

PROCEEDINGS

OF THE
193143

Academy of Science



and Letters

OF

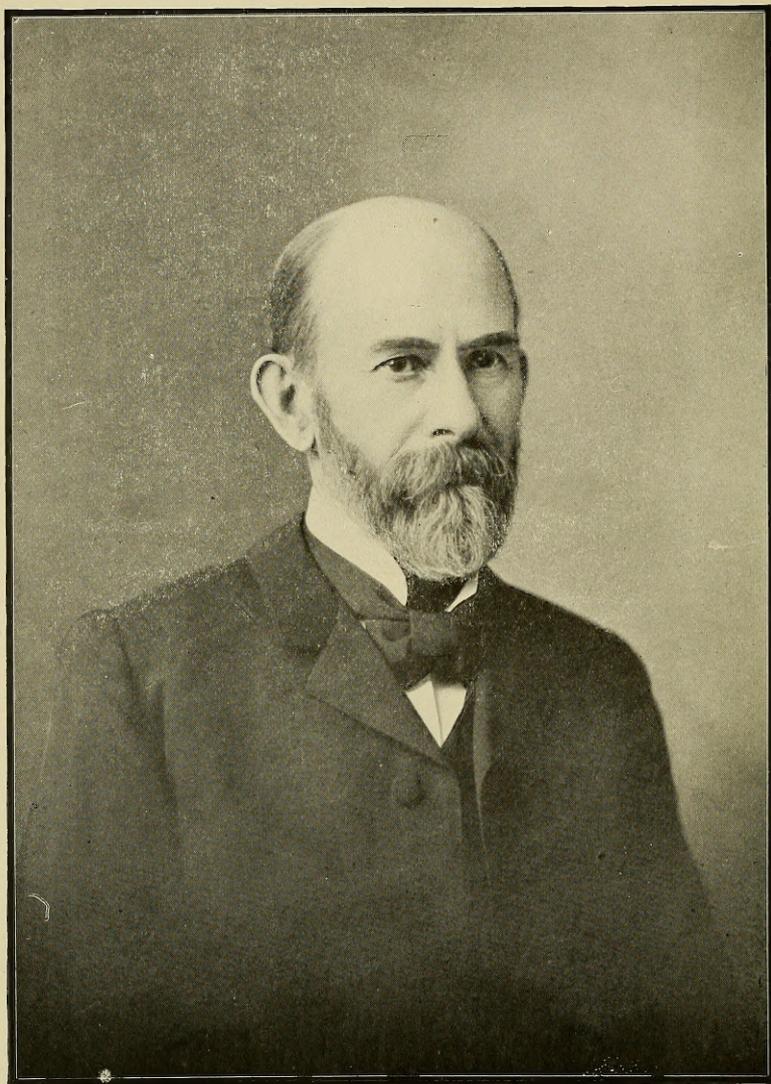
SIoux CITY, IOWA

FOR 1903-4

VOLUME I

PUBLISHED BY THE ACADEMY

SIoux CITY, IOWA:
PERKINS BROS. CO., PRINTERS.
1904



HON. GEORGE W. WAKEFIELD.

PROCEEDINGS

OF THE

Academy of Science and Letters

OF

SIOUX CITY, IOWA

1903-4

VOLUME I

COMMITTEE ON PUBLICATION :

ALFRED N. COOK, Editor

F. H. GARVER

H. C. POWERS

G. B. HEALY

PUBLISHED BY THE ACADEMY

Perkins Bros. Co.,  Printers, Sioux City.

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THE BEAUTIFUL PALACE CALLED HOME

BY WILLIS MARSHALL.

*Reprinted from "Cycles" by Permission
of the Author.*

Where'er I may wander, where'er I may roam,
A beautiful vision is luring me there.
No matter if lowly or humble or poor,
A bright cot of love, that is spotlessly fair,
Lifts up to the sunshine its lily-decked walls—
'Tis the beautiful palace called home.

The prayer that I murmur beneath the blue dome,
Far off from that sweet blessed haven tonight,
Oh waft it, ye angels, O waft it away!
My message of love to that castle of light,
And grant to my darlings a fullness of trust
In the beautiful palace called home!

I'm wafted tonight o'er the billowy foam
Afar from my darlings, afar from their kiss,
Afar from the love which the angels might crave
Away in their mansions of glorified bliss—
Oh, I will be true to the loved of my soul,
In the beautiful palace called home!

I've read the dim pages of many a tome.
Have heard the wild echoes of many a song;
I've felt the deep thrill of the poet-born soul,
Have won the applause of the wondering throng:
But yet of all memories the sweetest is that—
Of the beautiful palace called home!

Oh, beautiful, magical mansion of home!
To thee I'll be tried, and to thee I'll be true,
Tho' tempest may roll, tho' the storms may conceal
The stars in their ocean of infinite blue—
The truest, the purest, the fondest of earth
Is the beautiful palace called home!

INTRODUCTION

BY THE EDITOR.

When it was first proposed to enlarge the scope of the old Scientific Association into the Academy of Science and Letters and publish a volume of proceedings containing original papers offered to the Academy that were deemed of sufficient importance, an objection was at once raised that the funds at its command would not be sufficient. It was realized at the time of the re-organization that one of the greatest problems which usually confronts young institutions of this kind is financial support for the regular publication of its proceedings. However, the funds for the publication of this first issue have been raised very easily. Two elect women, Mrs. Emma Stone and Mrs. Caroline Groninger, who have the welfare of the Academy greatly at heart, as soon as the needs of the Academy were known, and without any solicitation, volunteered to contribute \$50.00 and \$25.00 respectively. Mr. John H. Charles, first president of the Academy and long-time president of the Scientific Association, also contributed \$25.00. The remainder was raised in smaller subscriptions among the members. The time may come, however, when lack of financial support may prevent the issuing of its publications regularly, and an endowment fund should be begun as soon as possible to assist not only in the publication of the proceedings, but to provide support for the library and the museum. The Sioux City Academy is one of four city academies in the middle west (so far as is known to the writer), the others being located in Chicago, St. Louis and Davenport, Ia. Each of these has a handsome building and one at least a goodly endowment. At present we are tenants of the City Building and Morningside College, the hall where most of our meetings

are held being in the former and the museum and library in the latter. May we not, with some degree of hope, look forward to the time when we shall have our own building, always open to the public and containing a valuable research library and museum, which would be a great source of profit and pleasure to the citizens of Sioux City and the surrounding region?

We now have a very respectable museum and the beginning of a library, both of which should be very largely increased in the near future. We respectfully solicit funds for binding books and buying new museum and book cases, and material for the library and museum as follows:

CONTRIBUTIONS DESIRED.

1. Reports of all kinds, minutes of religious bodies, conventions, conferences, synods, etc.
 2. Books, papers, pamphlets, etc., by Sioux City authors.
 3. Files of old and current newspapers, magazines and catalogues published in any part of the Northwest.
 4. Old letters, manuscripts, diaries, personal narratives, or biographies of old settlers.
 5. Well authenticated facts concerning the naming of cities, towns, townships, lakes and rivers of the Northwest.
 6. Facts of Indian history, manners, customs, stories, or legends.
 7. Catalogs of Iowa, Dakota and Nebraska educational institutions, together with their histories.
 8. State publications or publications of state institutions, such as geological surveys, historical societies, etc.
 9. In brief, anything that relates to the history of the great Northwest, which will soon decay or be destroyed or forgotten unless preserved in a museum or well cared for library.
 10. We desire for our museum articles of historical interest, photographs of prominent citizens, and public buildings, or drawings, paintings or portraits of historical value.
 11. Arms, flags, and equipment of the soldiers of any of our great American wars.
 12. Arrow heads, weapons, pottery, clothing, trinkets, and utensils of the American Indian.
 13. Fossils, minerals, shells, mounted specimens of animals and plants, curios, or anything of scientific value.
- Correspondence should be addressed to the librarian or curator.

OFFICERS OF THE ACADEMY

1903-'04.

President—JOHN H. CHARLES.
 Vice-President—HON. GEORGE W. WAKEFIELD.
 Secretary—H. C. POWERS.
 Treasurer—JOHN AMERLAND.
 Editor—ALFRED N. COOK.
 Librarian—FRANK H. GARVER.
 Curator—G. B. HEALY.

STANDING COMMITTEES

Programme—A. N. Cook, Geo. W. Wakefield, H. C. Powers.
 Library—F. H. Garver, J. S. McSparren, C. R. Marks.
 Museum—G. B. Healy, H. C. Powers, Geo. F. Barsalou.
 Papers and Publications—A. N. Cook, F. H. Garver, H. C. Powers,
 G. B. Healy.

PAST PRESIDENTS

J. C. C. HOSKINS.....	1885-'86
J. C. C. HOSKINS.....	1887
J. C. C. HOSKINS.....	1888
J. PERRIN JOHNSON.....	1889
J. PERRIN JOHNSON.....	1890
G. J. ROSS.....	1891
JOHN H. CHARLES.....	1892
JOHN H. CHARLES.....	1893
JOHN H. CHARLES.....	1894
JOHN H. CHARLES.....	1895
JOHN H. CHARLES.....	1896
JOHN H. CHARLES.....	1897
JOHN H. CHARLES.....	1898
JOHN H. CHARLES.....	1899
JOHN H. CHARLES.....	1900
JOHN H. CHARLES.....	1901
JOHN H. CHARLES.....	1902
JOHN H. CHARLES (Pres. of the Academy).....	1903-'04
JOHN H. CHARLES, President Emeritus for life.....	1904
GEO. W. WAKEFIELD (Pres. of the Academy, elect).....	1904-'05

OFFICERS OF THE ACADEMY--(Elect)

1904-'05.

Honorary President—JOHN H. CHARLES.

President—GEO. W. WAKEFIELD.

First Vice-President—T. J. STONE.*

—C. R. MARKS.**

Second Vice-President—WILLIS MARSHALL.

Secretary—W. T. STAFFORD.

Treasurer—JOHN AMERLAND.

Editor—ALFRED N. COOK.

Librarian—F. H. GARVER.

Curator—H. C. POWERS.

STANDING COMMITTEES

Programme—George W. Wakefield, W. T. Stafford, H. C. Powers.

Papers and Publications—A. N. Cook, F. H. Garver, W. T. Stafford
and H. C. Powers.

Museum—H. C. Powers, G. B. Healy, R. B. Wylie.

Library—F. H. Garver, C. R. Marks, J. H. Quick.

*Mr. Stone died suddenly on the evening of his election.

**Elected to fill the vacancy.

MEMBERS

AMERLAND, JOHN.....	Lawyer and Real Estate
BARSALOU, GEORGE F.....	Professor, Morningside College
BLANCHARD, A. W.....	Salesman
BROWN, E. A.....	County Supt. of Schools, Woodbury Co.
BROWN, H. I.....	Lawyer and Justice of the Peace
BURTON, R. H.....	Lawyer
CASSADY, IDA M.....	271 Jackson St.
CALDWELL, E. W.....	Ex-Mayor of Sioux City
CHANDLER, S. L.....	Pastor Haddock Memorial Church
CHASE, H. W.....	Lawyer
CLARK, WHIT H.....	Principal of Longfellow School
CLUETT, F. G.....	Osteopath
COOK, A. N.....	Professor of Chemistry, State University, Vermillion, S. D.
DAILY, MILTON.....	Physician
GARRETSON, A. S.....	Banker
GARVER, F. H.....	Professor of History, Morningside College
GREEN, J. W.....	Coast and Geodetic Survey, Washington, D. C.
GREYNALD, REYNARD....	Professor of French, Morningside College
*GRONINGER, AUGUST	Banker
HARVEY, LEROY F.....	Professor of Biology, Yankton College, S. D.
HAYNES, F. E.....	Professor of Sociology, Morningside College
HEALY, G. B.....	President Board of Waterworks Trustees
HEIZER, FRED.....	Supervisor of Music, City Schools
HOSKINS, J. C. C.....	1523 Rebecca St.
HUMBERT, L. E.....	Business
HOSKINS, S. B.....	Physician
KANTHLENER, H. F.....	Professor of Greek, Morningside College
KILBORNE, C. P.....	Manager International Harvester Co.
LARSON, EDITH.....	Vocalist, Morningside Conservatory
LEWIS, W. S.....	President Morningside College
MANNHEIMER, E.....	Rabbi
MARKS, C. R.....	Lawyer
MARSH, S. P.....	Real Estate
MARSHALL, WILLIS.....	Insurance Agent
McSPARREN, J. S.....	Deputy Auditor of Woodbury County
OBERHOLZER, MRS. ROSA.....	Librarian of City Library
PERKINS, GEORGE D.....	Editor of Daily Journal
PINCKNEY, J. M.....	Book Dealer
POWERS, H. C.....	College Professor, Retired
POWERS, J. D. O.....	Pastor of Unity Church
QUICK, J. HERBERT.....	Lawyer and ex-Mayor
ROSS, G. J.....	City Physician

*Deceased.

- SMYLIE, DR. ROBERT.....Presiding Elder, Sioux City District
- SAWYER, P. A.....Lawyer
- *STONE, T. J.....Banker
- STAFFORD, W. T.....Lawyer and Justice of the Peace
- THOMPSON, R.....Prin. of South Sioux City Schools
- TREDWAY, O. C.....Lawyer
- VAN HORNE, ROBERT Professor of Mathematics, Morningside College
- WAKEFIELD, GEORGE W.....Judge of the District Court
- WYLIE, ROBERT B.....Fellow in Botany, Univ. of Chicago

*Deceased.

CORRESPONDING MEMBERS.

- BURCHARD, ERNEST F.... U. S. Geological Survey, Washington, D. C.
- HADDEN, DAVID E.....Druggist and Astronomer, Alta, Ia.
- McCLELLAND, NELLIE B.....Co. Supt. of Schools, Sturgis, S. D.
- O'DONOGHUE, J. H.....City Supt. of Schools, Storm Lake, Ia.
- WAKEFIELD, BANDUSIA.....Point Loma, Cal.

LIFE MEMBERS.

- CHARLES, JOHN H.....721 Pierce St.
- FINK, DR. B.....Professor of Botany, Iowa College, Grinnell, Ia.
- GRONINGER, MRS. CAROLINE.....714 Pearl St.
- STONE, MRS. EMMA.....624 Jones St.

FELLOWS.

- BARSALOU, G. F.....Elected, Jan. 29, 1904
- BURCHARD, ERNEST F.....Elected, Jan. 19, 1904
- CHARLES, JOHN H.....Elected, Jan. 19, 1904
- COOK, ALFRED N.....Appointed by the President, Oct. 27, 1903
- FINK, DR. B.....Elected, July 30, 1904
- GARVER, FRANK H.....Elected, Jan. 19, 1904
- HADDEN, DAVID E.....Elected, Jan. 19, 1904
- HARVEY, LEROY F.....Elected, Jan. 19, 1904
- HAYNES, FRED E.....Elected, Jan. 19, 1904
- HEALY, G. B.....Elected, Jan. 19, 1904
- HOSKINS, J. C. C..... Appointed by the President, Oct. 27, 1903
- KANTHLENER, H. F.....Elected, Jan. 19, 1904
- LEWIS, W. S.....Elected, Jan. 29, 1904
- MARKS, C. R.....Elected, Jan. 19, 1904
- MARSHALL, WILLISElected, Jan. 19, 1904
- POWERS, H. C.....Elected, Jan. 19, 1904
- QUICK, J. H.....Elected, Jan. 19, 1904
- ROSS, G. J.....Elected, Jan. 19, 1904
- TREDWAY, O. C.....Elected, Jan. 19, 1904
- WAKEFIELD, GEO. W.....Appointed by the President, Oct. 27, 1903
- WAKEFIELD, BANDUSIA.....Elected, Jan. 19, 1904
- WYLIE, ROBERT B.....Elected, July 30, 1904

CONSTITUTION AND BY-LAWS

CONSTITUTION.

ARTICLE I.

NAME.

The name of this organization shall be the Academy of Science and Letters of Sioux City.

ARTICLE II.

OBJECT.

The object of the Academy shall be: First, Original investigation in Science, History, Sociology, and other branches of useful knowledge and the promotion of the study thereof; Second, the publication of the Proceedings of the Academy and such original papers as may be deemed profitable; Third, the maintenance of a Museum and a Library and to provide for public meetings for the delivery of papers and lectures.

ARTICLE III.

MEMBERSHIP.

Section 1. The Academy membership shall consist of regular members, corresponding members, honorary members, life members, and fellows.

Sec. 2. Candidates for admission to membership, whether as regular, or corresponding, or honorary members, must be proposed in writing by two members at a business meeting, and be balloted for at the next regular meeting, and any candidate receiving three negative ballots shall be rejected.

Sec. 3. A rejected candidate shall be ineligible for membership for three months next ensuing.

Sec. 4. Any member may be expelled or removed from office, after due hearing, by a two-thirds vote of the members present at any regular meeting, provided, that notice of contemplated action in the case shall have been given at the regular meeting next preceding.

Sec. 5. Fellows shall be elected as occasion requires by the board of fellows from among the members who may be deemed worthy to be so distinguished. The president of the Academy shall be chairman of the board of fellows, [and shall appoint and name the first three].

Sec. 6. Life members may be elected to the Academy upon such terms as may be deemed best in each individual case.

ARTICLE IV.

OFFICERS.

Section 1. The officers of the Academy shall be President, First Vice-President, Second Vice-President, Secretary, Treasurer, Editor, Librarian, and Curator, who shall be elected by ballot at an annual meeting of the Academy, to be held on the second Tuesday in April of each year and shall hold office for the year, or until their successors are elected and qualified.

