Earth Interpreters: F. M. Fryxell, Geology, and Augustana*, edited by D. A. Schroeder and Richard C. Anderson, pp. 7-24. Library Publications No. 36. Augustana College, Rock Island, Illinois.

Baker, Charles L.
1933 Memorial to Johan August Udden. *Bulletin of the Geological Society of America* 44: 401-413.

Hansen, W. B.
1985 Dust in the Wind: J. A. Udden's Turn-of-the-Century Research at Augustana. In *Geologists and Ideas: A History of North American Geology*, edited by E. T. Drake and W. M. Jordan, pp. 203-214. Geological Society of America, Centennial Special Volume 1.

Heiman, Monica
1963 *A Pioneer Geologist, Biography of Johan August Udden.* Braswell Printing, Kerrville, Texas.

Udden, Johan A.
1900 *An Old Indian Village.* Augustana Library Publications No. 2. Augustana College, Rock Island, Illinois.

The Life of Johan August Udden, Geologist, Teacher, Inventor: Through the Kansas Years

James R. Underwood, Jr.
Kansas State University

The Kansas Anthropologist *23:5-14*

Johan August Udden, born in the village of Udd, Sweden in 1859, immigrated with his family to the United States in 1861; they settled in a farming community in Carver County, Minnesota. J. A. Udden attended Augustana College and graduated in 1881, having completed a classical program with emphasis in the natural sciences; he did not, however, have a formal course in geology. He accepted a post in Lindsborg, Kansas, in the fall of 1881 at Bethany Academy, later Bethany College, and remained there until 1888, when he was invited to return to Augustana as the first occupant of the Oscar II Chair of Natural History. He made the decision during his stay at Bethany to make geology his career, and although he did not publish his first scientific paper until after he returned to Augustana, his early papers were based on observations made and materials collected during his years in Kansas.

Reprinted from Transactions of the Kansas Academy of Science *95(3-4):177-191.*

In the Geological Society of America memorial to Johan August Udden, prepared by Charles Laurence Baker following Udden's death on January 5, 1932, Baker (1933) wrote:

> Kindliness, gentleness, a modesty amounting virtually to bashfulness, moral and intellectual honesty, unfailing courtesy and desire to be helpful, were outstanding traits of Udden .... A model for others to follow, a great geologist, a good man in every sense of the word—he was all these ..... Johan August Udden was one of Nature's noblemen.

Who was this talented geologist and exemplary individual so eloquently honored by Baker, an outstanding geologist himself?

Johan August Udden was born in 1859 at Uddabo in Lekasa parish, Vastergotland, Sweden, the son of Andreas and Inge Lena Larsson (Sebelius, 1949). In the summer of 1861, the Larssons and their four children immigrated to America, the journey from Göteborg to New York, requiring eight weeks on the sailing vessel Minoa (Heiman, 1963). By mid-September, the family had made its way to Carver County, Minnesota, where they established their home among other Swedish immigrants (Law, 1984).

The minister of the West Union Church in Carver County, which the family had joined, suggested that, because the name Larsson was so common in the area, the family should adopt the name Udd from their home village in Sweden, Uddabo. Years later when Johan and his older brother, Svante, first went away to school they added the suffix "en" to soften the sound of the name (Heiman, 1963).

Andreas, the father, was religious and musical and wrote songs for family worship that he played on a psalmodicon brought from Sweden (Sebelius, 1949:89). In the summer of 1864, he was drafted into the Union Army but was released 14 months later because of ill

health (Law, 1984). During his service in the army, he learned to read and write English; upon his return home he was able to assist his children with their studies (Heiman, 1963). Shortly after his return from the Union Army trenches in Alabama, Andreas Larsson bought 80 acres of virgin land, the south half of the southeast quarter of Section 5 in San Francisco Township in Carver County (Heiman, 1963). Four years later, on Johan's tenth birthday, his father, aged 42, died of pneumonia (Heiman, 1963). His mother, also aged 42, was now a widow with seven children to care for and a farm to operate. During the next several years, Johan and his mother worked the farm themselves (Heiman, 1963). Writing in later years, Udden described that difficult period (Udden, 1913):

> Widowed at the age of 42, my mother continued for more than 10 years to clear, fence, ditch, and cultivate the ... farm .... My brother Svante was sick in bed for nearly three years (1870-1873) and during this time I was my mother's principal outdoor hand. We plowed, harrowed, cut, and stacked hay and grain, built fences, and dug ditches.

When Johan and his older brother, Svante, left home in 1873 to attend St. Ansgar's Academy (1873-1876), their mother did most of the farm work herself. Her two daughters provided limited assistance, but the three youngest children, all boys, had died by the spring of 1876 (Heiman, 1963). A brief description of this remarkable woman was provided, in later years, by Udden (1913):

> My mother was a woman of quick temperament and very positive convictions. She had a somewhat domineering disposition, and possessed an unusual endurance, physically and mentally. She made heroic sacrifices for the education of her children.

In 1873, Johan and his older brother, Svante, only recently recovered from a prolonged illness (1870-1873) entered St. Ansgar's Academy. The academy, at that time occupying a building approximately 6 x 6 m located between East Union and West Union in Carver County, Minnesota, later was moved to St. Peter, Minnesota and renamed Gustavus Adolphus Academy (Heiman, 1963). In reminiscing about those years, Dr. Udden wrote:

> I went to a little academy winters, carrying my provisions for the week on a sled.

Records show (Law, 1984) that each week students of the academy had 22 sessions on English and Swedish, 15 on religion, 8 on arithmetic, 6 on geography, 5 on Latin, and 2 on American history (Law, 1984). One can imagine that, during the years at St. Ansgar's, Johan's intellectual horizons were broadened by his teachers. That, coupled with the firm support of his mother, resulted in his enrolling in 1876, again with his brother Svante, in Augustana College, Rock Island, Illinois.

Why Augustana? It had been founded in 1860 as Augustana Seminary by the Scandinavian Evangelical Lutheran Augustana Synod to provide educated clergy to serve the rapidly growing number of Swedish and Norwegian immigrants. In 1862, the school was renamed Augustana College and Seminary, reflecting its broader role in education. The school was viewed as one with high standards (Schroeder and Anderson, 1992).

> ... the fledgling synod was not interested in funding merely a so-called "missions school," where training would be limited to a few brief courses in biblical exegesis and homiletics. These Scandinavian immigrants placed a premium upon a properly educated ministry, and they set their standards high, even though it meant fewer ministers, and a longer and more expensive period of training.

Augustana was a natural choice for two brothers, one of whom wished to enter the ministry, the other who wanted to pursue, as Johan wrote years later (Heiman, 1963): "... a classical course, which included courses in Physics, Botany, Geology, and Astronomy."

School life at Augustana was spartan (Fryxell, 1924):

> ... the faculty (consisting of the president and three professors) and the students (all boys) together boarded, roomed, and recited in the one college building; when boarding, fuel, light and room might be had for $2.50 per week; when as yet no degrees had been conferred by Augustana; and when on week days the college bell, instead of proclaiming varsity victories as it now does, sounded reveille for everyone on the campus at 5 o'clock a.m.

At Augustana, J. A. Udden completed a two-year preparatory program, then graduated in 1881, having completed the three-year A.B. curriculum (Law, 1984). At the time that the brothers enrolled at Augustana, the academic program was designed primarily to prepare

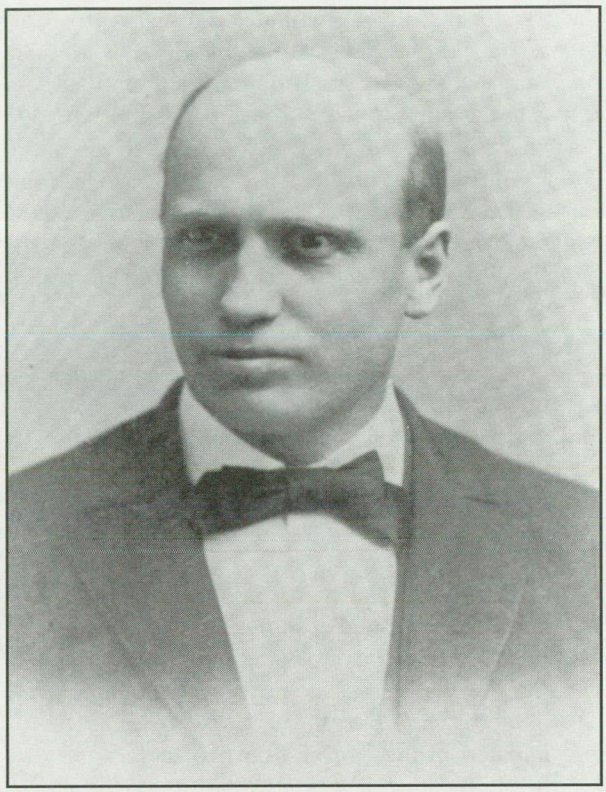


Figure 1. Johan August Udden. Photograph taken sometime during his tenure at Bethany College, Lindsborg, Kansas. (Photo courtesy of John Pearson and the Bethany College Archives.)

students for the ministry; science was not emphasized. In 1878, for example, J. A. Udden had four hours per week of geometry and algebra, two of natural philosophy, and three of a combination of history and geography (Law, 1984).

In December 1878, Johan Joshua Harold Lindahl was appointed Professor of Natural History at Augustana, and although Natural Philosophy had been taught there since 1871, Lindahl established a new Natural Science Department (Heiman, 1963). During Lindahl's 10-year tenure at Augustana, separate courses in the sciences were established; a formal course in geology, however, was not offered until 1883 (Heiman, 1963), two years after Udden's graduation.

Lindahl's influence on Augustana was strong and lasting. He "... brought impeccable academic credentials to the fledgling college, established a science curriculum that was to serve virtually unmodified for almost 50 years, and turned out graduates who could take their place among the very best. Representing the latter was J. A. Udden ..." (Anderson, 1992).

Lindahl's influence on Udden was no less great. In addition to having taken his courses at Augustana, throughout the next 25 years, and especially during Udden's early years as a teacher and scientist seeking to find the subject area most appropriate for his specialization and research, they exchanged a series of some 90 letters (Hansen, 1985). Lindahl's letters to Udden were thoughtful and frank; Lindahl was not reluctant to offer suggestions or even, on occasion, criticism (Anderson, 1992).

In 1881, at age 22, Johan August Udden became the third science graduate of Augustana College (Heiman, 1963). A week later, he journeyed to Lindsborg, Kansas as a delegate to the Augustana Synod from West Union, Minnesota (Udden, 1919). Reminiscing about this period in his life, Udden (1919) wrote:

> I came to Kansas in order to get work so that I could continue my studies. That was all that I had on my mind. I had no idea what career I wanted to pursue, but I knew that I did not want to be a preacher. I was dissatisfied with my four years in college. I have often wondered how the overworked teachers at Augustana had the strength to teach as many classes as they did.

Just after the close of the synod meeting, Udden attended a four-week teachers' training program in nearby McPherson, Kansas, that resulted in his receiving offers of three teaching positions (Lungstrom, unpubl.). He was asked by Rev. Carl A. Swensson, pastor of Bethany Church in Lindsborg, to take charge of the Bethany Church parochial school just west of Lindsborg; then a short time later Rev. Swensson invited him to come to Lindsborg to assist him in founding a high school, Bethany Academy (Lindquist, 1975; Udden, 1919; Fig. 1).

Udden wrote movingly of a friend from his teaching days west of Lindsborg and, in so doing, provided insight to Udden's own character and principles, including his deep appreciation and affection for his wife (Udden, 1919):

> One of my keenest memories from my school days in the west district was my association with Mr. Peter Fallquist, a farmer with whom I stayed .... I have never seen anyone work as hard as my friend, Mr. Fallquist. His only rest periods were when he had morning and evening devotions and Sundays. Night and day he worked his farm. It was only on Sunday that we had an opportunity to visit and to

become really acquainted. I soon found out that he had more than an outward form of Christianity. He was reasonable in everything; loving, considerate of everyone, kind in his criticism of others, a very tolerant man. He was even tolerant toward a young student who was considered a skeptic by many. It was a blessing to know such a man. Long after his death I still see his face. It resembled the face of Christ. I know of no other person who is as near my ideal as he, except the one who has shared both joy and sorrow with me these thirty-six years. How true it is that the most beautiful plants that nature gives often grow in the hidden places in the woods. In the midst of the early drudgery and misery, in the midst of life's most prosaical and everyday cares, one finds some of the most valuable people. I feel I have received two of earth's greatest treasures in Mr. Fallquist and my wife.

Bethany Academy, the forerunner of Bethany College, opened its doors on October 15, 1881; it was reported that on that first day no students reported and that Udden overslept (Heiman, 1963). Eventually 10 students, 6 boys and 4 girls, paid $5.00 tuition each, and classes began in the sacristy of the Bethany Lutheran Church (Lindquist, 1975). Rev. Swensson, only two years older than Udden, taught classes in Bible and religious history one hour each day; Udden taught the remaining classes: arithmetic, geography, orthography, English reading, Swedish reading, penmanship. Udden (1919) recalled those first classes and students (Fig. 1):

> The students were willing workers, and I was a zealous teacher, maybe too zealous for some of them.

Earnest F. Philblad, one of his early students and later (1904-1921) president of Bethany College, remarked (Sellards, 1932):

> ... [I] enjoyed the privilege of being a member of his classes. I recall him as a great teacher and a warm-hearted friend.

Udden's salary was $40.00 per month for six months; after deducting $20.00 per month for meals and $32.25 for incidental expenses, he had a balance of $87.75 in April 1882 (Lindquist, 1975).

Undoubtedly a highlight of the academic year was the organization of a community chorus by Mrs. Carl Swensson and their presentation of Handel's Messiah on March 28, 1882, establishing a tradition that continues to the present time. Concerts in Lindsborg and elsewhere in the valley of the Smokey River raised $99.75 for Bethany Academy (Lindquist, 1975). Joining the community choir for the presentation of the Messiah was the Augustana College orchestra, and Udden delighted in the reunion with former schoolmates. He wrote (1919):

> We practiced together again. My classroom, the sacristy, was changed into a music hall where stringed and wind instruments vibrated in harmony and disharmony. Concerts were given and feasts enjoyed in Lindsborg, Assaria and Fremont.

Udden described the inevitable emotion letdown following such a delightful and exciting period (Udden, 1919):

> But everything must come to an end. A spirit of inertia came over the people who had participated in the festivities when these were over. Besides, it was also the time of year when spring work demanded the presence of some of my students. The last day of school there were just twelve students in school. The reaction that set in after the festivals depressed me so much that I actually shed tears after the last student had left. It seemed to me that my teaching amounted to nothing compared to the magnificent concerts we had heard.

During the summer of 1882 Udden was asked by Rev. Swensson to purchase laboratory equipment and other supplies and Udden wrote from Chicago in August (Lindquist, 1975):

> It was best to buy a few good things rather than many cheap ones. I therefore bought the best globe and a better electrical machine than they had at Augustana College .... An air pump and a set of physiological charts ought perhaps to come next in order. But an air pump for less than $50.00 is worth nothing .... I cannot tell you how important such books [pupil account books] are. It trains the teacher as well as the pupil to be particular about small things and to be particular always; and you know nothing is more important for success.



Figure 2. J. A. Udden and his wife Johanna in Austin, Texas, probably in the 1920s.

The summer of 1882 was an eventful one for Udden. He returned to Minnesota where he and Johanna Kristina Davis (Figure 2), a member of the West Union Church in Carver County, were married on August 27. Two weeks later, the journey to Lindsborg was their wedding trip (Udden, 1919).

The State of Kansas issued a charter for Bethany Academy in September 1882. On October 4, Bethany Academy was dedicated at festive services conducted in Swedish, and classes began the following day; 44 students had enrolled by the end of the first week and 92 students by the end of the year. Tuition and board remained $2.00 per week (Lindquist, 1975).

Mrs. Udden was persuaded to take charge of the Academy's meals for the year, and further insight to Udden is provided by his description of that arrangement:

> We were young and naive. I was foolish enough to permit my wife to take over the school's eating establishment. She did this very satisfactorily. There were no complaints from the students about the food that term. But the management of the work deprived the bride of the real home enjoyment she should have had, something that I did not understand

> at that time. We hardly became acquainted that year because we were busy with our separate jobs.

Classes that fall of 1882 were held in the Welin blacksmith shop and in the old public schoolhouse, which had been moved and renovated. The Lindgren Hotel served as a boarding and rooming house for the students (Udden, 1919). The expansion both of the curriculum and the faculty resulted in a broader offering of courses, but less of the burden of instruction fell to Udden. He taught classes in Latin, English, and civil government (Lindquist, 1975). He also recalled that at about that time he began to teach physical geography, zoology, and botany (Udden, 1919). The record is not clear, but he may have exchanged his classes in Latin, English, and government for those in geography, zoology, and botany primarily because other members of the faculty, now totaling four, were not qualified to teach the sciences, or did not wish to teach them.

A student at Bethany told Udden about the Indian Mounds by Paint Creek, probably in 1883, and during the succeeding five years he spent considerable time and money in excavating and studying them (Udden, 1919). He recalled that on the frequent trips to the mounds he would be accompanied either by his wife, one of his colleagues, or several students. Even some of the local farmers occasionally would drive them to the site and use their plows and tools to assist in the excavations. Udden also recalled, somewhat ruefully, that during the years that he studied the mounds, he spent more than $125 for transportation (horses and wagons) and for helpers. The work that he did then and the material that he collected was described, 12 years after he left Lindsborg in Augustana Library Publication No. 2 (Udden, 1900), a scientific publication series that he initiated in 1891. In reminiscing many years later about his work on the Indian Mounds in Kansas, he wrote (Udden, 1919):

> I have often wondered if the recognition I received ... was worth the time and money. Does it pay for a young man of moderate means to "cast his bread upon the water" as the scripture says? The question is answered in different ways by different people. It has significance for everyone.

Countless teachers, young and old, before Udden's time and after, have faced the issue of investment of personal resources in behalf of one institution or the other without hope of compensation. Most probably resolved it as he did, that is they did what their professional instincts suggested and thus, in undertaking a project, subsidized the state or the institution by their investment of personal funds and time.

A highlight of the work alongside Paint Creek was the discovery there of a piece of chain mail about which he wrote (Udden, 1919):

> ... [it was] no doubt, part of the armor worn by one of Coronado's soldiers. It was rust-bound, yet held together even though it was hit by a spade.

The piece of armor, unfortunately, was lost although a photograph was made of it before it disappeared (Udden, 1919).

Udden (1919) recalled that, during the spring of 1883, he first became familiar with Kansas flora and made numerous collecting trips, some with Dr. John Rundstrom, pioneer Lindsborg physician (Lindquist, 1975), who had studied botany in Lund, Sweden. Udden wrote:

> When I needed help, I went to him. On one of my visits he showed me his collection of plants. This aroused in me the desire to have a collection as large as his .... During the next three years, I took the time to become acquainted with many of the plants of Kansas. I made almost all of my plans and trips so as to find as many new plants as possible .... One thing led to another. One summer I set out to find zoology material in order to teach it. I was fortunate enough to be able to gather hundreds of species of birds which later became useful in the classroom.

Udden's tendency to observe natural materials carefully and, when possible, to collect them for the classroom or laboratory was reinforced by his former professor, Joshua Lindahl, in a letter to Udden, December 21, 1886 (Anderson, 1992):

> The time allowed for the natural sciences in our Sw-Am. sectarian schools, where two mother tongues and Christianity together with Latin and Greek occupy about 66% of all the class studies, is and must remain entirely inadequate for the demands on a college bred man in America in this 19th century .... I am now of the opinion, that the very best way in which both you and I can be useful to our resp. schools, is just making good museums .... What shall we do to help this sad state of

> our department in our schools? Make the museum attractive, extensive, carefully arranged, well labelled, so that the students will find it a pleasure to drop in there as often as possible; and they cannot help to learn a great deal without knowing that they are thus actually studying. They will then not only learn names and classification, but they will acquire a taste for observing, and spontaneously exercise their mental facilities on work, that is not demanded of them, and which may, just on that ground, prove so much more profitable in developing them to men of sound and strong intelligence.

Udden followed Lindahl's advice and, upon leaving Lindsborg and Bethany College in 1888, had collected 1200 plants, mostly from Kansas, and the aforementioned hundreds of species of birds (Udden, 1919).

Bethany College enjoyed remarkable growth in its early years because of the dedication, energy, and vision of its founder, Rev. Carl Swensson, because of the support of the Swedish Lutheran community in and around Lindsborg, and because of the quality and dedication of its faculty. Enrollment for the academic year 1886-1887 was 339 and, by early 1887, part of the third building at Bethany, later known as Old Main, was occupied. It was five stories tall, not including the basement, and "loomed large on the landscape of the Smoky Valley and in the minds of Bethany faculty, students, and friends" (Lindquist, 1975).

Udden took a brief leave of absence from Bethany in the spring of 1886 and did graduate study in chemistry and zoology at the University of Minnesota (Heiman, 1963). It was during this period that his interest in electricity resulted in his asking advice of Lindahl about undertaking extensive study in the field. Lindahl's reply, December 21, 1886, was typically candid and forthright (Anderson, 1992):

> Friend August:—My modesty obliges me to acknowledge, that there are certain things that fall beyond my knowledge. You have just happened to strike something of that kind in your electrical experiments. You ask, whether I regard it to be worth your while to further inquire into the matter. To this I would answer—no! not under your present circumstances. There are two classes of men, who do such work, and you belong to neither. The one consists of men, possessing an exhaustive knowledge of the state of the physical sciences, and who with such a foundation perform systematical experiments to verify or correct the conclusions drawn from facts already established .... The other class comprises such men, who have an encyclopedic knowledge of a certain class of phenomena and possess more skill in their fingers than in their brains. They experiment at random, hoping to strike something new by accident .... You cannot afford to spend a great deal of time or money on random experiments, nor can it be advisable for you to aim at the acquiring of a high scientific standing in the science of electricity. The field is already worked too much, and you cannot expect to accomplish much without spending years of assiduous labor on this topic exclusively. Get a good textbook, repeat the experiments described in that book, and enlarge upon it to a limited extent for the purpose of strengthening your power of observing and interpreting phenomena, but for no other purpose. You have another field, in which you should invest your spare time to far better advantage, and that is the study of the mounds. There is a *tabula rasa,* every little observation may prove a valuable contribution to our fragmentary knowledge of that branch of archeology.

Joshua Lindahl and Udden had a very special friendship, one that could withstand even sharp chiding by Lindahl, who wrote Udden on December 30, 1887 (Anderson, 1992):

> But allow me once more to play the part of your schoolmaster, and take you to task for careless writing. Your penmanship is perhaps not as bad as it used to be, but your spelling of technical terms, in the very subject of which you are now making a special study, contains inexcusable errors. If a farmer with a common school breeding should write to me that he has found some interesting specimens in the "Quarternary" (sic) gravel, and some in the "underlaying" (sic) rock, I might not even notice his blunders, but it is absolutely painful to me to see a Swedish-American college professor and that an alumnus of Augustana College repeat such cacographies, every time he uses those terms. I know, the fault is not entirely yours. When you studied at Augustana College, the instruction given in English and Swedish was very inadequate. But ambition

> ought to arouse yourself to make up by close attention to the matter what you failed to learn whilst studying at college. You must know, when you cannot be certain about the correctness of an expression, why not then consult a dictionary? I am doing that habitually.

But when did Udden begin to view geology as his life's work? Although he wrote some 130 papers between 1891 end his death in 1932, he published nothing prior to his departure from Bethany College and Lindsborg in 1888. That he was undecided about the focus of his career in science as late as December, 1886 is shown by the letter, cited above, that Lindahl wrote to him on December 21.

Udden had read the short report of the one-year Geological Survey of Kansas, prepared by Professor Benjamin F. Mudge and wrote (1919):

> ... the geology of Kansas ... interested me so much more since on my botany trips I had seen much of what was described by this author. I bought a horse cheap .... I borrowed a buggy from a friendly farmer .... I took a month's vacation to study the nature of the soil between Lindsborg and Junction City. To save money I slept in the open most of the time ....
>
> This trip became an eye opener for me. I came home determined that geology would be my future career. This determination I have kept.

These recollections were recorded long after the events they described, but it seems likely that the decision to make geology his life's work probably was made by Udden in the spring of 1887, after having received Professor Lindahl's letter late in 1886 and after having studied the geology between Lindsborg and Junction City, some 80 km east-northeast of Lindsborg.

Sometime thereafter Udden's interest in geology resulted in his being asked to find a "competent person" to examine the Lindsborg area for coal deposits. Udden knew of a minister from England, "well-versed" in geology, and they spent six days on the project (Udden, 1919). Searching farther afield for coal, Udden studied the area south of Marquette in northwest McPherson County, and the Cretaceous rocks in Rice and Ellsworth counties to the west and southwest (Udden, 1919). A student called his attention to a "peculiar layer of soil" along Sharps Creek, and thus was first discovered volcanic ash that occurs in many localities in McPherson County and elsewhere in Kansas (Udden, 1919).

In the Bjorndyke area, a few kilometers west of Lindsborg while exploring for coal, Udden collected a great number of "fossils and petrifactions" that he thought might be of Triassic, Jurassic, or Cretaceous age. Not having the references needed to identify and date the material, he sent it to a person for verification whom he considered to be an authority. Udden (1919) described this effort:

> The material was never returned, nor was anything written about it. This incident taught me the important lesson that a certain amount of self-confidence is necessary in all that we do. If I had had greater self confidence in my own observations, it is possible that our geology textbook would now tell about the Smoky Hill Age in place of the Comanche Age. Layers of the same age were later found in Comanche County in Texas. Thus the name, "Comanche Age."

The years in Lindsborg had been busy and exciting ones for the Uddens, but in addition to the excitement and challenge of founding a new school, they also had experienced heartbreak: two daughters were born to them, one stillborn and the other dying at age 14 months. Two sons also were born in Lindsborg: Jon Andreas on May 19, 1885, and Anton David on December 28, 1886. Udden, in order to provide additional income to care for his growing family, served as editor from time to time of local newspapers (Heiman, 1963).

In August 1888 the Udden family left Lindsborg and moved to Rock Island, Illinois where Johan August Udden had been selected to replace Joshua Lindahl who had resigned to accept the position of Curator of the State of Illinois Museum. Udden became the first occupant of the Oscar II Chair at Augustana College, the responsibilities for which were to teach Natural History and Geology (Heiman, 1963). Udden's interest in returning to his alma mater apparently caught his good friend and former professor by surprise, but Lindahl provided enthusiastic endorsement of the governing board's decision, as stated in a letter to Udden, July 2, 1888 (Anderson, 1992):

> Friend Udden!
>
> The Board has today called you to be my successor in biology and geology .... Singularly enough, I had never for a moment thought that you would accept a position here with your present bright prospects for a far more remunerative office in Kansas (I am told that your salary will be $2000). Else I would at

> once have proposed you .... Of course, I told the board that they would make an excellent choice in appointing you .... I had no thought that you would be available.

A letter from Lindahl to Udden, July 8, 1888, clarifies the "bright prospects" referred to above and provides insight to the agony of spirit that Udden was undergoing as he considered leaving Bethany College:

> Dear Friend: Cheer up! You certainly need not break with S. [presumably the Rev. Carl A. Swensson, founder of Bethany College] for, if I understood things rightly, he had recommended your appointment .... Anyway, you have duties to yourself and to your family more sacred than those to Bethany College and to your friend C.A.S. He has a big heart and *could* not do otherwise than cordially approve of any action of yours, by which you manifested a greater interest in your family than in even the truest friend. It never occurred to me before that any such consideration would keep you from applying for or accepting a call to Aug. Coll.—To the contrary, I was under the impression, that you for the sake of your family would refuse the position in Rock Island as the income you will get as county Superintendent will probably be twice as great as that offered you in Rock Island ($800 + house rent $150) ....

It must not have been easy to pass up the opportunity to obtain significantly greater financial security for his growing family, to leave an institution in which he had invested so much effort and seven years of his life, to leave a small close-knit community of friends and associates where their four children had been born and where two were buried following early childhood deaths, but his love of science resulted in his making the decision to forego the more remunerative field of educational administration and to remain in teaching and research. In the years to come, the science and profession of geology, Augustana College and The University of Texas, and the states of Iowa, Illinois, and Texas, among others, benefited greatly from the decision made in July, 1888.

Udden would not publish his first paper until three years following his arrival at Augustana, but it and many of his early publications were based on the careful, meticulous geologic work that he did in Kansas (Hansen, 1985). Throughout his career he had the insight to identify problems and research opportunities in topical and geographical areas that others might consider uninteresting. About Kansas, Udden wrote (Hansen, 1985):

> A western naturalist once said the geology of Kansas was monotonous. In one sense this remark is certainly justified .... Occasionally, however, some feature of special interest crops out from the serene uniformity, and the very nature of its surroundings makes it appear all the more striking.

Thirty years after departing Lindsborg to take up his new post at Augustana, Udden wrote (1919):

> One day in August 1888, my dear wife and I packed our few possessions in a couple of trunks and found ourselves at the depot with our two sons ready to leave [the] place where we felt so much at home. We thought we were going to be gone for one or two years. Surely we would return in the near future. The train started to leave. Soon we saw the beautiful trees beside the Smoky Hill River disappear. Our attention was drawn to our two boys, Jon and Anton, who were gazing regretfully out the window. Our thoughts were mutual. This was our last memory of Lindsborg.

The years 1881-1888 had been crucial ones: a career as a teacher of science begun, a family started, and the decision made to emphasize geology in his teaching and research. Johan August Udden was poised to undertake the geologic teaching and research that would distinguish him as an innovative thinker and investigator, an indefatigable worker and meticulous observer, and a master teacher.

Acknowledgments. Members of the Udden family have been very helpful in providing me with information about Dr. and Mrs. J. A. Udden: Ms. Sam Udden and Mr. Marshall Udden helped me with suggestions and information at the beginning of the project, and Ms. Jane Anderson has kindly furnished me material on the Uddens that I could have acquired no other way. Professor Emeritus Leon Lungstrom assisted greatly by providing me with a copy of the English translation of that part of Bergin's book (1919) that contained the contribution by Udden. Professor Richard C. Anderson, Department of Geology of Augustana College, graciously sent me a copy of his unpublished manuscript on the history of the first 75 years of geology at Augustana, and Ms. Judy Belan, Head, Special

Collections, Augustana College Library, graciously assisted me in examining the Udden materials there. The early photograph of J. A. Udden was supplied by Mr. John Pearson of Bethany College.

Literature Cited

Anderson, Richard C. 1992. The first 75 years of geology at Augustana. *In* David A. Schroeder and Richard C. Anderson (eds.), Earth Interpreters: S. M. Fryxell, Geology, and Augustana. Augustana College Library Publication 36:7-24.

Baker, Charles Laurence. 1933. Memorial of Johan August Udden. Geol. Soc. America Bull. 44:402-413.

Bergin, Alfred. 1919. Lindsborg efter Femtio Ar. Augustana Book Concern, Rock Island, Illinois. 239 pp.

Billdt, Ruth Bergin, ed. 1965. The Smoky Valley in the after years [English translation of Bergin, 1919]. Lindsborg News-Record, Lindsborg, Kansas. Pp. 80-84.

Fryxell, Fritiof M. 1924. The Augustana Museum of Natural History: a semicentennial retrospect 1874-1924. Augustana Bulletin, Series 19, 5:6-30.

Hansen, William B. 1985. Dust in the wind: J. A. Udden's turn of the century research at Augustana. Geol. Soc. America Centennial Special, Vol. 1, pp. 203-214.

Heiman, Monica. 1963. A Pioneer Geologist: Biography of Johan August Udden. Privately printed by S. M. Udden, Kerrville, Texas. 215 pp.

Law, John. 1984. A Durkheimian analysis of scientific knowledge: the case of J. A. Udden's particle size analysis. Knowledge and Society: Studies in the Sociology of Culture Past and Present. 5:85-113.

Lindquist, Emory. 1975. Bethany in Kansas: the history of a college. Bethany College Publications, Bethany, Kansas. 309 pp.

Lungstrom, Leon. Recognition of Three Pioneer Scientists of Swedish descent. Unpublished Manuscript. 10 pp.

Schroeder, David A., and Richard C. Anderson, eds. 1992. Earth Interpreters: F. M. Fryxell, Geology, and Augustana. Augustana College Library Publication 36. 207 pp.

Sebelius, Sven Johan. 1949. Master Builders of Augustana. Augustana Book Concern, Rock Island, Illinois. Pp. 88-96.

Sellards, E. H. 1932. Memorial to Dr. Johan August Udden. Univ. Texas Bull. 3201:8-12.

Udden, J. A. 1900. An Old Indian village. Augustana College Library Publication 2, 69 pp.

Udden, J. A. 1913. Unpublished Biographical Notes on the Ancestors and Relatives of the Children of Johanna Kristina Udden (Born Davis) and Johan August Udden. April, 1913. 17 pp.

Udden, J. A. 1919. Memories of my sojourn in Lindsborg. Pp. 80-84 *in* Billdt, Ruth Bergin (ed.), 1969, The Smoky Valley in After Years. Lindsborg News-Record. Lindsborg, Kansas.

The Geologic Work of J. A. Udden

Richard C. Anderson
Augustana College

The Kansas Anthropologist 23:15-21

Udden's earliest geological studies were conducted in areas close to home, the vicinity of Lindsborg, Kansas, and later, Rock Island, Illinois. Most notable among his early work are his reports on the geology of six counties in Iowa, published between 1899 and 1902; his report with T. E. Savage on the geology of the Edgington and Milan Quadrangles in Illinois; and his Belleville-Breese, Illinois, folio of the Geologic Atlas of the United States *with E. W. Shaw. These studies led Udden to consider certain fundamental aspects of midwestern geology: the cyclic nature of Pennsylvanian sedimentation, the configuration of the bedrock surface beneath the glacial deposits, the origin of loess. He was among the first to use well cuttings to determine subsurface geology and the depth to bedrock. He collected wind-blown dust and analyzed its particle size by sifting it through a series of screens, devising a logarithmic scale to describe the particle sizes. From this he concluded that wind was capable of producing the loess.*

Udden began geological work in Texas during the summers of 1903 to 1905, while he was still teaching at Augustana College. In 1911 he joined the Texas Bureau of Economic Geology and Technology, and in 1915 he was appointed director of the Bureau. In this position he advised the regents of the University of Texas to drill for oil on the university lands in west Texas, a decision that brought great wealth to the university. Udden was instrumental in the discovery and utilization of Texas mineral resources, particularly quicksilver and potash. He was a pioneer in the use of seismology to reveal subsurface geology. According to one biographer Udden ranks second only to Sam Houston in the value of his service to the state of Texas.

In response to an inquiry regarding whether he should pursue research in electricity, J. A. Udden was advised by his mentor and former professor, Joshua Lindahl, to instead study the mounds where "every little observation may prove a valuable contribution to our fragmentary knowledge of that branch of archeology" (Joshua Lindahl to J. A. Udden, letter, 21 December 1886). Implicit in Lindahl's advice was the suggestion that Udden concentrate on topics overlooked by others and examine these topics in minute detail. That Udden followed this advice is attested by the report reprinted in this volume. But this study, conducted early in his professional career, also illustrates other characteristics that can be recognized in much of his subsequent work: his emphasis on field observation and his pragmatism. He studied the "Old Indian Village" because it was near at hand; required little or no expensive, specialized equipment; and because it was an open field of inquiry. The decision to undertake this study was a very practical one for a fledgling scientist with limited resources. Although his interests shifted rather quickly from archeology to geology, Udden continued to conduct his research in the field, to observe in minute detail, and to direct his study toward practical ends.

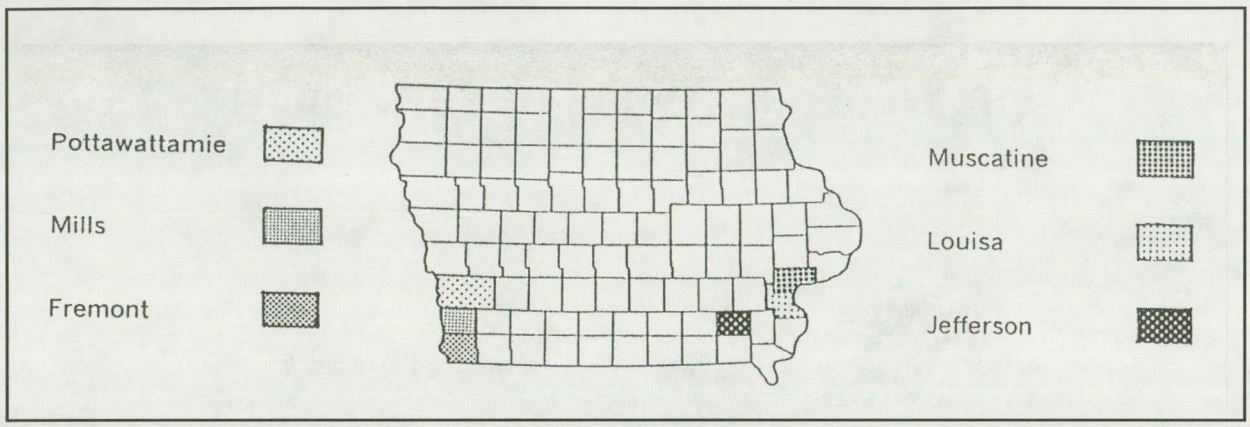


Figure 1. Map of Iowa showing the counties for which Udden furnished reports published in the Annual Reports of the Iowa Geological Survey (Anderson 1997).

Locus of Udden's Geologic Studies

Not surprisingly, Udden's earliest geologic studies were conducted in areas close to home, the vicinity of Lindsborg, Kansas (Udden 1891, 1893; Underwood 1992, herein), and later Rock Island, Illinois (Udden 1897a, 1898a , 1898b, 1898c), and northern Illinois (Udden 1895). Though the field work for his report with T. E. Savage on the geology of the Edgington and Milan Quadrangles, an area that included Rock Island, was undoubtedly completed in the early 1900s, the report itself was not published until 1921 (Savage and Udden 1922). Likewise, his field work in the first decade of the twentieth century as a special agent of the United States Geological Survey took him somewhat farther afield and resulted in the publication, with E. W. Shaw, of the Belleville-Breese, Illinois, folio of the *Geologic Atlas of the United States* (Udden and Shaw 1915).

Udden's work with the Geological Survey of Iowa began before the turn of the century and resulted in the publication of reports on the geology of six counties (Figure 1; Udden 1899a, 1901a, 1901b, 1902a, 1903). These reports are notable for their numerous measured sections, tabulations of water well locations and elevations, and extended lists of fossil occurrences. Several shorter papers that illustrate Udden's attention to detailed field observation grew out of these county studies (for example, Udden 1899b, 1902b, 1902c, 1903). His report on Muscatine County contains what may be the earliest map showing the topography of the surface of the bedrock beneath the glacial deposits, information derived from the study of the water well logs. The county reports also reveal an increasing tendency to express relationships quantitatively, such as the percentage of different rock types occurring as pebbles in glacial till and Cretaceous conglomerates, variations in the thickness of the coal-bearing rocks, and the size distribution of spheroidal concretions. In addition, Udden's work in Iowa presented opportunities to study the character and origin of loess, particularly in the "loess hills" counties in the southwestern corner of the state, and the character of the sediments associated with the coal beds of Pennsylvanian age. In further study of these topics Udden later made important, innovative contributions.

Udden's introduction to Texas geology began in 1890 during brief visits to Fort Worth and Amarillo (Heiman 1963). In 1901 the state legislature established the University of Texas Mineral Survey to conduct "a mineral survey of all lands belonging to the public schools, University, asylums, of the state" to identify the mineral resources on these lands so as to prevent their sale at unreasonably low prices (Ferguson 1967). In 1903 Udden was invited to join this survey, spending May and June studying the geology of the Shafter silver mine in Presidio County (Udden 1904). He returned the following summer to study the quicksilver deposits at Terlingua and the geology of the Chisos Mountains. This resulted in the first report on the geology of what is now Big Bend National Park (Udden 1907a) and a "classic" study of the occurrence of cinnabar at Terlingua (Udden 1918; Ferguson 1967). From June until December 1905, Udden conducted a geological survey of the lands of the New York and Texas Land Company, an effort devoted primarily to an evaluation of their mineral resources. The work was privately funded and was published by Augustana College (Udden 1907b). It has been described as "almost a classic oil prospect report" (Ferguson 1967).

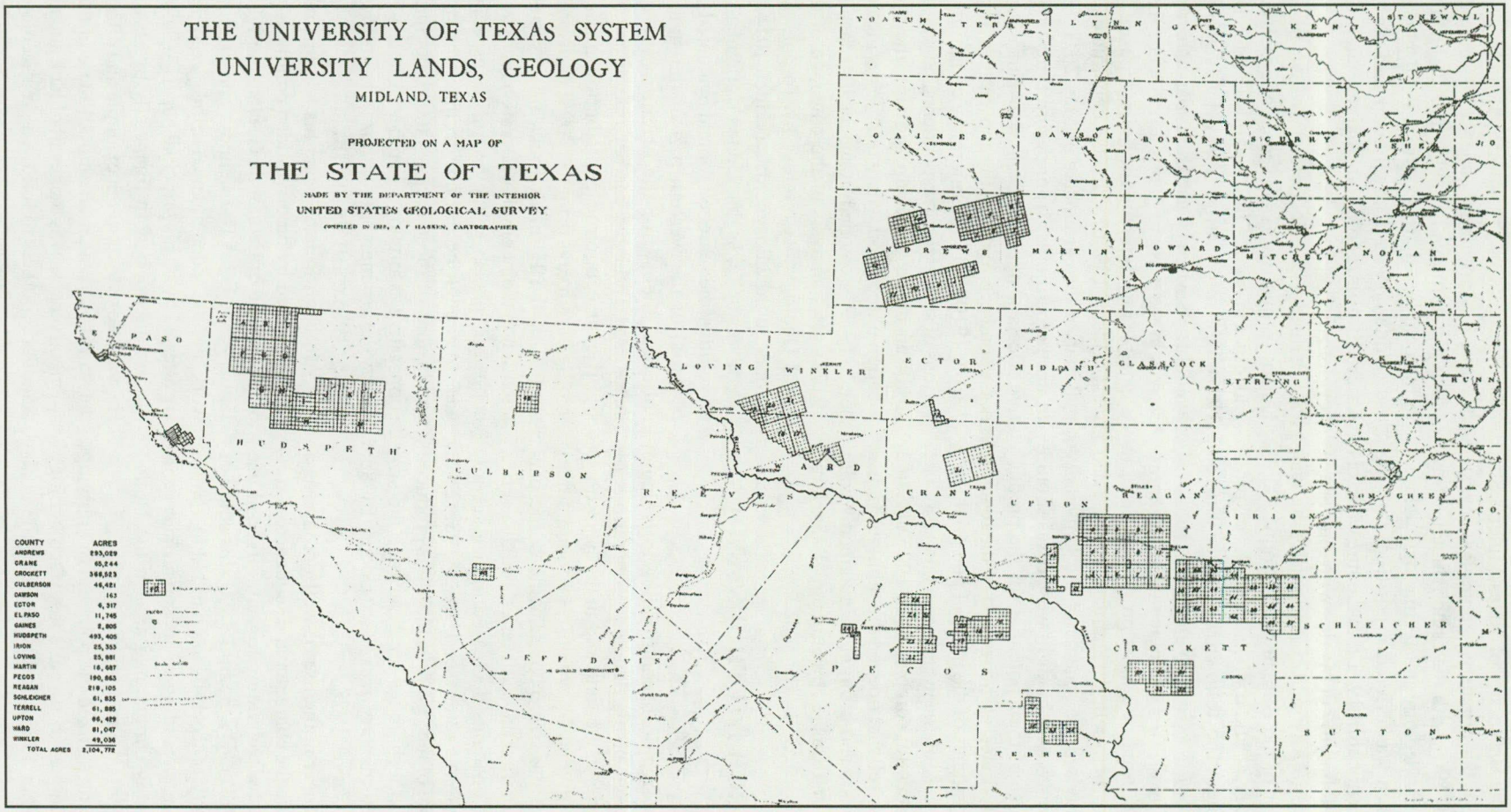


Figure 2. Map showing the University Lands of the University of Texas System.

Funding for the University of Texas Mineral Survey ended in 1904, but organized geological investigation resumed in 1909 with the establishment of the Bureau of Economic Geology and Technology. Almost immediately Udden was offered a position with the Bureau, but it was not until 1911 that the lure of Texas geology finally led him to cut his ties with Augustana College and move to Austin, Texas. In 1915 he was appointed Director of the Bureau of Economic Geology and Technology, at a time when interest in oil prospects was growing. The following year the Bureau published *Review of the Geology of Texas* (Udden et al. 1916) containing the first geologic map of the entire state. Coming as it did at a most propitious time, it quickly became a "best-seller" (Heiman 1963). Also in 1916 Udden advised the regents of the University of Texas that the university lands in west Texas should not be sold because of their potential for the production of oil and gas. Later, at the request of the regents, Udden undertook studies of the mineral potential, particularly oil and gas, of these university lands. The result was the successful completion in 1923 of Santa Rita No. 1, the oil well that opened the fabulous riches of the Permian Basin and brought unimagined wealth to the University of Texas (Schwettmann 1943; Haigh 1986).

Research Methods and Results

Udden's most significant contributions to geologic knowledge grew out of his detailed observations of rocks and sediments in the field and in the laboratory. During his study of wind-blown dust, he found it necessary to measure the size of these wind-borne particles. For this he sifted the sediment through a series of screens whose openings decreased in size according to a set logarithmic ratio (see Hansen 1985:210). The basic principle of the "grade scale" thus produced has led to standard techniques for describing the size distribution of sedimentary particles (Udden 1898d; Krumbein 1932; Carver 1978).

He was a pioneer in the use of well-cuttings as a means to determine the character and sequence of subsurface rock units, a technique now in universal use (Udden 1896a, 1921). By the mid-1890s his study of wells in the vicinity of Rock Island had led to a more comprehensive understanding of its subsurface geology than that of any comparable area in the United States (Norton 1899).

Likewise, he recognized the potential of applying geophysical techniques to reveal subsurface geology (Udden 1920; Baker 1933). In his study of the coal-bearing rocks in the Peoria, Illinois, area, Udden described a repeating sequence of sedimentary rock types, a pattern that has subsequently been recognized in the coal-bearing rocks from Pennsylvania to Kansas (Udden 1912; Langenheim and Nelson 1992). Later, Illinois geologists named such a pattern a "cyclothem."

Perhaps as a reflection of his 23 years as a teacher, Udden seemed always in search of unsolved problems and topics in need of further study (Udden 1923, 1928). He sought information from whatever sources were available, as when he used newspaper accounts of dust storms in the western plains as evidence that the wind is capable of producing the loess deposits of the Midwest (Udden 1896b). He also constructed an isoseismal map of the earthquake of May 26, 1909, centered in northern Illinois, from descriptions of its destructive effects as published in newspapers in northern Illinois, southern Wisconsin, and eastern Iowa (Udden 1910a, 1910b). Furthermore, by compiling the observations of some 60 correspondents, he was able to construct an interesting map showing the approximate location of the point where the "Texas meteor of October 1, 1917" exploded in spectacular fashion (Udden 1917a). His analysis of the coverage of the International Geological Congress by Toronto newspapers borders on the idiosyncratic (Udden 1914a).

It was in Texas that Udden's pragmatism reached its zenith as he searched for and evaluated the mineral potential of the western part of the state. Udden's anticlinal theory for the origin of the quicksilver deposits at Terlingua has been described as the most significant economic contribution made by Texas geological surveys prior to 1909 (Ferguson 1967). His studies of the Permian rocks of west Texas called attention to their complex lateral changes and their rich deposits of potash, salt, gypsum, and especially, oil and gas. Although he did not decipher the relationships and history of these rocks— a task completed by the cooperative efforts of a number of later workers—he did lay the groundwork for those who followed (Udden 1914b, 1915a, 1915b, 1917b).

Although in later years his administrative duties were assumed by others, Udden continued as director of the Bureau of Economic Geology until his death on January 5, 1932. "The richness and originality of his work and the independence of his geological thought are attested by all his principal papers" (Sellards 1936).

He did not benefit financially by his discoveries. He was one who, through example and effort, enriched the world. He maintained until the end that his conspicuous success was the result of luck and not of merit. A model for others to follow, a great geologist, a good

man in every sense of the word—he was all of these. Ranking with Sam Houston alone in the measure of his services to the State of Texas, Johan August Udden was one of nature's noblemen (Baker 1933).

Acknowledgments. I wish to thank Sigrid Clift of the Texas Bureau of Economic Geology and Tim Hunt of the University Lands office in Midland, Texas, for making available the map of the university lands of the University of Texas System.

References Cited

Baker, C. L.
1933 Memorial of Johan August Udden. *Memoirs of the Geological Society of America* 44:402-413.

Carver, Robert E.
1978 Udden scale. In *The Encyclopedia of Sedimentology*, edited by Rhodes W. Fairbridge and Joanne Bourgeois, p. 840. Dowdin, Hutchinson, and Ross, Inc., Stroudsburg, Pennsylvania.

Ferguson, W. Keene
1967 *Geology and Politics in Frontier Texas 1845-1909*. University of Texas Press, Austin.

Haigh, Berte R.
1986 *Land, Oil and Education*. Texas Western Press, El Paso.

Hansen, W. B.
1985 Dust in the Wind: J. A. Udden's Turn-of-the-Century Research at Augustana. In *Geologists and Ideas: A History of North American Geology*, edited by E. T. Drake and W. M. Jordan, pp. 203-214. Centennial Special Volume I. Geological Society of America, Boulder, Colorado.

Heiman, Monica
1963 *A Pioneer Geologist: Biography of Johan August Udden*. Braswell Printing, Kerrville, Texas.

Krumbein, W. C.
1932 A History of the Principles and Methods of Mechanical Analysis. *Journal of Sedimentary Petrology* 2:89-124.

Langenheim, R. L., and W. J. Nelson
1992 The Cyclothemic Concept in the Illinois Basin: A Review. In *Eustasy: The Historical Ups and Downs of a Major Geological Concept*, edited by R. H. Dott, Jr., pp. 55-71. Memoir No. 180. Geological Society of America, Boulder, Colorado.

Norton, W. N.
1899 Geology of Scott County. *Iowa Geological Survey Annual Report for 1898* 9:389-520.

Savage, T. E., and J. A. Udden
1922 The Geology and Mineral Resource of the Milan and Edgington Quadrangles. In *Year-Book for 1917 and 1918*, pp. 117-208. Bulletin No. 38. Illinois State Geological Survey, Urbana.

Schwettmann, Martin W.
1943 *Santa Rita*. Texas State Historical Association, Austin.

Sellards, Elias H.
1936 Udden, Johan August. In *Dictionary of American Biography*, vol.19, edited by Dumas Malone, p. 19. Charles Scribner's Sons, New York.

Udden, J. A.
1891 Megalonyx Beds in Kansas. *American Geologist* 7:340-345.

1893 On a Natural Formation of Pellets. *American Geologist* 11:268-271.

1895 A Geologic Section Across the Northern Part of Illinois. In *Report of the Illinois Board of World's Fair Commissioners*, pp. 115-158. H. W. Rokker, Printer, Springfield, Illinois.

1896a An Account of the Paleozoic Rocks Explored by Deep Borings at Rock Island, Illinois, and Vicinity. In *17th Annual Report*, Pt. 2, pp. 135-155. U. S. Geological Survey, Washington, D.C.

1896b Dust and Sandstorms in the West. *Popular Science Monthly* 49 (September):655-663.

1897a A Brief Description of Devonian Rocks Exposed in the Vicinity of Rock Island, Illinois, with a Statement of the Nature of its Fish

Remains. *Journal of the Cincinnati Society of Natural History* 20(3):93-95.

1898a A New Well at Rock Island, Illinois. *American Geologist* 21:199-200.

1898b The Pine Creek Conglomerate. *Proceedings of the Iowa Academy of Sciences* 6:54-56.

1898c Fucoids or Coprolites. *Journal of Geology* 6:189-193.

1898d *The Mechanical Composition of Wind Deposits*. Augustana Library Publications No. 1. Augustana College, Rock Island, Illinois.

1899a The Geology of Muscatine County. *Iowa Geological Survey Annual Report for 1898* 9:247-388.

1899b The Sweetland Creek Beds. *Journal of Geology* 7:65-78.

1901a The Geology of Louisa County. *Iowa Geological Survey Annual Report for 1900* 11:57-126.

1901b The Geology of Pottawattamie County. *Iowa Geological Survey Annual Report for 1900* 11:199-277.

1902a The Geology of Jefferson County. *Iowa Geological Survey Annual Report for 1901* 12:355-431.

1902b Loess with Horizontal Shearing Planes. *Journal of Geology* 10:245-251.

1902c On the Occurrence of Rhizopods in the Pella Beds of Iowa. *Proceedings of the Iowa Academy of Science* 9:120.

1903a The Geology of Mills and Freemont Counties. *Iowa Geological Survey Annual Report for 1900* 13:123-183.

1903b Foraminiferal Ooze in the Coal Measures of Iowa. *Journal of Geology* 11:283-284.

1904 *The Geology of the Shafter Silver Mine District, Presidio County, Texas*. Bulletin No. 24. University of Texas, Austin.

1907a *A Sketch of the Geology of the Chisos Country, Brewster County, Texas*. Bulletin No. 93 and Scientific Series No. 11. University of Texas, Austin.

1907b *A Report of a Geological Survey of the Lands Belonging to the New York and Texas Land Company, Limited, in the Upper Rio Grande Embayment in Texas*. Augustana Library Publications No. 6, pp. 51-107. Augustana College, Rock Island, Illinois.

1910a Observations on the Earthquake on May 26, 1909. *Popular Science Monthly* 73(August):154-162.

1910b Observations on the Earthquake in the Upper Mississippi Valley, May 26, 1909. *Transactions of the Illinois State Academy of Science* 3:132-134.

1912 *Geology and Mineral Resources of the Peoria Quadrangle, Illinois*. Bulletin No. 506. U. S. Geological Survey, Washington, D.C.

1914a Science in Newspapers. *Popular Science Monthly* 84:483-489.

1914b *The Deep Boring at Spur*. Bulletin No. 363. University of Texas, Austin.

1915a *Potash in the Texas Permian*. Bulletin No. 17. University of Texas, Austin.

1915b The Age of the Castile Gypsum and the Rustler Springs Formation. *American Journal of Science* 40:151-156.

1917a A Texas Meteor. *Science* 46(21 December):616-617.

1917b *Notes on the Geology of the Glass Mountains*. Bulletin No. 1753, pp. 1-59. University of Texas, Austin.

1918 *The Anticlinal Theory as Applied to Some Quicksilver Deposits*. Bulletin No. 1822. University of Texas, Austin.

1920 Suggestions of a New Method of Making Underground Observations. *Bulletin of the American Association of Petroleum Geologists* 4:83-85.

1921 Characteristics of Some Texas Sedimentary Rocks as Seen in Well Cuttings. *Bulletin of the American Association of Petroleum Geologists* 5:373-385.

1923 The "Rim Rock" of the High Plains. *Bulletin of the American Association of Petroleum Geologists* 7:72-74.

1928 A Neglected Field in Stratigraphy. In *Contributions to Geology, 1928*, pp. 55-66. Bulletin No. 2801. University of Texas, Austin.

Udden, J. A., C. L. Baker, and Emil Böse
1916 *Review of the Geology of Texas*. Bulletin No. 44. University of Texas, Austin.

Udden, J. A., and E. W. Shaw
1915 *Belleville-Breese, Illinois. Geological Atlas of the United States*. Folio No. 195. U. S. Geological Survey, Washington, D.C.

Underwood, James R., Jr.
1992 The Life of Johan August Udden, Geologist, Teacher, Inventor: Through the Kansas Years. *Transactions of the Kansas Academy of Science* 95:177-191.

Notes

"More's the Pity": The Short Archeological Career of J. A. Udden

Marlin F. Hawley
Wisconsin Historical Society

The Kansas Anthropologist 23:23-33

While at Bethany College in Kansas from 1881 to 1888, Johan A. Udden conducted archeological investigations at the Paint Creek site. In these excavations he was not unique, as other would-be archeologists investigated other sites throughout Kansas in this era. A substantial collection of artifacts, including a fragment of chain mail armor, resulted from the Paint Creek site excavations. The chain mail pointed to contact between the site's inhabitants and Coronado or some other Spanish entrada. *The interest in the chain mail fragment may have been what eventually spurred Udden to write his monograph,* An Old Indian Village, *published in 1900. This monograph was in many ways, especially in its attention to detail, ahead of its time. After leaving Kansas in 1888, Udden conducted no further archeological research, turning his attention to geology instead. He did maintain a general interest in archeology, however.*

In this paper I examine, to the extent possible given the limited nature of primary source material, Udden's archeological pursuits. Other than his investigation of several low mounds at the Paint Creek site (14MP1), excavation of two stone mounds—mentioned in the introduction to his monograph but otherwise not reported anywhere in detail—Udden made only brief, closing remarks in his report on elephant remains from Iowa and Illinois. Field notes appear not to exist, and only a few pieces of correspondence survive on which to form impressions. These documents are located at the Kansas State Historical Society, Oklahoma Historical Society, and Archives at Augustana College.[1]

The Paint Creek site (Figure 1) is now attributed to the Great Bend aspect, named by Waldo R. Wedel in 1935 (Wedel 1935a; Vehik herein). The Great Bend aspect is inferred to represent the archeological manifestation of the various bands of the Wichita, the natives encountered in 1541 by Don Francisco Vásquez de Coronado and by subsequent Spanish expeditions. The find of a fragment of chain mail at the site enabled Udden to inferentially tie it to these early *entradas*. As ethnographers and historians had concluded that the *Quivirans* cited in the Spanish documents of the sixteenth and seventeenth centuries were the Wichita-speaking peoples, Udden suggested that the site was a Wichita (or less plausibly, a Pawnee) village. With this work, Udden established himself as the "father" of Great Bend aspect-Wichita archeology and of "historic sites" archeology in the central Great Plains.

Let the Digging Commence

Udden (1969, herein) indicates that he was made aware of the presence of low, rather non-descript mounds at a site on Paint Creek near Lindsborg as early as 1881 (Figure 2). For seven years Udden, accompanied by students, other professors, farmers, and even his wife, visited the site, digging into the mounds and possibly trash-filled pits. From this work was amassed a fairly substantial collection of artifacts—ultimately the subject of *An Old Indian Village*. Within the same span of years, Udden also investigated two burial mounds situated atop high bluffs overlooking the Smoky Hill River and Gypsum Creek, respectively, in McPherson County. Unlike the mounds at Paint Creek,



Figure 1. View to the north at the Paint Creek Site (14MP1) in 1992.

these "were partly built of rocks, under which there were charred human bones and some roughly chipped flints" (Udden 1900:11).

Udden was by no means unique in these endeavors. By the 1880s settlers and others with an interest in the natural sciences were busy opening mounds and noting campsites, villages, and rock art over much of Kansas. For instance—and keeping within the realm of the archeology of the Great Bend aspect—James Mead had begun to surface-collect sites near Wichita in the years following the Civil War (Mead 1890). Benjamin Franklin Mudge, whose geologic work inspired Udden, noted the presence of low mounds up the headwaters of Little River and its tributary, Cow Creek, in the early 1870s (Mudge 1873). By the early 1870s as well, Melvin O. Billings and Judge E. P. West, a self-taught natural scientist from Kansas City and later employee of the Museum of Natural History at the University of Kansas, were busy exploring the Cottonwood River valley from Florence to north of Marion Centre (now Marion). These investigations were carried on sporadically for several years (West 1880; Billings 1882). In 1879 Frederic Ward Putnam of the Peabody Museum at Harvard dispatched a field collector named Edward Serviss to make artifact collections in the vicinity of Marion. Serviss opened mounds of both earth and stone, and the collections generated were returned to Harvard (Putnam 1880). Farther south, A. R. Reinsch at Arkansas City in Cowley County was in 1879 already digging into mounds similar to those which Udden would soon be exploring (Mason 1881).

As the pace of the settlement of Kansas gained speed, sod was turned by the plow, towns platted, and houses built, more and more sites came to light. It fell to those with broad interests, grounded especially in natural history, to explore and report on these sites. The investigations at the Paint Creek site by Udden were conducted squarely within a natural history context.

The Paint Creek Site

Udden offered few details of his excavations; extant contemporaneous accounts are few, and field notes appear to no longer exist. Possibly notes were not taken, as excavations in this era tended to be unsystematic and generally aimed at securing artifacts. Although he and Professor Lindahl, his mentor at Augustana College, corresponded on a regular basis, it seems that Lindahl did not save the letters. Udden did keep those from his teacher, later giving them to Augustana College where they remain. Udden's archeological investigations were discussed, but we have only Lindahl's exhortations on archeology as a

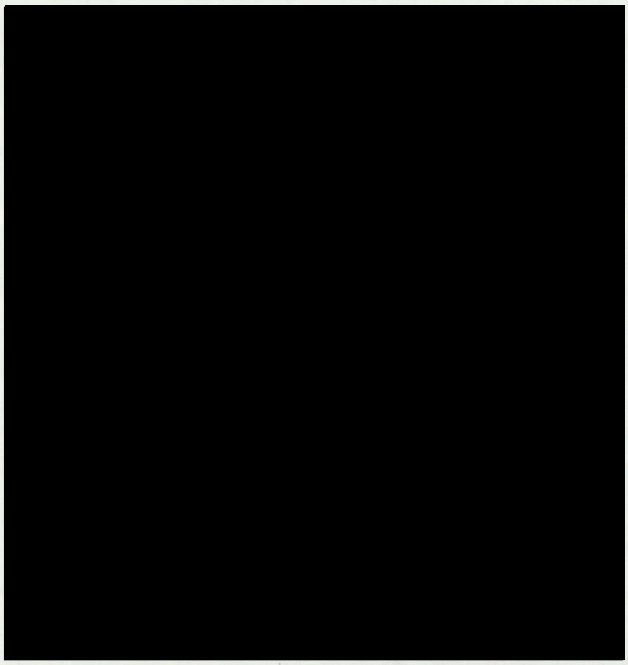


Figure 2. Map of central Kansas, showing Lindsborg and the approximate location of the Paint Creek site.

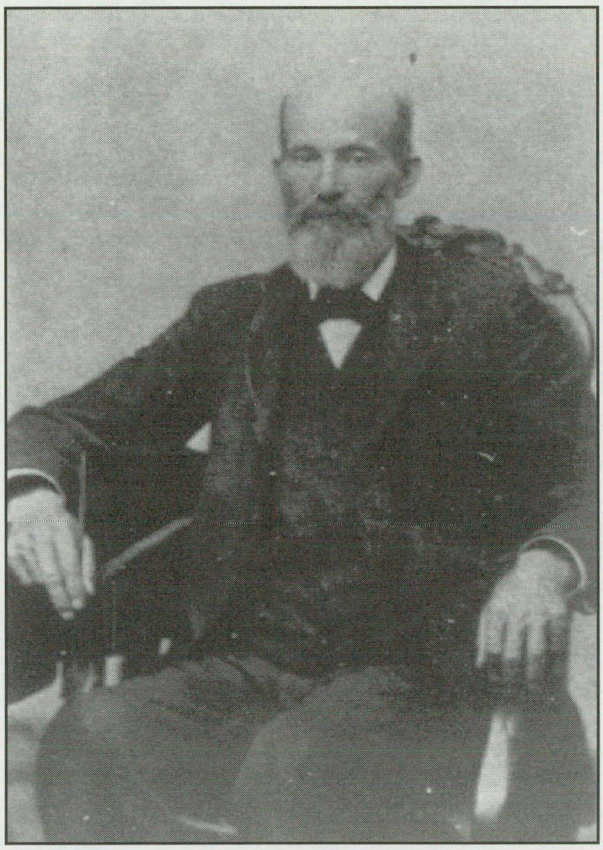


Figure 3. Franklin G. Adams, Secretary of the Kansas State Historical Society, 1876-1899.

career (Underwood 1992, herein; Anderson herein); details of the fieldwork and how it progressed are, without Udden's side of the exchange, missing.

In 1883 Udden wrote to Franklin G. Adams, the secretary of the Kansas State Historical Society (Figure 3). Adams had an abiding interest in archeology, presenting papers at conferences and publishing others in the pages of the *Transactions of the Kansas Academy of Sciences* (e.g., Adams 1878). At the Kansas Academy of Science meeting in Topeka in 1883, Adams had read a paper entitled, "The Metate," in which he discussed "such relics as could be found on the abandoned site of what was at one time the principal village of the Kansas [Kansa] tribe of Indians, near Manhattan" (Adams 1883:4). Udden wrote to him, seeking a copy of the paper (J. A. Udden to F. G. Adams, letter, 29 November 1883). He, incidentally, made the sort of gaffe in the letter that Lindahl chided him for (Underwood 1992, herein): "I see in The Capital a mention of a paper read by you ... on the subject of 'The Petate.'" Either Adams corrected him or he realized his mistake for in a subsequent missive a few weeks later, Udden used the correct spelling. Udden's interest in obtaining a copy of the paper arose from his having obtained a "petate" from the Paint Creek site.

It was to Adams that Udden confided details of his investigations. The letter provides a glimpse of the work, as it stood in 1883:

> The metate was found by a farmer in his field, which is located in the [redacted] on the [redacted] side of Paint Creek about [redacted] from it. At this place there are some 12 or #13 mounds of a small elevation. I have seen the place several times and dug into two of the mounds. These mounds I have thought (until recently) to have been made by the Moundbuilders, and that they should be classed with what Dr. S. D. Peet [archeologist and editor of *American Antiquarian and Oriental Journal*] calls "Village mounds," for they contain much broken pottery like that of the Mound builders, and a stone hammer (limestone) has been found there in form very much like the stone hammers found in the copper mines near Lake Superior. All over lie scattered chips of flint and broken as well as entire arrow-heads of the same material. However, there are other facts which would tend to prove these mounds to be of a later age, than that which, I believe, is generally ascribed to the Moundbuilders. Bones, teeth

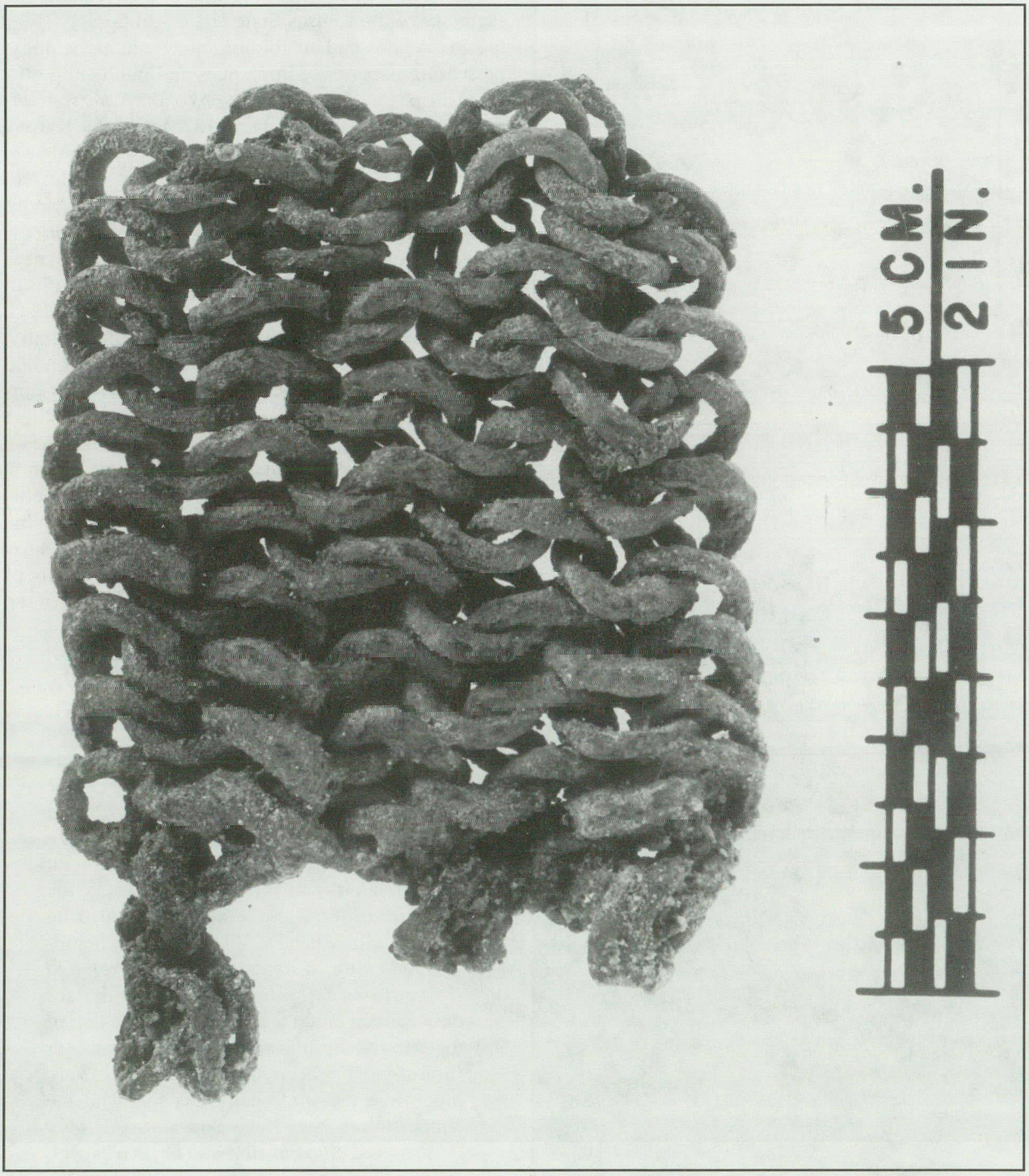


Figure 4. Chain mail fragment from 14MP1, as photographed in 1975, now on exhibit at the Kansas Museum of History.

> etc found in these mounds are not very much decayed and a piece of ivory,[2] which was taken up from one foot below the surface of one of the mounds, and which for the sake of its shape might be the broken handle of a tooth-brush, is still strong enough to work flint with. A week ago I found a small piece of what seemed to have been a pipe, of genuine pipe-stone, like the one taken from Pipestone Co. Minnesota.
>
> Next week I intend to dig into some more of the mounds, and will inform you if I shall have found any more relics, what they are (J. A. Udden to F. G. Adams, letter, 15 December 1883; emphasis in original).

By 1886 the work at Paint Creek had resulted in the recovery of pottery, stone and bone tools, ground stone such as the metate, and chain mail (Figure 4). Years later, Udden recalled the moment when this artifact was found by C. A. Hven, "the most persistent" excavator. All crowded round and watched, unsure of what they were seeing, as Hven loosened the rust-bound, 2-inch square mass of tiny ringlets from the ground. This occurred sometime after 1883, as Udden made no mention of it to Adams.[3]

Udden presented a paper discussing his work at Paint Creek at the annual meeting of the Kansas Academy of Science in Emporia in 1886, suggesting the possibility that the mail pointed to a connection to the *entrada* of Coronado into the Great Plains in 1541. At the same meeting, J. D. Parker, the founder of the Academy read a paper, "Mounds in Davis [Geary] County," and J. R. Mead of Wichita reported on "Results of Some Explorations among the Pueblo Ruins in New Mexico." Udden was in good company. Excited by the reception of his paper, he quickly wrote to Lindahl. Lindahl applauded his effort, remarking on the camaraderie Udden found at the meeting and in the informal gatherings afterward:

> Tell me frankly, didn't those 15 toasts inspire you with a greater love for science and with more hopefulness of your own progress as a scientist than all the learned papers read as the regular meeting hours? In Sweden we are fully aware of the fact, that the by far greatest importance of such reunions, is the opportunity, thus offered, of bringing naturalists together in social, intimate communication with each other (J. J. H. Lindahl to J. A. Udden, letter, 24 November 1886).