Sec. 2. Vacancies in any of the said offices shall be filled by ballot at any regular meeting of the Academy, notice of the vacancies and proposed elections having been given by the President at the regular meeting next preceding

ARTICLE V.

DISQUALIFICATION TO VOTE.

No member shall be allowed to vote unless he shall have paid all dues, fines, and assessments that may have been levied upon him.

ARTICLE VI.

DIRECTORS.

The President, Vice-Presidents, Secretary, Treasurer, Editor, Librarian, and Curator shall constitute a Board of Directors by whom the affairs of the Academy shall be managed, but they shall at all times be under the control and direction of the Academy.

ARTICLE VII.

SUSPENSION AND EXPULSION.

Any member failing to pay his dues, fines or assessments for the space of one year shall be notified of his delinquency by the Treasurer and if such dues, fines, or assessments remain unpaid after ten days, he may be suspended or dropped from membership by a two-thirds vote of the members present at any regular meeting.

ARTICLE VIII.

COMPENSATION AND EXPENSE.

No compensation shall be paid to any person or any expense incurred unless the same shall be authorized by a vote of the members present at a regular meeting.

ARTICLE IX.

AMENDMENTS.

Any proposition to alter or amend this constitution shall be submitted in writing at a regular meeting, and shall lie over for consideration until the next regular meeting, when it may be adopted, upon a call of yeas and nays, by a two-thirds vote of the members present.

BY-LAWS.

I.—DUTIES OF OFFICERS.

Section 1. The President shall preside at all meetings of the Academy and Directors, and exercise such general supervision on and control of the affairs of the Academy as may be consistent with the Constitution and By-Laws.

Sec. 2. The Vice-President shall perform the duties of the President in case of his absence or inability to act.

Sec. 3. The Recording Secretary shall take and preserve minutes of the proceedings of the Academy, and of the Board of Directors, in books to be kept for that purpose; shall have charge of all records belonging to the Academy; shall notify resident members of their election, and committees of their appointment; shall call special meetings when directed by the President and shall notify resident members of all meetings, and officers of all matters which shall occur at any meeting requiring their action. He shall also have charge of the seal of the Academy. He shall conduct the correspondence of the Academy, and shall keep a record thereof; acknowledge all donations, notify corresponding and non-resident members of their election, and receive and read to the Academy all communications which may be addressed to him as its Secretary.

Sec. 4. The Treasurer shall have charge of all money and other property of the Academy; shall collect all fees and assessments and receive all donations; shall pay all accounts against the Academy when the same shall have been approved by the directors, by warrants drawn by the Secretary and countersigned by the President; shall keep a correct account of all receipts and expenditures in books belonging to the Academy, and shall at each annual meeting, and at other times when required by the Board of Directors, make a detailed report, and add thereto a full and complete inventory of all property of the Academy in his possession or under his control, and shall give bond in such amount as shall be required by the Academy.

Sec. 5. The editor shall have charge of the publication of the proceedings, assisted by the Secretary, Librarian, and Curator.

Sec. 6. The Librarian shall have charge of the library and shall superintend the distribution of publications. He shall make an annual report at the close of the year.

Sec. 7. The Curator shall have charge of the museum and shall make an annual report at the close of the year.

Sec. 8. The Board of Directors shall control all expenditures of money, and have full power to act for the interest of the Academy, in any way not inconsistent with the Constitution and By-Laws, and shall present, under the direction of the Academy, at each regular meeting, a programme of exercises for the next regular meeting, and provide for its execution.

II.—FEES AND ASSESSMENTS.

Section 1. Every member shall pay at his admission an initiation fee of \$1.00 and thereafter annual dues of \$2.00 before the day prescribed for the annual meeting of each year, and resident Fellows shall pay an annual fee of \$3.00. The dues of corresponding members shall be \$1.00 per year. Students of Morningside college, the Sioux City High School and non-residents of Sioux City shall be eligible to corresponding membership.

Sec. 2. No other assessment of members shall be made, except after one month's notice, and by a vote of three-fourths of the members present.

III.—MEETINGS.

Section 1. At the annual meeting the Board of Directors shall make an annual report embodying the several reports of the officers.

Sec. 2. Regular meetings shall be held at such times, from year to year, as shall be named by the programme committee.

Sec. 3. Special meetings may be called by the president and upon request of not less than five members he must call such meeting.

IV.—QUORUM.

Five members of the Academy shall constitute a quorum for business.

V.—ORDER OF BUSINESS.

The order of proceedings shall be as follows:

1. Reading the record of preceding meeting.
2. Proposal of candidates for membership.
3. Balloting for members.
4. Written communications read.
5. Verbal communications made.
6. Business called up by special resolution or otherwise.
7. Directions announced.
8. Adjournment.

VI.—ALTERATIONS OR AMENDMENTS.

The By-Laws of the Academy may be altered or amended in the same manner as is provided in the Constitution for its alteration or amendment.

SECRETARY'S REPORT

To the Officers and Members of the Sioux City Academy of Science and Letters:

As Secretary I would report as follows of the last year's work of the Academy:

During the year just closing fourteen meetings have been held, besides the annual picnic of the members. Two of these meetings were for business and were called for the purpose of changing from the old Scientific Association to the present Academy of Science and Letters.

The new constitution of the Academy was proposed at a meeting held at the home of President John H. Charles, on Sept. 21st, 1903. This was unanimously adopted on Oct. 27th, 1903.

There have been read before the Academy during the past year thirteen papers, with authors and subjects as follows:

Oct. 27th by Hon. G. W. Wakefield, on "Protozoa."

Nov. 17th by Prof. L. H. Harvey, on "The Physiographic Ecology of Mt. Katahdin in Maine."—Stereopticon.

Dec. 1st by Mr. W. T. Stafford, on "Cliff Dwellings."

Dec. 15th by Dr. Milton Daily, on "The Phenomena of Life as Illustrated in Plant and Animal."

Jan. 5th by Hon. J. H. Quick, on "The Outlook for Constitutional Progress in the United States."

Jan. 19th by Prof. H. F. Kanthlener, on "A Study in Greek Religion; Grave Offerings as Illustrated by White Lekythoi."

The same evening a second paper was read by Prof. F. H. Garver on "Some Phases of the Early History of Sioux City."

Feb. 2d by Prof. F. E. Haynes, on "The Most Hopeful Method of Dealing with the Criminal."

Feb. 16th by Mr. C. R. Marks, on "Stories of Early French Settlers of Sioux City."

Mar. 1st by Prof. Willis Marshall, on "Some Instances of Mind Transferences."

Mar. 15th by Prof. W. H. Clark, on "Ventilation in the Public Schools of Sioux City."

Mar. 29th by Rev. J. D. O. Powers, on "Tolstoy's Message to the World."

During the past year there has been proposed for membership in the Academy forty-one names, all of the persons being elected.

On Jan. 19th the following was adopted as an amendment to the By-Laws:—"The dues of corresponding members shall be one dollar per year. Such members shall be entitled to all the privileges of full membership except that of voting. Students of Morningside College, the Sioux City High School and non-residents of Sioux City shall be eligible for Corresponding Membership."

On Mar. 15th the following amendment to the constitution was adopted:—"Life Members may be elected to the Academy upon such terms as may be deemed best in each individual case."

H. C. POWERS, Secretary.

Sioux City, Ia., April 19, 1904.

TREASURER'S REPORT

RECEIPTS.

Jan. 13, 1903. Balance on hand.....	\$ 72.82
April 19, 1904. Receipts from dues.....	48.00
Total	\$120.82

EXPENDITURES.

Oct. 22, 1903—Perkins Bros Co., printing postal cards.....	\$ 6.25
Oct. 27, 1903—Perkins Bros. Co., printing programmes.....	4.50
Oct. 28, 1903—Geo. W. Wakefield, expense	92
Oct. 28, 1903—H. C. Powers, picnic expense.....	1.68
Oct. 31, 1903—R. H. B. Smith, picnic expense.....	92
Dec. 29, 1903—Mrs. C. K. Smith, picnic expense.....	46
Dec. 29, 1903—G. B. Healy, picnic expense.....	2.00,
Dec. 9, 1903—J. C. C. Hoskins.....	46
Dec. 29, 1903—Sioux City Traction Co.....	2.50
Jan. 3, 1904—Perkins Bros. Co., printing 250 applications.....	2.00
Jan. 30, 1904—Montford Stereopticon.....	3.00
Jan. 30, 1904—Perkins Bros. Co., 300 letter heads.....	2.75
Feb. 2, 1904—Fullerton Lumber Co.....	21.02
Feb. 20, 1904—Perkins Bros. Co., printing 500 letter heads.....	3.00
Feb. 29, 1904—Oscar Ruff, 2 boxes glass.....	11.40
Mch. 1, 1904—Gillette Hardware Co., hardware.....	1.50
Mch. 5, 1904—Fullerton Lumber Co.....	2.80
Mch. 16, 1904—H. C. Powers, work on cases.....	16.00
Apr. 11, 1904—H. C. Powers, trays.....	2.50
Apr. 11, 1904—H. C. Powers, varnish.....	2.00
Mch. 12, 1904—Perkins Bros. Co., printing.....	6.50
Total	\$92.16
April 19, 1904—Balance on hand.....	28.66

JOHN AMERLAND, Treasurer

LIBRARIAN'S REPORT

BOOKS AND PAMPHLETS BELONGING TO THE SCIENTIFIC ASSOCIATION.

UNITED STATES GEOLOGICAL SURVEY—

- Year 1889-90 Part II.
- “ 1891-2 Parts I, II, III.
- “ 1891 (Paper, 2 vols.)
- “ 1892-3 Parts I, II.
- “ 1892 Mineral Resources.
- “ 1893-4 Part I.
- “ 1893 Mineral Resources.
- “ 1894-5 Parts I, II, III, IV.
- “ 1895-6 “ I, II, III, IV.
- “ 1896-7 “ I, II, III, IV, V (2 vols.).
- “ 1897-8 “ I, II, III, IV, V (2 vols.), VI (2 vols.).
- “ 1898-9 “ I, II, III, IV, V (V maps), VI (2 vols.), VII.
- “ 1899-0 “ I, II, III, IV, V (atlas), VI (2 vols.), VII.
- “ 1900-1 “ I, II, III, IV.

Geography, Geology and Gold Deposits of Alaska, with maps, 1898.

Preliminary report of Cape Nome Gold Region, Alaska, 1900.

IOWA GEOLOGICAL SURVEY REPORTS—

- Volume 1—1892 Annual Report.
- “ II—1894 Coal Deposits.
- “ X—1899 Annual Report.
- “ IV—1894 “ “
- “ VI—1897 Lead, Zinc, Artesian Wells, etc.
- “ X—1889 Annual Report.
- “ XI—1900 “ “
- “ XII—1901 “ “
- “ XIII—1902 “ “

U. S. DEPARTMENT OF AGRICULTURAL REPORTS—

General Reports, 1886, 1888.

Division of Forestry Reports, 1887, 1888 (bulletin 2), 1891, 1892, 1893 (bulletin 7).

Division of Vegetable Pathology—

1891—Bulletin No. 1.

1892—Journal of Mycology, Vol. VII, No. 2.

1893—Journal of Mycology, Vol. VII, No. 3.

1893—Bulletin No. 4.

Division of Economic Ornithology—

1889—Bulletin No. 1

1888—Bulletin No. 2.

Farmer's Bulletin, No. 7, Spraying Fruits, 1892.

ANNUAL REPORT OF CHIEF OF U. S. ENGINEERS—

1894—Appendix A. A.

Improvement of the Missouri River.

CORNELL UNIVERSITY AGRICULTURAL EXPERIMENT
STATION—

Horticultural Division, Bulletins Nos. 69, 70, 73, 74, 75, 76, 77.

THE TRANSIT, STATE UNIVERSITY OF IOWA—

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APRIL 19, 1904.

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A. Publications by the Academy—

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ganisms in the Bowlder Clays of Chicago and vicinity
—Johnson and Thomas.

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Bulletin No. 6—Bowlder Clays—Dawson.

Bulletin No. 7—Some Points on the Micro-Chemistry of
Fats—Long.

Bulletin No. 8—Chicago Artesian Wells—Stone.

Bulletin No. 9—On Rhizocarps in the Erian Period in
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- Bulletin No. 2—Preliminary Outline of a New Classification of the Family Muricidæ—Baker.
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- “ 1901, “ XIII, “ II.
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- “ 1896, “ IV.
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(Through G. S. Robinson).

- Biennial Reports—1st 1899.
- “ “ —2nd 1901.
- “ “ —3rd 1902.

Quarterly Bulletins, 5 volumes, 20 numbers.

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(Through Chas. Aldrich.)

- Larrabee, Wm.—The Railroad Question.
- Shambaugh, B. F.—History of Iowa Constitutions.
- Dodge, Major-Gen. G. M.—Personal Recollections of Gen. W. T. Sherman.
- Dodge, Major-Gen. G. M.—Sketch of Major-Gen. J. A. Williamson.
- Statute Laws of the Territory of Iowa, enacted 1838-9.
- Laws of Territory of Iowa, enacted 1839-40.
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- Journal of the Council of 2nd Legis. Assem., 1840.
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- Pioneer Lawmakers Report, 8th annual, 1902.
- Handbook of Iowa Soldiers' and Sailors' Monuments.

FROM THE IOWA STATE BAR ASSOCIATION—

(Through G. W. Wakefield).

Annual Reports, 1896, 1897, 1898, 1899, 1900, 1901, 1902.

FROM WILLIS MARSHALL—

Cycles—a volume of poems.

FROM MRS. G. P. GOLDIE—

Light Out of Darkness.

FROM H. W. ALLEN—

The Hundred Days Men in the War of Rebellion.

FROM MRS. W. W. BROWN—

White Wings of Peace.

FROM G. W. WAKEFIELD—

Evolution of the Mental Horizon.

Evolution of the Humane Sentiment.

Arjuna.

Emerson the Poet.

Eight Sonnets.

FROM A. N. COOK—

Iowa Weather Crop Service, 1902.

Mineral Resources of Kansas, 1897.

Proceedings Iowa Academy of Science, Volume III, 1895.

FROM F. H. GARVER—

Ninth Annual Report of the Bureau of Labor Statistics of
Iowa, 1899-1900.

Biennial Report of Supt. of Public Instruction, Iowa, 1899.

The Indian, The Northwest, 2 copies.

Wonderland, 1900, 2 copies.

Hoar, Geo. F.—American Citizenship.

Avery—Some Fragments of Iowa History.

FROM F. C. BAKER—

Baker, Frank C.—A Naturalist in Mexico.

FROM DAVID E. HADDEN—

U. S. Geological Survey, Reports—

1884-5—

1886-7—Parts I, II.

1889-0— “ II.

1890-1— “ I, II.

1891-2— “ I, II.

1892-3— “ I, II.

1899—

Memoirs of National Academy of Science—

1884—Volume III, Part I.

1889— “ IV, “ II.

1899— “ VIII.

FROM DAVID E. HADDEN—CONTINUED.

- Publications of U. S. Naval Observatory—
 - 1880—Appendix I; The Great Comet of 1882.
 - 1882— “ II; Annular Eclipse of Sun, 1885.
 - 1887—Report of Magnetic Observations of Europe.
- Meteorological Observations and Results.
- International Marine Conference, 1889, 3 volumes.
- Year Book U. S. Dept. of Agriculture, 1886, 1895, 1896.
- Bureau of Animal Industry, 3rd annual report, 1886.
- U. S. Entomological Commission, 4th annual report, 1883-5.
- Smithsonian Inst. Reports, 4 volumes.
 - 1884, Part II; 1886, Part I; 1887, 1900.
- Origin and History, 2 volumes.
- Proceedings National Educational Association, 1895.
- Report of Chief Signal Officer, War Dept., 1890.
- The Naturalists Directory of U. S. and Canada, 1895.
- Iowa Year Book of Agriculture, 1898, 1901.
- Iowa Official Register, 1899.
- Popular Astronomy, Nov. 1903.
- Hadden, David E.—Total Solar Eclipse of May 28, 1900.
 - “ 1500 Miles in Quest of a Shadow, 1900.
 - “ Review of Solar Observations at Alta, Ia., for year 1901.
 - “ The Solar Surface During the Past Twelve Years, 1890-1902.
 - “ Recent Large Sun Spots, 1903.

SUMMARY.

VOLUMES POSSESSED BY SCIENTIFIC ASSOCIATION—

Bound volumes	65
Paper volumes	5
Total number volumes.....	70
Pamphlets	29

ACCESSIONS DURING YEAR ENDING APRIL 12, 1904.

Bound volumes	47
Paper volumes	10
Total number volumes.....	57
Pamphlets	66

NOW IN LIBRARY—

Number of volumes.....	127
Numbers of Pamphlets.....	95

EXCHANGE LIST.

There are now on the exchange list of the Academy the following publications:

- Proceedings of the Iowa Academy of Science.
 “ “ Chicago Academy of Science.
 “ “ Davenport Academy of Science.
 “ “ Wisconsin Academy of Science, Arts and
 Letters.
 Reports of the Geological Survey of Iowa.
 Annals of Iowa.
 Bulletin of State Board of Control.

It is expected that this list will immediately grow very materially in length now that the first volume of our proceedings is ready for distribution. We respectfully solicit exchange with other Academies, Historical Societies and kindred organizations.

 WANTED.