Once the paper on Paint Creek was delivered, Udden's attention to archeology flagged, even while his interest in the local geology increased. While exploring the geology of the area in 1887, he found the skull of a giant sloth (*Megalonyx leidyi*) in Harper township. To Lindahl went the honor of naming and describing the fossil (Billdt 1965:21). At the same time, a letter from Lindahl, which discussed the just mentioned Megalonyx skull, indicates that Udden was becoming intrigued by loess (J. J. H. Lindahl to J. A. Udden, letter, 30 December 1887). Udden was to conduct pioneering research on the origins of these sediments (Hansen 1985; Anderson herein). As Underwood (1992, herein) notes, 1887 seems to have been a pivotal year in Udden's life, the year in which geology won out over archeology. As for Paint Creek, it would have to wait its turn.

It was not until the mid-1890s that Udden renewed his interest in the collections he had made. But for the fortuitous (and errant) fragment of mail armor and the interest it provoked relative to the early Spanish expeditions into the plains by Coronado and others, it seems quite likely that no monograph would have been written.

The chain mail was the key find. With it, Udden was able to shake free from the tyranny of the Mound Builders, the mythical race of old, a pre-Indian people who had left behind mysterious earthworks—some in the form of animals and humans—others of enormous scale, throughout the Midwest, Ohio River valley, and Southeast (Silverberg 1968).

Udden, as we have seen, already had his doubts; to Adams he had enumerated reasons why he thought the mounds should be attributed not to any vanished peoples but to the Native Americans. The relative freshness of the bones ranked high among them, as did the presence of what Udden took to be pipestone from Minnesota and which he associated with historic groups.[4] Even so, as he observed in his reminiscence, he was still in thrall to the myth. Immediately prior to the find of the mail fragment, he noted that he had been telling his colleague Professor Edward Nelander, "that these mounds were of remote antiquity, a period referred to in the books as the period of the Mound Builders" (Udden 1969:84, herein). That single artifact ruled out great antiquity and instead pointed to an association with Coronado or another early Spanish explorer.

Udden argued that Coronado or some member of his party had lost the mail. Colonel Henry Inman (1897:5), on the other hand, in his volume *The Old Santa Fé Trail* preferred to think "that it was worn by one of De Soto's unfortunate men, as neither Panphilo de Narvaez, De Vaca, or Coronado experienced any difficulty with the savages of the great plains."

Jacob V. Brower (Figure 5), an archeologist with the Minnesota Historical Society, asked Udden for information about the find in 1897. Brower believed that the mail had been lost by Coronado as he and his men passed through central Kansas to the principal villages of Quivira, which he located in the Kansas River valley near present-day Junction City, Kansas (Brower 1898, 1899).

Frederick Webb Hodge (1900), in a laudatory review of Udden's monograph, suggested the mail could be most reasonably attributed to either the failed expedition of Francisco Leyva Bonilla and Juan de Humaña of about 1594 or that of Juan de Oñate in 1601. The mail common to the McPherson and Rice County Great Bend aspect sites is now generally attributed to the former, the Bonilla and Humaña expedition, wiped out in central Kansas by the natives (Wedel 1975).

The armor fragment was immediately photographed and almost immediately lost. Udden acknowledged its loss in a letter to Adams, who had asked for a photographic print of it. Udden sent a print, via Reverend C. A. Swenson at Bethany, and commented: "My negative is lost by this time, as well as the original [artifact], which was thrown away by a careless servant many years ago in Lindsborg. I understand things like this were sometimes used by travelers on the plains for 'dish rags', for cleaning out pots etc." (J. A. Udden to F. G. Adams, letter, 17 January 1895). He wondered: "It would be interesting to know how much this 'armor' resembles such a dish rag or pot-cleaner." The mail fragment, long feared as lost, resurfaced in the 1970s in New Mexico and, due to its unique configuration, was identified as the Hven-Udden fragment. It is now is on exhibit in the Kansas Museum of History in Topeka.

In the same letter of January 17, 1895, Udden mentioned to Adams that, "a gentleman who contemplates publishing a work on the natural history of Kansas" had inquired after the collection. Possibly, though not certainly, this was Brower. To Adams, Udden noted, "It has been my wish to describe these [relics] and the mounds, but so far I have not found time." As yet no manuscript existed, but in the spring of 1897, one did. Again, Udden wrote to Adams, informing him that, "I received last Saturday a letter from J. V. Brower inquiring about the piece of chain mail I found in McPherson County." This time he added, "For the last two years I have been on the point of writing to you offering to you a manuscript of a paper giving an account of the mounds in which this piece of chain mail was found and all their contents in the way of relics of aboriginal art" (J. A. Udden to F. G. Adams, letter, 14 March 1897). He proudly observed, "[t]he paper is, as far as I know[,] the most full account of any mounds published in Kansas." "I will sell it for the small sum of $25.00," he concluded.

The manuscript, entitled "A Group of Indian Mounds near Lindsborg, Kansas," in fact, was sent to Adams. The manuscript consisted of 19 double-spaced, typewritten pages with a handwritten, 2-page table of contents. It was illustrated with 50 figures, including a map of Coronado's route, as inferred by various scholars. The paper, now in the archives at Augustana College, is readily seen as a draft of *An Old Indian Village*, though the latter is a more full accounting, especially in its concluding remarks on the origin of the chain mail. In the manuscript Udden attributes the mail to the Coronado expedition. Uncomfortable with this conclusion, to Adams he wrote:

> You notice that the subject of Coronado's route is discussed only in passing. You know more about this subject than I and in case my proposition can be accepted, I would have no objections to such changes in this part as you may deem judicious. In fact, were it proper, I would ask if you would be willing to be joint author and rewrite this last part (J. A. Udden to F. G. Adams, letter, 3 April 1897).

The Kansas State Historical Society, having no funds available, returned the paper to Udden.

Udden sent his manuscript to Brower, who summarized its contents in his own book, *Quivira* (Brower 1898:viii, 55-56). Brower's work stirred up controversy, especially with some locals such as William E. Richey. The controversy was about not so much the exact location of Quivira but over methods (Judge 1982; Vehik herein). In any case, it was all so much wasted ink; Udden had already found Quivira. Brower and others missed the significance of his work.

Udden had informed Secretary Adams that he wanted his paper to be published in Kansas, "where the collection was made" (J. A. Udden to F. G. Adams, letter, 3 April 1897). The return of the paper must have been disappointing. In the end it was published as a monograph by Augustana College in 1900. The volume, revised from his paper and copiously illustrated, was, as he was aware, the most detailed example of an archeological report on a site and collection from Kansas so far published. Most archeological reports in Kansas from the 1870s to 1900 generally consisted of a few pages at best. For instance, the report on Reinsch's excavations in Cowley County consisted of a paragraph only (Mason 1881) and Judge West (1880) offered but six pages on multiple sites near Marion.

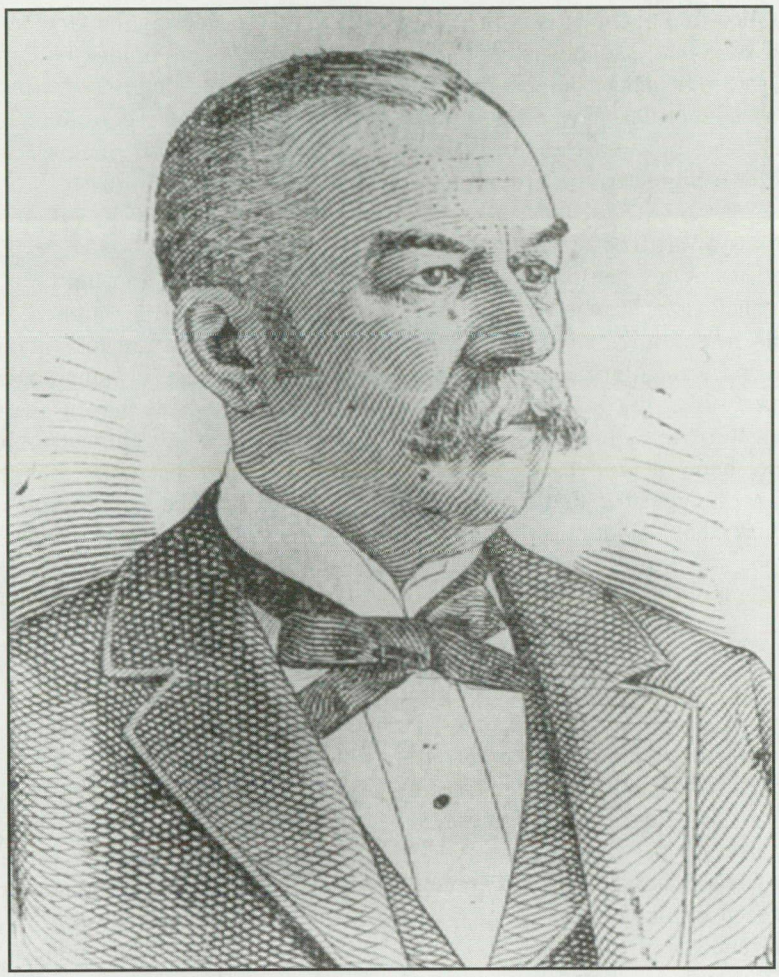


Figure 5. Jacob V. Brower, archeologist with the Minnesota Historical Society, 1889-1906

The Peabody Museum's collecting efforts at Marion were reported in the space of a single page, with a few additional sentences listing artifacts recovered (Putnam 1880:718, 738). Brower (1899) devoted eight pages to a rambling account of the Elliott site, the reputed location of Quivira. *An Old Indian Village* went far beyond what anyone in the central Plains had attempted to 1900 and for sometime afterward.

What distinguishes the volume from contemporary publications was not only its length, level of detail, and the use of numerous photographs and drawings but also its empiricalness. Udden counted artifacts and studied them closely. Throughout the volume he did not stray far from personal observation, even resorting to occasional experiments to back up those observations. In his conclusions, too, Udden stuck to what he felt safe in inferring. Although he argued that the Paint Creek site was most likely a Wichita village, he did not attempt to go farther and use the *entrada* documents to sketch Wichita society or to try to relate the ethnohistorical details from those documents to the artifacts he had found and so carefully described.

Udden considered the mounds in modest detail. The mounds themselves, he found, consisted of "loose soil or mud" heaped upon the prairie. Intermingled were domestic artifacts of all kinds; in some cases the degree of weathering from top to bottom suggested that the mounds were accretional and possibly of considerable age. Udden interpreted the mounds as house mounds, where people had tracked in sediment or where windblown materials had settled in over periods of time, possibly after the abandonment of the houses. With this explanation Udden combined the archeology and his interest in windblown sediments. Later investigations at Paint Creek (dubbed "Salina 1") by Wedel (1935b, 1959) and other sites (e.g., Keller

1961; Witty 1977) failed to detect post patterns. The conclusion ultimately was that Udden was wrong; the mounds came to be regarded as midden dumps. Recently, however, Lees and Mandel (1993) have proposed that the mounds, in some cases anyway, are related to structures. Houses may have protected the ground under them from erosion.

In his descriptions of artifacts, Udden's eye for detail—so characteristic of his geological work—is evident, though his conclusions have not always stood the test of time. Thus, he carefully noted the presence of wear on artifacts and was cognizant of efforts by their users to resharpen tools. In considering grooved sandstone implements (arrow shaft abraders), Udden drew attention to the shape of grooves. Some were rounded and others not, suggesting that the abraders were used for other tasks than smoothing arrow shafts. In the case of chipped stone tools, such as scrapers, Udden did not consider long-term effects of use, however. "Well-finished" may be nothing more than well used.

Hansen (1985:209) regards Udden as a pioneer in actualistic studies in geology, and there is evidence of this kind of thinking in Udden's analysis of artifacts. Actualism refers to "[t]he theory that present-day processes provide a sufficient explanation for past geomorphological phenomena" (Allaby and Allaby 1999:6). Udden's interest in actualism in archeological contexts can be seen in his consideration of flint (oval) knives. For instance, he (Udden 1900:39) noted that, "[b]y proper effort and care they can yet be used to cut off stems of shrubs and small branches of trees." Artifacts interpreted as awls, he observed, "can readily be used for making stitches through leather and, if proper care is taken, for boring small holes in soft wood" (Udden 1900:46).

Actualistic studies were becoming more important in archeology in the late nineteenth century, though more often than not these involved analogies drawn between living peoples and the archeological remains left by those long-deceased. Some contemporaries, such as William Henry Holmes, also conducted experiments, replicating stone working practices, aimed at clarifying artifact assemblages attributed to early (glacial and pre-glacial) humans in North America. Fernlund (2000:151, 166) equates these kind of studies with uniformitarianism, the core idea of Lyellian geology. Trigger (1989:270-271) suggests that, "the interest in how artifacts were manufactured and what use had been made of them" were not uncommon in the late nineteenth century and anticipated later functionalist approaches to archeological analysis.

Udden was aware, too, of the limitations of his data. In considering the fact that scrapers appeared to outnumber arrow points, he commented: "It should be remembered that they [arrow points] are of small size and not quite as conspicuous in the field as scrapers" (Udden 1900:41, herein).

After Paint Creek

After Udden and his family left Lindsborg, he conducted no further archeological investigations; nonetheless, there are indications that he still maintained an interest in archeological matters. Heiman (1963:14) indicates that by the turn of the twentieth century, Udden, in addition to publishing several papers a year on geological topics, was also "lecturing on aerodynamics, science and religion, and Indian remains."

In 1905 in a paper on mammoth and mastodon remains from Iowa and Illinois, Udden concluded with a few remarks on "Man and the Elephants."

> On the co-existence of the elephant or the mastodon with man, these data [in the accompanying paper by Anderson (1905)] give no direct testimony ....

There was one possible exception: the find by Justus M. T. Myers, Fort Madison, Iowa, of mastodon remains in association with a human leg bone and "one flint arrowhead" (Anderson 1905:28; Udden 1905:57). With due caution Udden added, "It is not known precisely how close this association was, and in view of the importance of the question, this find would seem to merit a more detailed study and a more full statement of the facts." He noted that these finds were from an area where members of the Davenport Academy claimed to have found elephant-effigy pipes in Native American burial mounds. If the pipes were genuine, then the association of mammoth bone, human remains, and a stone tool, if it were borne out by additional work, would have added significance. Of course, it is now known that these pipes were fakes, planted by some members of the Academy to dupe another (McKusick 1970).

In 1914 and 1915 Udden corresponded with Joseph B. Thoburn, a historian and amateur archeologist with the Oklahoma Historical Society (Lambert 1980). Thoburn, who apparently sought Udden's advice on interpreting the so-called "prairie mounds" of Oklahoma, was involved in a study of these at the time. Udden confessed, "I have long ago been compelled to neglect to further follow those problems" (J. A. Udden to J. B. Thoburn, letter, 13 February 1914). He did offer the general location of several mounds,

including two burned rock middens, indicating that he noticed these things in the course of conducting geologic investigations. Upon receiving Thoburn's manuscript, "Origin of the Prairie Mounds of Oklahoma," the following year, he pointed to his *An Old Indian Village*. (Thoburn, by the way, disagreed with Udden, suggesting that the Paint Creek mounds were attributable to the Siouan-speaking Kansa rather than the Wichita or Pawnee as Udden argued. Vehik [herein] reviews Thoburn's later ideas on the location of Quivira.) Udden praised Thoburn's empiricism: "You have certainly selected an interesting study and I admire the way in which you go about it, in that you make your own observations the foundations for your conclusions ..." (J. A. Udden to J. B. Thoburn, letter, 10 October 1915).

Of note in this brief exchange are Udden's comments on the work of N. H. Winchell, particularly his 1913 book, *The Weathering of Aboriginal Stone Artifacts: A Consideration of the Paleoliths of Kansas*. Winchell had analyzed patination on tools, as well as tool morphology. From these he deduced that the tools were assignable to either the "old" or "new" stone ages and, therefore, took it as proof that humans had been present on the continent prior to the Wisconsin glaciation (Winchell 1913). Udden felt differently: "While I consider Winchell's work as a geologist in Minnesota as very creditable, and his description of the antiquities of Minnesota as very valuable and of greater importance than any other similar work in any other state of which I know, his last work on the flints in Kansas appears to me to be a tragedy" (J. A. Udden to J. B. Thoburn, letter, 10 October 1915).

Conclusions

Udden's career path, as it might now be called, was not yet set when he took his first appointment at Bethany College, though his interests over the years spent there clearly leaned increasingly toward the earth sciences. Inspired by the words of his professor and mentor, Udden obviously gave serious consideration to pursuing archeology, spending much time and not a little of his own meager funds in its service. He might well have stayed the course had not the local geology proved of even greater interest.

With the publication of *An Old Indian Village*, Udden (1900:7) announced that this would be "his last as well as his first paper bearing on topics of this kind...." Frederick Webb Hodge, in a review of the book in *American Anthropologist*, called it "a well dressed, well prepared, and altogether sensible account of personal researches" and added that it could serve as "a model for students of local archeology throughout the Mississippi valley" (Hodge 1900:749,751). On Udden's comment that he would pursue archeology no further, Hodge (1900:751) commented ruefully "more's the pity."

Notes

1. Specifically these sources are a small number of letters from Udden to Franklin G. Adams, Vertical File "Hist Mound Builders" and "Biography—Misc Udd," Library and Archives Division, Kansas State Historical Society; letters between Joseph B. Thoburn and Udden, Joseph B. Thoburn Papers, Oklahoma Historical Society; letters of Joshua Lindahl to Udden in the Johan August Udden Papers, Archives, Augustana College, Rock Island, Illinois.

2. Obviously Udden meant bone.

3. Inman (1897:5) dates the totality of Udden's work at Paint Creek to 1884. Possibly this resulted from a miscommunication with Udden, suggesting that this might be the year in which the chain mail fragment was recovered.

4. It is now known that much of the so-called pipestone from Great Bend aspect sites is not "true" pipestone or catlinite but rather a similar material found in till sources in northcentral and northeastern Kansas, among other places.

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References Cited

Adams, Franklin G.
1878 Kansas Mounds. *Transactions of the Kansas Academy of Science* 6:51-54.

1883 The Metate. Ms. on file, Vertical Files, "Hist Mounds," Library and Archives Division, Kansas State Historical Society, Topeka.

Allaby, A., and M. Allaby
1999 *Dictionary of the Earth Sciences.* 2nd ed. Oxford University Press, New York.

Anderson, Netta C.
1905 *A Preliminary List of Fossil Mastodon and Mammoth Remains in Illinois and Iowa.* Augustana Library Publications No. 5. Augustana College, Rock Island, Illinois.

Billings, Melvin O.
1882 Ancient Remains in Marion County, Kansas. *The Kansas City Review of Science and Industry* 6: 211-212.

Billdt, Ruth
1965 *Pioneer Swedish-American Culture in Central Kansas.* Lindsborg News-Record, Lindsborg, Kansas.

Brower, Jacob V.
1898 *Quivira.* Memoirs of Exploration in the Basin of the Mississippi, vol. 1. H. L. Collins, St. Paul, Minnesota.

1899 *Harahey.* Memoirs of Exploration in the Basin of the Mississippi, vol. 2. H. L. Collins, St. Paul, Minnesota.

Fernlund, Kevin J.
2000 *William Henry Holmes and the Rediscovery of the American West.* University of New Mexico Press, Albuquerque.

Hansen, W. B.
1985 Dust in the Wind: J. A. Udden's Turn-of-the-Century Research at Augustana. In *Geologists and Ideas: A History of North American Geology*, edited by E. T. Drake and W. M. Jordan, pp. 203-214. Geological Society of America, Centennial Special Volume 1.

Heiman, Monica
1963 *A Pioneer Geologist, Biography of Johan August Udden.* Braswell Printing, Kerrville, Texas.

Hodge, F. W.
1900 Review of An Old Indian Village by Johan August Udden. *American Anthropologist* (new series) 2(4):749-751.

Inman, Henry
1897 *The Old Santa Fé Trail.* The Macmillian Company, New York.

Judge, Sara E.
1982 Brower, Richey, and the Quivira Controversy. *Journal of the Kansas Anthropological Association* 3(6-7):187-200.

Keller, Gordon N.
1961 *The Changing Position of the Southern Plains in the Late Prehistory of the Great Plains Area.* Unpublished Ph.D. dissertation, University of Chicago, Chicago.

Lambert, P.
1980 *Joseph B. Thoburn, Pioneer Historian and Archaeologist.* Oklahoma Heritage Association, Oklahoma City.

Lees, William B., and Rolfe D. Mandel
1993 Origin of the Mounds at Sharps Creek. *Kansas Anthropological Association Newsletter* 5(4):6-8.

Mason, Otis T.
1881 Mounds in Cowley County. In *Annual Report of the Smithsonian Institution for 1880*, pp. 446. Washington, D.C.

McKusick, Marshall
1970 *The Davenport Conspiracy.* Office of the State Archaeologist, University of Iowa, Iowa City.

Mead, James R.
1890 Camps of Prehistoric Peoples in Sedgwick County, Kansas. *Transactions of the Kansas Academy of Science* 12:64-65.

Mudge, Benjamin F.
1873 Traces of the Moundbuilders in Kansas. *Transactions of the Kansas Academy of Science* 2:5-6.

Putnam, Frederic W.
1880 Report of the Curator. *Thirteenth Annual Report of the Peabody of the Peabody Museum of American Archaeology and Ethnology (for 1879)* 2(4):709-755.

Silverberg, Robert
1968 *Mound Builders of North America*. New York Graphic Society Ltd., Greenwich, Connecticut.

Trigger, Bruce G.
1989 *A History of Archaeological Thought*. Cambridge University Press, Cambridge, England.

Udden, Johan A.
1900 *An Old Indian Village*. Augustana Library Publications No. 2. Augustana College, Rock Island, Illinois.

1905 *On the Proboscidean Fossils of the Pleistocene Deposits in Illinois and Iowa*. Augustana Library Publications No. 5. Augustana College, Rock Island, Illinois.

1969 Memories of My Sojourn in Kansas. In *Smoky Valley in the After Years*, edited by Ruth Bergin Billdt and Elizabeth Jaderborg, pp. 80-84. Lindsborg News-Record, Lindsborg, Kansas.

Wedel, Waldo R.
1935a Preliminary Classification for Nebraska and Kansas Cultures. *Nebraska History Magazine* 15(3):251-255.

1935b Salina 1. *Nebraska History Magazine* 15(3):238-250.

1959 *An Introduction to Kansas Archeology*. Bureau of American Ethnology Bulletin No. 174. Smithsonian Institution, Washington, D.C.

1975 Chain Mail in Plains Archeology. *Plains Anthropologist* 20(69):187-196.

West, Judge E. P.
1880 A Buried Race in Kansas. *The Kansas City Review of Science and Industry* 4(2):86-90.

Winchell, N. H.
1913 *The Weathering of Aboriginal Stone Artifacts, A Consideration of the Paleoliths of Kansas*. Collections of the Minnesota Historical Society No. 16, Pt. 1. Minnesota Historical Society, St. Paul, Minnesota.

Witty, Thomas A., Jr.
1977 The 1977 Kansas Anthropological Association Dig and Kansas Archeology Training Program. *Kansas Anthropological Association Newsletter* 23(1):1-11.

Notes

Topics, Themes, and Theories in Little River Focus Archeology: Research After Udden

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The Kansas Anthropologist 23:35-44

Over 100 years ago J. A. Udden began research on the Paint Creek site (14MP1). Today the Paint Creek site is included in the Little River focus. Although minimal research was done on the Paint Creek site after Udden, quite a bit of work took place at other Little River focus sites. This essay discusses some of the issues that have confronted Little River focus researchers over the years and comments upon possible future research directions.

I was asked to write about where we have come in Great Bend aspect archeology since Udden. More has been written on that topic than one might think, so I decided to limit the essay to what has come to be called Little River focus.

Little River focus includes Udden's Paint Creek site and other very Late Prehistoric-early Historic period sites located mostly along Cow Creek, Sharps Creek, and the Little Arkansas River in Rice and McPherson counties, Kansas. Even with that limitation, discussion had to be further restricted to what seem to be the more important or interesting issues.

Questions of Classification

Prior to 1935 sites on Cow Creek, Paint Creek, Sharps Creek, and the Little Arkansas River were generally referred to as Quivira or Harahey or just identified by their locations. Following excavations at the Paint Creek (14MP1) or Salina 1 site in 1934, Waldo Wedel (1935a:249) placed that site and others into a Paint Creek culture. Following the McKern taxonomic system, Paint Creek culture was categorized as a focus within the Smoky Hill-Great Bend aspect (Wedel 1935b:Table IV). Paint Creek focus was later expanded to include sites on the Walnut River in Cowley County, Kansas, and others in the vicinity of Wichita, Kansas (Wedel 1940:Fig. 20).

The name of the aspect was subsequently changed to Great Bend. In it were placed both the "Quiviran or Paint Creek culture" sites, as well as the sites in southern Kansas (Wedel 1947:150-151, Fig. 51). Later refinements put the sites in Rice and McPherson counties in the Little River focus of the Great Bend aspect (Wedel 1959:343-344, 571-589). The Cowley County sites were grouped into the Lower Walnut focus. Keller (1961) proposed a third focus, the Ninnescah focus, but this seems to be earlier and lies outside the scope of this paper.

Until recently, taxonomic organization was not further modified. Comparison of lithic material types used at two sites in Rice and McPherson counties resulted in creation of a new taxonomic entity, the Lindsborg focus, for the McPherson County sites (Zehnder 1998:48).

Taxonomic organization is perhaps not the most important research topic at the moment. Analyses of five sites on the Little Arkansas River indicated that *each site* differed in lithic material types, as well as in ceramic rim and lip decoration. Time, space, and sociopolitical variability in access to resources are represented in these differences (Vehik 2002a, 2002b). The differences probably also reflect variability in the cultural origins of the people who came to comprise Little River focus. Furthermore, people from Rice County may well have established the McPherson

County sites later in time. The choice of different lithic resources by occupants of the latter sites may reflect lessening access to western resources. For these reasons it is better to leave taxonomy alone and instead look at variability within sites and localities. Once we have a better understanding of the causes of variation, a new taxonomic organization should be discussed.

Little River Focus: Issues of When, Who, and Why

Chronology

Apart from Little River focus sites having been occupied at the time of Coronado, chronology was not addressed for some time. Ultimately, a late 1600s-early 1700s date for the end of Little River focus was proposed (Ross 1928:520).

Detailed exploration of chronology depended on seriation and dates for associated southwestern ceramics and European objects. There are only a few radiocarbon dates. The time frame finally was refined to between the latter half of the fifteenth century and the first half of the eighteenth century (Loosle 1991:153-154; Smith 1949; W. Wedel 1959:584-585, 1975a, 1982). Nonetheless, not all sites are contemporaneous (Loosle 1991:138, 153-154; Ranney 1994:75). Some sites in McPherson County may have been established late, perhaps between A.D. 1500 and 1700 (M. Stein to S. C. Vehik, letter, 24 September 1999; Wedel 1975a:194-195).

Substantial cultural changes took place over the approximate 300-year life of Little River focus (Vehik 2002a, 2002b). To understand those changes and to refine the taxonomy, control of chronology is one of the more important future research problems.

Coronado and Quivira

As early as 1886, Udden (1900:73-78) suggested an association of the Paint Creek site with Coronado's expedition. Arguments soon developed over whether the sites represented Quivira or Harahey (Brower 1898:xxvi, 55-56, 1899:77-89, 128, 1903:26, 51-52, 56-56, Plate XXII; Richey 1900:483, 1904a).

In the late 1920s excavations at sites on Cow Creek and the Little Arkansas River prompted several articles identifying these sites as Quivira (H. Jones 1928; P. Jones 1929, 1937; Moorehead 1931:84-88; Ross 1928:514-519; Thoburn 1927). Waldo Wedel (1940:326, 334, 1941:15, 1942, 1959:21, 60-62, 1968a:370, 1970:136, 1990:149) frequently promoted the Quivira identification, albeit sometimes with less certainty than others.

There recently have been some suggestions that perhaps the McPherson County sites represent Harahey. The Coronado expedition documents are quite fuzzy on the distinction between Quivira and Harahey. The Spanish in general were unclear in their use of "Quivira." Often the term was used quite broadly, encompassing what appears to have been all Wichita speakers. Linguistically, Harahey is very similar to the word often used later for the Pawnee, *Awahe*. There is good evidence in the historic record to link the McPherson County sites with some ancestral Wichita and hence with Quivira (Vehik 1992, 2001). Thus, the McPherson sites are more likely part of Quivira than not.

This issue may appear to be silly on the surface. However, within the early documents mentioning Quivira, there is ethnographic information that can prove useful to archeologists. Thus, one needs to have some idea of what Quivira did and did not include.

Ethnic Identity

Udden (1900:72-73) identified the occupants of the Paint Creek site as either Wichita or Pawnee. A debate over this ensued (Brower 1903:52; Connelley 1918:441; Zimmerman in Ross 1928:530; Thoburn 1927:407). Wedel repeatedly promoted a Wichita-Little River focus association, although sometimes he seemed less sure (Wedel 1935a:249, 1940:Fig. 21, 1941:10, 1942:10, 1950a:107, 1953:507, 1959:587, 1968a:370-371, 1970:136, 1990:149; Wedel and Wedel 1976:13).

While there was debate over the ethnic identity of Little River focus people, there was little concern over the development of this identity. This identity developed with the formation of Little River focus (Loosle 1991:219; Vehik 2002b.; Wedel 1940:328-334, 1959:633, 1970:136). Little River focus, however, does not encompass all ancestors of the Wichita but instead most directly relates to the Tawakoni subdivision (Vehik 1986, 1992, 1993; M. Wedel 1981:23). The early historic record indicates that there were three groups of Tawakoni, one of which came to be recognized as the Waco. Although these three groups of Tawakoni presently cannot be associated with the three spatial divisions of Little River focus, I think that is not impossible (Vehik 2001, 2002b).

Again, the ethnic identity of Little River focus and its origin may seem somewhat trivial. It is not. The various subdivisions of the Wichita had very different sociopolitical and economic organizations. Those differences can be traced back into precontact

times where they no doubt originated (Vehik 2002b). We need to define how and why those differences developed.

Origins

Udden did not specifically address the question of origins. Brower (1903:69, 73) placed the ancestors of the Pawnee and Wichita in Missouri and Arkansas. Zimmerman's (1928) discussion of origins stands as the most truly bizarre article ever published about Little River focus.

Great Bend origins were later sought in an in-situ development from Woodland through Upper Republican (Wedel 1950b:86). That idea proved untenable, and the Pratt complex was identified as ancestral. Pratt complex origins were thought to lie in a middle- to late-fifteenth-century movement of people from Oklahoma, especially people who belonged to what are now called Washita River, Turkey Creek, and Antelope Creek phases (Drass 1998; W. Wedel 1959:630, 632, 1968a:384, 1968b:57-59, 1970:135-136, 1982:152; Wedel and Wedel 1976:10). Great Bend aspect was proposed to represent a southern Plains coalescent tradition analogous to the northern Plains coalescent (Loosle 1991:234, 242-244; Wedel 1953:507, 1959:633, 1968a:384, 1970:136).

Vehik (1976) argued that an origin in Washita River, Custer, and Antelope Creek phases was unlikely. Instead, Little River focus was proposed to reflect an in-situ origin through Pratt complex.

I do not think there can be any doubt that Little River focus represents a coalescence (Vehik 2002a, 2002b). Pratt complex is part of this, as likely are other groups from southwest Kansas and perhaps the Oklahoma panhandle (i.e., Mid-Arkansan focus, Buried City complex, Plains Border variant) (Bevitt 1999; Drass 1998; Keller 1961; Ranney 1994; Vehik 1998). I doubt those are the only groups involved. People living south of the Kansas-Smoky Hill river drainage in central and east-central Kansas probably also contributed to the coalescence. Donor complexes for Little River focus also likely contributed to other coalescent groups (Vehik 1998, 2002a, 2002b).

Conflict

To Udden (1900:71) conflict was unimportant until after contact. Conflict was most often brought up as a cause of Little River focus leaving central Kansas (P. Jones 1929:145-150; Loosle 1991:16; Ross 1928:520; Wedel 1968a:384; 1970:139). Only rarely was conflict seen as having been important in the formation of large groups like Little River focus (Wedel 1940:328-330).

There is now substantial evidence that conflict was increasing during the Late Prehistoric period in many areas of North America (LeBlanc 1999). For the Southern Plains increasing conflict resulted from competition over bison, both for food and trade. Conflict prompted coalescence and the formation of Little River focus and other similar groups. Conflict and coalescence significantly changed the social, political, and economic organizations of the people involved (Vehik 2002a, 2002b).

Life In Little River Focus

Food

Udden (1900:16) thought only select parts of bison were returned to the Paint Creek site. Ninety years later, Loosle (1991:92-95) came to the same conclusion for other Little River focus sites. The Lewis site (Ranney 1994) near Liberal, Kansas, is an example of the type of Little River focus bison hunting strategy that would result in the sorts of observations made by Udden and Loosle. The Lewis site is a bison hunting and processing camp that fits in nicely, both in terms of location and function, with the Coronado expedition account of encountering a bison hunting task force. The task force was out hunting bison for its village that was farther on to the east (Winship1990:197, 209).

Bison were not the only animal resource, however. Dog bones are quite common at some sites, and dogs were likely a source of food (Thies 1993; Wedel 1959:233). Little River focus people also exploited other animals, especially deer (Romine 1998:16).

The importance of farming was unclear to Udden (1900:70). Others considered farming to have been practiced, if not to have been a major source of food (Brower 1903:56; P. Jones 1929:93-94, 97-100; Wedel 1935a:248, 1941:8-9, 1942:4, 1959:231-233, 303-304, 329, 588, 631, 1968a:372). The numerous and extremely large size of Little River focus storage pits, along with the high frequency of bison scapula hoes, provides clear evidence of the importance of farming. Compared to earlier sites, the dependence on horticulture increased substantially. There are a number of possible reasons for the emphasis on farming, ranging from a large aggregated population not being able to gather adequate food resources within a daily travel distance, to circumscription as a result of conflict, to excess production for trade. All of these are probably involved.

Little River focus sites need much more research effort devoted to issues of subsistence. An important



Figure 1. Aerial view of the ceremonial circle at the Paint Creek site (14MP1), photographed by Wedel in 1966 or 1967.

debate that needs to be resolved is how Little River focus people hunted bison. Zehnder (1998) argued for communal bison hunting with seasonal abandonment of villages. I think it highly unlikely that people would abandon either growing crops or huge storage pits. Unattended crops do not produce well (Dimmick 1994:247; Dunbar and Allis 1918:660, 667; Morse 1822:205). Subterranean storage pits also were not impossible to detect by others and not a sure way to hide resources (Thwaites 1905:277). Little River focus bison hunting was very likely undertaken primarily by special task forces, as reflected in the Coronado accounts and the Lewis site. I suspect that the reliance on dog and deer will ultimately be shown to increase over time as westward access to bison became increasingly restricted.

Council Circles

Noticeably absent from Udden is a discussion of council circles. Council circles involve circular arrangements of four houses surrounding an open, mounded area. There are only five of these sites known. A council circle exists at the Paint Creek site (Figure 1), but it was apparently not recognized or else not considered important by Udden (Wedel 1968a:374-384).

The council circles have been seen as communal lodges and as the seats of government and religion for Quivira (H. Jones 1928:542; P. Jones 1929:109). They have been portrayed as temple or ritual centers, as residences of village elites who had some ritual functions, and as men's lodges (Wedel 1942:4, 1959:574, 1967:59, 1977:142, 1990:145). The council circles possibly functioned together to monitor solstices

(Wedel 1967:60-62, 1977:143-145, 1990:145).

Human skeletal remains, both fragmentary and complete, have been found in council circle houses as well as in the mounded areas. An early council circle excavation encountered several layers of ash and human teeth in the central mound. The teeth were considered evidence for the practice of human sacrifice (H. Jones 1928:542; Ross 1928:526). In later excavations, one council circle house yielded a large number of skeletons. These skeletons may have been of Little River focus people (Wedel 1967:59, 1968a:380-381). Possibly, they represent the practice of human sacrifice during solstice observances (Wedel 1967:62, 1968a:383), or perhaps they were "honored" members of the local community who died in an enemy attack or from smallpox (Wedel 1967:59, 1977:143-144).

Most often the council circles have been considered relatively late constructions (Lees 1990; Loosle 1991:210; Wedel 1968b:57, 59). They may reflect the development of sociopolitical inequality with the advent of European trade (Loosle 1991:210).

The council circles on the Little Arkansas River definitely postdate the first Little River focus settlements. After the circles were abandoned, people continued to reside at the sites for an unknown period of time. Still, I do not think that the council circles are historic in origin, although they certainly continued to be used during the early historic period. I would argue that the circles represent the increasing control of political/religious leaders over access to resources within the context of spatial circumscription resulting from conflict with mobile bison hunters (Vehik 2002a, 2002b).

The council circle houses were both residences and ritual/ceremonial facilities. Recovered from them were a number of items of likely ceremonial function, including large, thin, well-flaked bifaces; large and well made notched points; and red pipestone pipes. More importantly, the circles themselves are organized using the number four: four houses, four large sequential fires in central mounded areas, and four bone beads under a center point rock, for example. Whether the council circles serve to observe solstices, their center points appear to have been placed in multiples of 75 m from a spot marking the intersection of lines that delineated solstice sunrises and sunsets. The council circles were the ritual facilities and residences of priests who were also political leaders (Vehik 2002a, 2002b).

I do not think that the bodies in the council circles are of local people. Some of the associated artifacts are of types not otherwise encountered in Little River focus sites. Additionally, some of the very large notched points, which are mostly of materials local to Little River focus, are associated with these skeletons. Some of these points have had their tips removed by impact fractures. In Arikara and Omaha sites these artifact types occur either with individuals who died a violent death or with very wealthy individuals (O'Shea 1984:191-192, 247, 272). Most likely, the skeletons are of nonlocals subjected to ritual death of some kind (Vehik 2002a, 2002b).

Trade

Udden (1900:59) did not discuss trade; instead, he thought nonlocal goods were obtained through direct access. Other authors, however, saw trade as having been important to the people at Paint Creek and related sites (H. Jones 1928:544; P. Jones 1929:109, 111-113; Richey 1904b; Ross 1928:525). Most discussions, though, did little more than note nonlocal items and their sources (B. Jones 1975:11; Terry and Terry 1961; Rucker 1971; W. Wedel 1935a:249, footnote 5, 1940:333, 1942:7, 1950a, 1959:571-589, 1967:58, 61, 1968a:372-373, 1968b:59, 1970:135, 1982, 1990:145). The rare exceptions proposed entrepreneurs, balanced reciprocity, and a regional economy designed to buffer food shortages as mechanisms for exchange (Loosle 1991:16; Roper 2000; M. Wedel 1982; Wedel 1990:145).

Alternatively, exchange may have been undertaken by political/ritual elites as a strategy to increase power and prestige (Vehik 2002a). Trade and politics are intimately related in the Little River focus. The calumet ceremony (ritual that has sacred pipe stems as its symbol and establishes a fictive kinship relationship between individuals of different clans, bands, or ethnic groups) no doubt was an important part of this relation, and Little River focus leaders might have even created the ceremony (Blakeslee 1981). Hides were also important calumet ceremony exchange items (Muller 1997:111-115). Production of pipes and bison hides was emphasized in the council circle houses (Vehik 2002b).

Craft Specialists

Craft specialists are not a feature of tribal-level societies and so this topic was rarely addressed in regard to Little River focus. One early author did state that gold and silver smiths occupied a street at the Quiviran capital (Ross 1928:524, footnote 5). It is not clear how the author arrived at this conclusion.

A later attempt to identify increasing specialization in bison hide production was unsuccessful. Loosle (1991:206) concluded that specialization of any kind in Little River focus was unlikely.

I suspect that the only full time craft specialists were the priests/political leaders. There is some historical evidence that political leaders did not engage in farming, although that has been difficult to document archeologically. There is evidence that hide processing, red pipestone pipe manufacture, and production of finely made bifaces and projectile points took place either exclusively or far more intensively within the council circle houses. Probably, part-time craft specialists or highly skilled individuals came to the council circle houses to produce these goods (Vehik 2002a, 2002b).

Theories

Unilineal evolution seems to have provided background for Brower (1903:56-57). Remaining discussions from the early twentieth century were simply descriptive.

Later archeologists on the Plains came to view ecology, environment, and climate as major factors in culture change (Mulloy 1958; Smith 1950:98-99, 1949:293-294; Wedel 1940:328-329, 1941, 1953, 1959:629). Partially this emphasis reflected contemporary theoretical practices and the long held view of the Plains as a difficult environment, but many Plains researchers also had firsthand experience with the drought of the 1930s (Van Royen 1937:640-645; Wedel 1940:329, 1941:10-11, 1953:499, 1975b). Climatic change was seen as having been the cause for the eastward retreat of farmers in the latter part of the Late Prehistoric period (Wedel 1940:332-334, 1941:15, 21, 25-26, 1953:507). To some of these researchers, the Plains periodically became so inhospitable that the region was abandoned (Mulloy 1958; Wedel 1950b:86, 1959:629).

The Direct Historical Approach also had an effect on how researchers viewed Paint Creek and related sites. Using the Direct Historical Approach, once a connection was made between an archeological complex and an ethnographic group, the latter came to structure how the former was explained or interpreted. Little consideration was given to the possibility that the contact experience had resulted in substantial change in some Plains cultures, including the ancestors of the Wichita. Many precontact ancestors of historic Plains societies were viewed as much simpler societies than they actually were. This problem is reflected in the difficulties Waldo Wedel had in explaining the council circles: they did not fit conceptually with historic tribal societies.

The role of the environment, ecology, and climate in human adaptation to the Plains continues to be important. It is often considered a primary relationship, and a variety of theories (such as human or cultural ecology and evolutionary ecology) have been used to link environment and certain aspects of cultural behavior. However, within that relationship other theoretical approaches have been employed to investigate human behavior as well. Loosle (1991) viewed trade as a buffering strategy for food procurement under conditions of climatic uncertainty. He couched buffering in terms of a regional economy model, developed from world systems theory (Baugh and Swenson 1980). Ethnic identity theory was used to suggest that Wichita ethnic identity emerged through competition for resources and coalescence (Loosle 1991:219).

I have used managerial and agency theory to explain the development of social inequality and trade within Little River focus. However, it is also the case that inequality and trade developed within a context of climatic change that ultimately caused an increase in the size and distribution of bison herds. Conflict over access to bison and the resulting population coalescence created managerial problems and provided opportunities for agents to act (Vehik 2002a, 2002b).

Conclusions

In many ways the archeology of the Little River focus has come a long distance from Udden. We know far more today about the lives of people who lived at sites such as Paint Creek, although we actually know very little more than Udden did about the Paint Creek site itself.

While many of the topics Udden covered in his report have been substantially resolved after a hundred years, some have not. For instance, while Udden was very perceptive in his comment about Paint Creek bison hunting, we still have a lot of work to do on Little River focus resource procurement and processing. At the same time, many new questions have developed—for example, council circle function and significance. Theoretical approaches used to explain and interpret the Paint Creek site and Little River focus will continue to change, although environmental factors always will likely be important. A lot more excavation and research remain to be done.

References Cited

Baugh, T. G., and F. E. Swenson
1980 Comparative Trade Ceramics, Evidence for the Southern Plains Macroeconomy. *Bulletin of the Oklahoma Anthropological Society* 29:83-102.

Bevitt, C. T.
1999 *Life on the High Plains Border: Archeological Investigation of Three Late Prehistoric Habitation Sites in Southwest Kansas*. Unpublished Master's thesis, Department of Anthropology, Wichita State University, Wichita.

Blakeslee, D. J.
1981 The Origin and Spread of the Calumet Ceremony. *American Antiquity* 46:759-768.

Brower, J. V.
1898 *Quivira*. Memoirs of Explorations in the Basin of the Mississippi, vol. 1. H. L. Collins, St. Paul, Minnesota.

1899 *Harahey*. Memoirs of Explorations in the Basin of the Mississippi, vol. 2. H. L. Collins, St. Paul, Minnesota.

1903 *Kansas*. Memoirs of Explorations in the Basin of the Mississippi, vol. 7. McGill-Warner, St. Paul, Minnesota.

Connelley, W. E.
1918 Notes on the Early Indian Occupancy of the Great Plains. *Kansas Historical Collections, 1915-1918* 14:438-470.

Dimmick, F. R.
1994 Creative Farmers of the Northeast: A New View of Indian Maize Horticulture. *North American Archaeologist* 15:235-252.

Drass, R. R.
1998 The Southern Plains Villagers. In *Archaeology on the Great Plains*, edited by W. R. Wood, pp. 415-455. University of Kansas Press, Lawrence.

Dunbar, J., and S. Allis
1918 Letters Concerning the Presbyterian Mission in the Pawnee Country, near Bellvue, Neb., 1831-1849. *Kansas Historical Collections, 1915-1918* 14:570-784.

Jones, B. A.
1975 Puebloan Pottery Sherds from the Major Site. *Kansas Anthropological Association Newsletter* 3(3):1-3.

Jones, H.
1928 Quivira-Rice County, Kansas. *Kansas Historical Collections, 1926-1928* 17:535-546.

Jones, P. A.
1929 *Quivira*. 2nd ed. McCormick-Armstrong, Wichita.

1937 *Coronado and Quivira*. Lyons Publishing, Lyons, Kansas.

Keller, G. N.
1961 *The Changing Position of the Southern Plains in the Late Prehistory of the Great Plains Area*. Unpublished Ph.D. dissertation, Department of Anthropology, University of Chicago.

LeBlanc, S.
1999 *Prehistoric Warfare in the American Southwest*. University of Utah Press, Salt Lake City.

Lees, W. B.
1990 Evidence for Early European Contact with the Wichita in Kansas. Paper presented to the Conference on Historical and Underwater Archaeology, Tucson.

Loosle, B. N.
1991 *Social Interaction among the Late Plains Village Populations in the Central Plains*. Unpublished Ph.D. Dissertation, Department of Anthropology, University of Kansas, Lawrence.

Moorehead, W. K.
1931 *Archaeology of the Arkansas River Valley*. Yale University Press, New Haven.

Morse, J.
1822 *A Report to the Secretary of War of the United States, Indian Affairs*. Davis and Force, Washington, D.C.

Muller, J.
1997 *Mississippian Political Economy*. Plenum Press, New York.

Mulloy, W.
1958 A Preliminary Historical Outline for the Northwestern Plains. *University of Wyoming Publications* 22:1-235.

O'Shea, J. M.
1984 *Mortuary Variability: An Archaeological Investigation*. Academic Press, Orlando.

Ranney, W. H.
1994 *Refining the Pratt Complex: Evidence from the Lewis Site*. Unpublished Master's thesis, Department of Anthropology, University of Kansas, Lawrence.

Richey, W. E.
1900 The Real Quivira. *Kansas Historical Collections, 1897-1900* 6:477-485.

1904a Early Spanish Explorations and Indian Implements in Kansas. *Kansas Historical Collections, 1903-1904* 8:152-168.

1904b Report of Committee on Mounds and Village Sites. *Kansas Historical Collections, 1903-1904* 8:135-136.

Romine, J.
1998 Sharps Creek Site Arrow Point Analyzed. *Kansas Preservation* 20(3)14-16.

Roper, D. C.
2000 Lower Loup Pottery in Great Bend Aspect Sites. *Plains Anthropologist* 45:169-177.

Ross, E. C.
1928 The Quivira Village. *Kansas Historical Collections, 1926-1928* 17:514-534.

Rucker, M. D.
1971 Additional Puebloan Sherd Dates from Kansas. *Kansas Anthropological Association Newsletter* 17(4):1-6.

Smith, C. S.
1949 Archaeological Investigations in Ellsworth and Rice Counties, Kansas. *American Antiquity* 14:292-300.

1950 Climate and Archaeology in Kansas. In *Proceedings of the Sixth Plains Conference (1948)*, pp. 98-99. Anthropological Papers No. 11. University of Utah, Salt Lake City.

Terry, K., and I. Terry
1961 Chain Mail and other Exotic Materials from South-Central Kansas. *Plains Anthropologist* 6:126-129.

Thies, R. M.
1993 Human Tooth Is Probably Coyote. *Kansas Anthropological Association Newsletter* 5(3):1-2.

Thoburn, J. B.
1927 An Important Archaeological and Historical Discovery. *Chronicles of Oklahoma* 5:407-413.

Thwaites, R. G.
1905 *Part I of James's Account of S. H. Long's Expedition 1819-1820*. Early Western Travels 1748-1846, vol. 14. Arthur H. Clark, Cleveland.

Udden, J. A.
1900 *An Old Indian Village*. Augustana Library Publications No. 2. Augustana College, Rock Island, Illinois.

Van Royen, W.
1937 Prehistoric Droughts in the Central Great Plains. *Geographical Review* 27:637-650.

Vehik, S. C.
1976 The Great Bend Aspect: A Multivariate Investigation of its Origins and Southern Plains Relationships. *Plains Anthropologist* 21:199-206.

1986 Oñate's Expedition to the Southern Plains: Routes, Destinations, and Implications for Late Prehistoric Cultural Adaptations. *Plains Anthropologist* 31:13-33.

1992 Wichita Culture History. *Plains Anthropologist* 37:311-332.

1993 Dhegiha Origins and Plains Archaeology. *Plains Anthropologist* 38:231-252.

1998 Prehistory and Ethnohistory of the Wichita Indians. Submitted to the Kansas State Historical Society, Archeology Office, Topeka, Kansas.

2001 Wichita Ethnohistory and Kansas. Paper presented at the 59th Plains Anthropological Conference, Lincoln, Nebraska, and for inclusion in *The Archaeology of Kansas*, edited by R. Hoard and W. Banks.

2002a Conflict, Trade, and Political Development on the Southern Plains. *American Antiquity* 67(1):37-64.

2002b "The Barbarian Hammer": Bison Hunters and Farmers on the Plains. Ms. on file, Department of Anthropology, University of Oklahoma, Norman.

Wedel, M. M.

1981 *The Deer Creek Site, Oklahoma: A Wichita Village Sometimes Called Ferdinandina, An Ethnohistorian's View*. Series in Anthropology No. 5. Oklahoma Historical Society, Oklahoma City.

1982 The Indian They Called Turco. In *Pathways to Plains Prehistory: Anthropological Perspectives on Plains Natives and Their Pasts*, edited by D. G. Wykcoff and J. L. Hofman, pp. 153-162. Oklahoma Anthropological Society Memoir No. 3 and Cross Timbers Heritage Association Contributions No. 1.

Wedel, W. R.

1935a Salina 1. *Nebraska History Magazine* 15:239-250.

1935b Appendix. *Nebraska History Magazine* 15:251-255.

1940 Culture Sequence in the Central Great Plains. *Smithsonian Miscellaneous Collections* 100:291-352.

1941 Environment and Native Subsistence Economies in the Central Great Plains. *Smithsonian Miscellaneous Collections* 101(3).

1942 Archeological Remains in Central Kansas and Their Possible Bearing on the Location of Quivira. *Smithsonian Miscellaneous Collections* 101(7).

1947 Culture Chronology in the Central Great Plains. *American Antiquity* 12:148-156.

1950a Notes on Plains-Southwestern Contacts in the Light of Archeology. In *For the Dean*, edited by E. K. Reed and D. S. King, pp. 99-116. Hohokam Museums Association and Southwestern Monuments Association, Santa Fe.

1950b Climate and Culture: Some Questions. In *Proceedings of the Sixth Plains Archeological Conference (1948)*, pp. 85-87. Anthropological Papers No. 11. University of Utah, Salt Lake City.

1953 Some Aspects of Human Ecology in the Central Plains. *American Anthropologist* 55:499-514.

1959 *An Introduction to Kansas Archeology*. Bureau of American Ethnology Bulletin No. 174. Smithsonian Institution, Washington, D.C.

1967 The Council Circles of Central Kansas: Were They Solstice Registers? *American Antiquity* 32:54-63.

1968a After Coronado in Quivira. *Kansas Historical Quarterly* 34:369-385.

1968b Some Thoughts on Central Plains-Southern Plains Archaeological Relationships. *Great Plains Journal* 7:53-62.

1970 Some Environmental and Historical Factors of the Great Bend Aspect. In *Pleistocene and Recent Environments of the Central Great Plains*, edited by W. Dort and J. K. Jones, pp. 131-140. University Press of Kansas, Lawrence.

1975a Chain Mail in Plains Archeology. *Plains Anthropologist* 20:187-196.

1975b Some Early Euro-American Percepts of the Great Plains and Their Influence on Anthropological Thinking. In *Images of the Plains: The Role of Human Nature in Settlement*, edited by B. W. Blouet and M. P. Lawson, pp. 13-19. University of Nebraska Press, Lincoln.

1977 Native Astronomy and the Plains Caddoans. In *Native American Astronomy*, edited by A. Aveni, pp. 131-145. University of Texas Press, Austin.

1982 Further Notes on Puebloan-Central Plains Contacts in Light of Archaeology. In *Pathways to Plains Prehistory: Anthropological Perspectives on Plains Natives and Their Pasts*, edited by D. G. Wykcoff and J. L.

Hofman, pp. 145-152. Oklahoma Anthropological Society Memoir No. 3 and Cross Timbers Heritage Association Contributions No. 1.

1990 Coronado, Quivira, and Kansas: An Archeologist's View. *Great Plains Quarterly* 10:139-151.

Wedel, W. R., and M. M. Wedel
1976 Wichita Archeology and Ethnohistory. In *Kansas and the West*, edited by F. R. Blackburn, E. Langsdorf, R. W. Richmond, J. W. Snell, and H. E. Socolofsky, pp. 8-20. Kansas State Historical Society, Topeka.

Winship, G. P.
1990 *The Journey of Coronado, 1540-1542*. Reprint of 1904 edition. Fulcrum Publishing, Golden, Colorado.

Zehnder, J. P.
1998 *Relationships between Two Little River Focus Sites in McPherson and Rice Counties of Central Kansas Based on Excavated Lithic Debitage*. Unpublished Master's thesis, Department of Anthropology, Wichita State University, Wichita, Kansas.

Zimmerman, M. E.
1928 Circular Shrines in Quivira and the Jehovah of the Ohio Mound Builder. *Kansas Historical Collections, 1926-1928* 17:547-558.

Memories of My Sojourn in Lindsborg

J. A. Udden

The Kansas Anthropologist 23:45-49

Reprinted from The Smoky Valley in the After Years, *edited by Ruth Bergin Billdt and Elizabeth Jaderborg, pp. 80-84, Lindsborg News-Record, Lindsborg, Kansas. Original published in 1919 as* Lindsborg Efter Femtio Ar *by Dr. Alfred Bergin, Augustana Book Concern, Rock Island, Illinois.*

It is now thirty-seven years since I came to Lindsborg directly from the commencement festivities at Augustana College. I graduated and a week later came to Lindsborg as a delegate to the Augustana Synod from West Union, Minnesota.

I came to Kansas in order to get work so that I could continue my studies. That was all I had in my mind. I had no idea what career I wanted to pursue, but I knew that I did not want to be a preacher. I was dissatisfied with my four years in college. I have often wondered how the overworked teachers at Augustana College had the strength to teach as many classes as they did.

But that does not belong here. A couple of weeks after the synodical meeting the summer school for teachers in the county opened in McPherson. I enrolled with the hope that I would get a teaching position for the winter. Before the four weeks were over I was asked to take charge of the parochial school west of Lindsborg. Later, I was asked to start a high school, Bethany Academy, in Lindsborg. I felt that I needed to review English grammar to be a teacher in the Academy. This I did. The decision was easily made. I also had a call to teach in the Kentuck Creek district. My deep regard for Dr. Swensson had more to do with my decision than I realized.

One of my keenest memories from my school days in the west district was my association with Mr. Peter Fallquist, a farmer with whom I stayed. Mr. Fallquist was one of those sincere Christians in our church at that time. He was a deacon in the church almost as long as I lived in Lindsborg. I had worked very hard on a farm in Minnesota until I was fifteen years old. I have never seen anyone work as hard as my friend, Mr. Fallquist. His only rest periods were when he had morning and evening devotions and Sundays. Night and day he worked his farm. It was only on Sunday that we had an opportunity to visit and to become really acquainted. I soon found out that he had more than an outward form of Christianity. He was reasonable in everything; loving, considerate of everyone, kind in his criticism of others, a very tolerant man. He was even tolerant toward a young student who was considered a skeptic my many. It was a blessing to know such a man. Long after his death I still see his face. It resembled the face of Christ. I know of no other person who is as near my ideal as he, except the one who has shared both joy and sorrow with me these thirty-six years. How true it is that the most beautiful plants that nature gives often grow in the hidden places in the woods. In the midst of the early drudgery and misery, in the midst of life's most prosaical and everyday cares, one finds some of the most valuable people. I feel I have received two of earth's greatest treasures in Mr. Fallquist and my wife.

All my memories of Lindsborg are precious. Bethany College, whose small beginning was in the sacristy of Bethany College, has given me wonderful memories from my teaching career. The first year we did not bother to teach foreign languages or higher mathematics. The students were willing workers, and I was a zealous teacher, maybe too zealous for some of them. I very carefully reviewed the English grammar. At the end of the spring term I had students who knew the subject so well they occasionally embarrassed the teacher. Anna Olsson and Otto Håkanson had much in

their favor. They have both become prominent; the first as an author, and the second as a businessman. I also remember a boy with a large head who had a most remarkable memory. But when it came to drawing conclusions, he would signify by shaking his head that he needed more information on the subject. He was quiet, unobtrusive, and thought it not presumptuous to say that he had a better memory than I. Eben Olson, a pastor's son, is another student I remember. He had great abilities and was a leader in sports. I had to be stern with him at times, but I think we remained friends in spite of it. When we met twenty years later in the Wisconsin woods, he was a prominent figure in a political campaign which he was heading. I have forgotten what the campaign was about, but his side won the election, as happened consistently in the ball games in Lindsborg.

The Messiah Chorus was started that winter. Dr. Swensson invited all singers in Lindsborg and surrounding communities to meet in order to form a chorus to sing Handel's "Messiah." Mrs. Alma Swenson became the director. It was this little woman's talent and her tenacious energy plus Dr. Swensson's charming personality that made the Messiah Chorus a possibility in Lindsborg. We must not forget that the chorus was formed during the early settler's period when there was desire for companionship among a chosen people.

No one who knows Lindsborg can deny that the people there, especially the church people, represent the best of the Swedish common people. Those who came with Dr. Olsson from Vårmland and those who moved from Illinois to Fremont were, in the main, idealists. Most of them were driven to greater desires than an economic advantage to settle so far out on the wild prairies. That became clear to me after living here seven years. They wanted to better their living conditions and to be permitted to choose their own way of life. This desire was for many just as strong as it was in the Pilgrims in New England. Lucky and fortunate the community that has had great and Christian leaders.

In the spring, Dr. Swensson invited the orchestra from Augustana College to come to Lindsborg. They were welcomed royally. Carl Esbjörn, John Krantz, Jacobson, Friberg, Gustav Andreen, Fritz Andren and others of my schoolmates were in the group. We practiced together again. My classroom, the sacristy, was changed into a music hall where stringed and wind instruments vibrated in harmony and disharmony. Concerts were given and feasts enjoyed in Lindsborg, Assaria and Fremont.

But everything must come to an end. A spirit of inertia came over the people who had participated in the festivities when these were over. Besides, it was also the time of the year when spring work demanded the presence of some of my students. The last day of school there were just twelve students in school. The reaction that set in after the festivals depressed me so much that I actually shed tears after the last student had left. It seemed as if my teaching amounted to nothing in comparison to the magnificent concerts we had heard.

The summer of 1881 was the most important year of my life. I decided then to devote my life to teaching and I chose my life's partner. My marriage does not really belong to my memories of Lindsborg. The wedding was celebrated in Minnesota. The wedding trip was to Lindsborg where I had been called to teach at Bethany. We were young and naïve. I was foolish enough to permit my wife to take over the school's eating establishment. She did this very satisfactorily. There were no complaints from the food that term. But the management and the work deprived the bride of the real home enjoyment she should have had, something that I did not understand at the time. We hardly became acquainted that year because we were busy with our separate jobs. I must confess that many years passed by before I fully appreciated our marriage. At our silver wedding I said that we had yet to have our first quarrel. I rightfully admit that the repartee which came from a friend among the guests was deserved: "I'm sure that is not the Doctor's fault."

The work at the school that fall was soon in full progress. The dining hall and bedrooms were in the old Lindgren Hotel, the classrooms were in the Velin blacksmith shop, and the old schoolhouse which had served as a public school was renovated and moved. I do not recall the other buildings. Having seniority as a teacher, I opened the school. My classmate and friend, Dr. Nelander gave a short talk to the students who were present. They were enrolled and classified. Then the classes began.

Here I must tell about the first faculty meeting held at Bethany. After two months had elapsed, something developed that had to be taken care of. I do not recall exactly what it was, but I think it was a discipline problem. Dr. Swensson said that it was necessary to meet to discuss the problem. The meeting was held in Dr. Nelander's home. Mr. Carl Norman had a short time before been engaged as an assistant teacher. He came from the coal mines near Osage City where he had been working for some time. Those present at the faculty meeting were Dr. Swensson, Prof. Nelander, Mr. Norman and the undersigned. "Well, who shall be the chairman?" was Dr. Swensson's first question. Prof. Nelander was suggested. I do not recall if it was Dr.

Swensson or Mr. Norman who seconded the motion, but I called for a vote immediately. It was unanimous. It came to me later that I should either have kept silent or suggested that Dr. Swensson be chairman. He was, after all, the leading personality. But I thought a teacher was best qualified. The result was that the founder of the college, a leader, did not officially become president until seven years later. I do not know if Dr. Swensson wanted to be chosen or not. I know that he was never petty or jealous, and neither was Prof. Nelander. The one who was chosen President at our first meeting handled his job very well. I knew him better than any of the others knew him, and I felt he was the man for the position. He had a dignity and a calm in a combination seldom found in one personality, a friendly, sympathetic nature, a benevolent attitude which made the students respect and trust him. Between Dr. Nelander and Dr. Swensson there was always a mutual goodwill and understanding which made effective cooperation possible. That Dr. Swensson was jealous of his co-worker seems very unlikely. Dr. Swensson's talents were such that we could manage every situation. I found out several years after my residence in Lindsborg that an argument was quietly settled which would have made him very unhappy if he had been president.

In the fall of 1882, I began my studies in Natural History. I took upon myself to act as editor-in-chief of the Kansas Posten in order to increase my income. This took much time, especially at night. Neither Dr. Nelander nor Mr. Norman wanted to teach physical geography, zoology or botany, so that became my responsibility. That spring I made my first acquaintance with Kansas flora. My interest became so keen that I often made trips into the country. Then I became acquainted with Dr. Rundstrom who had studied botany in Lund, Sweden, and had taken his interest in botany to America. When I needed help, I went to him. On one of my visits he showed me his collection of plants. This aroused a desire in me to have a collection as large as his. We made some trips together during which I obtained much information and knowledge, which is a product of all art and science. We were only two or three generations away from the master himself, Linné. During the next three years, I took the time to become acquainted with many of the plants in Kansas. I made almost all of my plans and trips so as to find as many new plants as possible. Before we moved from Kansas I had a collection of 1,200 plants, most of which I found in Kansas, some of which I had found in Illinois and Minnesota. One thing led to another. One summer I set out to find zoology material in order to teach it. I was fortunate to be able to gather hundreds of species of birds which later became useful in the classroom. They were, as I recall, almost worn out due to handling when I last saw them at Bethany.

It soon became clear to me that I lacked both the literature and collections that were necessary to continue in this system. I had read Prof. Mudge's little brochure concerning the geology of Kansas which interested me so much more since on my botany field trips I had seen much of what was described by this author. I bought a horse cheap because the owner would not guarantee that the horse could be driven singly. I borrowed a buggy from a friendly farmer through Dr. Lincoln's kind help. I took a month's vacation to study the nature of the soil between Lindsborg and Junction City. It was an interesting trip in every way. To save money I slept in the open most of the time, places where I could tether and feed the horse. One morning I was awakened early by rain falling on my face so I crawled into a nearby haystack. This gave me both protection and warmth. My haversack was used to carry necessary nourishment. I was given many meals by the hospitable American settlers living by the wayside.

This trip became an eye-opener for me. I came home determined that geology would be my future career. This determination I have kept. It is said that one will succeed in that which one really desires to do. That depends, I'm sure, on the fact that he is eager to find ways of doing it. This happened to me. Some businessmen in town wanted the area around Lindsborg examined to find out if there were deposits of coal. I was asked to find a competent person to take care of such a request. I spent six days in the company of a minister from England who was well versed in geology. He was at this time the only geologist obtainable in Kansas. A farmer in Marquette became interested in this same cause. With this help I studied the cretaceous formation in Rice and Ellsworth districts. Another time Mr. Underwood took me to inspect the area south of Marquette. He wanted to know if there was salt in the red clay out there. One of my students told me of a peculiar layer of soil by Sharp's Creek. I was the first person in this area to find and recognize the widespread volcanic ashes on the western prairies. These ashes are supposed to be from the now sleeping or dead Spanish Peak volcanoes in New Mexico. Later, I found the same soil in New Gottland and on the roadside between Lindsborg and McPherson. This find led to other excursions on which observations were made which proved that the territory around Lindsborg had cretaceous formations, older than any of that time found in America. Excavations near Björndyke were for the purpose of finding coal. I found a great number of fossils and petrifications which possibly belonged to

the Jura-layer or an earlier chalk or cretaceous period. But the necessary information to verify this material found by the Smoky Hill River was not obtainable, so the whole collection was sent to an expert whom I thought knew more about it than I did. The material was never returned, nor was anything written about it. This incident taught me the important lesson that a certain amount of self-confidence is necessary in all we do. If I had greater self-confidence in my own observations, it is possible that our geology textbook would now tell about the Smoky Hill Age in place of the Comanche Age. Layers of the same age were later found in Comanche County in Texas. Thus the name, "Comanche Age."

There was a crop failure in the Lindsborg area in the summer of 1888. This was a critical period. I was editor of the Lindsborg News, a weekly newspaper, that year. This gave me the opportunity to become acquainted with the political situation in the community. Someone suggested that I try to become county superintendent of schools. I was at first not interested because it meant I would have to give up further studies. But then I realized that this office required much travelling which would give me opportunities to study the geology of the region. The position was for two years. In two years it should be possible to write a description concerning the geology of the region and also carry out my duties. I decided to run due to the enthusiastic help of my friends. I think the campaign began in July. I was given a glimpse of the local politics as it was in Kansas at that time. The possibilities of my winning the election I will never know. Help was given to me from many sources. The out-going superintendent gave me his recommendation, a leading man in a certain township for whom a couple of years before I had the privilege of doing a good deed, sent word that the people of his district would vote for me. A veteran in the politics of the community hinted that I should send beer to some before the primary and give talks at other places about the dangers of alcohol. Others who were interested in getting the Swedish vote helped me to become acquainted here and there. The campaign had not been going on for more than two weeks when I realized that I was not qualified for a political office. An unexpected call to become a professor of natural history in Rock Island made me give up my political career. There was much for a newcomer to learn about the geology of Illinois. A couple of years later I came back to Kansas to continue my study of volcanic ashes in New Gottland. My contribution by this study was a short treatise concerning this earth stratum. The complete geology report of the McPherson county locality has not been written yet. The rich knowledge concerning the layers of earth is still unknown. Someday when the teachers of Bethany do not have to have an extra job to support themselves and their families, perhaps a Bethany archeologist will give us information.

Another memory from Lindsborg was the discovery of Indian mounds by Paint Creek. An upper classman, Mr. Otto Håkanson, was the first to tell me about the mounds. For five years I often visited these mounds accompanied either by my wife, one of the professors, or several students. A couple of times we were given help by farmers who drove us to the mounds taking with them plows and tools. Students did the excavation.

Mr. C. A. Hven was the most persistent and consequently secured the best prize; a piece of chain mail which, no doubt, was part of the armor worn by one of Coronado's soldiers. It was rust-bound, yet held together even though it was hit by a spade. We gathered around to watch C. A. Hven loosen the object. At first we did not realize what it was. It was either of iron or steel. In a conversation with Dr. Nelander on the way out I had made clear to him that these mounds were of remote antiquity, a period referred to in the books as the period of the Mound Builders. These Mound Builders had no knowledge of iron or steel, yet here we had piece of one or the other. This discovery would be of more than unusual interest. We photographed the cuirass. It was necessary to do this because there was as yet no museum at Bethany. It was a good thing we did, because the piece of armor was lost soon after I came home from a trip to Junction City, and has not yet been found. Later I was given the opportunity to describe the other pieces of antiquity in an article entitled: "An Old Indian Village." This treatise brought me ample testimonies in a review written by one of our foremost ethnographers in the East. I ran out of funds while gathering these ancient pieces. During the five years I was collecting this material, the livery stable, rent and helpers cost me over one hundred and twenty-five dollars. I have often wondered if the recognition I received from Prof. Hodge was worth the time and money. Does it pay for a young man of moderate means to "cast his bread upon the waters" as the scripture says? The question is answered in different ways by different people. It has significance for everyone.

I do not recall much concerning the social life of Lindsborg. My wife and I did not have much time for such. She had her boys and me for whom to care. I had lessons to learn, lectures to deliver, compositions to correct besides writing for newspapers in order to get extra money. We did attend one or two gatherings

and invited friends to our home occasionally. It was especially pleasant to be guests in the country home of some of the older settlers. I do remember one episode in which I felt chagrined. It was the time when I brought home a couple of guests and forgot to tell my wife until they arrived. The guests were one of the most respected farmers and his wife. The man was also a member of the College board. An explanation of my forgetfulness would have made matters worse. If those concerned read these lines, I want them to know that the fault was altogether mine and I have never been more embarrassed. I am sure the quests could not help but sense that something was wrong. Fortunately, the guests were understanding people.

The best, and for me the most worthy, memories of Lindsborg concern the people who lived there at the same time I did. Among them were Dr. Olsson and Dr. Swenson. The greatest privilege a young man can enjoy is to associate with honest, sincere and strong personalities. Dr. Olsson and Dr. Swenson were such personalities. In many ways, these two men were opposites, but in their most important characteristics they were the same. Both were deeply interested in the welfare of mankind. Both had the truly human and Christ-like characteristic which was shown in the sincere, personal interest in everyone with whom they associated. Such men influence those who become leaders. Their environment becomes a part of them. They themselves receive strength from the multitude, but give more of themselves to others. Lindsborg and surrounding communities will never forget the worthy and high ideals that were inculcated by these men. I was in contact more with Dr. Swensson than Dr. Olsson. The former was more my age. While at Bethany, I went in debt in order to support my family. My salary was small. I owe a debt of gratitude to these men for the encouragement they gave me. The monetary debt I have paid; the latter I will never be able to pay.

One day in August 1888, my dear wife and I packed our few possessions in a couple of trunks and found ourselves at the depot with our two sons ready to leave this place where we felt so much at home. We thought we were going to be gone for one or two years. The train started to leave. Soon we saw the beautiful trees beside the Smoky Hill River disappear. Our attention was for some reason drawn to our two boys, Jon and Anton, who were gazing regretfully out the window. Our thoughts were mutual. This was our last memory of Lindsborg. When the conductor came for our tickets the spell was broken. We turned our thought to a new home and a new field of work in Rock Island, Illinois.

Notes

List of Papers by Johan A. Udden

Marlin F. Hawley
Wisconsin Historical Society

The Kansas Anthropologist 23:51-56

The list of Udden's published papers presented here is based on Udden's own privately printed 1924 compilation of his writings, as well as the list of publications presented by Charles L. Baker in his 1933 "Memorial of Johan August Udden" in the Bulletin of the Geological Society of America *44:402-413 and by Monica Heiman in her 1963 biography,* A Pioneer Geologist, Biography of Johan August Udden. *Udden's list omits several entries included in the list by Heiman and vice versa. In a few instances there are discrepancies between dates; generally the date chosen for this list defaults to Heiman's list. The intent is neither a comprehensive bibliography for Dr. Udden nor a finding aid but rather to give readers unfamiliar with his oeuvre an idea of his of scientific interests and output.*

1891

Megalonyx Beds in Kansas. *American Geologist* 7:340-345.