To complete our files the Academy respectfully solicits, among other works, the following:

- U. S. Geological Survey, for years 1885-6, 1887-8, 1889-90,
 Part I.
 Iowa Geological Survey, volumes 5, 7, 8 and 9.
 U. S. Ethnological Reports.
 Smithsonian Institution Reports, except for 1887, 1900, 1884
 Part II, and 1886, Part I.
 Proceedings of any and all Academies of Science.
 Reports of Iowa State Bar Association for 1895 and 1903.
 Reports of Pioneer Lawmakers' Association, except 8th.
 Annals of Iowa, 1st and 2nd series.
 Iowa Official Register, except 1899.
 Congressional Records.
 Journals, etc., of the State Legislature.
 Directories (old) of Sioux City, except 1894-5.
 Publications of Sioux City Officers.
 Sioux City, Ia., April 19, 1904.

F. H. GARVER,
 Librarian.

CURATOR'S REPORT

To the Officers and Members of the Sioux City Academy of Science and Letters:

As Acting Curator I offer the following report for the past year:

Soon after the organization of the Sioux City Academy of Science and Letters, Dr. W. S. Lewis, President of Morningside College, offered for our use as museum and library a very fine room in the new college building. To this room our collection of specimens, as well as those in our care but not belonging to us, together with our books, were moved during the close of last year. Since then there have been made three large glass-topped cases to hold the specimens, and the small case that formerly held the Brown collection in this room, has been changed to a book case, in which are the larger part of our books. The natural history specimens have been placed in the cases made for them, but are not yet properly named and classified. There should be provided labels for these specimens, so that name, number, and where they came from could be plainly shown.

There have been accessions to our collection since its removal, from different persons as donations. We are also promised more specimens from the Chicago Academy of Science and from the Smithsonian Institute at Washington.

When our collection is properly named and arranged it will make a very creditable showing as to size and variety, and can easily be increased very much. There are many specimens of minerals, fossils and shells in the homes of Sioux City and vicinity whose owners might feel disposed to donate to our collection if they knew they would be preserved and cared for.

I hope that before the end of another year we shall build up the museum far beyond its present size so that it may become a source of pleasure and profit, not only to the members of the Academy, but to all the citizens of our city, and especially to the students who come to us from all directions.

H. C. POWERS, Acting Curator.

Sioux City, Ia., April 19, 1904.

TRANSACTIONS OF THE BOARD OF FELLOWS

On Oct. 27, 1903, three men were appointed by President Charles as Fellows, according to a provision which was adopted with the constitution, who were to form the nucleus of the Board of Fellows. This board met on Jan. 19, 1904, and adopted the following report:

Sioux City, Iowa, Jan. 19, 1904.

To John H. Charles, President, Officers and Members of the Sioux City Academy of Science and Letters:

The undersigned committee and Board of Fellows, appointed by the President of the Academy, have had under consideration the election of Fellows and have elected additional Fellows and report herein the names of Fellows, including those appointed by the President. We have concluded that John H. Charles, President of the Academy, and for many years the earnest and efficient President of the Scientific Association, and J. C. C. Hoskins and G. B. Healy, C. R. Marks, Dr. Grant J. Ross, O. C. Tredway and Geo. W. Wakefield, who for years have been active members of the Scientific Association and have contributed largely to its life and success by numerous papers prepared for and read at its meetings, should be advanced to Fellows, and each of them have accordingly been elected to membership to the Board of Fellows. We have also elected the following members of the Board of Fellows, to-wit: Prof. A. N. Cook, of Morningside College, who has prosecuted important original scientific work; Prof. F. H. Garver, of Morningside College, who is engaged in original work in local history; Dr. Fred E. Haynes, of Morningside College, who is giving special attention to sociology; Prof. L. H. Harvey, of Morningside College, who is doing original work in biology; David Hadden, of Alta, Iowa, who has by his published papers achieved a wide reputation as an astronomer; J. H. Quick, of Sioux City, lawyer and author, having published one book, which has been well received, and has another announced, which is highly commended; Prof. Willis Marshall, of Sioux City, who is author of a book of poems; Prof. H. C. Powers.

the active and efficient secretary of the Academy; Prof. H. F. Kanthener, professor of Greek in Morningside College, who has been carrying on research work at Harvard University on the Greek religion; Prof. Ernest Burchard, who is now connected with the United States Geological Survey, and Miss Bandusia Wakefield, who is now at Point Loma, California.

ALFRED N. COOK.

J. C. C. HOSKINS.

GEO. W. WAKEFIELD.

Another meeting was called at the home of Mr. John H. Charles on the evening of Jan. 29th. A large number of the newly elected Fellows were present. Various lines of possible original work were suggested and discussed at length, much of which seemed very feasible for members of the Academy to undertake, but no definite recommendations were made to the Academy. However, the discussion of the evening has already begun to bear fruit.

A short meeting was held at the office of W. T. Stafford on July 30, 1904, when Dr. B. Fink, professor of botany in Iowa College, author of many important papers on lichens and withal one of the leading botanists of the west, and Dr. Robert B. Wylie, professor of botany in Morningside College and for three years Fellow in Botany in University of Chicago, and author of an important research in Botany, were elected Fellows of the Academy.

ANNUAL PRESIDENTIAL ADDRESS.

By Vice-President GEO. W. WAKEFIELD.

Officers and Members of the Sioux City Academy of Science and Letters: At the request of our much esteemed and revered President, Mr. John H. Charles, who has served as presiding officer most faithfully for many years, I present the following annual address:— This Association was incorporated in 1886 to promote scientific study and investigation. Through the intervening years each winter there has been presented to the Sioux City public a series of papers on scientific subjects, for the most part prepared and read by our members. These efforts have largely served to increase our store of knowledge of the observations and speculations of others, yet we have in some measure gathered and reported data within our own field of observation. The persistent interest and energy on the part of Mr. Charles has been a potent influence in maintaining our organization and meetings, and we still delight to honor him. Last summer we revised our articles of incorporation with the purpose of enlarging the scope of our efforts, and particularly with the view that in the future we should give careful attention to the facts in nature that are all about us and near us. Such facts constitute in part the data upon which true science is founded. For the data within our own field we should use our own eyes, observe, record and report the facts. By so doing we may make the Academy an important recruiting station for scientific data. As I have intimated, the past has not been barren in this respect, and I will mention some matters that now occur to me. One of our members gathered, arranged and numbered the remains of a saurian found in southwestern Plymouth county, which are still in the custody of the Academy. These remains were sent to Prof. O. C. Marsh

to be examined, classified and named. Though he retained them for years, he did not classify or name the specimen, and it was returned to us after his death. Here is work for the paleontologist. We also have some huge remains from Cherry county Neb., that should receive his attention. Another associated with us observed, identified and reported to Prof. Coulter quite a number of plants growing here not before listed as growing in Iowa. Another first directed the attention of members of our state geological survey to the till interbedded with the loess in the vicinity of Sioux City. Our Mr. Hoskins from time to time has been the guide of eminent scientists who have visited this locality to inspect the geological formations here and at a time when they were of especial interest. The location of burial mounds and kitchen middens in this vicinity has been observed and reported to the Association and to the bureau of ethnology at Washington. Mr. Quick's report of pictographs found on the rocks near the Winnebago reservation was given place in the report of the bureau.

We should not overlook the Indians now living on the Winnebago and Omaha reservations, near us. While the government has done much, the field of observation and interest there has not been exhausted. The native fauna and flora should be determined and catalogued before it is too late. A few years ago an orchid grew in one ravine about a mile north of North Riverside, but it can be found there no longer. In a few years it is likely that the more delicate wild flowers of wooded ravines will be exterminated in the march of civilization, through its herds and the woodman's ax. We must also give attention to the beginnings of that civilization here, the early settlers and their struggles and successes. An artesian well was sunk 2,000 feet in Sioux City, and specimens of the drillings brought up by the sand pump were preserved at the time. It may be that these can still be secured for the museum. I need not now further enumerate work ready for our hands. That there is plenty of it is very evident. It is not incumbent upon us to complete the work, but we should begin it and do what we may, as best we may. Again I urge upon you, that the Academy begin at once.

THE SIOUX CITY SCIENTIFIC ASSOCIATION.

By H. C. POWERS.

In every city and village in our land there are always some men who are more interested in the phenomena of Nature than the others. They not only observe closer, but try to learn why. They reason about the things they see and try to know what causes have produced the effects they see about them. There is an affinity or common feeling between such men which always draws them together to talk of what they are interested in and compare notes on what they have seen. Nearly all men have some hobby, some pursuit they follow from pure love of it. Nearly all of us lead two lives separate from each other, one in the business or profession we are compelled to follow for a support, and the other for relaxation, amusement or interest in scientific phenomena of some kind.

Here in Sioux City, back in the days when its inhabitants were fewer in number than now, there were such men. A few in number who were interested in the things that Nature was doing, were in the habit of gathering together in the evening after the business of the day was done, to talk about the subjects they thought about. In all concretions there is a nucleus or center about which the material which forms the concretion gathers. So in the group of friends in our city who gathered to talk of scientific matters, there was one who seemed to be the leader, and in whose office the meetings were held. This was Mr. D. H. Talbot, who is still in our city. Such was the beginning of the Sioux City Scientific Association, which was organized and incorporated in the year 1885. Of the group of men who were charter members then, some have gone over the "Great Divide," learning secrets we can never know here. Others have left the city, some

are still here, but business cares have prevented their continued membership, and a few are still honored members of the Sioux City Academy of Science and Letters, which is the name of the new organization which has grown out of the Scientific Association. The following are the names of the charter members of the old "Scientific Association":—D. H. Talbot, J. C. C. Hoskins, C. R. Marks, J. Perrin Johnson, E. H. Hubbard, A. W. Erwin and E. H. Stone.

Going back to the records kept by the first Recording Secretary, A. W. Erwin, we find that the first meeting as an organization was held at the office of Mr. D. H. Talbot, on the evening of Dec. 23rd, 1885. At this meeting it was decided to incorporate the new Association, and a committee consisting of Mr. J. C. C. Hoskins, A. W. Erwin, D. H. Talbot and E. H. Hubbard, was appointed to prepare a constitution and by-laws for the government of the same, while Mr. E. H. Hubbard was appointed to prepare articles of incorporation.

At the next meeting, held on Dec. 30th, 1885, the constitution, by-laws and articles of incorporation were presented and adopted, and the following were elected as officers for the ensuing year:

President—J. C. C. Hoskins.

Vice-President—Dr. J. Perrin Johnson.

Recording Secretary—A. W. Erwin.

Cor. Secretary—E. H. Hubbard.

Treasurer—D. H. Talbot.

At this same meeting also, Mr. E. H. Hubbard was requested to prepare and read the first paper before the Association on the subject of, "The Definition of the Word Evolution."

At a meeting on Feb. 10th, 1886, the following topics were assigned, as follows, marking out the first program of the new Association and showing the scope of the work it was proposed to do.

"In the Beginning."—J. C. C. Hoskins.

"Evolution of Our Particular Material Universe."—C. R. Marks.

"Evolution of Life in Its Organic and Varied Forms."—J. Perrin Johnson.

“Differentiation of Species and Increasing Complexity of Structure and Multiplicity of Function.”—D. H. Talbot.

“Evolution of Social Amenities, and Growth into Nations.”—A. W. Erwin.

“Evolution of International Relations as Affected by Commerce.”—W. R. Smith.

“Evolution of Banking.”—E. H. Stone.

All of these papers were prepared and read in this first year’s course of meetings.

Applications for membership in the Association began to be made as soon as its organization was made public, and the first two names presented were John H. Charles and W. R. Smith, who were elected on Feb. 10th, 1886. At the next meeting the names of Hon. Geo. W. Wakefield and A. L. Hudson were presented.

From that time to the present regular programs have been issued each year and hundreds of papers on scientific subjects, as well as many others on various interesting topics, have been prepared and read at the meetings of the Association.

During the first two years the meetings were held at the offices or homes of the members, but on March 19th, 1887, the membership had increased so much that a committee was appointed to consider the question of rooms for future meetings.

In the spring of 1887, Dr. Alfred R. Wallace delivered three lectures under the auspices of the Association on the following subjects: “The Darwinian Theory.” “The Origin and Uses of Colors in Animals.” “Oceanic Islands.” These lectures were given in the old Academy of Music and were exceedingly interesting and instructive.

On Nov. 19th, 1887, the County Board of Supervisors granted to the Association the use of the room of the County Superintendent of Schools in the Court House for its meetings and also space in same room for its cases of specimens. On Jan. 17th, 1890, the place of meeting was changed to the new High School building. On completion of the new city library building a permanent home for the Association was gained, a room was suit-

ably furnished, and in this the meetings have since been held. The first meeting in this building was held on October 14th, 1892.

On January 4th, 1889, Dr. J. P. Johnson was elected as President of the Association, which office he held for the ensuing two years. On January 2d, 1891, Dr. G. J. Ross was elected as president, which office he ably filled for the ensuing year, when, on January 8th, 1892, Mr. John H. Charles was elected as President, and has ever since filled the office with honor to himself and the Association.

At a meeting of the Scientific Association on March 31, 1903, a proposal to change the name and broaden the scope of the work of the organization was presented in writing. The proposed change was as follows, and the matter was referred to a committee consisting of H. C. Powers, Geo. W. Wakefield and A. N. Cook.

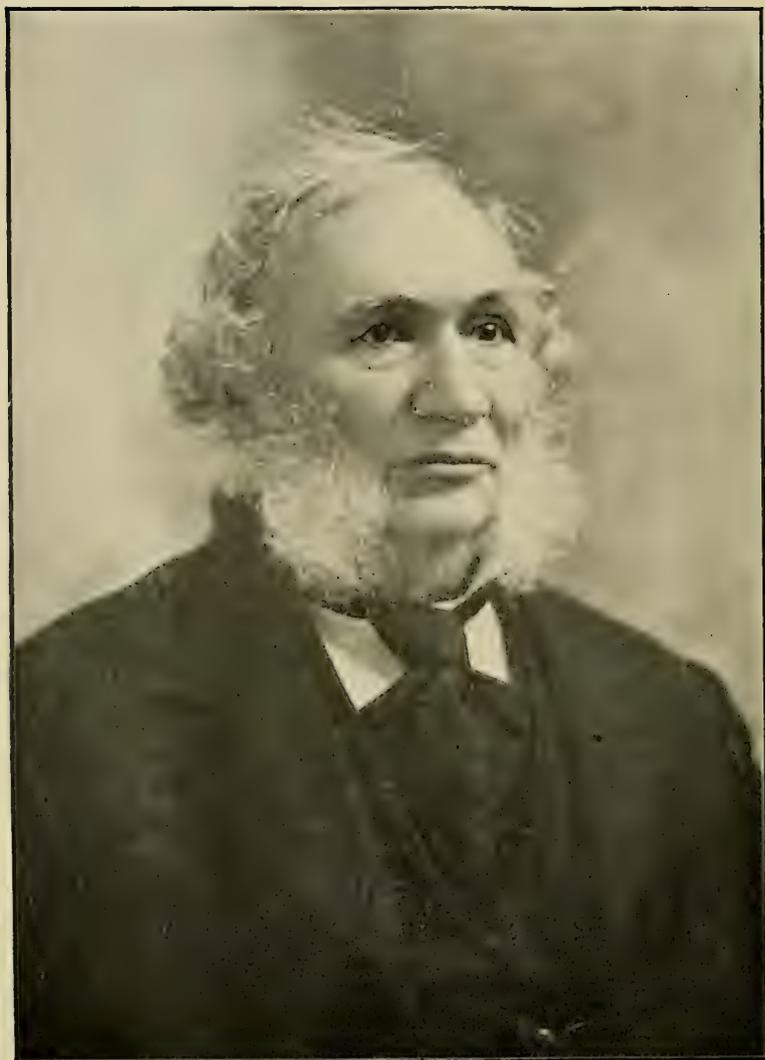
The proposal was as follows: "Change the name from The Scientific Association to The Academy of Science and Letters of Sioux City."

"The object of the organization shall be the diffusion of knowledge and the promotion of original investigation in the Natural Sciences, History, Political Science, Sociology, Literature and other branches of useful knowledge, by the reading and publishing of original papers, establishing and maintaining a museum and library, and by other suitable means."

At a meeting on October 27, 1903, the committee made a favorable report which was unanimously adopted. The necessary amendments to the Constitution and By-Laws, as well as new articles of incorporation were presented and adopted, and the old "Scientific Association" was succeeded by the new "Academy of Science and Letters."

I could not well close this brief sketch of the Scientific Association without speaking of the continued faithfulness and untiring exertions of the older members who have been with it from its beginning, and who are still honored members of the Academy. It would be hard to choose out any single names from so many who are worthy. Of the charter members of the Scientific Association who are still with us, as well as of those who

joined soon after its organization, and who are members of the Academy, are Mr. J. C. C. Hoskins, first president of the Association; Mr. C. R. Marks, Mr. John H. Charles, President Emeritus of the Academy; Hon. Geo. W. Wakefield, President of the Academy, and Dr. Grant J. Ross. Dr. J. Perrin Johnson was an untiring and honored member to the time of his death, two years since. Many others who joined the Association in its early years are still our associates in the work of the Academy. All alike have done what they could to promote the objects of a scientific organization. To all of them the younger members are deeply indebted for the good work of the Sioux City Scientific Association.



JOHN H. CHARLES.

JOHN H. CHARLES.

By FRANK H. GARVER.