1893

On a Natural Formation of Pellets. *American Geologist* 11(April):268-271.

1894

Erosion, Transportation, and Sedimentation Performed by the Atmosphere. *Journal of Geology* 2:318-331.

1895

A Geological Section Across the Northern Part of Illinois. In *Report of the Illinois State Board of World's Fair Commissioners*, pp. 115-158. H. W. Rokker, Printer, Springfield, Illinois.

A Geological Section of Northern Illinois. *The Mine, Quarry and Metallurgical News* December:28-29. Chicago.

Fossil Frost Cracks. *Scientific American* 72: 102.

1896

Dust and Sandstorms in the West. *Popular Science Monthly* 49(September):655-663.

An Account of the Paleozoic Rocks Explored by Deep Borings at Rock Island, Illinois, and Vicinity. In *17th Annual Report*, Pt. 2, pp.135-155. U.S. Geological Survey, Washington, D.C.

1897

A Brief Description of the Section of Devonian Rocks Exposed in the Vicinity of Rock Island, Illinois, with a Statement of the Nature of its Fish Remains. *Journal of the Cincinnati Society of Natural History* 20(3):93-95.

A New Idea in Corn Culture. *The Orange Judd Farmer*, 22 May.

Loess as a Land Deposit. *Bulletin of the Geological Society of America* 9:7-9; abstract, *American Geologist* 20:274-295 and *Science* (new series) 6:291.

Origin of the Loess. *American Geologist* 20:274-275.

1898

A New Well at Rock Island, Illinois. *The American Geologist* 21(March):199-200.

Some Pre-glacial Soils. *Proceedings of the Iowa Academy of Sciences* 5:93-95 and *American Geologist* 21:262-264.

The Pine Creek Conglomerate. *Proceedings of the Iowa Academy of Sciences* 6:54-56.

Fuciods or Coprolites. *Journal of Geology* 6:189-193.

The Mechanical Composition of Wind Deposits. Augustana Library Publications No. 1. Augustana College, Rock Island, Illinois. 69 p.

A Geological Romance. *The Popular Science Monthly* 54(December):222-229.

1899

Diatomaceous Earth in Muscatine County. *Proceedings of the Iowa Academy of Sciences* 6:53.

Some Cretaceous Drift Pebbles in Northern Iowa. *American Geologist* 24(December):389, 390.

The Sweetland Creek Beds. *Journal of Geology* 7:65-78.

Dipterus in the American Middle Devonian. *Journal of Geology* 7:494-495.

The Geology of Muscatine County. *Iowa Geological Survey Annual Report for 1898* 9:247-388.

Some Cretaceous Drift Pebbles in Northern Iowa. *American Geologist* 24:389-390.

1900

An Old Indian Village. Augustana Library Publications No. 2. Augustana College, Rock Island, Illinois. 80 p.

1901

The Geology of Louisa County. *Iowa Geological Survey Annual Report for 1900* 11:57-126.

The Geology of Pottawattamie County, Iowa. *Iowa Geological Survey Annual Report for 1900* 11:199-277.

1902

The Geology of Jefferson County. *Iowa Geological Survey Annual Report for 1901* 12:355-437.

Loess with Horizontal Shearing Planes. *Journal of Geology* 10:245-251.

On the Occurrence of Rhizopods in the Pella Beds in Iowa. *Proceedings of the Iowa Academy of Sciences* 9:120.

Pleuroptyz in the Iowa Coal Measures. *Proceedings of the Iowa Academy of Sciences* 9:121.

1903

The Geology of Mills and Freemont Counties. *Iowa Geological Survey Annual Report for 1902* 13:123-183.

Foraminiferal Ooze in the Coal Measures of Iowa. *Journal of Geology* 11:283-284.

1904

The Geology of the Shafter Silver Mine District, Presidio County, Texas. Bulletin No. 24. University of Texas, Austin. 60 p.

With Wm. B. Phillips and B. F. Hill. *Geologic Map of a Portion of West Texas*. University of Texas Mineral Survey, Austin.

1905

On the Cyclonic Distribution of Rainfall. Augustana Library Publications No. 4. Augustana College, Rock Island, Illinois. 2 p., 10 figs.

On the Proboscidean Fossils of the Pleistocene Deposits in Illinois and Iowa. Augustana Library Publications No. 5, pp. 45-47. Augustana College, Rock Island, Illinois.

1906

Cyclonic Distribution of Precipitation. *Proceedings of the Iowa Academy of Sciences* 13:223-225, Pl. 27.

The Origin of Small Sand Mounds in the Gulf Coast Country. *Science* 23:849-851.

Fossil Tracks in the Del Rio Clay. *Transactions of the Texas Academy of Science* 9:51-52

1907

A Sketch of the Geology of the Chisos Country, Brewster County, Texas. Bulletin No. 93 and Scientific Series No. 11. University of Texas, Austin. 101 p.

A Report on the Geological Survey of the Lands Belonging to the New York and Texas Land Company, Ltd., in the Upper Rio Grande Embayment in Texas. Augustana Library Publications No. 6, pp. 51-107. Augustana College, Rock Island, Illinois. 46 p., 1 map, 7 pl.

1908

A Cycad from the Upper Cretaceous in Maverick County, Texas. *Science* (new series) 28(31 July):159-160.

Defects in Coal Number 5 at Peoria. In *Year-Book for 1907*, pp. 255-267. Bulletin No. 8. Illinois State Geological Survey, Urbana. 22 p., 1 pl.

With F. W. DeWolf. Notes on the Belleville-Breese Area. In *Year-Book for 1907*, pp. 246-254. Bulletin No. 8. Illinois State Geological Survey, Urbana.

Artesian Wells in Peoria and Vicinity. In *Year-Book for 1907*, pp. 318-334. Bulletin No. 8. Illinois State Geological Survey, Urbana. 22 p., 1 pl.

1909

With Edward Bartow, S. W. Parr, and George T. Palmer. *Mineral Content of Illinois Waters.* Bulletin No. 10. Illinois State Geological Survey, Urbana. 192 p., 1 fig., 9 pls. 8-21.

1910

Observations on the Earthquake in the Upper Mississippi Valley, May 26, 1909. *Transactions of the Illinois State Academy of Science* 3:132-134.

Observations on the Earthquake on May 26, 1909. *Popular Science Monthly* 73(August): 154-162.

1911

Structural Relations of Quicksilver Deposits. *The Mining World* 34(13 May).

The Eastward Extension of the Sweetland Creek Shale in Illinois. *Transactions of the Illinois Academy of Science* 4:103-107.

1912

With B. M. Beausang. Floral Calendar for Rock Island, Illinois. *Augustana Observer* 10:102-105. Rock Island, Illinois.

Museum Buildings in the United States. *Science* 36:110-112.

Oil and Gas Fields of Wichita and Clay Counties, Texas. *Mining and Engineering World* 36:767.

Geology and Mineral Resources of the Peoria Quadrangle, Illinois. Bulletin No. 506. U.S. Geological Survey, Washington, D.C. 103 p., 2 maps.

Potash in the Permian Rocks of Texas. *The American Fertilizer* 37(14 December):40-41.

With D. M. Phillips. *A Reconnaissance Report on the Geology of the Oil and Gas Fields of Wichita and Clay Counties [,Texas].* Bulletin No. 246 and Scientific Series 23. University of Texas, Austin. 308 p., 8 figs., 26 pls.

1913

On the Trail of a Catastrophe. *The Texas Magazine* 7(3):242-244.

Blocks and Segments. *Science*, New Series, 37(958)(9 May).

The Effects of Leaching on Drift Pebbles. *Journal of Geology* 21(6)(September-October):564-567.

1914

Flattening of Limestone Gravel Boulders by Solution. *Bulletin of the Geological Society of America* 25(1)(March):66-68. 1 pl.

The Buck Zinc Prospect Near Boracho, Texas. *Mining and Scientific Press* 108(12)(21 March):493-494.

The Deep Boring at Spur [Dickens County, Texas]. Bulletin No. 363. University of Texas, Austin. 101 p., 19 figs., 15 pls.

Science in Newspapers. *Popular Science Monthly* 84(5)(May):483-489.

Continental Physiographic History Recorded on the Rio Grande. *Texas School Magazine* 16(9)(May):13-15.

Mechanical Composition of Clastic Sediments. *Bulletin of the Geological Society of America* 25(14 December):655-744.

Some Deep Borings in Illinois. Bulletin No. 24. Illinois State Geological Survey, Urbana. 141 p., 4 pls.

1915

With E. W. Shaw. *Belleville-Breese, Illinois. Geological Atlas of the United States*. Folio No. 195. U.S. Geological Survey, Washington, D.C. 13 folio pages, 1 pl., 4 maps.

Potash in the Texas Permian. Bulletin No. 17 (March). University of Texas, Austin. 59 p., 1 fig.

Thrall Oil in Serpentine. *The Oil and Gas Journal* 13(46):27. Tulsa, Oklahoma.

The Age of the Castile Gypsum and the Rustler Springs Formation. *American Journal of Science* 40(August):151-156.

Oil in an Igneous Rock. *Economic Geology* 10(September-October):582-585.

1916

Notes on Ripple Marks. *Journal of Geology* 24(2)(February-March):123-129.

[List of] Geological Maps in Texas. In *Annual Report [for the Bureau of Economic Geology and Technology] for the Year Ending December 31, 1915*, by M. E. Stiles, pp. 17-21. Bulletin No. 35. University of Texas, Austin. 1 pl.

With C. L. Baker and E. Böse. *Review of the Geology of Texas*. Bulletin No. 44. University of Texas, Austin. 167 p., 12 figs., 1 map.

The Iron Ores of Llano County, Texas. *Manufacturers Record* 70(16)(19 October):55.

With H. P. Bybee. *The Thrall Oil Field*. Bulletin No. 66. University of Texas, Austin. 83 p., 7 pl., 7 figs.

1917

Good Roads an Investment. *Farm and Ranch* 36(5)(3 February):33. Dallas, Texas.

Road Maintenance and Erosion. *Farm and Ranch* 36(10)(10 March):p. 2. Dallas, Texas.

Hints to Prospective Geologists. *Bulletin of the Southwestern Association of Petroleum Geologists* 1:127-130.

Foreward. In *The Rustler Springs Sulphur Deposits*, by E. L. Porch, Jr., pp. 7-9. Bulletin No. 1722. University of Texas, Austin.

A Texas Meteor. *Science* 46(21 December):616- 617.

Notes on the Geology of the Glass Mountains. Bulletin No. 1753. University of Texas, Austin. 177 p., 1 map, 3 pls.

The Texas Meteor of October 1, 1917. Bulletin No. 1172. University of Texas, Austin. 56 p.

Geology of the Texas Quicksilver Deposits. *Texas Mineral Research* 1:1-2, 28-29.

1918

Discussions of papers presented at the meeting of the American Institute of Mining Engineers in St. Louis, October, 1917. *Bulletin of the American Institute of Mining Engineers* 133(January):17, 18, 91, 93-95.

Fossil Ice Crystals. An Instance of the Practical Value of "Pure Science." Bulletin No. 1821 (10 April). University of Texas, Austin. 8 p., 10 pls.

The Anticlinal Theory as Applied to Some Quicksilver Deposits. Bulletin No. 1822. University of Texas, Austin. 30 p.

Forecast of Oil Development in Texas. *Manufacturers Record* 73(19)(9 May):64.

Funnel and Anticlinal Ring Structure Associated with Igneous Intrusions in the Mexican Oil Field (Discussion). *Bulletin of the American Institute of Mining Engineers* 133:93-95.

The Theory of Volcanic Origin of Salt Domes. (Discussion of De Golyer's paper). *Bulletin of the American Institute of Mining Engineers* 139:1147.

1919

With V. V. White. Microscopic Characteristics of the Bend and the Ellenburger Limestones. Austin, Texas. 25 mimeographed pages with 20 photographs of the microscopic texture of these rocks as seen in thin sections. Edition limited to 300 copies.

Aids to Identification of Geological Formations. Handbook Series No. 1. Bureau of Economic Geology and Technology, University of Texas, Austin. 69 p.

Probable Life of Texas Oil Fields. *Oil News* 5 July:7. Chicago, Illinois.

Oil Bearing Formations in Texas. *Bulletin of the American Association of Petroleum Geologists* 3:82-98.

Observations on Two Deep Borings Near the Balcones Faults. *Bulletin of the American Association of Petroleum Geologists* 3:124-131.

With V. V. Waite. Observations on the Bend in Bough No. 1 in Brown County (Texas). *Bulletin of the American Association of Petroleum Geologists* 3:334-344.

With C. L. Baker and Emil Böse. *Review of the Geology of Texas*. 3rd printing, revised. Bulletin No. 44. University of Texas, Austin. 164 p., illustrations, map.

1920

Letter in symposium "Standardize the Word Geologist." *Oil News* 8(12)(20 May):22-23. Chicago.

Suggestions of a New Method of Making Underground Observations. *Bulletin of the American Association of Petroleum Geologists* 4(1):83-85.

1921

Chronology in Geology. *Bulletin of the Geological Society of America* 32(1)(March):21-23.

Characteristics of Some Texas Sedimentary Rocks as Seen in Well Samples. *Bulletin of the American Association of Petroleum Geologists* 5(3):373-385.

The Troup, Texas, Meteorite. *Proceedings of the United State National Museum* 59: 471-476. 1 pl., 2 figs.

On the Discovery of Potash in West Texas. *Chemical and Metallurgical Engineering* 25(26)(28 December):1179-1180.

1922

Research Funds in the United States. *Science* 54(13 January):51-52.

With T. E. Savage. The Geology and Mineral Resources of the Edgington and Milan Quadrangles. In *Year-Book for 1917 and 1918*, pp. 117-208. Bulletin No. 38. Illinois State Geological Survey, Urbana. 96 p., 20 figs., 1 pl., 6 tables.

Some Cavern Deposits in the Permian of West Texas. *Bulletin of the Geological Society of America* 33(1):153-155.

Wide Extent of Texas Potash Formations. *Pan-American Geologist* 37:249-251.

Potash Wells in Western Texas. *Pan-American Geologist* 37:344-345.

1923

The "Rim Rock" of the High Plains. *Bulletin of the American Association of Petroleum Geologists* 7(January-February):72-74.

By Reginald Aldworth with discussions by J. A. Udden and others. Earth's Crust and Its Evolution. *Bulletin of the Geological Society of America* 34:61-62.

1924

Laminated Anhydrite in Texas. *Bulletin of the Geological Society of America* 35:347-354. 4 pl.

Laminated Anhydrite in Texas. *Pan-American Geologist* 41:227.

1925

Etched Potholes. Bulletin No. 2509. University of Texas, Austin. 9 p., 6 pls.

Study of the Laminated Structure of Certain Drill Cores Obtained from the Permian Rocks of Texas, with Particular Reference to the Bearing of the Stratigraphic Sequence upon Problems of Climatic Variation. *Carnegie Institute Yearbook* No. 24:345.

Texas Bureau of Economic Geology [activities]. *Pan-American Geologist* 44:327-328.

A Sketch of the Geology of Texas. In *Texas Almanac and State Industrial Guide*, pp. 158-159. Belo and Company, Dallas, Texas.

Nature Sketches. Augustana Book Concern, Rock Island, Illinois. 72 p.

Preface. In *Geology of a Part of Western Texas and Southeastern New Mexico, with Special Reference to Salt and Potash*, by Harold W. Hoots, pp. 33-126. Bulletin No. 780. U.S. Geological Survey, Washington, D.C.

Contribution to *Researches in Sedimentation in 1924; Report on the Committee on Sedimentation* by Twenhofel, Henry, and others. Issued in mimeograph form by the National Research Council, Washington, D.C.

1926

The Southwest Earthquake [of July 30, 1925]. Bulletin No. 2609. University of Texas, Austin. 32 p., 1 map.

1927

Fossils from the Word Formation of West Texas (abstract). *Bulletin of the Geological Society of America* 38:159 and *Pan-American Geologist* 47:156.

With V. V. Waite. *Some Microscopic Characteristics of the Bend and Ellenburger Limestones*. Bulletin No. 2703. University of Texas, Austin. 8 p., 9 pl.

1928

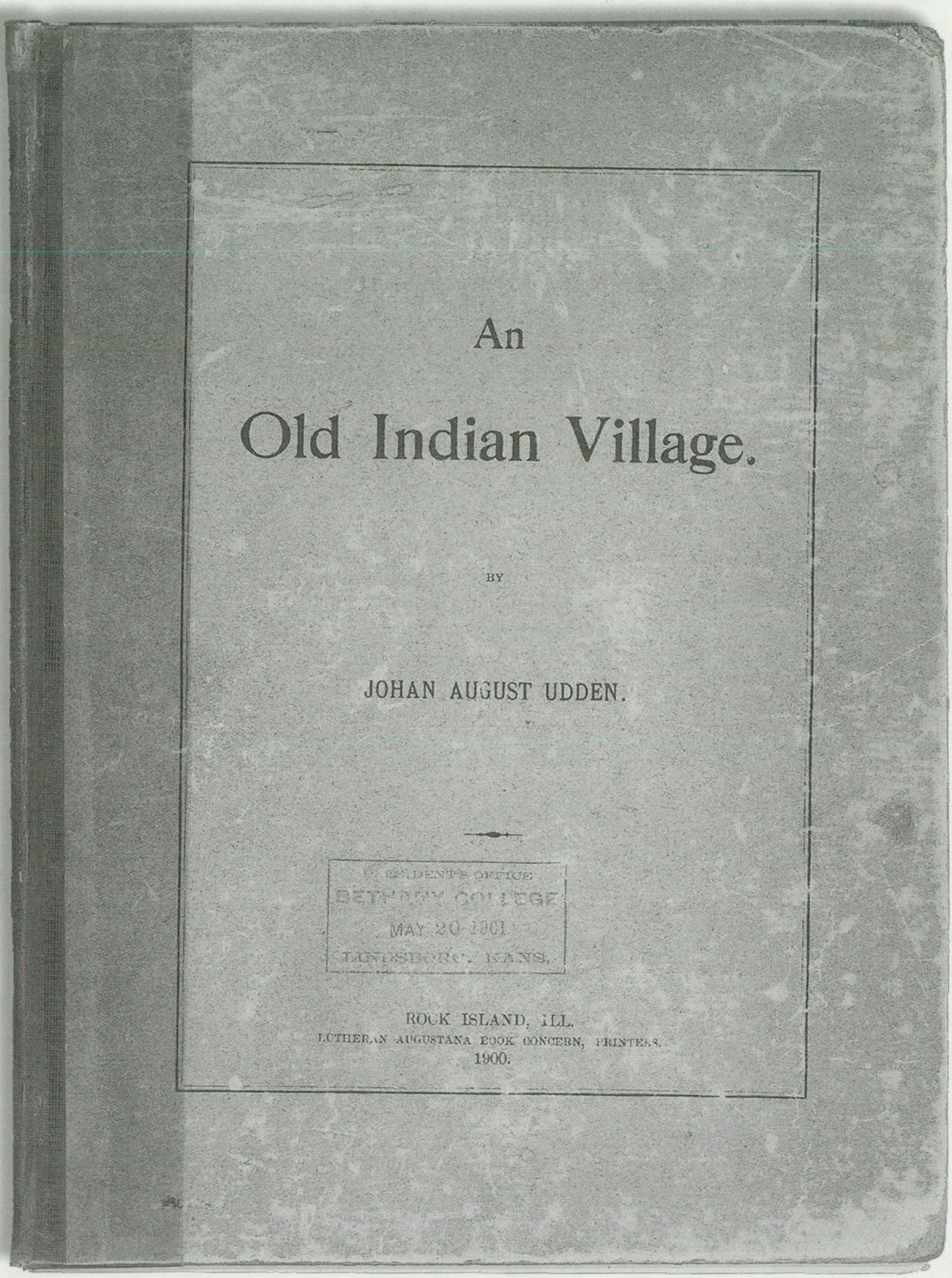
A Neglected Field in Stratigraphy. In *Contributions to Geology, 1928*, pp. 55-66. Bulletin No. 2801. University of Texas, Austin.

Potash in Texas. *International Bergwirtschaft* 3, H. 4-5:80-81.

Study of the Laminated Structure of Certain Drill Cores Obtained from Permian Rocks of Texas. *Carnegie Institute Yearbook* No. 27:363.

1929

With E. H. Sellards. *Contributions to Geology, 1929*. Bulletin No. 2901. University of Texas, Austin. 226 p., 6 pls.



An

Old Indian Village.

BY

JOHAN AUGUST UDDEN.

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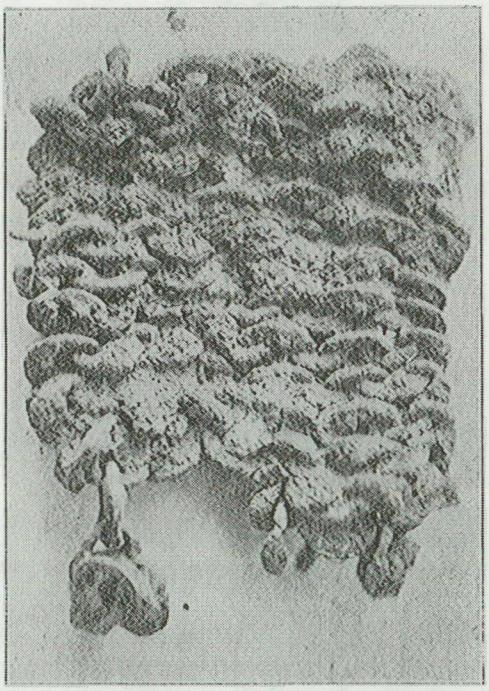

A piece from a chain mail, found on the old village site on Paint creek, McPherson county, Kansas.

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BY

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CONTENTS.

Page.

Frontispiece 2
Contents 5
Author's note 7
INTRODUCTORY 9
THE PAINT CREEK DWELLING SITES 12
STRUCTURE OF THE MOUNDS 14
ANIMAL BONES 16
ARTICLES MADE FROM BONE AND SHELL 17
- Hoes 17
- Gouges 17
- Notched bone 17
- Flakers 18
- Hairpins? 19
- Beads 19
- Spoons of shell 19

POTTERY 23
- Forms and kinds of vessels 23
- Methods of fastening the handles 27
- Ornamentation 28

ARTICLES MADE OF CHERT 31
- Scrapers 31
- Irregular forms of scrapers 34
- Flint knives 39
- Arrowpoints 40
- Spearheads 41
- Awls 46
- Drills 47
- Leaf-flints and tomahawks 47
- Hand hammers 49

ARTICLES MADE FROM SANDSTONE 50
- Grindstones 50
- Arrow-smootheners 53
- Cupped stones 56

CATLINITE PIPES 57
ARTICLES MADE FROM VARIOUS MATERIALS 59
- Stone mallets 59
- Throwing-stones? 64
- A problematic relic 65

A PIECE OF AN OLD ARMOR 66
PROBABLE CHARACTERISTICS OF THE TRIBE 68
INVENTORY OF THE VILLAGE RELICS 69
ETHNIC RELATIONSHIP 71
A VISIT FROM THE SPANIARDS? 73
INDEX 79

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AUTHOR'S NOTE.

In the fall of 1881, while engaged as instructor in Bethany Academy, now Bethany College, at Lindsborg, Kansas, one of my scholars called my attention to some mounds south of the Smoky Hill river, where various antiquities had been picked up by the settlers. I visited the locality and saw that it gave promise of interesting finds of aboriginal relics. Here was something worth taking care of. During the subsequent seven years I frequently went to the place, sometimes in company with fellow teachers and with students. The contents and the structure of the mounds were noted and their locations were marked on a small plat of the land. In course of time a collection of relics accumulated. This is yet intact in the possession of the institution in whose service I was then employed, and additions are still being made by my successor Professor J. E. Welin.

At the Emporia meeting of the Kansas Academy of Science in 1886 I made a brief report of my observations on these antiquities. But it was impracticable at that time to present the details. It seems that these mounds and their relics are of more than passing interest and in a way are representative of the archæology of the state. Before I parted with the material which had been secured up to 1889, I concluded to write an account of the collections then on hand. This account has served as a basis for the present paper.

In preparing the following pages I have deliberately had two objects in view. I have sought to present some brief and correct descriptions of a collection strictly limited to one single locality. This is done in the hope that the descriptions together with the photographic reproductions presented in the figures and plates may prove serviceable to science. The author is, however, no archæologist. This will be his last as well as his first paper bearing on topics of this kind, unless, perchance, he should again find his residence in the front yard of some prehistoric domicile. I have also sought to write these few pages in such a way that they may prove profitable reading to such of the general public as are interested in the study of Indian relics. It is believed that the material lends itself to such a double purpose.

The average American has a scientific instinct, which he is fond of cultivating wherever he be. Many farmers, merchants, and professional men in the West are making small collections of Indian relics. Should this paper come into the hands of collectors or students of this class, I hope that it may whet their appetite for more and better literature of the same kind. I also hope that it may aid and encourage them in their efforts to study and to take care of the antiquities ***found in their own immediate vicinity.*** *To do this is at the same time their particular privilege and their special duty to the cause of science.*

To former pupils, fellow teachers, and others who aided in making the explorations on Paint creek I extend my thanks and my greetings of most pleasant recollections. In particular I keep in grateful remembrance the kindly interest, aid, and valuable advise always freely bestowed by the venerable pioneer and scientist Dr. John Rundstrom, formerly of McPherson county, Kansas. For special aid in preparing the paper I am under obligations to Dr. C. A. Swensson, president of Bethany College, to Professor Frank Nelson, Superintendent of Public Instruction of the State of Kansas, and to Professor J. E. Welin of Bethany College.

The photographs for the illustrations were, with one exception, made by Mr. B. G. Gröndahl of Lindsborg, Kansas, and figures 6 and 27 were drawn by Professor Olof Grafström of Rock Island, Ill.

J. A. U.

Augustana College, May 1st, 1900.

INTRODUCTORY.

The monuments left by prehistoric races in the United States are much more numerous in the eastern part of the Mississippi valley than over the Western Plains. This is plainly shown on a map issued some years ago by the Bureau of Ethnology and prepared to exhibit the geographical distribution of prehistoric works east of the Rocky Mountains.* From the Mississippi river and eastward, the localities of mounds and other prehistoric works appear numerous and crowded, while westward from the great river they are few and scattered. Evidently in prehistoric times as at present the more fertile and more richly watered eastern plains afforded a more congenial environment to the inhabitants than the less favored western country. In another respect, also, the monuments of early man in America bear witness to a comparatively small population in prehistoric times westward from the great river. On the Western Plains we find none of those magnificent earthen structures, that were erected by the prehistoric people of the Ohio valley and by those who dwelled near the Mississippi. The conditions of existence in the west evidently did not result in the development of such powerful communities as could spare the energy needed for the construction of great mounds.

* Catalogue of Prehistoric Works east of the Rocky Mountains, by Cyrus Thomas, Smithsonian Institution, Washington, D. C., 1891.

But the greater observed frequency of antiquities east of the Mississippi river is to some extent due to a less complete knowledge of the western territory. A number of explorers have been at work in the eastern territory for more than three quarters of a century, while comparatively few have paid any attention to archæological explorations on the west slope of the great central valley, and this for only the last few decades. This region has only tardily received the attention it deserves. There can be no doubt that future work will bring to light many more localities in the west where prehistoric man has left traces of his existence. Some recently made discoveries give decided promise that this will be the case. In the last few years Mr. J. V. Brower has located some sixty hitherto unknown sites of aboriginal villages in the eastern part of the state of Kansas,* and others have reported similar localities from the region north of this state.

From such explorations in Kansas as are known to the author of this paper, it appears that the antiquities in this state are associated with two distinct types of mounds: burial mounds and elevated dwelling sites. Many of the latter, perhaps the greater number, are no mounds at all but merely the flat surface of the ground where the dwellings of an earlier race have once been standing. These would never be noticed, were it not for the relics of household art, chase, and warfare scattered about the place. But frequently there occur

* Memoirs of Explorations in the Basin of the Mississippi, Vol. II, Harahey, by J. V. Brower, p. V., St. Paul, 1899.

together with these relics heaps of earth a foot or two high and perhaps a rod wide. These village sites, as they have been called, do not occupy any conspicuously high places, but usually lie on or near some flat and fertile lowlands as on the border of an alluvial plain. The burial mounds are different. They are higher and somewhat less flat on top. Frequently there is a pile or a layer of rocks within them, and under this, some human remains. They are usually built on high bluffs or on upland hills overlooking some extensive lowlands. They can almost always be found on bluffs near the junction of larger streams and their size is somewhat proportionate to that of the confluent waters. Mounds of this kind have been reported from near the mouth of the Kansas,* near the junction of the Big Blue and the Kansas, and near the junction of the Republican and the Smoky Hill.** The author has seen some along the Smoky Hill river west of the latter locality and on several of the high buttes in Saline and McPherson counties, and he has opened two in the latter county. One of these is on the summit of the highest butte of the Smoky Hills and the other is west of Gypsum creek near the northeast corner of McPherson county. Both mounds were partly built of rocks, under which there were charred human bones and some roughly chipped flints. In the present state of our knowledge of the antiquities of Kansas we are hardly justified in making any conjectures as to whether these two types of mounds

* Traces of the Aborigines in Riley County. Prof. G. H. Failyer. Trans. of the Kansas Acad. of Sci., 1879—1880, p. 132.

** Kansas Mounds, F. G. Adams. Trans. of the Kansas Acad. of Sci., 1877—1878, p. 51.

are the products of two different people or whether they have been made by the same race for different purposes. In either case there is little doubt that the burial mounds served some purpose in connection with some mortuary or religious customs, or possibly military practices, among entire tribes or nations, while the dwelling sites merely mark the place of the abode of some household or clan, occupied in ordinary and peaceful every day pursuits.

THE PAINT CREEK DWELLING SITES.*

On the [redacted] bank of Paint creek about [redacted] of the Smoky Hill river in McPherson county there is a group of some fifteen low mounds which must be classified as dwelling sites in an aboriginal village. They are scattered over the [redacted] of the sixth principal meridian. For the most part the group occupies a [redacted] to the [redacted] which extends from the [redacted] bank of the creek. The mounds do not seem to be arranged in any particular order, but the distance separating them is, in most cases, about 125 feet, or a multiple of this distance. (Fig. 1). This left a convenient space beeween the dwellings. A line running through the outer members of

* These are the same mounds that Mr. J. V. Brower has called the Udden Village Site in his Quivira, Vol. I, Memoirs of Explorations in the Basin of the Mississippi, p. 55. It is from no disregard for the distinguished explorer that the present author prefers to here retain the designation above used.

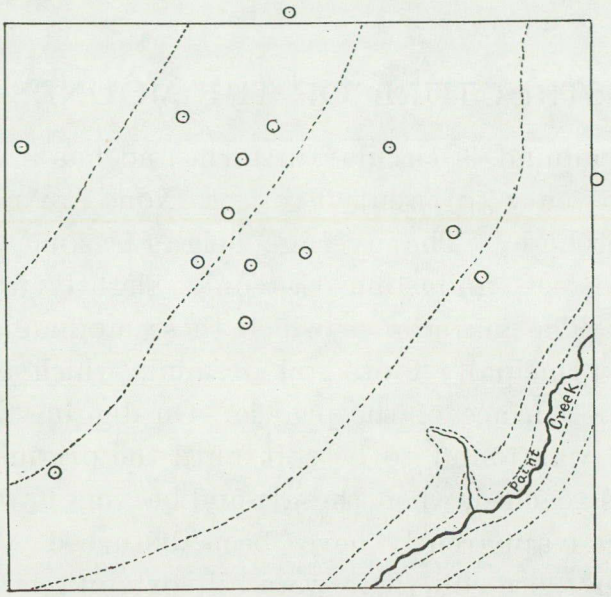

FIG. 1. Plat of the mounds on the old village site on Paint creek in McPherson county, Kansas. The plat covers [redacted] of the sixth principal meridian. The dotted lines are contour lines, with [redacted] intervals.

the group would inclose an area of about twenty acres. The site may have been chosen with regard to convenient access to water and fuel. There are some good springs in the creek a short distance to the south and there is some small timber along its banks. In other respects the choice seems to have been equally fortunate. To the south and west there is a gravel containing boulders of chert, from which darts and scrapers could be made. The southeast slope of the ground would tend to modify the severity of the northwest winds in winter. Fishing was profitable in the Smoky Hill river near by to the north. The surrounding hilly slope of the upland and the river bottoms to the north afforded a variety of game at all seasons. It was an ideal village site for a savage tribe.

STRUCTURE OF THE MOUNDS.

Each mound is circular in form and has a diameter of from twenty to twenty-five feet. None are more than three feet high. The average height is somewhat less than two feet, and some rise only slightly above the ground. The material of which these mounds are composed is principally loose soil or mud, which is heaped up on the surface of the prairie. On digging down the material was found to be soft until the original prairie level was reached, when the ground became hard. Below this it had apparently never been disturbed. Through the upper loose soil there were all sorts of relics, mostly broken. There were also broken bones of animals, pieces of pottery, here and there bits of charcoal, pockets of ashes, flint chips, various kinds of arrowpoints, scrapers, and knives of flint. Occasionally small blocks of sandstone or limestone were met with, which had been subjected to the action of fire. It was not possible to detect any order in the arrangement of the contents of the mounds and there were no buried human remains. Just how the mounds were built seems uncertain. The mud perhaps accumulated inside the dwellings during a repeated residence of the natives, which occurred at some certain season of the year. All the materials found imbedded, were such household goods as may be supposed to have become useless to the inhabitants, or such as may from time to time have been lost. Most of them were broken. The pockets of ashes occasionally found may mark the site of the places where fires were

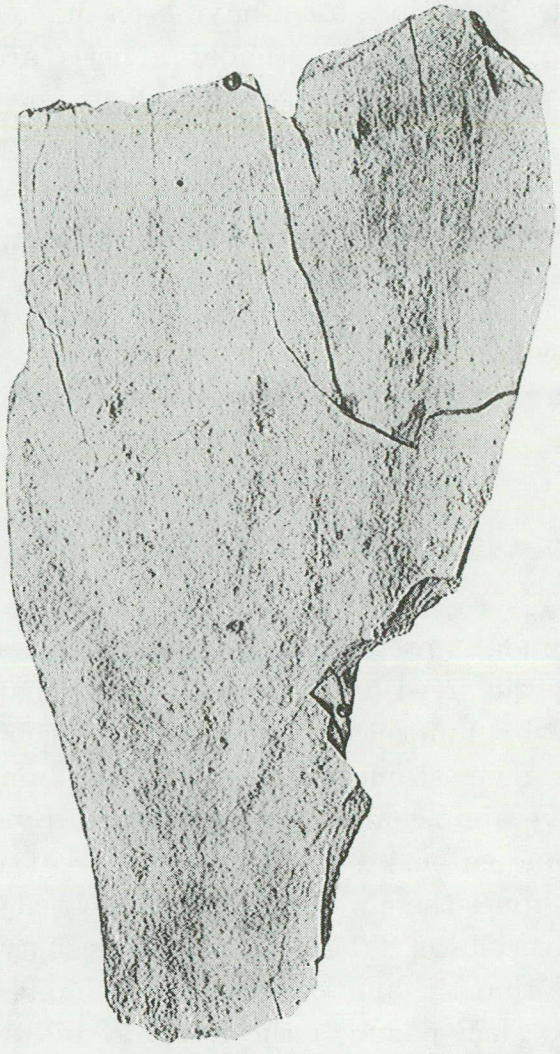

FIG. 2. Hoe, made from a shoulder blade of the bison.
Reduced about ⅛.

made. Possibly the ground was built up for the purpose of keeping the run-off away during rains. If such was the case, additions must have been made from time to time, for discarded household articles are found in the lower part of the heaps as well as in the upper. Evidently the mounds were not completed all at once. The bones found in the upper part are not as far advanced in decay as those found near the bottom. Indeed it seems possible that the mounds may have been built up from wind-blown dirt and sand settling in dwellings which were left vacant during some season by a nomadic tribe which occupied them during only a part of the year.

ANIMAL BONES.

The abundant presence of animal bones testifies that the people who lived here secured a great part of their sustenance by hunting. The meat of the bison must have been their staple food. The long bones of this animal have almost always been broken. Evidently the marrow was eaten. Considering the great number of these long bones there was a noticeable scarcity of skulls, ribs, and vertebras. This circumstance may be taken to indicate that the hunters were in the habit of leaving in the field such parts of the bison as did not furnish the most suitable food. Bones of the antelope, the wolf, the wild-cat, the skunk, and the wild turkey were also observed, as well as the vertebras of various fishes, and the valves of common river clams.

ARTICLES MADE FROM BONE AND SHELL.

Bones were manufactured into various kinds of implements. The shoulder blade of the bison is frequently found beveled on the vertebral border in such a way as to suggest that it has been used as a spade or as a hoe (Fig. 2). From the fragments of the long bones gouge-shaped tools were prepared by beveling one end on the concave side (Fig. 3). About a dozen of these gouges were found, two of them entire, the others being more or less fragmentary. It seems probable that such tools may have been useful in the preparation of hides, or for digging in the ground. One piece of a bone, about eight inches in length, evidently a part of a rib of a bison, was marked by a number of transverse grooves. This may have been some sort of a record or calendar (Fig. 4). Three specimens

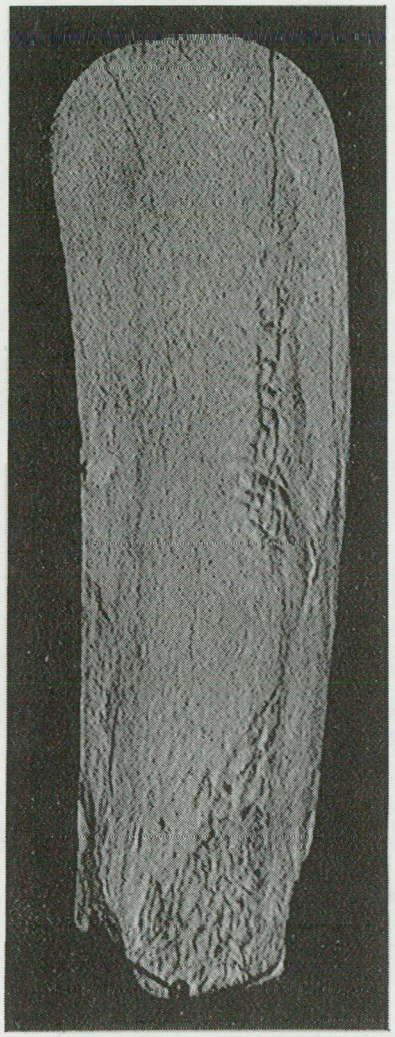

FIG. 3. Gouge-shaped tool made from a long bone of the bison. Reduced about ⅛.

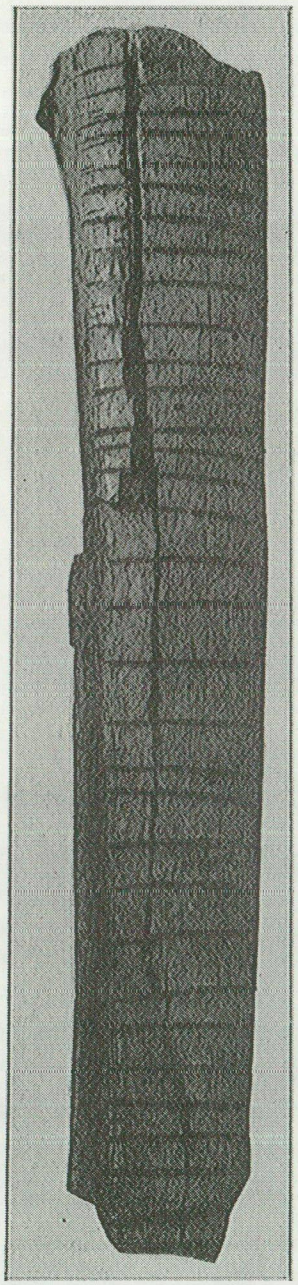

FIG. 4. Notched record on a rib of the bison. Slightly reduced.

of clavicles of some animal were cut off at both ends and smoothened and polished as from wear. It has been suggested that these may have been used as hair-pins (Fig. 5). One specimen of the lower jaw of a bison had the teeth worn down straight and smooth to about half their length, as if rubbed against a concave object. The lower end of a tarsal bone of a prong-horn antelope was detached by a circular groove running around the entire bone. There were three tools of bone shaped with one smooth and rounded end, very much like the handle of a tooth brush and marked by irregular transverse cuts near the other end (Fig. 5). These were perhaps used as flakers in shaping flint tools, for they can still be applied so as to detach small flakes from flint chips. This is described by some ethnologists as being done by holding the flaker firmly in one hand and pressing it against the flint, which is placed between the bone and the thumb and held in the other hand (Fig. 6). In his paper on *Arrowpoints, Spearheads, and*

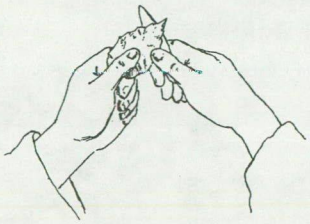

FIG. 6. Method of chipping flint with a bone tool.

Knives of Prehistoric Times Dr. Thomas Wilson has mentioned some similar objects, which are believed to have been used in this way. He says they are usually made of deer horn and are "short and round with a point like one's little finger". It is difficult to see for what other purpose such bones could serve.

A few long beads, made from bones of birds, were picked up (Fig. 5), as were also some bear's teeth.

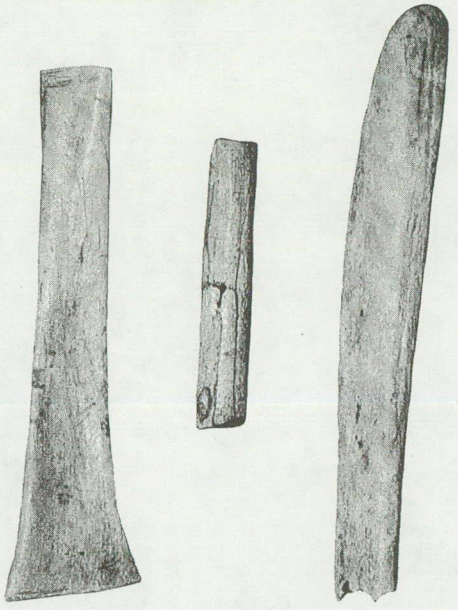

FIG. 5. Figure to the left: hairpin? made of bone. Middle figure: bead made from the bone of a bird. Figure to the right: Flint flaker? made from bone. All slightly reduced.

Two large *unio* shells were found, which had been ground round on the edges and carefully polished so as to resemble spoons. These were in a far advanced state of decay and fell to pieces before they could be properly cared for. It may be of interest to note that these shells, as near as the author could ascertain, belonged to a species which inhabits the water of the Smoky Hill river.

EXPLANATION OF PLATE I.

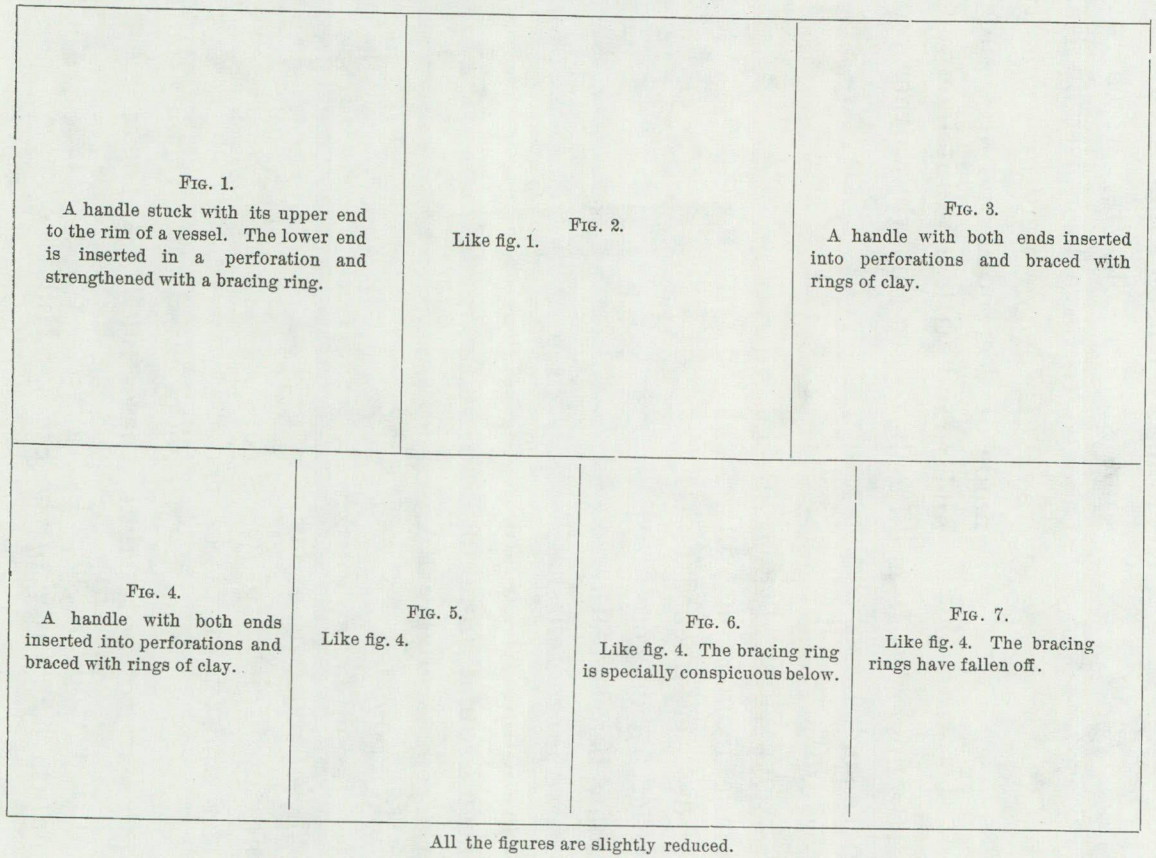

FIG. 1.
A handle stuck with its upper end to the rim of a vessel. The lower end is inserted in a perforation and strengthened with a bracing ring.

FIG. 2.
Like fig. 1.

FIG. 3.
A handle with both ends inserted into perforations and braced with rings of clay.

FIG. 4.
A handle with both ends inserted into perforations and braced with rings of clay.

FIG. 5.
Like fig. 4.

FIG. 6.
Like fig. 4. The bracing ring is specially conspicuous below.

FIG. 7.
Like fig. 4. The bracing rings have fallen off.

All the figures are slightly reduced.

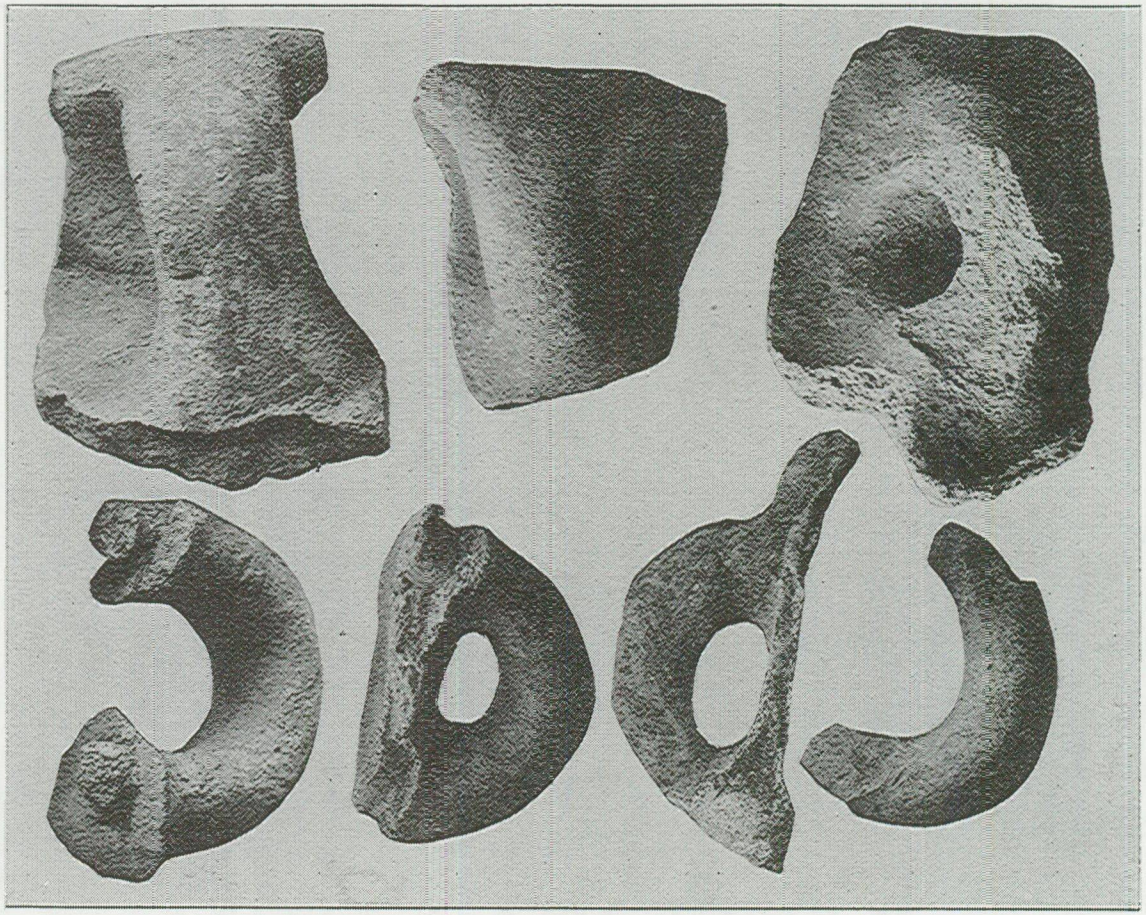

PLATE I.

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POTTERY.

All through the material of the mounds there was a great number of broken pieces of earthenware, several hundreds of which were gathered up. This earthenware is made from a clay which is mixed with sand, ground shells, or bone. It does not show any great skill on part of the workmen. Most of the vessels have been made with little care. This can be seen in the variations in the thickness of the broken pieces and in their uneven edges wherever these follow the upper rim of the vessels. Finger marks are often to be found on the surface of the sherds. The inferior quality of the workmanship is also evident in the method of attachment of the handles and in occasional rude attempts in decoration. The burning also seems uneven and imperfect. Only one vessel was found in nearly entire condition, and the workmanship of this was greatly superior to that of the rest.

Forms and Kinds of Vessels. It is not possible in every instance to make conjectures as to the real shape of the vessels that are thus found only in broken fragments. Some are large enough to indicate the general

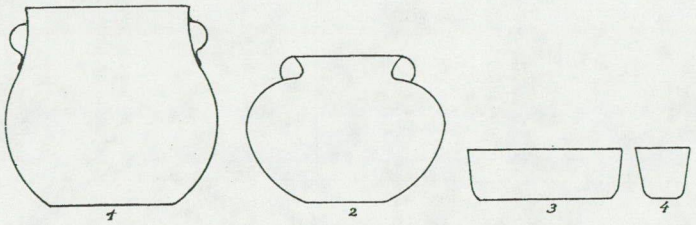

FIG. 7. Various forms of earthenware.
1) Large jar. 2) Smaller jar. 3) Bowl. 4) Cup.

EXPLANATION TO PLATE II.

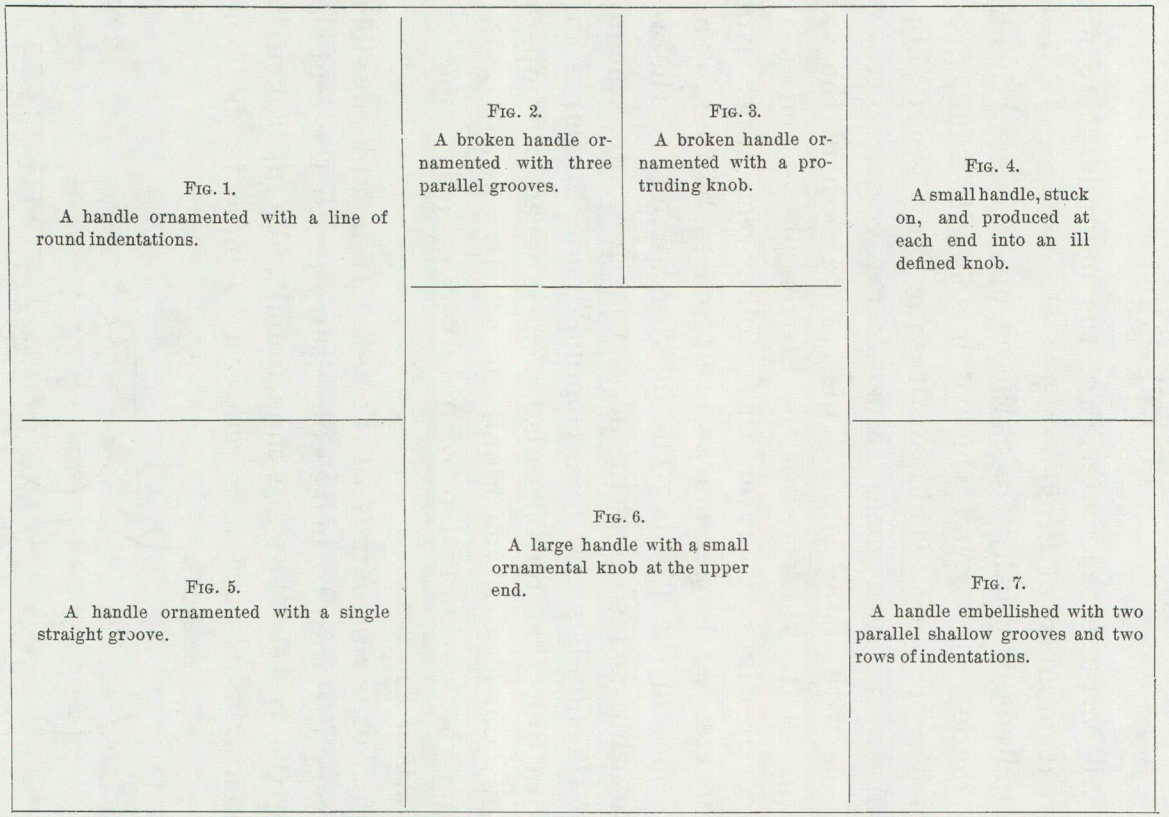

Fig. 1.
A handle ornamented with a line of round indentations.

Fig. 2.
A broken handle ornamented with three parallel grooves.

Fig. 3.
A broken handle ornamented with a protruding knob.

Fig. 4.
A small handle, stuck on, and produced at each end into an ill defined knob.

Fig. 5.
A handle ornamented with a single straight groove.

Fig. 6.
A large handle with a small ornamental knob at the upper end.

Fig. 7.
A handle embellished with two parallel shallow grooves and two rows of indentations.

Figures 1, 3, and 5 are slightly reduced.

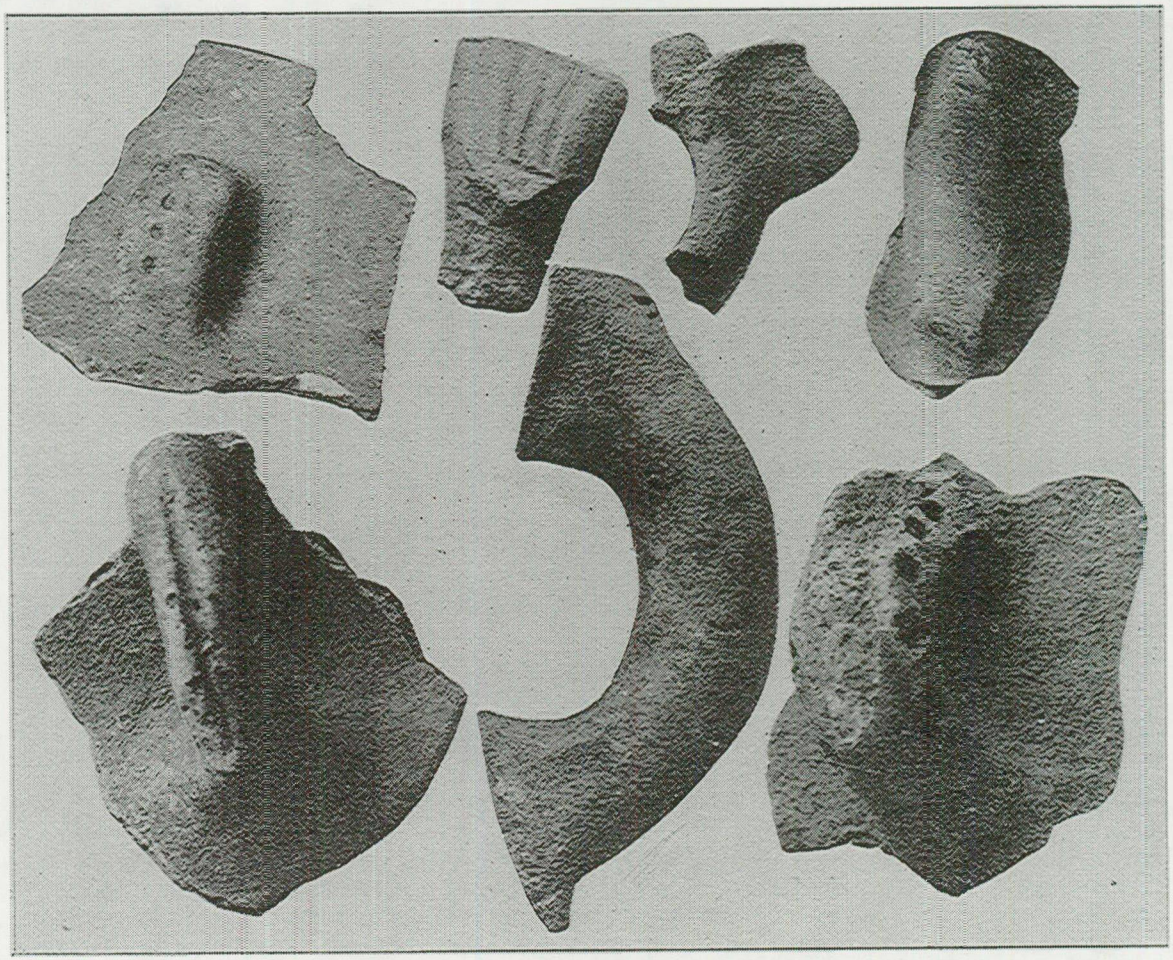

PLATE II.

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form. The greater number appear to have been large jars, about a foot in diameter and from eight to ten inches in height, with an opening more narrow than the widest part (Fig. 7, nos. 1 and 2). The upper rim was either vertical or more or less abruptly flaring. One fragment indicated a form quite similar to that of the modern tea-cup (Fig. 7, no. 4). Another must have been a part of a wide elliptical bowl (Fig. 7, no. 3).

Methods of Fastening the Handles. Handles were attached to the rim of all large pots. There were two methods in use for fastening these to the vessel. One was that of perforating the sides of the vessel and inserting the ends of the handle into the perforation and then bracing it by placing a ring of clay around the inserted ends (Plate II, figs. 4, 5, and 7). The other method consisted in merely plastering the ends of the handle to the outer side of the vessel (Plate II, fig. 3). In some cases the two methods were combined and the upper end of the handle was stuck on the rim, while the lower end was inserted into a perforation (Plate I, figs. 1 and 2). When the handles are stuck on, there is also often a bracing ring applied to make the joint stronger. The first method was used in larger vessels as a rule, and the latter method was more common in the case of the smaller ones. In many cases when the handle is stuck on, it is too small for the insertion of a finger and may have been used for the purpose of suspending the vessels by means of a thong or string. Near the place of attachment of the two ends of the handle, there is often a protruding knob, which may be absent, however, either above or below (Plate I, fig.

6, Plate II, figs. 3, 4, 6). All of the handles observed, with one exception, were placed vertically. In the case of the exception it extended laterally in a horizontal plane, about one inch and a half below the upper rim of the vessel.

Ornamentation. The style of ornamentation occasionally seen on the common pottery is particularly crude and consists mostly in the placing of linear and dotted indentations on the handles, or ears, and on the upper rim of the vessels. (Plate II). These indentations are arranged in the simplest kind of patterns, such as single, double, or triple lines. No attempts to represent animate objects have been observed on any specimens. The convex surface of a few sherds is painted red. On many pieces there were some shallow indentations suggesting partly obliterated impressions of some coarse plaited fabric (Fig. 8), which indicates that the vessels were moulded in some sort of plaited form. This is known to have been a common method of moulding clay among the Indians. On the sherd from the bottom of one vessel there was a circular raised ring (Fig. 9). This seems to be too small for increasing the stability of the vessel on the ground and was perhaps rather intended to secure its equilibrium when placed on the head, where Indian water carriers are in the habit of supporting

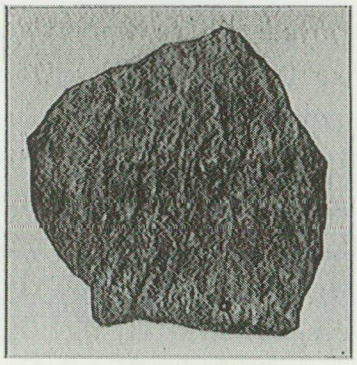


FIG. 8. A potsherd with partially obliterated indentations of some plaited fabric. The impressions are on the outer (convex) surface. Slightly reduced.

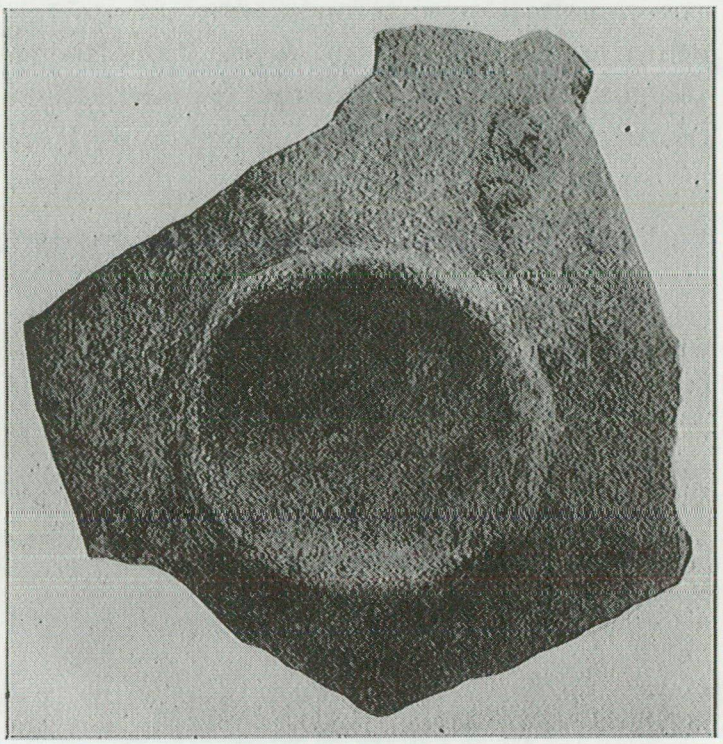


FIG. 9. A potsherd with an elevated ring, forming the base of the vessel. Slightly reduced.

them. In one of the mounds there was found, standing in an upright position, a broken fine vessel of large size, not far from fourteen inches in diameter and about a foot high (Fig. 10). The sides of this vessel were quite thin, only little exceeding an eighth of an inch in thickness. The upper outer surface was decorated by straight parallel lines forming V-shaped patterns. Below the widest part of the vessel the outside was smooth. A number of ears adorned the outside of its upper rim. Parts of the upper rim as well as of the bottom were wanting.

In its imperfection of manufacture and in its crude ornamentation the pottery gathered from the mounds is related to that of the aboriginal people in the northern Mississippi valley.* From the tempering it appears

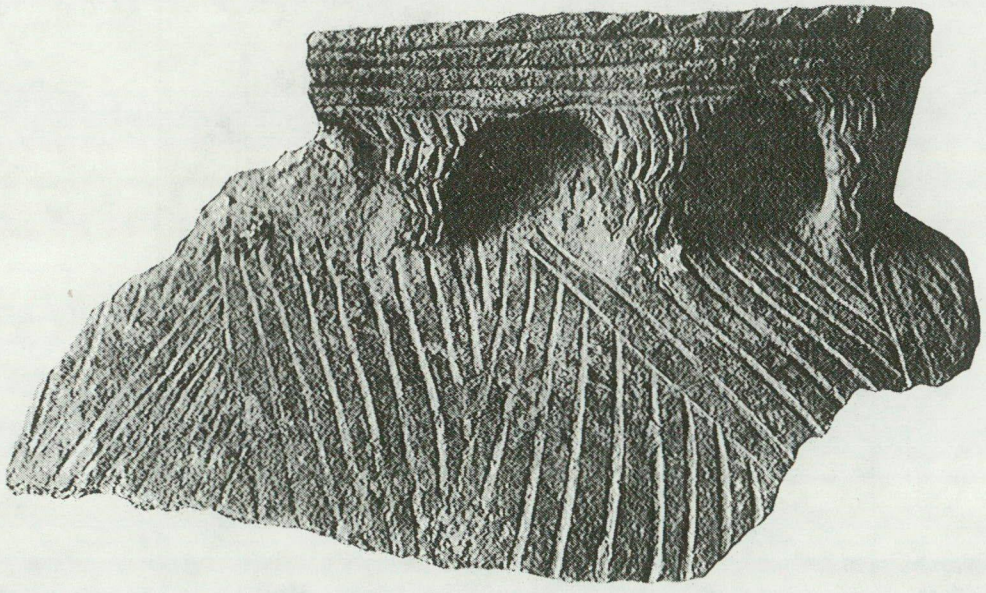


FIG. 10. A piece of a broken ornamented vessel. Slightly reduced.

that the potters were familiar with the use of ground shells, which is found in the southern pottery, as well as with the use of sand, which was commonly mixed with the clay for the same purpose among the prehistoric people in the north.*

* See Ancient Pottery etc., Holmes, Rept. Bur. of Ethn., Smithsonian Institution, Wash., D. C., 1882—1883, p. 426.

ARTICLES MADE OF CHERT.

Chips and implements of flint are found all through the material in the mounds and are scattered on the surface on the ground between them. Some of the chert contains silicified *fusulinas*. This was perhaps brought from the region of the cherty limestone farther east in the state. Other material resembles that found in the Equus gravel and may well have been taken in the surrounding country. It was manufactured into a variety of objects such as scrapers, knives, arrowpoints, spearpoints, awls, drills, hoes, spades, tomahawks, and hand-hammers.

SCRAPERS.

The scraper was the most common tool made from chert. They are found everywhere. The author collected some two hundred specimens and many have been carried away by others. These implements average one and three-fourths of an inch in length and one inch in width. It is triangular, with a rounded point at one end and a convex wider base at the other (Figs. 11, 12 and 13.) The scrapers occur in all conditions of perfection of workmanship and in all stages of wear and hard usage. There are great variations in size. The length runs from seven-eighths of an inch to nearly four inches; the width, from one to two inches; and the thickness, from one eighth of an inch to two thirds.

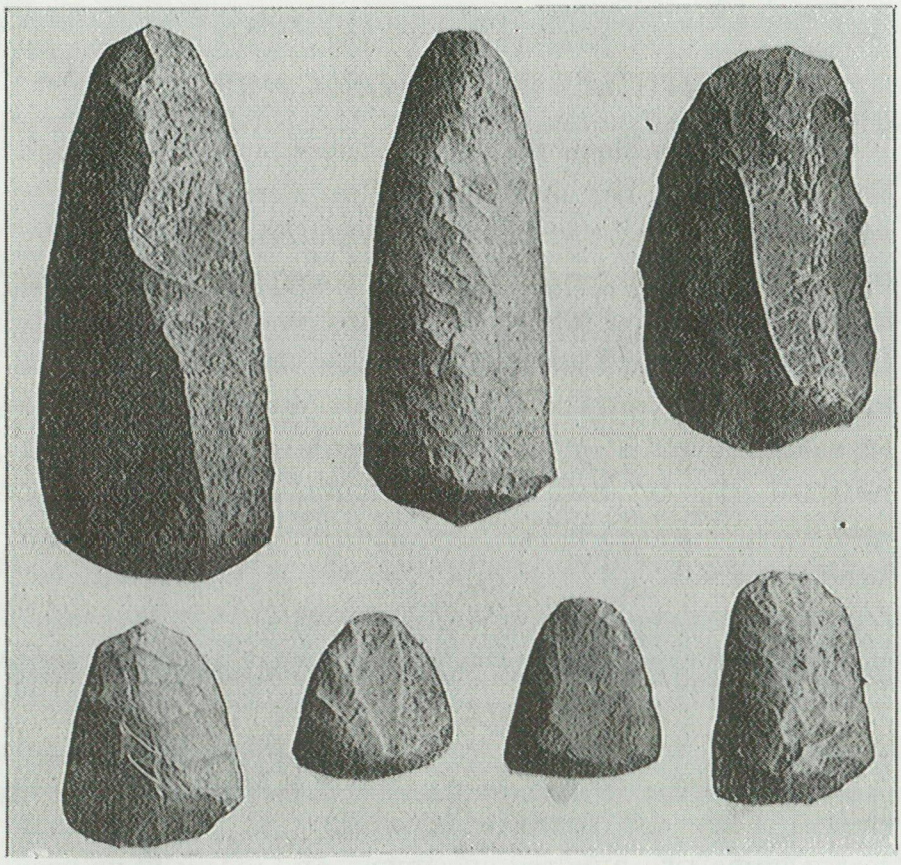


FIG. 11. Typical scrapers. Natural size.

The method of making this tool seems to have determined its form. It is always a flake with one flat side showing no chipping. On this side it was evidently detached from a larger piece of chert. Then the edges were trimmed and straightened by small flaking on the outer convex edges. This was the easiest and quickest way of making an edged tool from chert. Some flakes have been put into service without any finishing whatever, as is evident from their worn unchipped edges.

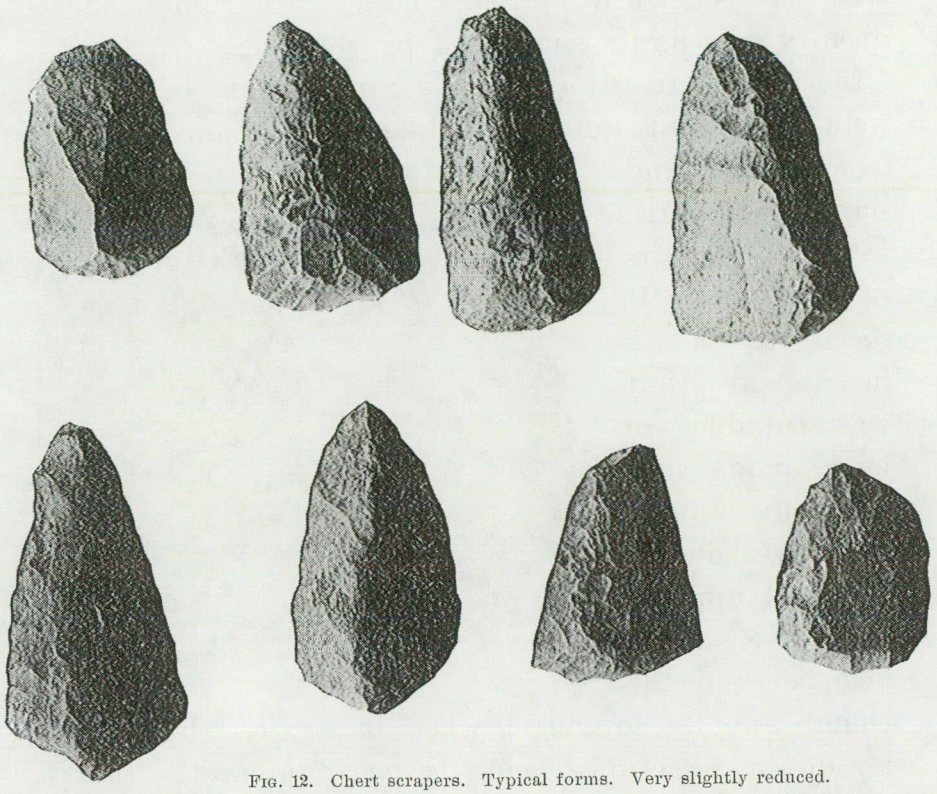


FIG. 12. Chert scrapers. Typical forms. Very slightly reduced.