At the regular annual business meeting of the Sioux City Academy of Science and Letters held on April the 19th, 1904, there was chosen in addition to the regular officers, an honorary president. The person for whom this office was created was Mr. John H. Charles, first president of the Academy and the subject of this sketch. Ever since its organization in 1885 Mr. Charles has been one of the most active and enthusiastic members of the Scientific Association of Sioux City. Indeed he was chosen president each year from 1890 to 1903, when the Association was merged into the new organization incorporated as the Academy of Science and Letters of Sioux City. In honor of his previous services the Academy unanimously chose him as its first president and at the close of its first year designated him as honorary president.

While in his prime, though a man of unusual activity and burdened with the cares of a large business, Mr. Charles yet found time to attend the meetings of the Scientific Association with great regularity; now, though his health does not permit of attendance upon the Academy sessions, yet his interest in its welfare is keen and is manifested in various ways.

This man whom his friends and fellow citizens have delighted to honor has led an active, eventful career. Born on the 19th of January, 1826, in Hempfield township, Lancaster county, Penn., he moved at the age of four months, taking his parents with him, (as he himself puts it), to Mifflin township, Richland county, Ohio, where he resided till he reached the age of twenty-four. In the meantime a shifting of boundaries threw his father's farm into Ashland county.

During this period Mr. Charles learned the carpenter's and joiner's trade at which he worked during the summer months. This occupation was varied for some five years by that of keeping school in the winter, for which employment he received during the first year, eleven dollars per month and "boarded around." When he quit teaching, five years later, he was receiving twenty dollars a month, the highest wages paid in his county at this time. That very year gold was discovered in California and our school teacher caught the "gold fever." Consequently, on March the 13th, 1850, he left home for California. From Cincinnati he went down the Ohio to St. Louis. He "fitted out" for the overland trip at Independence, Mo., and after a westerly journey of five months finally "brought up at Hangtown, or Placerville, Cal., on the 20th day of August. After trying the mines unsuccessfully for a few months he returned to Ohio by way of the Isthmus. Eighteen months was now spent at home when a second expedition to California was undertaken. This time a longer stay was made in California, but with no better results, the return to Ohio being made by way of Nicaragua.

Gold mining was now abandoned for something more reliable, though the determination to go west still prevailed. A careful consideration of various prospects did not cause a change of plans. Consequently our subject, after an overland journey via Chicago, Iowa City, Des Moines and Ft. Dodge, arrived on Dec. the 1st, 1856, at Sioux City, Ia., a frontier settlement on the very edge of civilization. This early arrival makes Mr. Charles one of the oldest settlers in the city or county, now living.

Before his first winter in Sioux City had passed he crossed over into Nebraska and took up a claim. From this claim he cut and sold enough cord-wood to buy himself a surveyor's outfit. With this equipment he started in the spring of 1857 up the Missouri river to locate a townsite for a party from Ohio. This was done successfully, the town, now St. Helena, Cedar Co., Neb., being then named Opechee. The following three years were spent in the real estate business, varied to a considerable extent by surveying.

In 1860 a departure was made, Mr. Charles entering Tootle's general merchandise store. Four years later he became a partner, the firm name changing to Tootle & Charles. From the first, the firm did a large business, an increasing percentage of which soon came to be that of fitting out steamboats. Mr. Charles continued active in the store 'till 1878, from which date to 1890 he gave all his time to steamboating, a business which, though profitable at first, gradually but steadily declined. The business consisted in furnishing Indian and military supplies to the reservations and forts of the upper Missouri. At one time not only the eight boats owned by the firm, but several others chartered by them, were busy the season through. Now all this is gone. The railroads killed the steamboat business, though not before our subject had made a competence out of it.

From 1880 to 1900 Mr. Charles was the local secretary of the Benton Transportation Co., a Montana firm. In the latter year he retired from active business, still vigorous in mind and spirit, though worn in body.

Mr. Charles has never sought political honors. But in spite of his personal attitude he has had his share of honors political and otherwise. At the first municipal election held in Sioux City, August, 1857, he was called upon to serve as a judge of election. At this time his fellow townsmen chose him alderman from the second ward. In the following October he was elected, much against his will, as justice of the peace. A year later he was appointed to the same position by the county judge. President Lincoln, in 1861, appointed him, without any previous knowledge upon his part, as Indian agent to all the Indians on the upper river. But, as it happened, Mr. Charles was then making preparations to return to Ohio to claim his bride, and as nothing could be allowed to interfere with this event, the appointment was declined. President Lincoln had sent the commission of appointment duly made out and signed. This was the first intimation to Mr. Charles that he had even been considered for the position. The commission is still in the possession of Mr. Charles, by whom it is highly prized.

In 1876, during his absence from the city, Mr. Charles was chosen mayor. Though he served out his

term, performing his duties in an able and conscientious manner, he declined a renomination at the hands of his party.

From the establishment of the Public Library Mr. Charles has been a library trustee continuously to the present time. He is also enrolled as a member of the State Historical Society of Iowa. These two facts illustrate his literary tastes, which are also shown by his private library, which is one of the largest and choicest collections in the city, stocked with the masterpieces of science, history and religion.

In 1895 there was organized at Sioux City the Floyd Memorial Association, the purpose of which was to commemorate the name of Chas. Floyd, a Sergeant of the Lewis-Clark expedition. Of this association Mr. Charles was president from 1896 on until the erection of a beautiful \$12,000 monument in 1900-1 marked the completion of its work. In this noble undertaking all agree that the most powerful single factor working for ultimate success was the ever faithful and resourceful President of the Association, Mr. John H. Charles.

Since 1900 Mr. Charles has lived in retirement at his comfortable home on Pierce street. Here, surrounded by his books, specimens (of which several large cases are full), and souvenirs, he spends his time with his family and friends, of whom his house is the Mecca of a large number. During the past year he has spent considerable time dictating his memoirs, which promise to be exceedingly interesting, since his life was so intimately connected with the business of steamboating, now entirely a thing of the past. Mr. Charles was also a pioneer of Sioux City. Few are left. His comrades and associates of the older days are one by one passing away. Living in the present, yet dwelling largely in the past, Mr. Charles quietly, patiently awaits his turn. May his days among us of a newer age be multiplied.

MR. J. C. C. HOSKINS.

By WILLIS MARSHALL.

Our esteemed and venerable friend, Mr. J. C. C. Hoskins, was born at Lyman, New Hampshire, on the 18th of January, 1820. His father was Samuel Hoskins, a reputable country physician of large practice although of small income. It will be remembered that money was not so abundant in those days. His mother was Harriet Byron, daughter of Caleb Cushing, Esq., of Orange, N. H. Mr. Hoskins was one of eight children—five sons and three daughters—all of whom exemplified the character of their paternal ancestry by a respectable mediocrity of ability, so far as the accumulation of wealth and extended influence go, and their maternal ancestry by a considerable fondness for reading and literature, which doubtless led to the college education of the subject of this sketch. Three of the sons—all that were physically able—also proved that the family hatred of oppression retained its ancient strength, by enlisting at the very outset of the war against slavery, and fighting for freedom until all were free. So in the Revolutionary war his grand-father Hoskins and four brothers fought from beginning to end. In Mr. Hoskins' boyhood there was not much money in his father's house. What fees his father collected from his farmer patients—the community was entirely agricultural—were paid in the products of the farm. So he, with an earnest desire for books and a college education, like most New England boys, had a poor show for success in a career that seemed to him as far off and as much to be desired as heaven itself. But he succeeded. By dint of working on the farm in the summer vacation, and teaching school in the winter, together with some aid from home, he worked his way through college, and at the age of twenty-one found

himself possessed of a diploma as bachelor of arts of Dartmouth college, with liberty to go out into the world to see what he could do with it. Mr. Hoskins spent several years teaching—from 1841 to 1846. In this, he was eminently successful, but breaking health made it necessary for him to change from school teaching to civil engineering. This latter became his life profession. Here also he acquitted himself with marked approval both to his superiors and to the public. On July 10, 1856, he married Clarissa Virginia Bennett, of Weston, Lewis county, Va., the second daughter of Hon. James Bennett, an influential lawyer, who had often represented his district both in the lower and in the upper house of the Virginia legislature. The Bennett family was numerous and prominent, and, though regretful of slavery, was outspoken in promoting secession. Because of this, and of interest in the Kansas war for liberty, Mr. Hoskins determined to go west, his first intention being to settle in Kansas; but his cousin, Mr. John C. Flint, insisted that he come to Sioux City before locating permanently. This Mr. Hoskins did, arriving on the 5th of May, 1857, with the result that Sioux City became his home. Mr. Hoskins led a very busy life until 1878, since which time he has had no regular occupation. The last work in his profession was done in the autumn of 1866, when he made the preliminary surveys for the Sioux City & St. Paul railroad, of which he was first president and chief engineer. He has been honored with various positions of trust, showing the confidence and friendliness of his fellow citizens. Financially and socially Mr. Hoskins has been a recognized factor in the growth of Sioux City. Into the fabric of her history have been woven out of the strength of this man's life the very threads which have made and are making for the permanent and the enduring. From the intellectual viewpoint, Mr. Hoskins was acknowledged to be a man of strength. He was one of the charter members and loyal supporters of the old Scientific Association—an association now reorganized into and rechristened, "The Academy of Science and Letters." Of this he is a Fellow, giving, so far as his strength may permit, the devotion

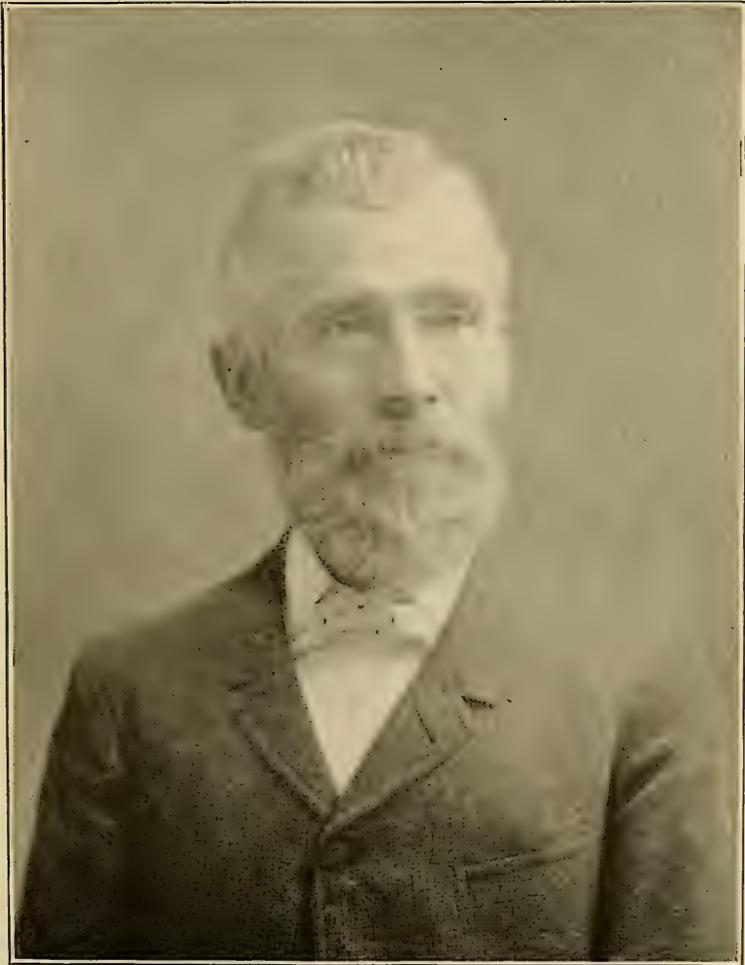
he gave to the old Association. And now in the evening twilight of his years, hopeful and optimistic concerning the world in which he has played so honorable a part, he is waiting calmly and fearlessly the great call.

AUGUST GRONINGER.

By H. C. POWERS.

During the past year Death has knocked at the door of the Academy of Science and Letters and called away some of our most honored and useful members. Of these the first to obey the summons to come up higher was our fellow member, Mr. August Groninger, whose portrait is on the opposite page. To those who knew him it will not be necessary for me to say much concerning his life among us. Coming as a pioneer in 1857 to the then little hamlet that was to grow into our present Sioux City, he took part in all the busy interests that have made our city what it now is. When he first settled among the pioneers in the little village on the Missouri, he at once began an active business life which he continued up to the time of his death. He was in the true sense of the word an honorable man, one of whom it could be said with truth, his word was as good as his bond. Quiet and unassuming in all his ways, his life made the world better for his having lived in it. His home life was especially dear to him. Here he and his kind wife gathered together mementoes of the many lands they visited, and their home is filled with beautiful specimens of art and nature. The book cases are filled with choice books, showing the literary taste and culture of the owners. The visitor can read in the simple and artistic furnishings of this home the story of a happy life lived here by Mr. and Mrs. Groninger in Sioux City. They were both active and useful members of the Scientific Association and its successor the Academy of Science and Letters, and we shall miss the genial presence of Mr. Groninger at all our future gatherings.

Mr. Groninger was born in Elsfleth in the Grand Duchy of Oldenburg, in Germany, on Christmas Eve.,



A. GRONINGER.

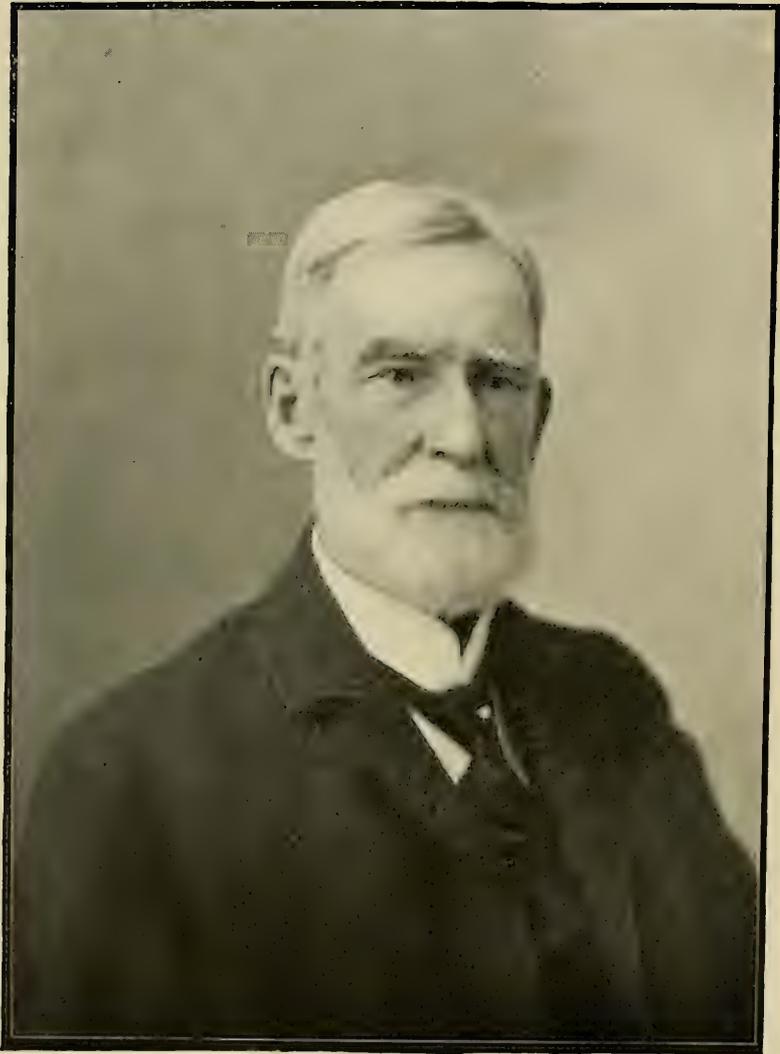
Dec. 24, 1828. After a liberal education in his fatherland, he came to the United States in 1849, in his 21st year, and remained in New York City for the first six months after his arrival. For the first five years he was in this country he was in several of the eastern states and cities and always at work of some kind. But in 1857 he followed Horace Greeley's advice to "go west young man and grow up with the country." Coming to Sioux City he at once opened a hardware store, which he owned and conducted for 24 years, always successful in what he undertook. After he sold this business in 1881, he entered the banking business in which he continued for the rest of his life. At the time of his death he was Vice-President of the First National Bank of Sioux City.

While a Republican in politics, Mr. Groninger was in no sense a politician. Never seeking for office, he was still elected as city treasurer, and served several terms as alderman and member of the school board.

In 1860 Mr. Groninger was married to Miss Caroline Reinke, who still lives among us, following her life of kindness and charity which so many of us have known and felt in the past. But one great sorrow has come into the life of this kind couple, the loss of an only son who was accidentally killed in his 14th year. This loss only drew their hearts closer together, and the love which was their son's has spread over and blessed all with whom they have come in contact since.

Mr. Groninger continued in active business up to the time when his fatal illness began. He was always at his post in the bank with which he was connected until the summons came which all must obey. He contracted a severe cold to which he paid little attention, thinking it would soon pass off. But instead of doing this it developed into pneumonia, which in spite of every endeavor of skilled physicians and kind friends terminated in death on the 15th of December, 1903. Thus he lacked but nine days of being 75 years old. He lived among us more than half of his long and useful life and his face and figure were familiar to all as he passed along our streets. He will be missed in public and in the business with which he was connected, but more than all else is he missed in the

home he loved so well. Happy the man who, like him, can lie down to his last long rest conscious of a whole life of kindness and honor in his public and private affairs. This Mr. Groninger could truly feel.



T. J. STONE.

THOMAS JEFFERSON STONE.

By A. N. COOK.