But the scrapers that are well finished show the most wear. In two hundred specimens which were carefully examined, one hundred and twenty-two were rounded on the left edge and one hundred and thirty-three showed wear on the right edge. Twenty-six of these specimens were also worn on the edge of the base. In this whole number only fifty-two specimens showed no signs of having been blunted by wear. Of thirty-five roughly finished specimens, twenty-three showed no signs of wear. This indicates a preference among the users for finished tools. Some of the specimens indicate

that the edge, after having been worn round, subsequently was again sharpened by chipping.

The uses to which such scrapers could be applied were no doubt quite varied, such as removing meat from bones and scraping the bark from the shafts of arrows. It seems to be an instrument that was capable of being made very generally useful in primitive industries. It appears to have been held between the thumb and the forefinger when in service, the flat side no doubt preferably being turned against the thumb. If the users were right-handed, it ought to follow that the average wear of the right edge of the scrapers ought to be greater than that of the left edge. Such appears also to be the case.

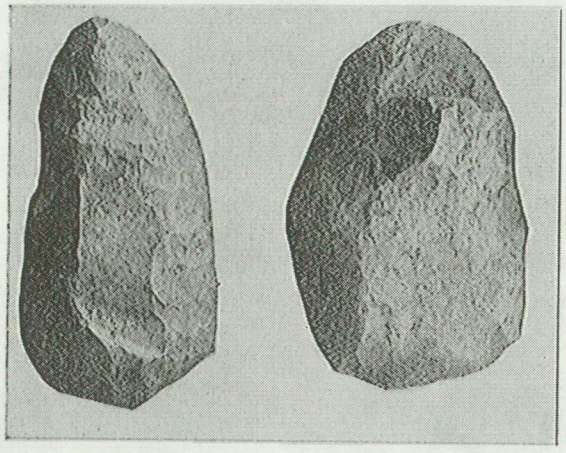


FIG. 13. Typical scrapers. Natural size.

IRREGULAR FORMS OF SCRAPERS.

Some scrapers had a lengthened and sharpened point and an irregular base, which did not seem to have been shaped for the hand (Plate III, fig. 5). These did not exhibit any wear of the edges and may have had



FIG. 14. 1, 2, 3. Thin chert flakes, fashioned to knives with sharp edges. 4. Broken specimen of the same kind. 5. Entire knife, finely finished. 6. Roughly finished scraper or knife. 7. A scraper with a rounded spoon-shaped termination. 8. A broken scraper or knife. All natural size.

some special use for which the sharp point was designed. They would be effective instruments for flaying a rabbit or for opening a fish or a fowl. Several scrapers agree in being fashioned with a rounded spoon-like termination instead of a point (Fig. 14, no. 7). The edges of these are well rounded and worn. Nine specimens were long and narrow and had only been chipped on one

EXPLANATIONS TO PLATE III.

FIG. 1.
A form of flint tool intermediate between a scraper and a knife.

FIG. 2.
A very evenly chipped thin and small knife

FIG. 3.
A small flake knife only slightly chipped.

FIG. 4.
A typical knife, chipped very smooth.

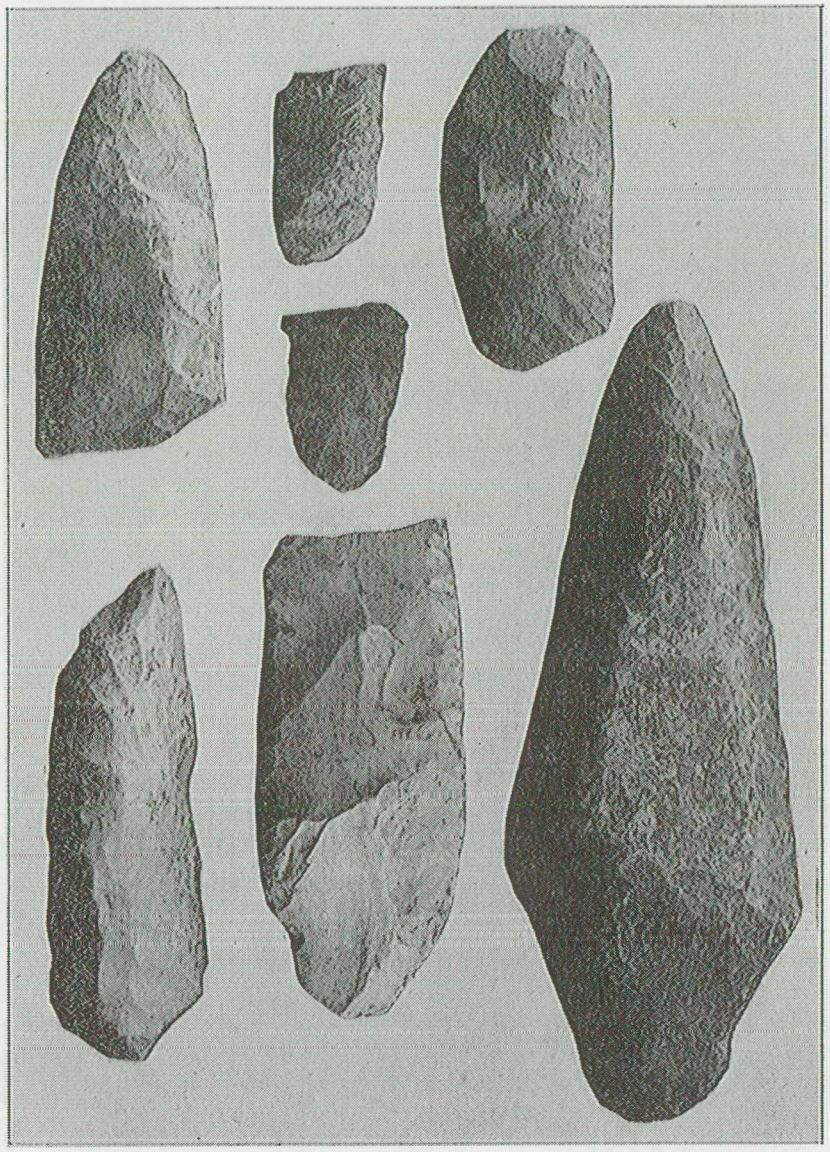
FIG. 5.
A long and pointed scraper.

FIG. 6.
A typical flaked knife.

FIG. 7.
The largest scraper found. The reverse flat side of the specimen has a concave flexure of .1875 of an inch in the direction from point to base.

All figures are the natural size.

PLATE III.



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edge, the other edge being a fracture inclined at a high angle to the flat side. Only three of these had the chipped edge worn; one of them was broken. The form suggests an adaptation of an accidentally formed chip for easily obtaining a tool with a long edge.

FLINT KNIVES.

Some of the flint implements which have a particularly sharp edge, may properly be called knives, as they were probably used for cutting. These are made of thin flakes which are more straight and usually longer than the scrapers (Fig. 14, nos. 1, 2, 3, 4, 5, and Plate III, fig. 1, 2, 3, 4, 6). In a lot of fifteen none exhibited the rounded blunted edges commonly seen among the scrapers. By proper effort and care they can yet be used to cut off stems of shrubs and small branches of trees. One of these knives shows a considerable amount of skill and care by the



FIG. 15. A perfect flint knife.

maker (Fig. 15). It is nearly five inches in length and measures almost two inches in width and not more than a quarter of an inch in thickness, with an even, sharp edge all around. Another flint which was sharp enough to be used as a knife, showed no finish whatever.

ARROWPOINTS.

Forty-five arrowpoints of flint were found, and of these only ten were entire. The rest were more or less broken. The greater part are so called bird's arrowpoints. These are about three quarters of an inch in

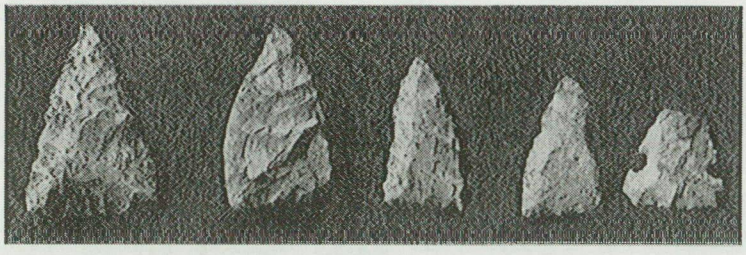


FIG. 16. Arrowpoints. Natural size.

length and a little less than one half of an inch in width and very thin (Fig. 16). Near the base they are quite thin, and have a triangular form, without any barbs or notches for attachment. Only three of them had such notches (Fig. 16, no. 5), and these otherwise perfectly resembled the other specimens. Another type of arrowpoints was somewhat larger, being a little more than one inch in length and slightly less than one inch in width, generally with notches above a narrow base. No points with true barbs have been noticed on the village site, as far as the author knows.

Flints of this kind are among the most common of prehistoric relics, and the number found in this locality seems rather small in comparison with that of the scrapers. It should be remembered that they are of small size and not quite as conspicuous in the field as the scrapers. Nor is it likely that scrapers were as well taken care of as the arrow-points, which were more difficult to make. Arrows were used and lost on the hunting grounds rather than in the village, beyond the limits of which the scrapers may not so often have been taken.

SPEARHEADS.

There were also found thirty-two chipped flint implements, which are supposed to have been used as spearheads. Only six specimens were entire. Ten were broken-off points, six of the fragments had the base entire, and ten had both the base and the point broken off. Three different types may be distinguished in the lot. In two of these types the left edge has been beveled upward and the right edge downward in such a way that when thrown the spear would tend to rotate from right to left (Plate IV, figs. 1, 2, 3, 4, 6). In the other type the chipping is equal on both sides of each edge and the edge itself is sharper (Plate IV, fig. 5). There are two kinds of the beveled spearheads. One has a base which is separated from the point by wide notches, evidently intended for strengthening the attachment (Plate IV, figs. 2, 4), while in the other kind the base is drawn

EXPLANATIONS TO PLATE IV.

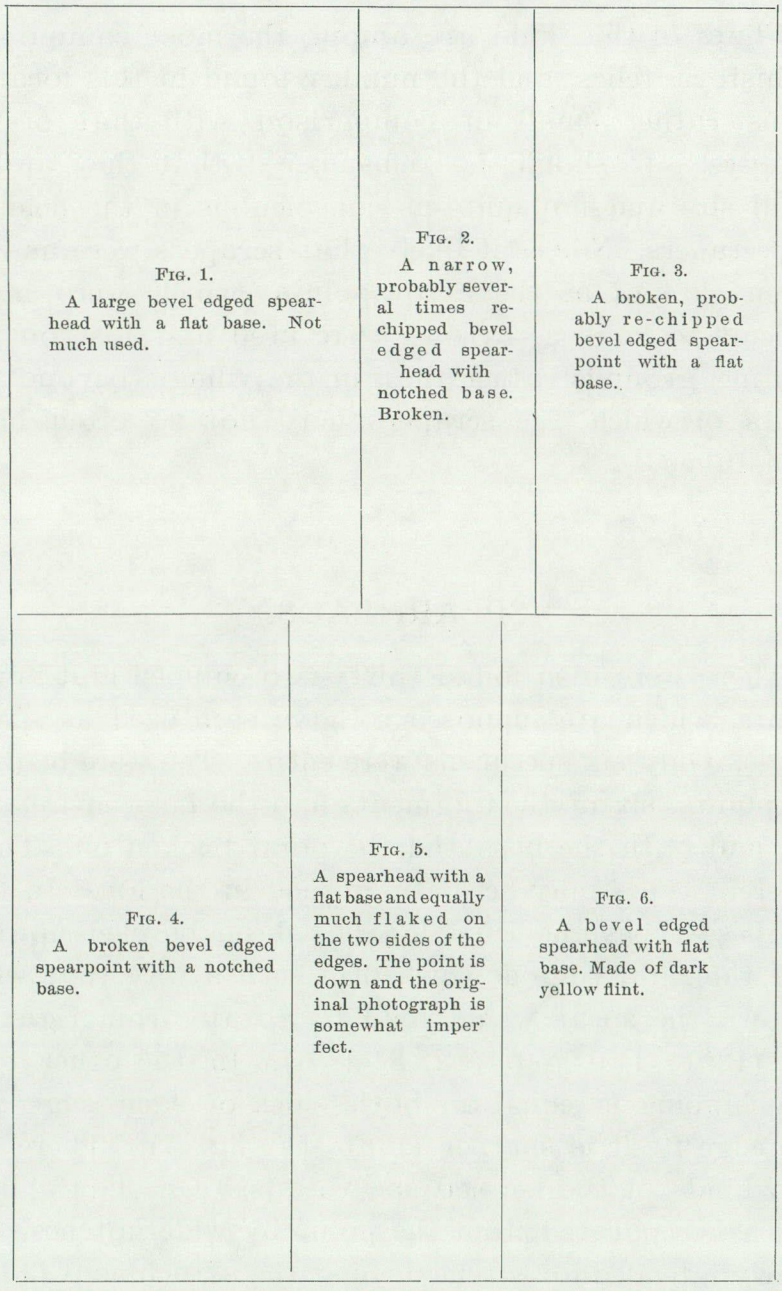


Fig. 1.
A large bevel edged spearhead with a flat base. Not much used.

Fig. 2.
A narrow, probably several times rechipped bevel edged spearhead with notched base. Broken.

Fig. 3.
A broken, probably re-chipped bevel edged spearpoint with a flat base.

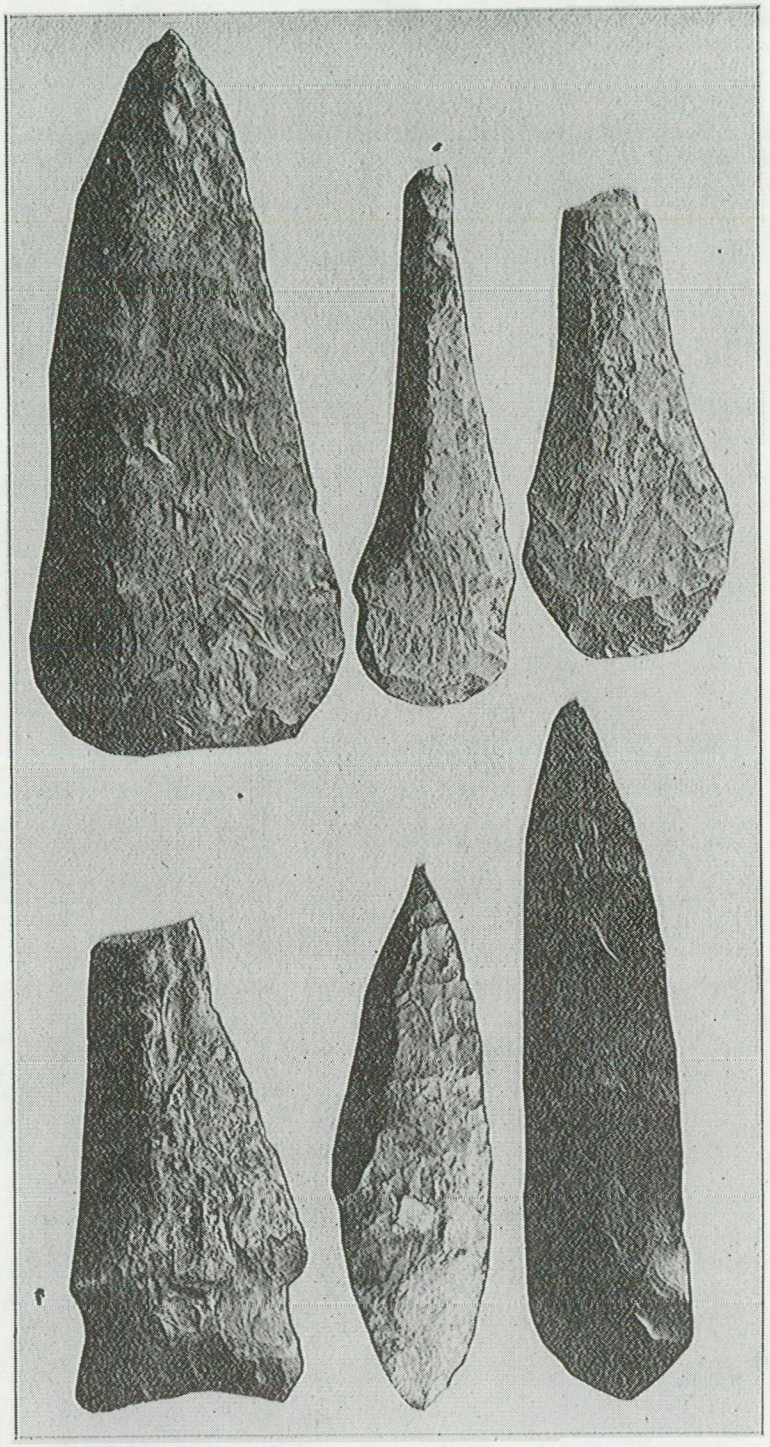
Fig. 4.
A broken bevel edged spearpoint with a notched base.

Fig. 5.
A spearhead with a flat base and equally much flaked on the two sides of the edges. The point is down and the original photograph is somewhat imperfect.

Fig. 6.
A bevel edged spearhead with flat base. Made of dark yellow flint.

All are nearly the natural size.

PLATE IV.



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out into a flat point without any notches (Plate IV, figs. 1, 3, 6). Most of the specimens seem to be of this latter kind. The users of these spearheads were probably in the habit of sharpening them by chipping off flakes on the beveled edges, whenever these would become blunt, for in some of the specimens that seem to have been much used, the point tapers very slowly at first and then rapidly toward the base, the whole edge presenting a concave outline instead of a convex one (Plate IV, figs. 2, 3). The edge may originally have been made straight, and sharpened by flaking afterward. The same is also indicated by the nature of the edge itself. The largest of the spearheads were four inches in length and one and three quarters of an inch in width.

Archaeologists have found it difficult to establish a precise distinction between arrowpoints and spearheads.* Some of the above described specimens may have been used for large arrows. The chief difference in the use of the spear and the arrow was that the former was thrown from the hand while the latter was impelled by the bow-string. Both were used in warfare and in chase. The spear was probably also used in fishing.

Dr. Thomas Wilson, who has made a special study of the bevel-edged spearheads, states that in their distribution these flints are confined to the interior part of the United States and to the South. He also regards it as evident that the beveling was intended to make the missile rotate in its flight, and notes that this

* Arrowpoints, Spearheads, and Knives of Prehistoric Times by Thomas Wilson, An. Rept. Smith. Inst., 1897, p. 889.

might have been more easily effected by twisting the feathers on the shaft. It should be remembered in this connection that if the point were not also twisted in a rotating spear, its penetration would no doubt be less, as the cutting edge would be made to traverse a plane which would always be more or less oblique to the plane of the point itself.

AWLS.

About a dozen implements of flint were of such form as to suggest a use like that of the awl, for making perforations through hides. These had an extended sharp point from half an inch to an inch in length,

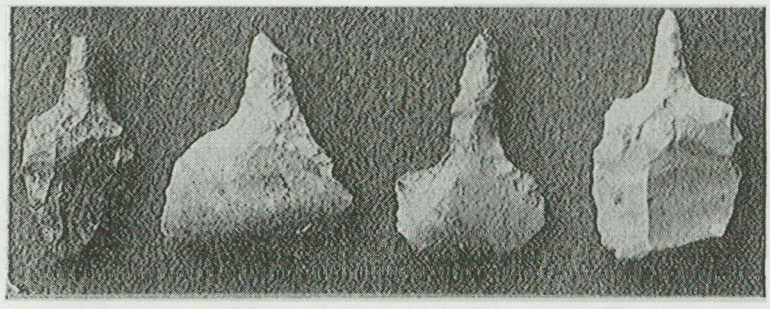

FIG. 17. Awls made from flint. Very slightly reduced.

about three sixteenths of an inch in width, and almost the same thickness, extending from a base of variable shape (Fig. 17). In one instance this base showed that the implement had been made from a scraper. These points can readily be used for making stitches through leather and, if proper care be taken, for boring small holes in soft wood.

DRILLS.

Related to the awls, there are some carefully chipped drills, which differ from the awls in being thicker, longer, less sharply pointed, more straight, and more uniform

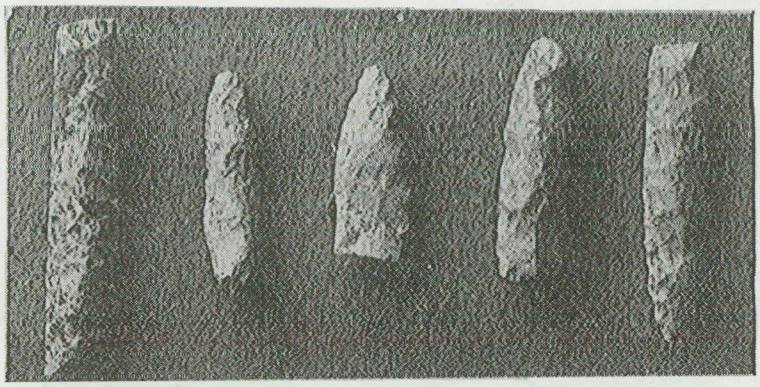

FIG. 18. Drills made from flint. Very slightly reduced.

in width (Fig. 18). These have no widened base to be used as a handle. . Most of them show considerable wear on the edges and the nature of this wearing is such as to suggest that it may have been produced by turning the instrument in a hole. The drilling observed in some catlinite pipes, described farther on, may have been made by means of these tools.

LEAF-FLINTS AND TOMAHAWKS.

Quite a number of large chipped flint pieces were found which may have served as hoes or spades for cultivating the soil and for digging in the ground (Figs. 19, 20). Only two of these specimens were found entire. One was six inches long, three and one half

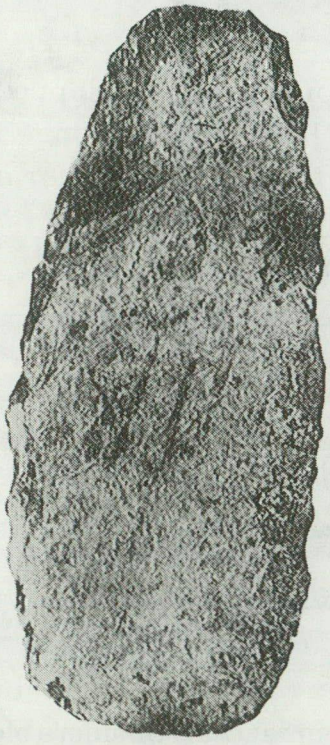

FIG. 19. Hoe(?) made of flint.
Reduced to about ½ of the natural size.



FIG. 20. Hoe(?) made from flint.
Considerably reduced.

inches wide, and three-fourths of an inch thick. Some of them must have been about a foot in length, perhaps six inches wide, and about an inch in thickness. They are oval in shape and are chipped to an irregular edge all around. They resemble the leaf-flints common in the mounds in the Mississippi valley. One large flint is evidently a tomahawk (Fig. 21). It is nearly five inches long, and has a wide constriction, produced by flaking around the middle, dividing it into two lobe-like ends. This constriction is worn smooth and polished by the handle to which it had been fastened.

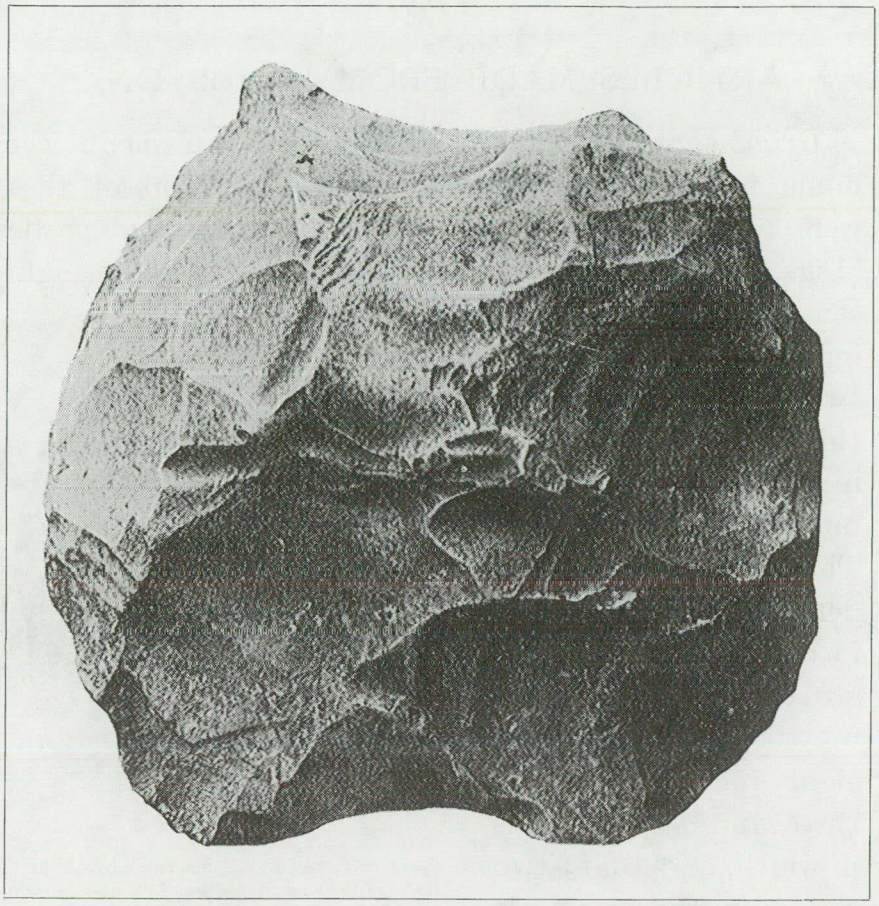

FIG. 21. Tomahawk made from flint. Somewhat reduced.

HAND HAMMERS.

Some irregularly shaped flint pieces were perhaps raw material for the manufacture of implements. Others were rounded and battered and have probably been used as hand hammers, as balls in games, or as nut crackers (Fig. 22).

ARTICLES MADE FROM SANDSTONE.

Grindstones. Several kinds of useful implements were made from sandstone. The most important of these were perhaps the grindstones, or metates and pestles (Figs. 23, 24). These are sandstone slabs some eighteen inches long, ten inches wide, and from two to six inches in thickness. They have a shallow concavity on one of their flat sides. This hollow was evidently produced by wear in grinding. The upper stone, or pestle, as it may be called, was about eight inches in length, three and a half inches in width, and about two inches in thickness. It was convex on both sides, but more flattened on the side which was applied to the lower stone. Three entire and several broken lower stones have been found on the site of the mounds, and more than a dozen pestles. Prof. J. E. Welin has kindly furnished the following measurements of these stones.

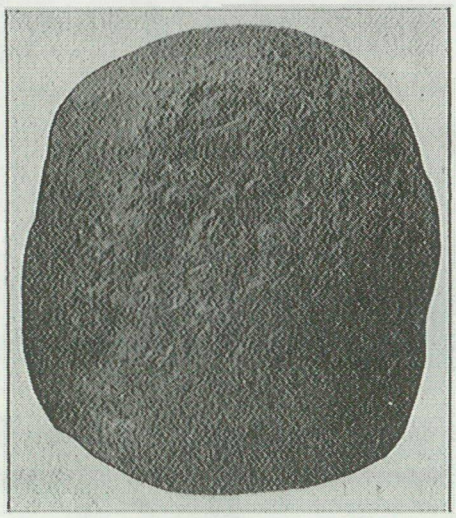

FIG. 22. Battered hand hammer made of flint. Reduced to about four-fifths of the natural size.

MEASUREMENTS OF METATES.

Number.	CONDITION.	LENGTH in inches.	WIDTH in inches.	THICKNESS in inches.
1	Entire (Fig 23)	21.	14.	6.
2	Entire (Fig 24)	18.	9.2	3.
3	Entire	16.5	10.	3.8
4	Much worn, and broken	10.5	15.5	5.
5	Entire	14.	8 2	1.5
6	Entire	9 5	5.5	1.6
7	Broken at both ends	5.5	9.	2.2

MEASUREMENTS OF UPPER OR HAND GRINDSTONES.

Number.	CONDITIONS.	LENGTH in inches.	WIDTH in inches.	THICKNESS in inches.
1	Entire	10.	3 8	2 6
2	Entire	9.2	3.7	2.9
3	Entire	8.7	3.6	1.8
4	Entire	8.7	3.8	1.7
5	Entire	8.2	3.6	2.
6	Entire	8.	3.5	2.2
7	Entire, much worn	7.2	3.5	1.4
8	Entire	7.	2.7	1.6
9	Entire	6.5	3.3	1.7
10	Entire	6.	3.2	1.4
11	Entire	6.2	2.8	1.6
12	Entire	6.2	3.7	1.7
13	Entire	4.7	4.1	1.4
14	Entire, but changed into a mallet by cutting a groove around the middle	5.7	3.7	3.2
15		5.2	3.3	1.7
16	Imperfectly shaped	8.2	4.	1.9
17	Possibly a broken metate	6.7	3.6	1.7
18	Broken	5.5	3.6	1.7

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in original book.

Most, if not all, of these grindstones are made from the Dakota sandstone. Specially indurated blocks have been selected. The metates have not all been dressed to their present form. A few appear to be merely broken, oblong, irregularly rectangular blocks, worn smooth on one side. More pains were taken with the hand grinders. Some slightly worn specimens of these show the pick marks of the dressing tool, whatever that may have been. Other ones have been further smoothened by special grinding or by wear in use. Several specimens bear the mark of long continued service, as do also most of the metates. A thickness of nearly two inches has been ground off from the upper face of some of the latter, and from the form of some of the hand stones we must infer that these have been reduced by nearly half of that thickness. There can be no doubt that these stones were used for grinding corn. Their number and condition testify that this grain was an important part of the food among the natives who used them. It is quite evident that these people must have had some knowledge of agriculture.

ARROW-SMOOTHENERS.

Thirty-five specimens of arrow-smootheners were taken up out of the material of the mounds (Figs. 25, 26.) These were all made from Dakota sandstone. Only five seem to be entire specimens. Of thirty broken ones quite a number show unmistakable evidence of having been used after they were broken. In one instance two

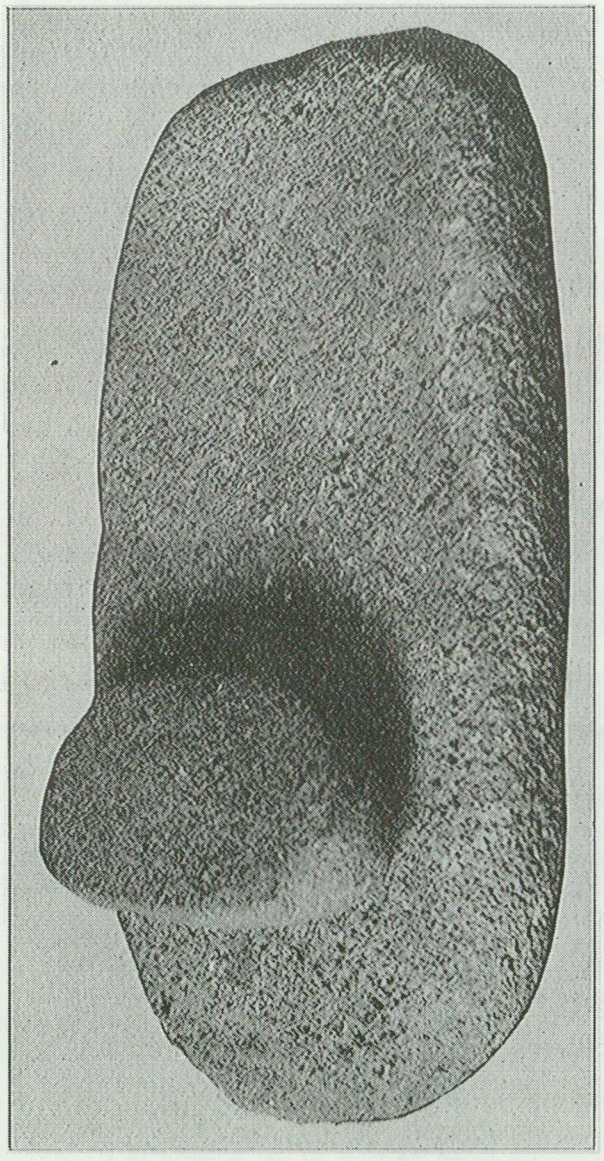


FIG. 24. Metate, or grindstone, made from sandstone, with hand grindstone of same material. The hand grindstone is turned over, so as to show the lower face, which has been worn flat. The lower stone measures eighteen inches in length.

such pieces were found to fit together endwise by their fractured surfaces, while one of them had its sides considerably more worn than the other (Fig. 27). These implements are pieces of sandstone of suitable size and

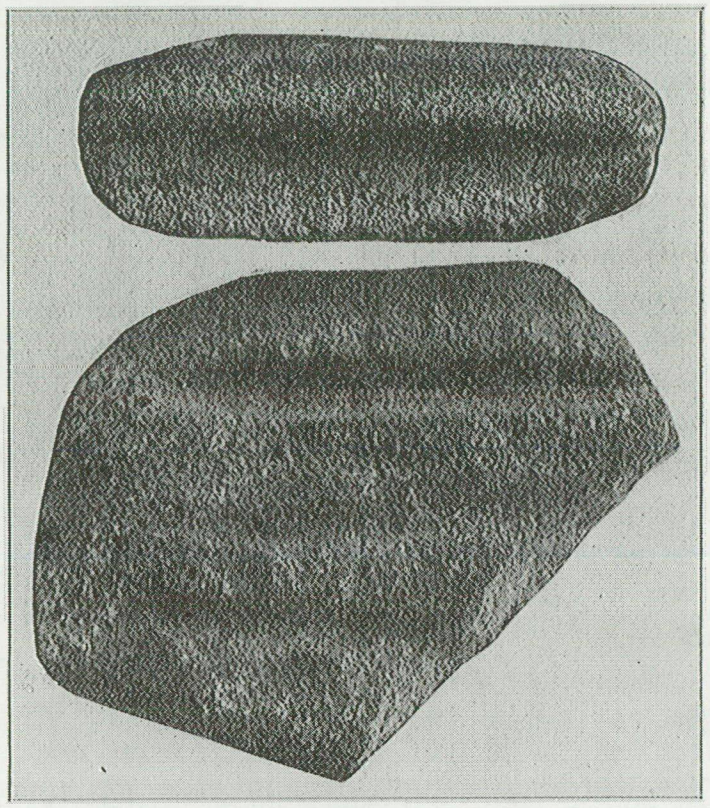


FIG. 25. Arrow-smootheners made from sandstone. The upper specimen shows the typical form. The lower specimen is perhaps a piece of an arrow-straightener. The grooves run out before reaching the end of the stone. Slightly reduced from the natural size.

shape for being held in the partly closed hand. They have one or more longitudinal grooves on one or several sides. It may be that the arrow-shafts were not the only objects ground on these stones, for the grooves are not always round. Some of the grooves have deep-

enings, widenings, and turns, and such stones cannot have been intended for use in smoothening a straight stick. The greater number of forms of this kind were probably used in straightening crooked arrow-shafts, as has been suggested in a recent paper by Dr. Thomas Wilson. Some specimens which seem well adapted for such a purpose, are wider than the rest and have on one side two or three parallel grooves, which terminate before coming to the end of the stone (Fig. 25). In the straightening process the crooked part of the shafts are supposed to have been pressed into these grooves. The stone was probably heated for the purpose of temporarily softening the wood. Such a procedure would account for the fact that nearly all the stones of this kind were broken across the middle.