Thomas Jefferson Stone was born at Royalton, Niagara county, N. Y., August 13, 1825, and died at Sioux City, April 19, 1904. He was the son of a farmer and as such acquired the habits of industry which led to marked success in later years. His parents were Isaiah P. and Mercy Sawyer Stone. He worked on his father's farm until 15 years of age, attending the district school during the winter months. He then entered Oberlin College, Ohio, where he expected to take a full course, but was compelled to drop out during his freshman year on account of failing health. He afterwards attended the high school at Mt. Vernon for a time, when his health had improved.

In May, 1852, Mr. Stone married Miss Alice A. Heathcoat, of Mt. Vernon, Ohio. Two children were born to them—Edgar H. Stone, a graduate of Yale College and one of the most successful of the younger business men of Sioux City, and a daughter, who is the wife of George P. Day, cashier of the Merchants' National Bank of Sioux City. The first Mrs. Stone died in 1882. In 1886 he married Mrs. Frances A. Flint, who lived but a few years. The present Mrs. Stone was originally Miss Emma Quintrell, of Cleveland. She was an expert primary teacher and was invited to go to Des Moines at a salary of \$1,000.00 per year, but she stayed there only a short time as the Board of Education of Sioux City offered her a salary of \$1,200.00 per year, which is more than double what is paid any primary teacher in the city at the present time. Her work, however, was largely that of supervising other primary teachers in the city. Later she became Mrs. Hedges, but in a few years she was left a widow. Mrs. Stone is an active Christian worker in the

Congregational church and is much interested in various benevolent enterprises.

While in school Mr. Stone had acquired a knowledge of surveying and in 1852, having just been married, he went west and became a surveyor in Wisconsin and Iowa for several years. He was also employed in the office of the county treasurer of Linn county, Iowa, for a time and was subsequently engaged in the banking business at Marion as a member of the firm of Smyth, Stone & Company.

“In May, 1856, Mr. Stone settled in the little frontier town of Sioux City, 300 miles from the nearest railroad. Nearly all of Northwest Iowa was then a vast, uninhabited region of prairie, still owned by the government, over which Indians, trappers, and white frontier hunters pursued deer, elk and other game and annually trapped beaver, muskrat, and mink. The few widely scattered settlements were of log houses and sod houses, built in the groves along the rivers, creeks, and lakes. Mr. Stone secured a clerkship in the office of the county treasurer soon after he settled in Sioux City. In 1861 he was elected treasurer and recorder, holding the office several years. This position enabled him to secure a very large business in paying taxes for more than a thousand persons. Mr. Stone opened up a land office and soon built up a good business, entering government lands, buying, selling and locating land warrants and scrip. He was not only a careful, capable business man, but he was enterprising, and far-seeing, and besides doing a large business for others, his knowledge of the country enabled him to make good investments in real estate in early days which brought him a large fortune in later years when the frontier town became a large city. For many years he carried on the largest real estate business ever established in Northwestern Iowa. In 1867 he opened a private bank in connection with his land business, and at the end of three years he, with the assistance of others, organized the First National Bank of Sioux City. He was first its cashier and later its president. For many years Mr. Stone gave his attention to the bank, which under his judicious management has grown into

a strong and popular institution. By virtue of the wholesale and jobbing trade which Sioux City has in Nebraska, the Dakotas, and Minnesota, the First National Bank has extensive business connections in all the vast northwest region. In early days Mr. Stone foresaw from its location that Sioux City must in time become a large and important place, and he began to purchase lots in choice locations, which as the city grew would increase rapidly in value. As years went by his most sanguine expectations were realized, and many of the lots are now covered with the best business blocks of the city.

“Mr. Stone was connected with the private company which built the waterworks plant now owned by the city. He was president of the Library and Building Association which erected the magnificent stone building at the corner of Sixth and Douglas streets. He was one of the chief spirits in building the Congregational church and the Samaritan Hospital.”

Mr. Stone had many friends and few enemies. In an editorial in the *Sioux City Journal* at the time of his death Mr. Geo. D. Perkins said, “Mr. Stone, while cautious in making loans, was very forbearing with his friends. Those familiar with his dealings say he never foreclosed a mortgage where he had confidence in the integrity of his customer or the sufficiency of the property. In other words, he never availed himself of the financial distress or embarrassment of men with whom he did business. He wanted his own but beyond that he wanted every man to have whatever he could realize for himself. So it was that here and there in the earlier times he held up many men. He nursed their property for them, and with their death he cared as best he could for their widows and children. He never made display of his benefactions, but his gentleness, his liberality, his continuous consideration will be remembered by many.” His happiest moments were spent with his four little grand-children on Sabbath afternoons. One of his most marked characteristics was his charity for his enemies of whom, however, he had exceedingly few. He never spoke unkindly or harshly of any one even in the presence of those nearest and dearest to him. He was much interested in literature and scientific subjects.

He had a large, well selected library of which he was a constant reader. His connection with the Academy of Science and Letters commenced with the old Scientific Association near its beginning, when it used to meet in the office of Mr. D. H. Talbot, and he continued to be a valued member until the day of his death. He and his wife were frequent attendants at the meetings held in the Library building. On the evening of the annual meeting he presided and was elected first vice-president of the Academy for the ensuing year. On their return home Mr. Stone complained of feeling chilly and dizzy. His wife felt no alarm, for he had been subject to such attacks. At the suggestion of Mrs. Stone he retired, but just as his head touched the pillow he gave a gasp and life was gone. Mrs. Stone hastened to his side, fearing the worst had come. The relatives and the doctor were quickly summoned, but all in vain. Dr. Knott believed that death had come instantaneously and without pain. The funeral services were held at the Stone residence on April 23d, Rev. Dr. Newhall White, of the First Congregational church, officiating. He was laid to rest in Floyd cemetery. The Masons had charge of the last services at the grave. All of the banks and the offices in the county court house were closed during the afternoon out of respect for Mr. Stone.

The principal recorded sources of his biography, aside from the two daily papers, which devoted much space to reports of his death, and to editorials are: *History of Woodbury and Plymouth counties*, page 625. *U. S. Biographical Dictionary*, page 408; *Prominent Men of the Great West*, page 369; and *Representative Men of Chicago, Iowa, and the World's Columbian Exposition*, page 564.

VENTILATION IN THE PUBLIC SCHOOLS OF SIOUX CITY.

BY WHIT. H. CLARK.

The aim of this paper is to set forth in brief a few observations on ventilation in the public school buildings of this city. Lack of time and opportunity has rendered it impossible to more than touch the subject in the briefest way.

An exhaustive investigation of the ventilating systems used and the results obtained therefrom would necessitate a thorough study of the sizes of inlets and outlets for the air in the various rooms, the velocity with which the air enters the rooms, the number of pupils seated in each room, and the number of cubic feet of air supplied to each pupil per minute; this last determination depending on the three factors: the number of pupils, the sizes of inlets and outlets, and the velocity of the incoming air. It would be further necessary to consider the source of the air supply and the methods of furnishing the air to the rooms, as well as the important study of the degree and rapidity of the contamination of the air through breathing and through exhalations and excretions from the bodies of the pupils. It would be necessary, further, to consider the effect which the weather conditions cause; the difference in the results obtained from a ventilating system under the conditions of high wind, medium wind, and calm; the influence of heat and cold, of humid atmosphere and of dry atmospheric conditions. And with all this it would still be necessary to take into consideration the varying effect of these different conditions in school rooms variously situated in the same building, the different effects which a strong wind has on two rooms situated respectively on the windward and the lee sides of a building. Amidst

this multiplicity of questions arising out of a study of ventilation, I have contented myself with some slight study of the presence of carbon dioxide in the air of the school rooms, believing that the amount of carbon dioxide present is a pretty accurate index of the degree of impurity or ventilation of the air.

The buildings chosen were: The High School, in which is used the Smead system with a rotary fan for forcing the air; the Longfellow building, in which is used the Smead system without the fan, the so-called gravity system; the Whittier building, in which is found a hot air system with return air from a part of the rooms and an exit opening from each room connecting with the outer air, and the Cooper building, in which the heating is by means of steam and in which, as is usually the case with steam heated buildings, there is but little thought for ventilation.

The method employed in the tests was to admit a few cubic centimeters of standard K O H solution into a flask containing air from the school room. The flask being then shaken violently for from three to ten minutes during which time the K O H absorbs all of the C O_2 present. The alkalinity of the K O H is thereby lessened. Enough of a standard $\text{H}_2 \text{S O}_4$ solution is now admitted to the flask to exactly neutralize the K O H . The amount of the acid thus needed deducted from the amount needed to neutralize the K O H without the presence of the C O_2 will leave as a remainder the amount of C O_2 which was actually present in the flask to unite with the K O H . Knowing the capacity of the flask it is an easy matter to reduce to a basis of 10,000 parts, corrections being made for temperature and pressure. During the progress of the experiments, due caution was observed to keep the solutions and the air in the flasks from contact with the outer air.

In the samples of air from the High School Assembly room it was found that 6.85 parts of CO_2 were present in 10,000 parts of air. In Longfellow 7.51 parts were found and a second determination in which only three rooms were tested, in two of which the conditions were

bad, and in one of which the conditions were favorable, showed 6.92 parts of CO₂ present. In Whittier 8.56 parts were found, and in Cooper 9.62 parts.

Authorities agree that 7 parts in 10,000 is permissible and that much beyond this point constitutes an injurious if not a dangerous condition.

The results of these tests sustain quite generally the theories regarding ventilation. It is held that the only true and successful system for all kinds of weather and atmospheric conditions is one in which a rotary fan or other propelling device forces a constant and pure stream of air into the rooms. Such a system is found at the High School building and that is the only school building thus equipped in the city. The results of the air tests from this building, showing 6.85 parts of carbon dioxide in 10,000 parts of air, are very satisfactory.

In the Longfellow building the results were quite satisfactory also, and in this building as in many others in the city the Smead system is used for heating and ventilating, but unlike the Smead system of the High School there is no rotary fan, the movement of the air currents being secured by gravity methods. The distinct benefit of this system is in getting the air supply, both for hot and cold air, directly from outdoors, a lever in the room permitting the teacher to regulate the supply as to kind—hot or cold—but in all cases *pure* air from out of doors. All the air passes out of the room through outlets connecting with a separate flue which passes up alongside of the furnace chimney and thus out of the building at the top. There is thus a steady stream of pure air entering the rooms and a steady stream of the vitiated air passing out and away from the building.

This system, however, will secure best results only in cold weather when there is a marked difference in the temperatures of the outer air and the air within the rooms, for when the temperature without is nearly or fully equal to that within, the ascending current from the room are both retarded, if not entirely stopped, and since the efficiency of this system, or any system depends upon the facility with which the air may be renewed in the rooms, the result is that the ventilation is much less perfect in spring and fall than in winter.

The Whittier building represents another type of ventilating system in extensive use in the city, and while it is open to the same criticisms as is the system at Longfellow, it is at the same time, open to another and much more serious criticism. There is absolutely no means of supplying *fresh* air to the furnaces, and consequently to the rooms, except as this may be supplied accidentally through cracks and crevices and the mistakes of carpenters and the occasional opening of doors. The furnace draws its air supply from a part of the rooms, reheats it and returns it to the rooms to heat the rooms and to furnish the breathing material for the occupants, just as is done in the majority of our house furnaces, only in the latter case the condition is not so serious, for the inmates of our homes are few compared with the number in school rooms who are constantly breathing and vitiating the air. The results of the tests show 8.56 parts of CO₂ present in this building in every 10,000 parts of air.

The Cooper building represents quite a common type of heating system—that of steam heating. The only attempt at ventilating according to the plan, is found in a little register of a foot or a foot and a half area, furnishing an outlet into a flue which carries the air from the building. The supply of fresh air is obtained in the good old fashioned way—the raising and lowering of windows over the children's heads and behind their backs. As might be expected, the results here show the poorest ventilation to be found anywhere. The presence of 9.62 parts CO₂ in 10,000 parts of air, as found in this building, is, according to authorities on hygiene, a distinct menace to health.

That the foregoing results are woefully bad, however, must not be taken for granted. I think I may safely say that the school buildings of Sioux City are as well ventilated as the usual run of public school buildings, and perhaps better than the average. Some tests in the Kansas City schools showed the presence of 6, 16, 19, 15, 10, 21, 33 and 30 parts of CO₂ respectively as the results of a series of eight tests there. Weaver found in a girls' school in England 53 parts per 10,000 parts. Pettenkofer found in an occupied room 72 parts in 10,000.

There is one other point, among many, which I feel impelled to mention in this consideration of ventilation, and that is in regard to the proper degree of humidity which is desirable in the atmosphere of our school rooms. Our school rooms, during the part of the year when artificial heat is necessary, are kept by regulation of a temperature of from 65 to 70 degrees F., but without any care as to the amount of moisture the air contains. Now, if a given volume of air be taken from without at a temperature of 30° F. and a humidity of 80 per cent., for instance, and heated to 68° F., it will contain per given volume only 202 per cent. of moisture. In other words its relative humidity has been decreased from 80° to 20° through heating and expansion and its consequent increased capacity to hold moisture. If air, therefore, when heated, is not supplied with a proper amount of moisture, it takes up moisture from every object that will yield it. The effect on things about us is very evident to ordinary observation, but the effect of dry air upon the bodies of persons who are subjected to it is not so clearly observable. Nevertheless it is just as positive. The artificially heated air, in which but a small per cent. of moisture remains, absorbs moisture from the skin, the lining membrane of the nasal passages, the mouth, the throat, and the lungs.

In an examination, a few years ago, of a very expensive heating and ventilating apparatus that had been placed in a grammar school, Prof. Shaw of the Institute of Pedagogy of New York University, found the humidity of the air at 10.15 a. m., to be 25 per cent. There were 700 pupils in the building. These pupils passed through an air of 80 degrees humidity in going to school, breathed an air of 25 degrees humidity from 9:00 o'clock 'till noon when they were sent out into an atmosphere having 80 per cent. humidity. They returned in the afternoon to breathe the same dry air and to be dismissed again into a more humid atmosphere. Such changes as these, the pupils of many schools undergo repeatedly in the winter season. Such conditions are unquestionably a cause of colds and inflammation of the throat and bronchial passages. Could the real effects of these imperfect conditions in our school rooms be fully realized by the public,

and the actual amount of impure air that is breathed be definitely known, such a knowledge would constitute a powerful stimulus toward solving the problem of ventilation, as well as create a disposition to provide the means necessary to a betterment of these conditions.

THE SMOKING BLUFFS OF THE MISSOURI RIVER REGION.

By H. C. POWERS.

When the Lewis and Clark expedition came up the Missouri River in 1804 on its way to the Pacific coast, the Indians, who lived along the river in Northwest Iowa and farther up, told them of smoking bluffs which seemed to be on fire deep down from the surface. They regarded them as the home of spirits and feared to go upon or near them. These bluffs were seen by many of the early white discoverers who passed up the river.

On pages 83-4 of the report of that expedition, by Elliott Coues, is found the following account from the Journals of Lewis and Clark concerning a visit to one of these bluffs: "Aug. 24th we proceeded two and a quarter miles to the commencement of a bluff of blue clay about 180 or 190 feet high, on the south side; it seems to have lately been on fire, and even now the ground is so warm that we can not keep our hands in it at any depth; there are strong appearances of coal, and also great quantities of cobalt, or a crystallized substance resembling it." The following note by the editor is also found on page 84 of the same report: "The formation of these bluffs, and the attendant phenomena suggestive of volcanic action, were very early the subject of observation and speculation. They were formerly styled pseudo-volcanoes by Nicollet in 1843, who also called attention in this connection to the peculiar, light, spongy stone, which Lewis and Clark repeatedly speak of as pumice, but which he (Nicollet) names pumiferous stone, as not being true pumice but resembling it. He found no hills smoking when he ascended in 1839, nor did Lewis and Clark, but he was credibly informed that such an occurrence had been witnessed in the interior."

Over a large area of country, on both sides of the Missouri River, through the State of Iowa and farther north, the sea bottom was upheaved and became dry land at the close of the Cretaceous Period. During the immensely long time from the close of the Cretaceous Period to the beginning of the Glacial Epoch, while all the Tertiary deposits were being laid down, this vast surface of land was exposed to erosion, and the plain was changed to valleys, hills and ravines; much the same in shape as we now see it. Then at the close of the Glacial Epoch, which had probably still farther changed the shape of the surface by ice action, all this region was covered by the Loess, left by the melting glaciers in their retreat to the north. Thus we now find in nearly all these river bluffs, which are on the surface loess, an old cretaceous hill as a core. Most of the cretaceous deposits throughout this region have large quantities of Iron Pyrites and Sulphate of Lime or Gypsum all through them. The crystals of Gypsum, which are very plentiful, and of all the characteristic shapes of that mineral when crystallized, are probably what Lewis and Clark called cobalt.

The larger part of the Iron Pyrites, which is so plentiful in the cretaceous deposits, is in a massive or uncrystallized form, and is in irregular lumps from the size of a pea up to those of many pounds in weight. When these masses are exposed to the air they soon disintegrate and fall into dust. This is caused from the absorption of oxygen from the air and the water held in suspension by the air. Such chemical action always produces heat, and is nothing but slow combustion of the matter so acted upon. This heat volatilizes and drives out the sulphur contained in the pyrites, and thus disintegration is produced. By this chemical action sulphuric acid is also generated and by its action produces still more heat. I had opportunity of observing closely this action of disintegration of pyrites on quite a large specimen which a friend of mine here in Sioux City had placed on a stone window sill outside of his home. It was exposed to the action of the air and the moisture contained in the air, but not to rain, as it was under a porch and so protected. When I first noticed it disintegration had

proceeded so far that most of the mass had fallen to powder, only a small piece in the center of the original specimen being still solid. On clearing away the dust, I found that the sulphuric acid had eaten into the stone window sill more than an eighth of an inch over the whole surface where the pyrites had lain. I have also often seen this process of disintegration of pyrites going on in specimens in my own cabinet, where they were entirely protected from exposure to outside air.

A few years since, while collecting geological specimens near Sioux City, I was at work on the side of a bluff which had been cut down to make room for a road between it and the Sioux River. The exposure faced the west and the day was warm and sunshiny. While resting under the shade of a tree on the top of the bluff at noontime I noticed a light mist or smoke rising from the ground or river which ran far below me. Thinking it came from the water I paid no further attention to it at the time. But when I again went down to the side of the hill below me I could not see the mist or smoke, but noticed quite a strong odor of burning sulphur. I at once thought of the smoking hills I had heard and read of before, and believed that the same phenomena was being manifested here before me. The ground was very warm as far down as I could dig with the tools I had.

During the same summer I was collecting near Jackson, Neb., and was down in a deep ravine of erosion where a small stream had cut through the Loess and far down into the cretaceous. While searching for specimens I found a place near the top of the cretaceous that had the appearance of a chimney or vent from some source of heat somewhere down in the earth, at and near the top the clay had been burnt to a bright brick-red color, while farther down, five or six feet below the surface, where it was as strongly altered by heat, it was a deep black. I took a number of pieces from this place and they were all very porous and light, strongly resembling pumice.

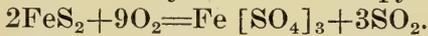
In the region about Sioux City the cretaceous deposits generally consist of dense blue-black clay in distinct layers, in the lower beds. As one ascends toward

the upper part, the sediment becomes coarser and more sandy with frequent layers of soft sandstone. It is evident that this deposit was thrown down on a rather rapidly rising sea bottom.

In the lower layers of fine-grained clay are many limpid crystals of gypsum or sulphate of lime. These are disseminated through the most dense parts of the clay deposits, and it is probable that the disintegration of the iron pyrites is responsible for the presence of these crystals of sulphate of lime. On the breaking up of the iron pyrites there would be set free the combined sulphur, which amounts to nearly 54 per cent. of the pyrites, in the form of sulphuric acid or sulphur dioxide. Some of this acid would unite with the lime, which is present in small quantities, forming sulphate of lime.

On consulting with Prof. Alfred N. Cook, chemist of Morningside College in Sioux City, he agreed with me in the belief that I had found the true causes for the "Smoking Bluffs" of the Missouri River region. He gave me the following:

"I think the following equations will accurately represent the oxydation of iron pyrites:



"Some of the SO_2 would escape and give the odor of burning sulphur. Some would dissolve in the water and form sulphurous acid, according to the equation, $\text{SO}_2 + \text{H}_2\text{O} = \text{H}_2\text{SO}_3$."

"This would then take on more oxygen from the dissolved air in the water and become sulphuric acid thus, $\text{H}_2\text{SO}_3 + \text{O} = \text{H}_2\text{SO}_4$."

"This would probably account for the presence of free sulphuric acid in the rocks that has been noticed in some localities near Sioux City."

STATE REFORMATORIES.*

BY FRED E. HAYNES.

The old idea of the treatment of the criminal was simply to punish him, to deter him from future offenses and to deter others from further violation of law. To accomplish this purpose, the penalty for even trivial crimes was made extremely severe. The English penal code, even as late as the eighteenth century, provided for capital punishment for a large number of crimes. There was no thought of the future of the criminal. The penology of the time was like the charity of the period. The thought was for the protection of society. Protection of society took the place of the good of the soul of the generous giver. Their spirit was of the kind shown by the people of Vienna, who petitioned that the torture of criminals should be carried on at a place remote enough, so that the cries of the victims should not disturb law-abiding people, engaged in their ordinary affairs. Indeed, with the conditions still existing in many of our jails and prisons, perhaps we ought not to criticise too severely earlier times and methods.

But a wiser understanding of the nature of crime and of the criminal has come to the minds of some of the people of our time. More careful study of educational methods, more knowledge of the workings of the human mind and of the connection between man's physical and mental activities has led to experiments, that, if they are not solving the criminal problem, are at least like the X-Ray throwing a flood of light upon many things once buried in darkness. Since 1870 a number of pioneers have been at work in different places, developing a method which is really reforming more than three-fourths of the persons who are brought under its influence. It is accomplishing far better than other

methods, the purpose of the older penologists, who aimed at deterring persons from the committal of crimes, and it is going far beyond any such mean object and it is training men, who in some way have gotten out of harmony with their environment, so that they are able to re-establish themselves as normal and useful members of society. I refer, of course, to the work in which Mr. Brockway of Elmira Reformatory has been so distinguished a leader. It is not my purpose to give an account of the origin of the method, but to describe it briefly, as a basis for a consideration of its merits, with a view to its application to the criminal problem in Iowa. I shall speak of the work at Elmira because of its importance, but my remarks will be based more fully upon the work of the reformatories for men and women at Concord and Sherborn, Massachusetts. I know the work of these institutions from actual investigation, and one of my treasured recollections is of the personality of Mrs. Ellen C. Johnson, who gave her life for the reformation of criminal women in Massachusetts.

The Elmira Reformatory receives "nominally first offenders not less than 16 nor more than 30 years old." They are placed in custody for an indefinite period to be determined by the managers at their discretion according to their conduct; the length of time cannot be greater than the maximum time which the statute allots for particular offenses. While in custody they are subjected to various reforming agencies. "These are educational, employment, and regularity of conduct." The prisoners are divided into grades. These grades are determined by a marking system which is based on the progress made by the prisoner. When the highest grade is reached the prisoner is a candidate for release on parole and after a certain length of time on parole, continued good conduct will procure his discharge from all supervision and he becomes again his own master. Thus the elements in this course of treatment for the young criminal are: the indeterminate sentence, reformatory discipline and conditional liberation.

The individual convict is brought to Elmira by an officer of the Reformatory, not by a deputy of the court. In the office of the Superintendent he is submitted to a

searching examination. He is put in a middle or neutral grade (lower first), instructed in the rules of the institution, and assigned to the work and school which seems best suited to him. He is carefully graded for his work in shop, school, and in moral conduct. If he falls below a certain rank, he drops into the lowest grade; if he keeps up the required rank for six months, he is promoted to the first grade, where if he maintains a satisfactory rank for six months more he becomes a candidate for conditional liberation. But before he can be released even conditionally, a place must be found for him where he can earn his living. After good behavior for another six months, he may be and usually is discharged from all control.

Upwards of 80 per cent. so released are practically reformed. This estimate is based upon careful investigation. About ten years ago "a special inquiry was made by the managers, who employed an intelligent and experienced clerk for nearly a year tracing out the facts concerning all the Elmira convicts who had been paroled up to that time." The result of this inquiry confirmed the reports already obtained by inquiry from year to year. "The whole number of men received up to October 1st, 1899, was 9,865; the whole number paroled 6,190; the number in confinement was 1,384. Of the 2,291 remaining to be accounted for, 841 were sent either to the State Prison or to the insane asylum, 1,151 were discharged by expiration of sentence, 27 were released without parole, 39 were pardoned, 179 died at Elmira, 26 escaped, and 28 were released for errors of some sort in commitments. Less than 9 per cent. therefore seem to have been transferred to other prisons or to criminal asylums." Even if we consider the whole number 2,291 as cases of failure to reform, we shall still have nearly 77 per cent. reformed.

October 1, 1896, after the reformatory had been in existence for twenty years, "there were in custody 1,373 convicts, of whom 52, or not quite 4 per cent., were paroled men returned from freedom. But these 52 were only about 1 per cent. of the whole number who had been paroled in twenty years (5,083), of whom nearly 5,000 are

supposed then to have been living. The average period in prison of those paroled men had been less than two years, although their maximum sentence averaged more than twice that time. Among 1,355 inmates then under the indeterminate sentence, 74 only were in the lowest or punishment grade; 485 were in the neutral grade; 498 were in the lower first grade, and 298 were in the upper first or probationary grade. Of the latter 66 reached that grade after only six months' trial; 57 from seven to nine months; 25 from ten to twelve months—that is 148, or one-half in their first year's residence. In their first year's parole 329 convicts of the same year's liberation showed at the end of the year these facts: 83 were absolutely free for good conduct; 165 were still serving, and of good conduct, 2 were dead, 2 discharges upon expiration of the maximum sentence; 9 sent to prisons, and 68 failed to correspond with the Elmira authorities, who computed that half, or 34, had resumed evil courses. Again regarding as cases of failure, all about whom no positive statements can be made, we have 75 per cent. practically reformed.

The method at Elmira has been to work with nature, not against it. The theory of the old education that the sole work of the teacher was to train the boy's mind and the boy's body was merely an incumbrance brought along of necessity to torment the teacher has given way to an intelligent understanding of the relation of the body and mind. This principle is provided for at Elmira by military drill and by physical training. Physical training has been used since 1886 and on a large scale since 1890. It has been used especially in dealing with the dull and physically abnormal among the inmates. These are described by Dr. Wey: "morbid minds and undeveloped, poorly nourished, and diseased bodies had made them stupid, slow, disinclined if able, to apply their minds to useful knowledge, and, generally, unprogressive. Many are illiterate and some are ranked not much above idiots. So long have they existed without effort made to cultivate their faculties that their brains yield slowly, if at all, to the ordinary processes of education. In conduct they rank with incorrigibles, often because they have no appreciation of the distinction between right and

wrong." For this class physical culture has done an immense amount of good. These classes range from 150 to 250 a year according to the total number in the reformatory. The experience gained in this way has thrown much light on the so-called class of "degenerates": a good many of the degenerates are found to be amenable to good physical training. In addition all new inmates are for a time tested in the gymnasium until their physical condition is entirely satisfactory.

Few persons are aware to what a degree the so-called "first offenders" are destitute of any trade by which to earn a living. If they can be made capable of earning a living and placed in a condition to do so, they are better protected from falling into crime than by any other method. At Elmira, accordingly, there has been developed "a great technological training school, in which more than 30 recognized and constantly practiced trades are taught to more than 1,200 young men, more than nine-tenths of whom have had no regular vocation in life and no special desire for one. Over 1900 persons received trade instruction during the year ending September 30, 1902. All the chief mechanical and semi-professional arts which are in demand in New York, Pennsylvania, and New England, whither most of the discharged men go at first, are represented." Of the 384 inmates paroled during the same year, 217, or fifty-seven per cent., found employment upon liberation at trades taught them in the reformatory. Trade instruction has gradually developed with the growth of the institution. It was taken up quite largely as an experiment in 1884 when the New York legislature abolished the contract system of labor. Some employment had to be found for the prisoners as a matter of discipline. So Mr. Brockway determined to make all possible use of the plant and materials left after the abolition of prison industries, which were forbidden as competing with free labor. With such a beginning, there has been developed a complete scheme of work which prepares the prisoner for life in the outside world, and also provides interesting and educationally valuable training.

Furthermore, at Elmira a comprehensive and practical scheme of school instruction has been developed. "The school and the library, supplemented by that unique weekly newspaper, the Summary, not only advances the general good of the convicts, but strongly promotes good discipline, and are a signal aid to the industrial training. The method followed is, first, to have teachers of a high grade. Then to make much use of lectures, private reading, and written examinations at set times; and finally, to sharpen the intellect by discussions on serious topics, not to dull the mind by suppressing opinion or failing to encourage its freest expression. The class in practical ethics, composed of some 300 of the more advanced students, is the culmination of the school system, and is a debating society concerned with high and moral subjects of thought and feeling. Few who have been present at its debates will ever forget the liveliness and shrewdness of these impassioned orators and causers."

The prison newspaper, the Summary, deserves a few words of explanation. It was first issued experimentally in 1883. It is used as a medium for the publication of rules and notices regarding the conduct of the institution; it keeps the inmates informed in regard to affairs in the outside world, and it can be kept free from the defects of the ordinary newspaper. It now prints weekly some 2,500 copies, of which upward of 1,600 are used in the reformatory, while the rest are sent out to different cities and countries, where information is desired as to affairs at Elmira.

"Not content with using the powerful agencies of hope and fear, reward and penalty, Mr. Brockway and his friends have created a complex, but symmetrically working, mechanism of daily schooling, occupation, sanitation, drill and moral and mental training which keeps those primal agencies in constant activity. The convict is placed in a succession of movements which not only carry him along whether or no, but which sooner or later—and generally quite early in the process—convert his will to the promotion of his own improvement. The way is not so much made easy for him as it is made desirable. Consequently, the public sentiment of the convicts

is enlisted on the side of reformation. Of cruelty, properly speaking, there is none; of severity much; of grace and mercy still more. The convict is kept from that idleness of mind which is proverbially 'the Devil's workshop;' nor is he allowed that physical idleness which saps and ruins the bodily health. He is taught a practical trade, never open to him before, and thus he has the chance, if he will but avail himself of it, to become a useful member of society. And all this is found to be better protection to society than the bloody and vindictive punishments of the last century."

The Massachusetts Reformatory for Men at Concord Junction was opened December 20, 1884. The buildings were constructed for a state prison in 1878. They are situated on a farm consisting of 300 acres. The main buildings are in an enclosure of 20 acres, surrounded by a brick wall 24 feet in height. The offices and houses for the officials and guards are just outside the walls. There are four cell blocks with accommodations for over 1,000 prisoners. There are buildings for dining room, chapel, storehouses, and workshop and trade-school buildings for 1,000 men. There is also a school house, with lecture hall and class rooms for the same number. The cost of the land and buildings has been \$1,319,300. "They are," in the opinion of the present superintendent, Mr. Scott, "well adapted to the work, and among the best prison buildings in the United States."

The reformatory makes use of the same agencies as are relied upon at Elmira. The desire of the prisoner for release is utilized to get him started in directions that will ultimately, if persisted in, result in his reformation. His physical condition is improved; he is introduced to a course of training that will make him far more capable of earning his living when he is released; a marking system, based upon the regularity of conduct, habituates him to a course of conduct that meets with the approval of those in authority; his mind and thoughts are filled with new ideas which will crowd out the morbid and criminal recollections which tend to draw him back into evil ways.

An unique feature of the work at Concord are the society organizations, designed to supplement the school

work. The meetings are held Saturday and Sunday evenings of each week. Each society has the necessary officers to carry on the organization and maintain order. "They are conducted without the presence of the prison officers. First grade men and such second grade men as have maintained a satisfactory conduct record may be admitted to membership if approved by the superintendent. Over 300 of the members assemble at each of the weekly meetings. Regular programs are arranged by the officers of the societies and printed for each meeting. These consist usually of declamations, musical selections, talks, and original papers." They have proved of great benefit both to the men and to the institution. They have helped in the reformation of the men by awakening good purposes and by contributing to the good discipline of the institution.

Especial emphasis is laid by Superintendent Scott upon moral and religious influence. He declares "that no matter how well prisoners may be instructed in trades, educated and physically trained, their reformation is not a complete work unless there has been instilled into their hearts a strong desire for the right." The religious official devoting all his time to the work. "There is a church service on Sundays which all officers and prisoners are expected to attend, and moral work is under the direction of the chaplain who is a paid officer. Sunday schools for both Catholics and Protestants, and meetings each evening of the week for special moral and religious instruction."

For seven successive years, the friends of the measure to establish a reformatory prison for women appeared before the Massachusetts legislature with their petitions before it was granted. At last in 1874 the prison commission was given authority to select a site and to have erected a suitable prison accommodating 500 prisoners. A site was selected in the town of Sherborn. The buildings were completed and occupied in the fall of 1877. The prison was officered from the start entirely by women. This institution and the Indiana Reformatory Institution for Women and Girls at Indianapolis were the pioneers in the experiment of entrusting prison discipline to women. Before these experiments it was thought

necessary to employ men to control the rougher and more turbulent class of criminal women. The success of the women officials of this institution has been remarkable in establishing and maintaining its discipline. Mr. Wines the distinguished prison reformer, said of it that he had applied to it every known test and had never detected a flaw in it.

A reformatory for women possesses many peculiarities in its administration. The law of 1877 provides that all females convicted of being "vagrants, common drunkards, lewd women, wanton and lascivious, common night walkers and other idle and disorderly females should be sentenced to the reformatory." The greater consideration shown to women results in the sending of women of confirmed criminal habits to the reformatory, whereas they should be sent to an institution for habitual offenders. In this way the work of reformation is made harder than in an institution for men. On the other hand women are more sensitive to the loss of the good opinion of others and are thus more easily influenced by the reformatory agencies.

The cloud of intemperance has always hung heavy over the reformatory. Of 231 women committed in the year ending September 30, 1902, 93 were for drunkenness. Of the remainder 91 were for crimes of a sexual nature.

Eighty per cent. of the prisoners received were addicted to drink or were fallen women. The reformatory is, therefore, an inebriate asylum and rescue home combined on a large scale. The nature of the work to be done, consequently makes the methods to be used entirely different than in an institution for men.

Naturally the main occupation or trade taught is that of housekeeping or home-making, a work in which most of the women are so sadly lacking. The women who have no homes to go to are usually released on probation to take places to do housework. The success of this training is shown by the long lists of applicants for such help.

One of the industries that has been educational is the raising of silk-worms. One hundred and twenty-five mulberry trees, set out by Mrs. Johnson furnish the food.

One year 13,000 cocoons were produced. "To gather the leaves with the necessary care, to feed so many hungry mouths from the time of hatching till the last cocoon is swung by its silken cables, means the learning of many a lesson of care, patience, self-control, neatness and hope. It develops also the powers of observation and of thought."