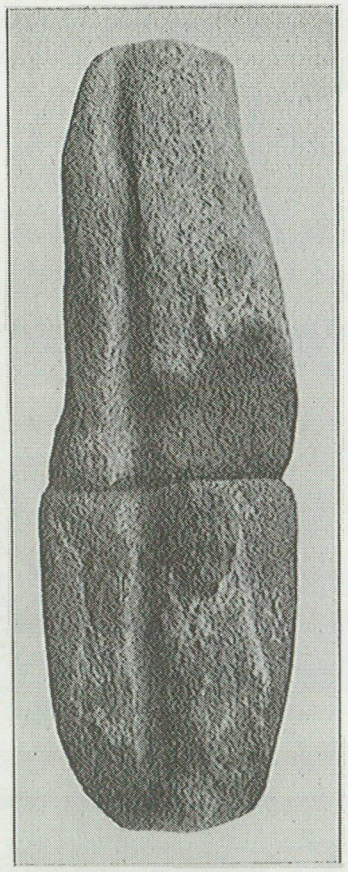


FIG. 26. Arrow-smoothener, made from sandstone. Reduced to ¾ of the natural size.

CUPPED STONES.

Some pieces of sandstone of irregular shape had cup-like cavities on their flat sides. These cups were about an inch or an inch and a half in diameter and had a

depth of a little more or less than a quarter of an inch. It is believed that these may have served as mortars for preparing paint used in personal decoration.

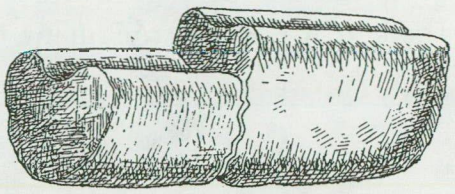


FIG. 27. Broken arrow-smoothener. Left fragment worn after breaking. Reduced to ⅔.

CATLINITE PIPES.

In the collection are four fragments of catlinite pipes (Fig. 28). Three of these were from very finely finished specimens, which, it may be supposed, had been used for some time and then broken by accident. One of them was the elbow of a pipe which had never been finished. Its outer surface showed the coarse scratchings made in grinding it into shape. The polishing was perhaps left until after the drilling of the holes, and in this case the drill went too far to one side so as to break through, thus causing the specimen to be discarded. The nature of the ends of the perforations show that the drill was not a hollow reed, but solid and somewhat pointed. One of the fragments was ground on the fractured surfaces and may perhaps have been carried about as a totem. Two small pieces of catlinite appeared to be chips struck off by the workman in roughly shaping the pipes. On a farm southwest of the site of the mounds, several finished and entire pipes have been picked up and also a piece of pipestone about three inches square and one inch in thickness. The

pipes are about two inches long, with a short bend near the end for the attachment of the stem. They are not



FIG. 28. Uppermost figure: Small catlinite pipe. Lower left hand figure: Piece of worked catlinite. Right hand figure: Fragment of a broken pipe (unfinished). All slightly reduced.

much more than five eighths of an inch in their greatest width, and the perforation is about three eighths of an inch in diameter. The piece of catlinite must have

been a stone in the rough intended for the manufacture of pipes. Pieces had been taken off from three of its edges by cutting grooves on both sides and then breaking along the grooves. On one side the groove is crooked, as if the part broken off had been intended for an elbow pipe. The two flat sides were somewhat convex and smooth and polished, as by wear. It was no doubt brought from the pipe-stone quarry in Minnesota and kept as a precious article by some native, who finally lost it. The small pieces taken from the mounds on the old village site, indicate that those who lived there had communication with the same distant place, either directly or through the channels of primitive trade. All of the pipes found, broken as well as entire, belong to the Siouan type as defined by McGuire.*

ARTICLES MADE FROM VARIOUS MATERIALS.

Stone Mallets. Several implements taken on the site of these mounds must be classed as mallets, or large hammers. These consist of cylindrical or slightly quadrangular rounded stones having a groove around the curving surface midway between the two ends (Plate V). Most of these implements were made from brown or red, strong sandstone, but two were of limestone. One consists of a highly ferruginous and tough sandstone or quartzite, with a bright red matrix. The sandstone in this specimen and that in some of the others does not resemble any of the local modifications of the

* Ann. Rep., Smithsonian Institution, 1897, p. 571.

EXPLANATIONS TO PLATE V.

FIG. 1.
Imperfectly shaped small mallet, made of local Dakota sandstone.

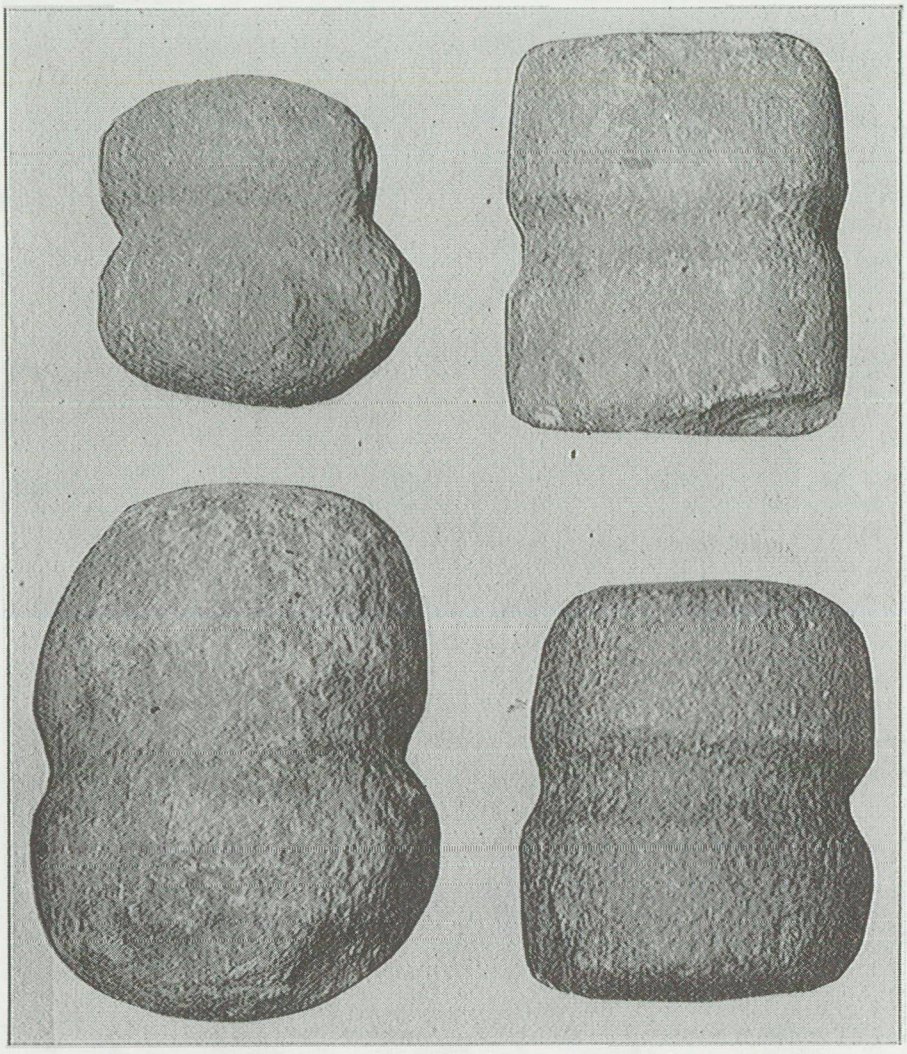
FIG. 2.
Perfectly formed mallet, made from a hard ferruginous sandstone of unknown locality.

FIG. 3.
Large, old and worn mallet, made of limestone.

FIG. 4.
Perfectly formed mallet, made from a hard ferruginous sandstone or quartzite. Probably not much used. Pick-marks are still to be seen on the surface.

Reduced to slightly less than one half the natural size.

PLATE V.



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Dakota rock in this vicinity, known to the author, nor do they resemble the usual form of the Sioux quartzite. The rock has no doubt been brought from some distance, and its presence here gives further evidence that aboriginal art was not limited to the resources of its immediate surroundings in the raw materials which it employed.

As to the particular purpose for which these implements were prepared it is difficult to form an opinion. The author must leave this to the conjecture of the reader, and to students who have more material for comparison and a better knowledge of the arts and customs of the prehistoric races. When in use they were perhaps attached to wooden handles. These may have been bent around the body of the stone, following the groove, and the bent end tied to the main handle, this mode of attachment being used in the case of stone axes similarly grooved. Mallets of the same size and shape are known to have been in use, probably as hammers or clubs, by some of the Sioux Indians in the region of the Yellowstone.* Such a weapon might be useful in hunting the buffalo or in warfare. The smallest ones are light enough to be thrown from thongs or ropes and to be used like the bolos of the Indians of South America.

Prof. Welin of Lindsborg has made the following measurements of the mallets now found in the collection. Linear dimensions are given in inches.

* See note by F. W. Putnam, Ethnology, U. S. Geogr. Surv. West of the 100 Mer., Vol. VII., p. 206.

MEASUREMENTS OF STONE MALLETS.

Number.	CONDITION AND MATERIAL.	Weight in av. ounces.	Greatest length.	Greatest diameter.	Diameter in groove.
1	Ends flat; hard sandstone.....	63.	4.3	3.6	3.3
2	Rounded ends; hard sandstone	53.5	4.5	4.5	4.
3	Flattened; hard sandstone.....	53.5	4.4	3.6	3.3
4	Irregular in shape; limestone....	51.	5.	3.9	3.5
5	Hard sandstone.....	36.	4 4	3.7	3.2
6	Hard sandstone.....	28 5	3.6	3.2	2.9
7	Hard sandstone.....	24.5	3.6	3.4	2.8
8	Broken; limestone.....	?	?	?	?

THROWING-STONES?

Ten disc-shaped or wheel-shaped stones were found (Fig. 29). These measured about three inches in diameter and from one inch to one and a half in thickness. The most carefully shaped specimens of this description have the circular surfaces flat and the round border straight. In several instances the border is convex, as is also to some extent the flat sides. In some cases there was only a rude approximation to this type. Two specimens were broken in halves. Some were made of limestone and some of sandstone. It is to be inferred that the texture of the rock was of no consequence in the use to which these stones were applied. Perhaps they represent some instruments in games. Their size permits them to be thrown from the hand with comparative ease, and they may then readily be caused to roll for a considerable distance on the surface of the ground.

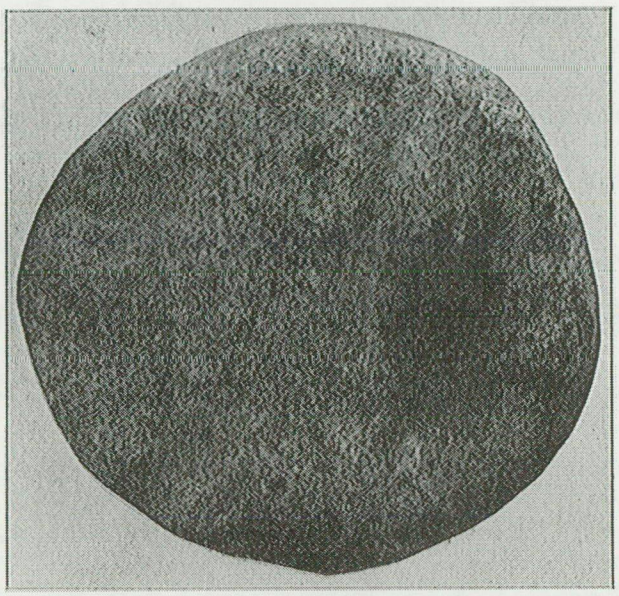

FIG. 29. Disc-shaped throwing-stone. Reduced to ⅝ of natural size.

A PROBLEMATIC RELIC.

A piece of white quartz, carefully worked and polished, is a relic of somewhat uncertain character (Fig 30). It may be described as a circular piece of rock an inch and a half in diameter, with one side convex and drawn out in the center into a blunt and rounded protuberance about half an inch in height. The other side is concave with a depth in the center of about three sixteenths of an inch below the

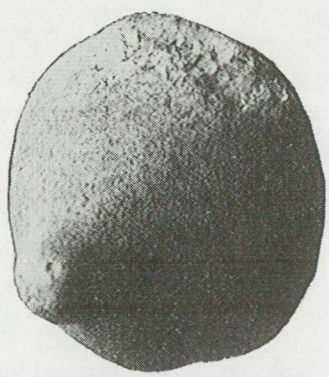

FIG. 30. Convex (anterior) side of a cupped piece of quartz. Slightly reduced.

rim (Fig. 31). The convex surface of this specimen is very smooth and almost polished, while the concave surface is less nicely finished. The edge of the disc is a fractured surface. The writer has seen no similar relic described anywhere from our aboriginal races. Its use seems, indeed, enigmatic. The concave side may have served as a paint cup, but this will not explain why the convex side has been so well finished. It has been suggested that the specimen may have served as a weaning-nipple. If such is the case, it is easy to understand why the convex side, with its protuberance, has been finished with such great care. It quite perfectly resembles the human nipple. This theory also explains the concavity on the opposite side. The suggestion is mentioned for what it is worth.

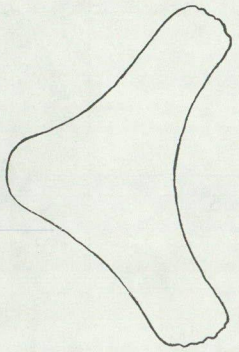

Fig. 31 Outline of a diametral section through a disc-like piece of worked quartz. There is a protrusion like a nipple on one side, and a concavity on the other. Slightly reduced.

A PIECE OF AN OLD ARMOR.

One of the relics found has a special historical interest. It demonstrates that this village was inhabited by Indians after the European race had come over to this continent. In one of the mounds located near the center of the group, there was found at the depth of six inches below the surface, a piece of chain-mail made of iron (Frontispiece).* It measured about two inches square and the size of the oval rings was a little less

* This relic was dug out in the author's presence by Mr. C. A. Hven, now of Garfield, Kansas.

than one half of an inch in length. The metal had suffered much from oxidation and the spaces between the rings were filled with rust so thick that the whole specimen was almost a solid mass. Unfortunately the precious relic was lost. The author took the precaution, however, to have it photographed soon after it was found. So far as the author is aware, the object itself was seen by only two parties who had a knowledge of antiquities of this kind and who could be considered competent to identify it as a piece of chain mail. It was shown to Dr. J. A. Enander of Chicago, then on a lecturing tour in the west. He is regarded as one of the best authorities in America on the antiquities of the Northmen. This gentleman stated that the metal fabric had a close resemblance to that of a Swedish *brynja*, the coat of mail used by the vikings. It was also examined by Dr. John Rundstrom, an accomplished gentleman and naturalist residing near Lindsborg at the time. He is well informed on European antiquities since the time of his residence as a student at the University of Lund in Sweden. In his judgement the relic was a fragment of a piece of chain mail.

On the surface of one of the mounds there were picked up one or two perforated beads of blue glass. Lying out in the open field on the opposite side of a creek from the nearest farm house, built and occupied by a lone bachelor, these beads are not likely to have been lost by recent settlers. More probably they once belonged to some inhabitant in the old village. It is needless to say that the beads were made in Europe or in some European colony in America.

PROBABLE CHARACTERISTICS OF THE TRIBE.

In describing these products of aboriginal art it seemed desirable to classify them as to the nature of the material from which they were made. If we wish to study the people to whom the relics once belonged, their mode of life, their habits, and probable tribal relationships, it will serve our purpose better to make our classification on the basis of the known or probable uses for which the relics once served. It is not the purpose of the author to say much on this phase of the subject. But a few remarks quite naturally suggest themselves in this direction also.

It must be remembered that the uses of some relics are uncertain. Notched bones (see page 18) have been variously regarded as records,* as instruments used in making bowstrings, and as appliances used in weaving. Recently Professor Starr has shown that some Indians use bones of this kind for producing rattling noises in certain dances. To do this another bone is drawn across the notches in rhythmic strokes that accompany the movements of the dancers.**

Disregarding such uncertainties we may, nevertheless, take into consideration the number of each kind of different relics and make a sort of inventory of the stock in hand, and thus draw some conclusions as to the occupations, customs, and wants of the original owners. Such an inventory is presented in the following table.

* See "Marked Human Bones from a Prehistoric Tarasco Indian", etc., Vol. X, Bulletin of the American Museum of Natural History.

** See Notched Bones from Mexico, by Prof. Fredrick Starr, Proceedings of the Davenport Academy of Science, Davenport, Ia., Vol. VII., p. 101.

INVENTORY OF THE VILLAGE RELICS.

KINDS OF RELICS FOUND.	NUMBER.
IMPLEMENTS USED IN DOMESTIC WORK	*240*
Scrapers	200
Knives	15
Millstones	25
HOUSEHOLD UTENSILS	*54*
Earthenware jars (number estimated)	50
Spoons, made of shells	2
Bowl (earthenware)	1
Cup (earthenware)	1
AGRICULTURAL IMPLEMENTS	*16*
Hoes and spades, made of flint	10
Hoes and spades, made of bone	6
IMPLEMENTS OF CHASE AND WARFARE	*87*
Arrowpoints	45
Spearheads	32
Stone mallets?	8
Tomahawks	2
TOOLS USED IN SPECIAL TRADES	*56*
Arrow-smootheners	30
Awls	12
Hand-hammers (for chipping flint?)	5
Drills	6
Flint flakers (bone)	3
OBJECTS RELATING TO PERSONAL ORNAMENT AND COMFORT	*10*
Paint mortars? (cupped stones)	3
Catlinite pipes	2
Bone beads	2
Hairpins?	2
Weaning-nipple?	1
OBECTS USED IN SPORTS AND GAMES?	*10*
Throwing-stones	10
Total	473

It will be seen that there are nearly five hundred objects represented in the collection. About half of the number consists of implements which have been used in

domestic work. This is quite natural. Things used about the dwellings would also be lost in their immediate proximity. The scraper is particularly abundant. It was a tool easily prepared (Fig. 27). Its manufacture required no particular skill. When lost it was easily replaced. By far the greater number of the scrapers are entire. They have not been thrown away. They have been lost. With the knives it is different. These were made with greater care and apparently also selected from fortuitously well adapted flakes; such as were thin and straight and had an even grain. There are only two or three entire knives. The others are broken and have evidently been thrown away only after becoming useless. A flint knife was a precious article, worth searching for if lost, and so we find a less number of them now. The many potsherds testify that these people took some pains in preparing their food and perhaps their drink. It is difficult to estimate to what extent they engaged in agricultural pursuits. The small number of implements adapted for tilling the ground seem out of proportion to the number of stones used in grinding the crops. Possibly wooden implements were used in this primitive farming. Or the cultivated land may have been at some distance from the village site and the hoes and spades may have been left and lost out in the field. Or it may be that the natives lived in the village only during the cold season and took up their abode at some other place during summer. The relative abundance of tools useful in primitive handicraft, such as arrow-smootheners, awls, flakers, and also scrapers, suggests that the inhabit-

ants were engaged in such work to a considerable extent, during the time of their stay on these grounds. The colder part of the year would seem to be specially conducive to such occupation.

These people do not seem to have been a warlike tribe. There are only two flints in the collection that resemble tomahawks. Their arrowpoints and spearheads seem better suited for the killing of small game than for the battlefield. But few of the relics can be regarded as implements of war. This may perhaps be taken as an indication that the inhabitants were a peaceful race, who quietly subsisted on the natural resources of the western plains, before the strife had yet begun which was a result of the encroachments of civilization from the East.

ETHNIC RELATIONSHIP.

A guess may perhaps be warranted as to the ethnic relationship of the tribe. We have seen that some fragments of catlinite pipes picked up with the other material were of the so called Siouan type and that the stone mallets are of a kind that is known to have been used by some tribes of the Sioux Indians of the west. The Sioux Indians were to some extent an agricultural people. They raised corn. So did also the inhabitants of this village. They possibly belonged to some tribe of the great Siouan family. But if such was the case, they lived on the outskirts of the Siouan domain. To the south and the west there were other Indians. Those of this village seem to have ground their corn on

mills that are more like those of their southern and western neighbors. Stone metates are more common in the southwest than in the territory to the north. The beveled form of spearheads seems also to be a feature of their rude art, which they had in common with the Indians of the south. Tribes of the Ponca family, as the Wichitas and the Pawnees, have at different times lived on the Arkansas, the Kansas, and the Platte rivers in the central part of the Western Plains. They seem to have migrated occasionally both north and south. Mr. Hodge says that the "Wichitas shifted their settlements from time to time as necessity demanded and that more than one time their settlements were on and north of the Arkansas river."* At an early time their home was farther south. In a border tribe there would inevitably be some mingling of arts and customs of the neighboring nations with those of its own. The use of ground shell as well as sand for tempering the earthenware may have such a significance. Captain Marcy, who visited a Wichita village near Washita river in 1852, says that their "lodges were about twenty-five feet in diameter at the base", and consisted of a frame-work of poles placed in a circle in the ground, bound together with withes and thatched with grass. He also states that they raised corn and other vegetables, using hoes for cultivating the soil, but depended on the chase for their sustenance during the greater part of the year.** It is

* Harahey, J. V. Brower, St. Paul, 1899, p. 72.

** Exploration of the Red River of Louisiana in the year 1852, by R. B. Marcy, p. 77.

quite probable that the Indians occupying this old village were Wichitas or perhaps some of their relatives, the Pawnees. On the basis of the character of the mounds and their relics alone, however, an inference as to their tribal relationship must be regarded as but little more than a guess. But it is none the less interesting to note in this border land of ancient nations a mingling of northern, southern, and western features of primitive industry and art.

A VISIT FROM THE SPANIARDS?

The finding of a piece of chain-mail with the other relics makes it certain that the village was occupied by Indians at least as late as after America had been discovered by the Europeans. At the Emporia meeting of the Kansas Academy of Science in 1886 the author suggested that this relic might have come to the Indians from Coronado's expedition to this region in 1542 and called attention to Col. Simpson's study of the route which this explorer followed in traveling from Tiguex to Quivira showing that he probably passed through the central part of the state of Kansas.* Several old Spanish documents relate the adventures of Coronado. They all state that he marched east from the mountains in New Mexico and across the plains for more than a month. Then selecting forty men he left his main army and marched with these few followers

* Coronado's March in search of the Seven Cities of Cibola," by J. H. Simpson. Annual Report, Smithsonian Institution, 1869, pp. 336—340.

first north, and then northeast for another month or a little more. Here he discovered a country called Quivira, and remained in it for twenty five days, visiting several villages and exploring the country generally, possibly going as far north as the fortieth degree of north latitude. Most of the students of the Spanish papers seem to agree that Quivira was located in the central or in the eastern part of the state of Kansas. Simpson has mapped the probable route that Coronado followed in going out and in returning. On his outward route he is supposed to have entered the present borders of this state somewhere near its southwest corner (Fig. 32). From there he is supposed to have pursued an easterly course over the country of the Cimarron, turning to the north from a point fifty miles or so west of the site of the present city of Wichita and returning from the northwestern part of the state by a more southerly route.

A. F. Bandelier, a well known archaelogist and student of early Spanish history in the southwest, believes that Quivira is to be sought in the central part of the state of Kansas about a hundred miles north of the Arkansas, but he thinks that Coronado's route of march was for most of the way in the territory south of Kansas.*

More recently Mr. G. P. Winship has made an exhaustive and critical study of the Spanish accounts of Coronado's Expedition.** This author doubts that

* Fray Juan de Padilla, by A. F. Bandelier, American Catholic Quarterly Review, Vol. XV, p. 551. Also The Gilded Man, New York, 1893.

** The Coronado Expedition, 1540—1542, by George Parker Winship, 14th Annual Report of the Bureau of Ethn., Washington 1896, Part I, pp. 329—613.

FIG. 32.

Map of Kansas, showing the probable routes of Coronado's march within the state and the location of ancient village sites. ⊙ The Village site on Paint creek. • Other village sites. (Some of these are taken from Brower's Herahey.) = = = Coronados march according to Simpson. ..... Coronado's march according to Hodge.

Coronado, after leaving the main army, "went much beyond the south branch of Kansas river, if he even reached that stream." Quivira should then have been located to the south and perhaps a little east of the centre of the state of Kansas.

The latest contribution to the history of this expedition is made by Mr. F. W. Hodge,* who is inclined to the opinion that Coronado, after having turned north, crossed the Arkansas river on its south bend not far from the place where Dodge City now stands. It was probably from this point that he marched (according to the Spanish chroniclers) six days to the northeast, following down the right side of the stream, and finding the first native village on the Great Bend. From there he continued to the northeast and "either followed down the Smoky Hill or crossed that stream and also the Saline, Solomon, and Republican forks, reaching Kansas river not far from Junction City." "After learning what they could about the province, the Spaniards then . . . . retraced their steps for two or three days, where they provided themselves with fruit and corn for the return journey . . . . This place was probably but a few miles from the present Salina" (Fig. 32).

It will be seen from the above that the Paint Creek dwelling site lies in the region which Coronado visited. It is recorded that during the twenty five days he and his forty followers remained in Quivira, he sent out captains and squads in varions directions to visit different villages, of which, he says, there were not more

* Harahey, by J. V. Brower, St. Paul, Minn., 1899, pp. 29—73.

than twenty-five.* Taking all of this into consideration it is quite possible that the piece of chain-mail may have been obtained by the natives of these villages, in barter or otherwise, from Coronado's soldiers. Col. Henry Inman has stated his positive opinion that it came from some soldier either of the command of Cabeça de Vaca, Coronado, or of De Soto,† most likely the latter. But our best historians doubt that De Soto's expedition came as far west as Kansas.‡

The archaeological evidence perhaps to some extent supports the view that it came from Coronado's expedition. The accounts we have of the people which he met in Quivira characterize in some respects the residents of the old village, as we know them from their dwelling sites and from the relics which these contain. In the anonymous Spanish document *Relacion de Suceso* we learn that the inhabitants of Quivira lived in houses built of straw. There were several villages of these houses. The inhabitants raised corn and made bread. This bread was cooked in fires under the ashes.‖ In Jaramillo's narrative we are told that the straw-houses were round and that "the straw of the walls reached down to the ground like a wall". People who have lived on the Plains will realize that in such a shelter the prevalent sandstorms would deposit drifts of dust and sand. In course of time there would then be a

* Winship, op. cit., p. 582.

† The Santa Fe Trail, New York, Mac Millan & Co., 1897.

‡ Narrative and Critical History of America, Justin Winsor, Vol. II., p. 296 Also History of United States, Geo. Bancroft, Vol. I., p. 52.

‖ Winship, op. cit., p. 578.

mound. In Coronado's own letter to the king of Spain he relates that these people used skins for clothing, and that they wandered around and hunted the bison. Such appear also to have been the habits of the Indians who lived on Paint creek. But other tribes did the same. At the best this evidence is not conclusive. The piece of chain-mail may have come from some other source. Future researches of the historian, the ethnologist, and the archeologist may eventually throw more light on this subject.

INDEX.

Page.

Academy of Science, Kansas 7, 11, 73
Adams, F. G., 11
Agricultural implements 69
Animal bones 16
Antelope 16
Arkansas river 76
Armor 66
Arrowpoints 40
Arrow-smootheners 53
Articles made of sandstone 50
Articles made of chert 31
Author's note 7
Awls 46

Bancroft, Geo., 77
Bandelier, A. F., 74
Beads of bone 19
Bethany College 7
Bevel-edged Spearheads 41
Big Blue river 11
Bones and shells 17
Bowls 23
Brower, Mr. J. V., 10, 12, 72, 76
Brynja 67
Burial mounds 10

Cabeça de Vaca 77
Catalogue of Prehistoric Works 9
Catlinite pipes 57
Chain-mail 66
Characteristics of village tribe 68
Chert 13, 31
Cimarron river 74
Coronado's march 73, 76
Cup, earthenware 23
Cupped stones 56

Dakota sandstone 53
Davenport Academy of Science 68
De Soto, Ferdinand 77
Disc-shaped stones 64
Dodge City 76
Drills 47

Page.

Enander, Dr. J. A., 67
Ethnic relationship 71

Failyer, Prof. G. H. 11
Flakers 19
Flint knives 39
Forms of earthenware 23
Fusulina chert 31

Games, instruments for 64
Gouge-shaped tool 17
Gravel with chert 31
Great Bend 76
Grindstones 50
Gypsum creek 11

Hairpins 18
Hand grindstones 51
Hand hammers 49
Handles, earthenware 27
Harahey 10
Hodge, Mr. F. W., 72, 76
Hoes, bone 15
Hoes, flint 48
Holmes, Prof. W. H., 30
Household utensils 69
Hven, Mr. C. A., 66

Implements of chase and warfare 69
Implements used in domestic work 69
Inman, Col. Henry, 77
Introductory 9
Inventory of Village relics 69
Irregular forms of scrapers 34
Jars 23
Juan de Padilla 74
Junction City 76

Kansas Academy of Science 7, 11, 73
Kansas mounds 10
Kansas river 11
Kinds of vessels 23
Knives of flint 39

Page.

Leaf-flints and tomahawks..... 47

Mallets..... 59
Marcy, Capt. R. B.,..... 72
Mc Guire, J. D.,..... 59
McPherson county 11
Measurements of mallets 64
Measurements of metates..... 51
Metates..... 50
Methods of chipping flint..... 19
Methods of fastening handles..... 27
Mounds in Kansas..... 11

Nelson, Prof. Frank,..... 8
Nipple..... 65
Notched bones..... 18, 68

Objects relating to ornament. 69
Ornamentation of earthenware.... 28
Ornamented vessel..... 30

Paint Creek mounds..... 12
Painted pottery..... 28
Pawnee Indians..... 72, 73
Pipes..... 57
Pipestone..... 59
Plat of dwelling sites..... 13
Ponca family..... 72
Pottery..... 23
Problematic relic..... 65

Quivira..... 12, 74, 76

Relacion de Suceso..... 77
Republican river..... 11
Rib, notched..... 17
Riley county..... 11
Rundstrom, Dr. John,..... 8, 67

Salina..... 76
Saline county..... 11
Santa Fe Trail..... 77

Page.

Scrapers..... 31
Shells..... 19
Simpson, Col. J. H.,..... 73
Siouan pipes..... 59
Sioux Indians..... 63, 71
Sioux quartzite..... 63
Sites of dwellings..... 10
Skunk..... 16
Smoky Hill river..... 19, 76
Smoky Hills..... 11
Spearheads..... 41
Spoons..... 19
Sports and games..... 69
Starr, Prof. Fredrick,..... 68
Stone Mallets..... 59
Structure of mounds..... 14
Swensson, Dr. C. A.,..... 8

Teeth of bison..... 18
Tempering of earthenware..... 30
Thomas, Cyrus,..... 9
Throwing-stones..... 64
Tomahawks..... 47, 49
Tools of special trades..... 69
Turkey..... 16

Udden village site..... 12
Unio shells..... 19

Weaning nipple..... 65
Wear of scrapers..... 32
Welin, Prof. J. E.,..... 7, 50, 63
Wichita..... 74
Wichita Indians..... 72, 73
Wild-cat..... 16
Wilson, Dr Thomas,..... 19, 45 56
Winship, Mr. G. P 74
Windsor, Justin,..... 77
Wolf..... 16

Yellowstone, hammers from..... 63

Notes

Notes

Book Review

Silver Horn: Master Illustrator of the Kiowas

Silver Horn: Master Illustrator of the Kiowas. CANDACE S. GREENE; forward by DONALD TOFPI. University of Oklahoma Press, Norman, 2001. xii + 236 pp., appendix, notes, bibliography, index. Hardcover $59.95. ISBN 0-8061-3307-4. *Reviewed by* Christine Garst.

Silver Horn: Master Illustrator of the Kiowas by Candace S. Greene offers a rare opportunity to learn not only of the development of a Kiowa artist of the late nineteenth and early twentieth century but also of the Kiowa and Plains Indian culture. Indeed, it was the expressed wish of one of Silver Horn's descendants that this book would enable the reader to come to know Silver Horn and the ". . . ways of the old Kiowas" (ix). Greene's excellent work allows the reader to do just that. By examining the artistic works of Silver Horn, numbering more than 1,000, Greene leads us on a journey that examines both Silver Horn's developing style and changing mediums and the Kiowa lifestyle from the viewpoint of a participant rather than an observer.

Greene begins with a comprehensive discussion of the Plains Pictorial Tradition, which includes rock art, hide painting, and ledger book art (i.e., all art on paper). Silver Horn's works encompassed both hide paintings and ledger book art, comprising nearly one-half of the known examples of the latter. This fact alone would qualify his work as important, but Greene does not merely offer a catalogue of his works. Instead, she comprehensively discusses each stage of Silver Horn's artistic development, according to the medium worked with and the subject matter portrayed.

Greene begins with a discussion of Silver Horn's family lineage and his early years on the reservation, both of which played a part in the development of his style. In seven subsequent chapters she looks at his work on paper and buckskin, treating various themes such as coup counting, ceremonies, oral traditions, calendars, shield and tipi decoration, and Kiowa lifestyles. In each of the traditional areas and mediums, Silver Horn's changing styles are examined with careful comparisons to other artists of the Plains Pictorial Tradition. The reader soon comes to understand why Silver Horn has been labeled both a traditionalist and an innovator.

The book is not without drawbacks. The reader will learn much about Kiowa culture as it pertained to men but little that has to do with Kiowa women, although Greene can hardly be criticized for what Silver Horn did not portray. While there are some women represented, mostly in courting scenes, the majority of Silver Horn's works depicted scenes of interest to men.

Another weakness lies in the arrangement of the book. For example, the color plates are referenced throughout the book, but they appear as a group in the middle of the book on unnumbered pages. Sadly, many of the details on these colored plates are too small to see without magnification. In contrast, the black and white prints often show fine detail but do not show the vivid colors that Silver Horn so often used.

This book has many fine points that outweigh these few flaws. Greene's careful background research includes documentation of the history of many of Silver Horn's works, from details about his paint sticks or pigments to information about the work's commission or owners. A most helpful appendix notes where the art is currently located should the reader wish to personally view Silver Horn's work. Perhaps most important is the excellent discussion of subject matter that is depicted by few other artists. For example, Silver Horn produced the only visual record of the Kiowa religious movement, which began at the end of the nineteenth century.

If a person is searching for a book to be displayed on a coffee table, he would do better to look elsewhere. However, if the reader is interested in the story of one man's development as an artist or is looking for a unique window into the past lifestyle of the Kiowa or Plains Indians, then this book fulfills that need. Silver Horn was indeed ". . . the premier graphic artist of the Plains region" (48), and Greene has done a masterful job of relating his story and discussing the Plains Pictorial Tradition.

Notes

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Richard Anderson is professor emeritus of geology at Augustana College, J. A. Udden's alma mater. He was educated in the public schools of Oak Park, Illinois, earned an B.A. at Augustana, and M.S. and Ph.D. in geology at the University of Chicago. He taught in the Department of Geology at Augustana from 1957 until his retirement in 1996. Since 1959 he has served as a research associate of the Illinois State Geological Survey.

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Notes

Notes

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INFORMATION FOR AUTHORS

Manuscripts are actively solicited for *The Kansas Anthropologist*. Articles should have a relationship to Kansas anthropology (archeology, ethnography, ethnohistory, cultural/social anthropology, physical anthropology, etc.). All manuscripts must be the original, unpublished work of the authors.

The varied readership of the journal should be kept in mind when preparing papers. **Jargon should be avoided**. The style authority is *American Antiquity* (see Volume 57, Number 4, 1992). Professionals are expected to submit their manuscripts in this form; others who are not familiar with the *American Antiquity* style guide will receive editorial assistance.

Illustrations are encouraged; at least two or three should be included if possible. All illustrations must be of reproduction quality and should be designed to fit within 6 x 8.5-inch margins, including caption. If protected by copyright, securing written permission for use is the responsibility of the author.

If IBM compatible computer technology is available, please submit papers on diskette or as an e-mail attachment, **using as little internal formatting as possible**. A single hard copy also should be provided.

Manuscripts will be reviewed by the editorial committee who will judge whether or not articles are appropriate and what revisions may be necessary for publication. Outside reviewers may be used. Five reprints will be provided free of charge to the author of each major article.

Book reviews are also requested. If you plan to review a book but have not been requested to do so by the editor, it would be best to check with the editor to make sure that a review of that work has not already been arranged. Book reviewers will receive two reprints.

The editor welcomes responses to articles. The journal is submitted for indexing in the *Kansas Periodical Index*.

Submit manuscripts to the address below. The editorial staff is here to help you. If you have any questions, please contact:

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