The farm connected with the institution has been increased from 75 to 400 acres. All the work that can properly be done by women is done by the prisoners and is thus made to contribute to their reformation. The income from the sale of farm products also reduces the cost of maintenance of the reformatory. For the year ending September 30, 1902, the income from this source was upwards of \$1,700. "The women are given a variety of exercise in the open air. Almost daily during the season women are sent out in squads to weed in the gardens, plant, pick small fruits, harvest vegetables and larger fruits, raking lawns, husking corn, filling beds; and not infrequently all the women are taken out on the lawn together for a half hour. On warm summer evenings devotions are held out-of-doors."

There is probably no prison in the world where the love of reading is fostered as here. Every woman has a pocket on the outside of her dress skirt large enough to contain a book of ordinary size. Here she keeps the library book which on certain days she draws for her own pleasure. This she is encouraged to read whenever she has a moment of leisure. When waiting for work or if, as sometimes happens, the work is not supplied in sufficient quantity to keep every woman busy all the day, they are at liberty to take out the books and go on with their reading. The taste for reading is sure to be a help to the many women who go to lonely country homes after release.

No account of the reformatory would be complete without a few words about Mrs. Johnson, who was superintendent from 1884 till her death in 1899. She had been one of the active workers for the establishment of the institution. She had been a prison commissioner from 1878 to 1884. During the war she had been an active

member of the Sanitary Commission, and after the war she had continued her interest in the soldiers and their families, especially those of the poorest and lowest class. In this work she came much in contact with criminals and discharged prisoners. She was in this way prepared for her work at Sherborn.

Besides the institutions described, there are reformatories for men in Kansas, Minnesota, Pennsylvania, Illinois, Ohio, Indiana, Wisconsin, and for women in Indiana and New York.

The present situation in Iowa is as follows: The 28th General Assembly in 1899 established at Anamosa an industrial reformatory for women and authorized the state Board of Control to open it. The buildings are ready, but they have not been opened because only girls from nine to sixteen, "who might be committed to the industrial school for girls at Mitchellville, and inmates of that school over fourteen, who are incorrigible, and whose presence is dangerous and detrimental to the welfare of the school," could be sent to it. The number of probable inmates, not more than 30 during the first year, made it seem doubtful whether the reformatory could be operated during that year on the funds available. Hence the Board of Control decided not to try to open it till further action by the legislature. In their report of 1901 the Board recommended that the law be so amended as "to permit the commitment to the reformatory of girls and women who are not less than twelve or more than twenty-two years of age." They also recommended that definite provision be made for payment of the necessary expenses until the per capita allowance became sufficient. No action was taken by the last General Assembly in accordance with the recommendation. At the same session a bill to establish a reformatory for men passed the Senate but was reconsidered and beaten. The Board has recommended in two successive reports "that a reformatory for males convicted of felonies who are not less than sixteen nor more than thirty years of age be established, and that a law providing for indeterminate sentences with proper limitations and safeguards, and for paroles be enacted."

The experience of the different states which have tried the reformatory system is ample warrant for its adoption in the State of Iowa. It has practically reformed three-fourths of the persons subjected to it. No such claim can be put forward by any system that undertakes to deter criminals from further offenses. Even on that low ground, it is more successful than a system that places before itself that single object. No advocate of a prison system simply to protect society can object to the reformatory system which prevents three-fourths of the persons subjected to it from returning to a criminal career. Granted the success of the system, the only objection can be made on the basis of expense.

What then will be the probable expense and how will it compare with the present expenditure in the State? The cost of the land and buildings for the Massachusetts Reformatory for Men has been \$1,319,000. It has a capacity for over 1,000 men. The net cost for the year ending September 30, 1902, was \$196,863.70. The average number of prisoners during the same year was 845, making the annual cost per capita \$230.52. The per capita cost for the Pennsylvania Reformatory for 1896 was \$271.27; for 1897 \$246.08. The per capita cost for the penal institutions of Iowa has ranged from \$281.54 to \$459.93 for the biennial periods ending in 1891, 1893, 1895, 1897, 1899 and 1901. The average per capita cost at Anamosa for these two year periods has been \$441.39, for Fort Madison, \$319.05. The average annual cost per capita would then be \$220.63 for Anamosa and \$159.53 for Fort Madison. This cost to be compared with \$230.52 at the Massachusetts Reformatory, and \$271.27 at the Pennsylvania Reformatory.

Furthermore, it should be borne in mind that the experience at Elmira has shown that the average period in prison of paroled men is less than two years although their maximum sentence averaged more than twice that time. The average of sentence for the 420 men received at Anamosa during the two years ending in 1901 is given by the warden as two years and nine months. Of the 853 men received during the two years at Fort Madison and Anamosa 184 were serving a second or more sentence.

We have therefore to deduct from the increased cost per capita each year, the shorter sentence served and the lessened probability of a second term. Upon this point Mr. Brockway writes in the annual report of the Prison Association of New York for 1902: "Economy is further shown by the operation of the indeterminate sentence with parole plan at Elmira during twenty years. A comparison of the saving of time in prison for 5,120 prisoners paroled, compared with what must have been, had the prisoners been under a determinate sentence, taking the minimum of sentences to the state prison for the similar offence as the basis of comparison, shows 10,112 years of imprisonment saved, and a saving of maintenance cost of \$1,395,456. If there should be computed and added the earnings of the paroled prisoners while on parole, a total economical benefit is shown of \$2,362,683.

Again, the average age of prisoners at time of conviction in the State is given as 28 years, 10 months and 11 days. They are at an age at which they are especially amenable to reformatory influence. The conditions in Iowa in this respect simply correspond with those in other states. Of the prisoners received in the penal institutions of the state during the years from 1891 to 1901 upwards of fifty per cent. have been unskilled. They are thus most likely to be benefited by the industrial training that a reformatory would give to them.

The chief arguments, then, that I have brought forward in favor of a reformatory in Iowa are, (1) the system has been successfully tried in a number of other states, (2) even from the point of expense it is not clear but that gains in the shortening of terms and the prevention of return for additional terms may balance the increased immediate cost, (3) the age of the prisoners and their industrial condition make the outcome of reformatory treatment particularly promising.

In conclusion, I wish to quote a few words from Superintendent Scott of the Massachusetts Reformatory for Men. He says: "You are bound to make the prison for your neighbor's son what you would reasonably want it to be if you could imagine that your own son was sentenced there. You would demand for your own son, under such conditions, that his health should be guarded;

and that within practical limits elementary education should be furnished him; that such industrial efficiency should be cherished in him as might enable him to make a fair struggle for industrial success when released; that in general the great object should be not to make him suffer especially, not to break down his respect for himself, not to disgrace him ineffably or to stain him beyond obliteration, but rather to send him out, if possible, better prepared for the struggle of life than when he went in, with a fair respect for the government which incarcerated him; and above all things that he should not be so placed that he could hardly avoid going out of prison a worse man physically, mentally, and morally, than when he was committed."

NOTE: My principal source of information, from which I have quoted freely, has been *The Reformatory System in the United States*, prepared by Rev. S. J. Barrows, for the International Prison Commission in 1900.

*Read at the State Conference of Charities and Corrections, November 12, 1903, and also before the Sioux City Academy of Science and Letters, February 2, 1904.

EQUIPMENT OF THE LEWIS AND CLARK EXPLOR- ING EXPEDITION.

(Copied from the Government records in the Schuylkill arsenal
at Philadelphia, Pa.)

By H. C. POWERS.

In the spring of 1804, one hundred years ago, the great exploring expedition of Lewis and Clark left their winter camp on the east shore of the Mississippi River, nearly opposite of St. Louis and started on their long journey across the continent to the Pacific Ocean. Their way was through an unknown country, inhabited by savage tribes of Indians among whom no white man had ever lived, and many of whom had never seen a white face. In this year of 1904, the centennial anniversary of the beginning of that wonderful expedition, the interest of all this great northwest part of the union, through which they passed, is aroused, and all details of the daily life of the members of the party are eagerly sought for. Expositions in memory of the trip are being held, books have been written concerning all that happened to the different members of the heroic body of men, from the journal of the common private to that of the officers who were in command of the expedition. All details are eagerly sought for and read.

A number of months since the writer of this sketch, sharing in the general interest in this direction, set on foot inquiries concerning the equipment of the expedition in all its details. After many searches had been made in the War Department and Smithsonian Institution at Washington, all of which resulted in disappointment, a happy chance led the quest to Philadelphia, and there, where the expedition was fitted out, complete success crowned the search.

Copies of all the requisitions of Capt. Lewis were obtained from the old Government records of a hundred years ago. In reading these old requisition lists and receipts I have been astonished at two things. These are, first, the small amount of supplies of all kinds that were called for, and second, the wonderful foresight of Capt. Lewis displayed in the choice he made. But when one remembers that every article had to be transported by the members of the party, as there were then no railroads in the United States and no steamboats on the rivers they must ascend, one will understand that every ounce of surplus weight must be avoided. This is reason enough for the small quantity taken. And as to the foresight of Capt. Lewis, we know that as soon as he was chosen by President Jefferson to lead the party he went to Philadelphia and there passed several months in hard study under competent masters, in preparing himself for all the duties that would devolve upon him as leader. He studied geology, botany, surveying and medical science, and in every possible way prepared himself for all coming emergencies. Thus he became able to foresee the needs of his party and so to provide for them in his requisitions for his supplies.

In my search for these lists I was fortunate in having a friend at Washington who had the knowledge and influence as well as love for work of this kind to enable him to succeed where I should, if working alone, probably have failed. This was Prof. E. E. Stacey, a teacher in the public schools of Washington. To him I owe my success in obtaining these copies of the old records.

Armed with a letter from a Congressman the doors of the War Department were open to him, but in answer to his letter to the Secretary of War he received the following:

“Washington, Mar. 2, 1904.

“Nothing has been found of record to show the character of the camping equipment taken by the Lewis and Clark expedition up the Missouri River, or relative to the aid, if any, rendered the expedition by the Sec. of War, except that instructions were issued by the War Dept.

July 2, 1803, to the end that the contractor's agent should put on Capt. Lewis' boat proper provisions to carry him and his men to Massac, and that he be furnished with eighteen light axes.

"No record has been found showing the items of the account rendered to the Sec. of War, referred to by Capt. Lewis in his letter to President Jefferson, dated at Fort Mandan, Apr. 7, 1805.

"By authority of the Sec. of War,

"F. C. AINSWORTH.

"Chief Record and Pension Office."

In explanation of this lack of records at the War Dept. in Washington, we must remember that the present organization of that department is comparatively recent, and that what old records escaped destruction at the hands of the British in 1814 are somewhat scattered. But as I have already said my friend learned almost by accident that the expeditions of a century ago were fitted out at Philadelphia, and that there could be found some curious information concerning such old matters in the records of the old "Purveyor of Public Supplies." A letter to the Depot Quartermaster at Philadelphia was referred to the Commanding Officer of the Schuylkill Arsenal, and from him came the desired information in copies from the old records in his office. The following is a copy of his endorsement:

"Phila. Depot Q. M. Dept.,

"Schuylkill Arsenal.

"Phila., Pa., Mar. 17, 1904.

"Respectfully returned to the Depot of Q. M., Phila., Pa., with copies of the papers specified below, relating to the Lewis and Clark expedition, which were found among the old records of this arsenal.

"No. 1. Copy of list of articles wanted by Capt. Lewis.

"No. 2. Copy of itemized statement of articles purchased and furnished to Capt. Lewis by Israel Whelen, Purveyor of Public Supplies.

"No. 3. Copy of invoice of articles received from the arsenal for the use of Capt. Lewis, May 18, 1803.

"No. 4. Copy of list of charges taken out of Capt. Lewis' account.

"No. 5. Copy of medical supplies.

"No. 6. Copy of bill of Rich. Wevill for making tents, &c.

"The foregoing comprises copies of all the papers which have been found pertaining to the expedition, except the bills for the purchases made by the Purveyor. The items on these bills, except medical supplies, are shown on the statement made by Mr. Whelen, copy of which is inclosed herewith, marked No. 2.

"JOHN T. KNIGHT,
"Major & Q. M. U. S. Army."

As of most interest among these copies I will first give the one marked in above endorsement as No. 1, of "Articles wanted by Capt. Lewis." First in his list comes his wants in

MATHEMATICAL INSTRUMENTS.

- 1 Hadley's Quadrant.
 - 1 Mariner's Compass and two pole chain.
 - 1 Sett of Platting instruments.
 - 3 Thermometers.
 - 1 Cheap Portable Microscope.
 - 1 Pocket Compass.
 - 1 Brass Scale one foot in length.
 - 6 Magnetic Needles, in small straight silver or brass case opening on the side with hinges.
 - 1 Instrument for measuring made of tape with feet and inches marked on it, confined in a circular lethern box of sufficient thickness to admit the width of the tape which has one of its ends confined to an axis of metal passing through the center of the box, around which and within the box it is rapidly wound by means of a small crank on the outer side of the box which forms a part of the axis, the tape when necessary is drawn out with the same facility and ease with which it is wound up.*
 - 2 Hydrometers.
 - 1 Theodolite.
 - 1 Sett Planespheres.
 - 2 Artificial Horizons.
- *Our common tape line

- 1 Patent Log.
- 6 Papers of Ink Powder.
- 4 Metal Pens, brass or silver.
- 1 Set of Small Slates & Pencils.
- 2 Crayons.
- 1 Miller's Edition Lineus in 2 Vol.
- Books, Maps, Charts, Blank Vocabularies, Writing Paper.
- 1 Pair large brass money scales with two setts of weights, the one of Troy the other Avord's.

ARMS AND ACOUTREMENTS.

- 15 Rifles.
- 15 Powder Horns and pouches complete.
- 15 Pairs of Bullet Moulds.
- 15 do. of Wipers or Gun worms.
- 15 Ball screws.
- 24 Pipe Tomahawks.
- 24 Large Knives.
- Extra parts of locks and tools for repairing arms.
- 15 Gun Slings.
- 500 Best Flints.

AMMUNITION.

- 200 lbs. Best rifle powder.
- 400 lbs. Lead.

CLOTHING.

- 15 3 ft. Blankets.
- 15 Watch Coats with Hoods and belts.
- 15 Woolen Overalls.
- 15 Rifle Frocks of waterproof cloth if possible.
- 30 pairs of Socks or half Stockings.
- 20 Fatigue Frocks or hunting Shirts.
- 30 Shirts of Strong linnen.
- 30 yds. Common flannel.

CAMP EQUIPAGE.

- 6 Copper Kettles, (1 of 5 gallon, 1 of 3, 2 of 2, & 2 of 1.)
- 25 Falling Axes.
- 4 Drawing Knives, short & strong.
- 2 Augers of the patent kind if they can be obtained, with 6 bits assorted, or otherwise 6 augers of the common screw kind assorted.
- 1 Small permanent Vice.
- 1 Hand Vice.
- 36 Gimlets assorted.
- 24 Files "
- 12 Chisels "
- 10 lbs. Nails "
- 2 Steel plate Hand Saws.
- 2 Vials Phosforus.
- 1 do. of Phosforus made up of allum and sugar.
- 4 Gross fishing Hooks, assorted.

- 12 Bunches of Drum Line.
- 2 Foot Adzes.
- 12 Bunches of Small cord.
- 2 Pick axes.
- 3 Coils of Rope.
- 2 Spades.
- 12 Bunches of small fishing line assorted.
- 1 lb. Turkey or Oil Stone.
- 1 Iron Mill for Grinding Corn.
- 20 yds. Oil linnen for wrapping & securing articles.
- 10 yds. do. do. of thicker quality for covering and lining boxes, &c.
- 40 yds do. do. To form two half faced tents or Shelters contrived in such manner their parts may be taken to pieces & again connected at pleasure in order to answer the several purposes of Tents, covering to Boat or Canoe, or if necessary to be used as Sails. The piece when unconnected will be 5 feet in width and rather more than 14 ft. in length.
- 4 Tin blowing Trumpets.
- 2 Hand or spiral spring steelyards.
- 20 yds. Strong Oznaburgs.
- 24 Iron Spoons.
- 24 Pint Tin Cups (without handles.)
- 30 Steels for striking or making fire.
- 100 Flints for do. do. do.
- 2 Frows.
- 6 Saddler's large needles.
- 6 do. large awls.
- Muscatoe Curtains.
- 2 Patent chamber lamps & wicks.
- 15 Oil cloth bags for securing provisions.
- 1 Sea Grass Hammock.

PROVISIONS AND MEANS OF SUBSISTENCE.

- 150 lbs. Portable Soup.
- 3 bushels of Allum or Rock Salt.
- Spices assorted.
- 6 Kegs of 5 Gallons each making 30 gallons of rectified spirits such as is used for the Indian trade.
- 6 Kegs bound with iron Hoops.

INDIAN PRESENTS.

- 5 lbs. white Wampum.
- 5 lbs. white glass beads, mostly small.
- 20 lbs. red, do. do. assorted.
- 5 lbs. yellow or orange do. assorted.
- 30 Calico Shirts.
- 12 Pieces of East India muslin handkerchiefs striped or checked with brilliant collors.
- 12 Red Silk Handkerchiefs.
- 144 Small cheap looking Glasses.
- 100 Burning Glasses.

- 4 Vials of Phosforus.
- 288 Steels for Striking Fire.
- 144 Small cheap Scissors.
- 20 Pair large do.
- 12 Groces Needles assorted No. 1 to 8 common points.
- 12 Groces do. assorted with points for sewing leather.
- 288 Common brass thimbles—part War office.
- 10 lbs Sewing Thread assorted.
- 24 Hanks Sewing Silk.
- 8 lbs. Red Lead.
- 2 lbs. Vermillion—at War office.
- 36 Large Knives.
- 288 Knives Small such as are generally used for the Indian trade,
with fixed blades and handles inlaid with brass.
- 36 Pipe Tomahawks—at H. Ferry.
- 12 lbs. Brass wire assorted.
- 12 lbs. Iron do. do. generally large.
- 6 Belts of narrow ribbon colours assorted.
- 50 lbs. Spun Tobacco.
- 20 Small falling axes to be obtained in Tennessee.
- 40 Fish Giggs such as the Indians use with a single barb point—at
Harper's Ferry.
- 3 Groce Fishing Hooks assorted.
- 4 Groce Mockerson awls assorted.
- 50 lbs. Powder secured in a keg covered with oilcloth.
- 24 Belts of worsted ferret or Gartering colors brilliant and assorted.
- 15 Sheets of Copper cut into strips an inch in width & a foot long.
- 20 Sheets of Tin.
- 12 lbs. of Sheet iron 1 in. wide 1 foot long.
- 1 P. red Cloth second quality.
- 1 Nest of 8 or 9 small copper Kettles.
- 100 Block-tin rings cheap kind ornamented with colour'd glass or
Mock Stone.
- 2 Groces of brass curtain Rings and sufficiently large for the finger.
- 1 Groce Cast Iron Combs.
- 18 Cheap brass combs.
- 24 Blankets.
- 12 Arm Bands silver at War office.
- 12 Wrist do. do. do.
- 36 Ear Trinkets do. part do.
- 36 Nose do. do.
- 6 Groces Drops of do.
- 4 doz. Rings for Fingers of do.
- 4 Groces of Broaches do.
- 12 Small Medals do.

MEANS OF TRANSPORTATION.

- 1 Keeled Boat light strong at least 60 feet in length her burthen
equal to 8 tons.
- 1 Iron frame of canoe 40 feet long.

- 1 Large Wooden Canoe.
- 12 Spikes for Setting Poles.
- 4 Boat Hooks & Points complete.
- 2 Chains & pad-locks for confining the Boat & Canoe, &c.

MEDICINE.

- 15 lbs. best powder'd Bark.
- 10 lbs. Epsom or Glauber Salts.
- 4 oz. Calomel.
- 12 oz. Opium.
- 2 oz. Tarter emetic.
- 8 oz. Borax.
- 4 oz. Powder'd Ipicacuana.
- 8 oz. Powder'd Jalap.
- 8 oz. Powder'd Rheubarb.
- 6 Best Lancets.
- 2 oz. White Vitriol.
- 4 oz. Lactaum Saturni.
- 4 Pewter Penis Syringes.
- 1 Flour of Sulphur.
- 3 Clyster pipes.
- 4 oz. Turlington's Balsam.
- 2 lbs. Yellow Bascilican.
- 2 Sticks of Simple Diachylon.
- 1 lb. Blistering Ointment.
- 2 lbs. Nitre.
- 2 lbs. Coperas.

MATERIALS FOR MAKING UP THE VARIOUS ARTICLES INTO
PORTABLE PACKS.

- 30 Sheep Skins taken off the animal as perfectly whole as possible, without being split on the belly as usual and dress'd only with lime to free them from the wool; or otherwise about the same quantity of Oil Cloth bags well painted.
- Other packing.

CAPT. LEWIS—ARTICLES WANTED BY HIM.

- 1. Blue Beads. This is a coarse cheap bead imported from China & costing in England 15c. the lb. in strands. It is far more valued than the white beads of the same manufacture and answers all the purposes of money, being counted by the fathom.
- 2. Common brass buttons more valued than anything except beads.
- 3. Knives with fixed wooden handles stained red, usually called red handled knives and such as are used by the N. W. Co. in their Indian trade.
- 4. Battle axes and tomahawks.
- 5. Saddler's seat awls, which answer for Mockasin awls.
- 6. Glover's Needles.
- 7. Cast Iron combs.

CAPT. LEWIS.

8. Nests of camp kettles, brass is much preferred to Iron, though both are very useful to the Indians, size from 1 to 4 gallons.

Each article to be weighed separate and the weight and price extended in the Invoice under the appropriate Head. In packing no regard need be had to the different divisions or classes as specified in the Invoice but packed indiscriminately as may be most advantageous, regard being paid to such articles as may be most likely to receive damage. The blankets may be used in the packing for the protection of the goods. Such articles as are taken from the Military stores are to be entered in the invoice under their proper heads with weight extended and without price.

The above is a copy of the requisition of Capt. Meriwether Lewis as made out in his own writing and following his sometimes peculiar spelling and capitalization. In it are included all he asked for the equipment of his exploring party to travel over an unknown country thousands of miles in extent. Every advance of the expedition took them farther from civilization and from all supplies, so that all needs of the party must be foreseen and provided for before starting.

Many of the articles required by Capt. Lewis were not kept in the Public Supplies Stores and so had to be bought in the markets of Philadelphia. Before me lies a copy of the bill for medical supplies purchased from a firm having the name of Gillaspy & Strong. The whole bill amounted to \$90.69. On taking this bill to one of the wholesale druggists of Sioux City and comparing the prices of one hundred and one years ago with those of the present time I learned that the same bill could be filled now at a good profit for less than one-fourth of what it cost in 1803. Fifteen pounds of pulverized Peruvian bark then cost \$30.00, while now it costs but \$4.50, and much like this through the whole list.

It is evident from the copies of the bills I have that many of the articles called for by Capt. Lewis could not be found and that others were substituted in their places. This is shown most plainly in the bill for the Indian presents, which was much the largest bill of all. Some of the items in this bill seem to have been very costly then as compared to present prices. Such is the item of 48 calico Ruffled Shirts which is charged at \$71.04, while cloth, ribbons, handkerchiefs and beads were very much more expensive then than now. In the matter of tents

too, Capt. Lewis showed the same wisdom and foresight he displayed in all his plans. Instead of taking the tents kept in the public stores which were in use by the army, Capt. Lewis had his tents made to order, and presumably of better material and workmanship than those kept in stock. He could not obtain new ones when these were worn out and, therefore, had the best that could be made. In the copy of the bill for materials and labor the amount for eight tents and forty-five bags made of Russian canvas is \$119.39. At the bottom of the bill is the receipt of Richard Wevill for this amount, dated July 20, 1803.

In a list of charges taken out of the account of Capt. Lewis to be charged to other specific accounts, I learned that his large boat and fittings were made in Pittsburgh, Pa.

The list of all articles purchased by Israel Whelen, outside of the public stores includes the Indian presents, which cost \$669.50; camp equipage, including tents, \$233.61; mathematical instruments, \$473.45; arms and accoutrements other than for the privates, \$218.33; clothing, \$317.73; provisions, \$366.70; medical supplies, \$94.49. In the bill for mathematical instruments there is a charge for a chronometer and keys costing \$250.00, or more than half of the entire amount of this bill. In arms and accoutrements 176 lbs. of gunpowder is listed as costing \$155.75. The whole of the clothing bill is made up of two items of 45 flannel shirts and 16 coatees costing respectively \$71.10 and \$246.63. In provisions 193 lbs. of soup cost \$289.50. These prices seem very high to us now, but it always costs the government much more for such articles than private parties could purchase the same for. But when we add the amounts of all these bills together the total is very small when we consider the size of the party and the long and dangerous journey they were preparing for. The first summer there were over forty members of the party and about twenty for the rest of the time they were away. The total amount paid for all these supplies was, according to these bills, \$2,373.81. Of course other supplies were taken from the public stores for which no prices are given. I doubt much if such an expedition could be fitted out now, at the very much lower prices prevailing, for any such sum as was the one of Lewis and Clark in 1804-1806.

MONONA COUNTY, IOWA, MORMONS.

BY C. R. MARKS.

The origin and development of the Mormons as a religious body, and a social and civil organization, during this century is part of the history of the United States; and the rise and fall of the colony at Preparation, Monona County, Iowa, should have its record added to the others. This colony was founded by Charles Blancher Thompson, and something of his former career and his previous connection with the general body of Mormons, throws much light on the actual origin of this settlement at Preparation.

The Mormon church, or as the Mormons themselves styled it, "The Church of Jesus Christ of Latter Day Saints," as a religious sect was founded at Manchester, New York, in 1830, by Joseph Smith, a poor, uneducated young man then about 25 years old, born in Vermont, who several years previously claimed to have had revealed to him the place where the engraved plates of the Book of Mormon, a supplement to the New Testament, were buried. These, it was claimed, were found, translated, and Smith under them declared God's Prophet.

Smith, in his youth, is reported to have been an overgrown, lazy, good-for-nothing story-telling creature. He claimed to see visions, and to be able to locate hidden treasures by a witch hazel rod.

We avail ourselves of this opportunity to add to the recorded history of his early career, a few items which we understand are not given in any published account of his life, or of Mormonism. The fact that he lived in Pennsylvania for a time has never been so mentioned. The following matters were furnished me by Mr. E. W. Skinner, of Sioux City, Iowa, who acquired them from his parents and grand-parents, as having occurred in the place of Mr. Skinner's birth:

Joseph Smith came to the towns of South Bend and Harmony, in Susquehanna County, Pennsylvania, probably prior to 1830, before he claimed to have discovered the plates of the Book of Mormon. He had with him a brother, probably Hyrum Smith, and Martin Harris, and another man. Harris was the man who helped Smith translate the Book of Mormon and furnished the money to print it. Joseph Smith there rented a two-story board house of Joseph McKewon, an uncle of E. W. Skinner. He had with him a stone which he claimed had some supernatural qualities, and its size was not equal to that of a man's fist. Smith would take this into a dark room, put it into his hat, and then hold the hat over his face and claimed he could then see where gold could be found. He carried this stone with him, and consulted it often, and he had his brother, Harris and the other man dig for the gold in the places the stone indicated along the sides of the mountains. Some of the places were at the back end of the farms of Israel Skinner and Joseph McKewon, Sr., Mr. E. W. Skinner's grand-parents. Smith did not do any digging himself, and no gold was actually found. He married his wife there; her name was Emma Hale; he lived there possibly two years. One of Mr. Skinner's relatives prepared a manuscript history of Smith's career there for publication at a time when his life was being written up, but for some reason it was never published.

From another personal source (J. C. C. Hoskins, of Sioux City, Iowa), one acquainted with Joseph Smith's sister in Vermont, and the locality where he was born, we learn that as late as 1842 there was a man in that region who claimed to have a divining stone which enabled him to locate lost goods or treasure. It was about the size of one's fist, like a meteorite or smoky quartz, and the owner would fix his gaze upon it intently for a long time, and he claimed the color of the stone cleared up, and he could then see in it a picture of the object searched for, and its location, and he allowed no one to touch it or come very near it. This stone had presumably been known for a long time there, and Joseph Smith had probably heard his parents tell of it, or may have heard of it as a child in Vermont. I record these

incidents here as throwing some light on the growth of ideas in Smith's mind leading up to the declared revelation of the location of the golden plates on which the Book of Mormon was said to have been recorded.

Shortly after their origin, the Mormons moved to Kirtland, Ohio, which was to be the seat of the New Jerusalem, where they were soon joined by Brigham Young. They started a bank, erected a temple, and sent out twelve apostles. In 1838 the bank failed and Smith went to Caldwell County, Mo., where numerous others followed, and there they again flourished. The native Missourians were hostile. Smith fortified his town and armed his people and defied the civil authorities. The militia was called out, and Smith arrested, and the colony was broken up. They had become numerous by this time, and it is said about 15,000 crossed the Missouri river back to Illinois.

A new colony at Nauvoo, Illinois, was organized. Smith escaped from prison in Missouri, and joined the Nauvoo colony, and became its leader. A charter was obtained from the Illinois Legislature on such terms as to make the colony almost independent of the State, and Smith a dictator. A new temple was started there in 1841; a military company, called the Nauvoo Legion, was organized.

In 1843 the revelation approving polygamy was promulgated. This provoked bitter dissension within, and great indignation without the colony. Smith destroyed a newspaper office which had published too severe criticisms, and the editor swore out a warrant for the arrest of Smith and others, who resisted the officers. The militia was called out, and the Mormons armed themselves, and civil war seemed imminent, when the Governor persuaded Joseph Smith and his brother Hyrum to surrender, and stand a civil trial, and they were placed in the Carthage jail, but at night a mob broke in the prison, and shot them both; this was in 1844. This made a martyr of Smith. Brigham Young was elected president of the twelve apostles, but there were grave dissensions in the ranks over polygamy, and there were temporal and religious differences.

Many contended that under the book of Mormon there was no such thing as a religious successor to Joseph Smith; that Smith had never had any revealed command to assume political authority; that he was only the religious head, and that he had been punished by authority of God for trying to go beyond his spiritual powers. The Legislature of Illinois repealed the charter of Nauvoo.

Early in 1846 the leaders of the Nauvoo colony determined on a western migration to the Rocky Mountains, out of the reach of the other settlers; and it is said that in one month over 1,200 wagons crossed the Mississippi River, and by May 10,000 persons were crossing Iowa toward Council Bluffs; and as fast as they could sell out in Nauvoo, and buy teams, they kept leaving Nauvoo. Many of these travelers stopped and formed settlements in Decatur and Union counties, Iowa, the primary object in so doing, being to raise crops to feed them in their further journey. By mid-summer the head of the column reached Council Bluffs. From here they sent pioneers who founded Salt Lake City, and in 1847 and 1848 Brigham Young and a large colony followed.

Nauvoo was cannonaded in 1846, and the colony there practically ended. Other bodies located under different leaders all over the west, but large numbers were left scattered through Iowa on the line of the march from Nauvoo to Council Bluffs.

One of the chief aims of all the Mormons from the beginning had been to establish a separate independent local temple, city, or colony; to get off by themselves; and the unsettled condition of the west seemed to afford a good opportunity for the realization of such a scheme. And once admitting that revelation and prophecy still existed in Divine Government, there seemed to be no limit to the number of prophets that might arise. Now that the original modern prophet, Joseph Smith, was dead, these religious enthusiasts were ready to believe in any additional prophet, and in new revelations. They were ready to take up with a prophet and a prophecy or revelation that seemed to coincide with their own views. The Mormon literature of this period is full of religious speculation and controversy over minor points of Mormon doctrine.

A brief sketch of the early life of Chas. B. Thompson, the founder of the Monona County Colony, will better enable us to understand his subsequent career, and we give it from his own written sketch of himself.

With relation to the revelation to Joseph Smith as to polygamy, I have this personal information to add, which I believe has never been published. A member of Congress from Northwest Iowa was in Salt Lake City when the memorial funeral services were held after the death of Brigham Young, and through an official acquaintance was permitted to attend. One of the survivors of the early day of Joseph Smith spoke on that occasion, and attempted to give the true history of that revelation, because even among Mormons, it had been claimed there never had been such a revelation. The speaker was the official clerk of the Church, or recorder of the Church, and said that Smith came to him and handed him the writing which contained the authorization for plural marriages, which had come to him, Smith, as a divine command, and that it was to be recorded and promulgated as a law of the Church. This secretary kept it, and made a copy of it. That shortly after this Joseph Smith came back and wanted the revelation paper, saying he had told his wife about it, and she was very much excited, and was making a great fuss over it, and he would have to pacify her by destroying the revelation, and took it away with him. This accounted for the original not being found among the records, but the speaker on this occasion spoke as being a living witness to the fact that polygamy came as a divine command to Joseph Smith. The congressman was surprised to find that in the full newspaper accounts of these funeral exercises nothing was said of this part of the proceedings, and concluded that it was intended for Mormon ears only.

Chas. Blancher Thompson was born January 27th, 1814, at Niskanna, Schenectady county, New York. His father was a Quaker; his mother died when he was three years old, and his father supported him until he was eight, from which time up to when he was fourteen he earned his own living, and then commenced to learn the tailor's trade. At 17 years old he became interested in religion and at 18 joined the Methodist church, and com-

menced business as a tailor in Watervliet, N. Y. At 20 he withdrew from the Methodist church, traveled a year, as he says, searching for the Church of Christ, when he heard an elder of the Latter Day Saints preach. He went to their then headquarters at Kirtland, Ohio, Feb. 10, 1835, he then being 21 years old, and was baptized, and afterward confirmed by Joseph Smith, as a member of the Church of Jesus Christ of Latter Day Saints. He wanted to preach, and claimed he was called of God in answer to special prayer. He was ordained by Joseph Smith, and Sidney Rigdon. Thompson, in one of his papers, gives in full what he claims were the words of such blessing and commission, which purport to confer great spiritual power, and prophesy great things for him. Thompson then started out to preach the new doctrine among his old acquaintances in New York, with indifferent success. In the fall of 1835 he came back to Kirtland, Ohio, and spent the winter, and again in 1836 went back to New York and preached in various places and was married this year. In the summer of 1837 he organized a church of Latter Day Saints at Sandusky, Ohio, and in the summer of 1838, following the westward migration of the Mormons, he moved with his family to Kirtland Camp in Far West Missouri, and soon moved to "Adam Ondie Ahem" in Davies county, Missouri, and under the exterminating order of Governor Boggs of Missouri was compelled to leave there, and went out of that state to Quincy, Illinois, with other Mormons. Early in 1839 Thompson was sent by the Mormon twelve apostles to New York, where his wife soon died from the effects of the exposure in the expulsion from Missouri, leaving a five-months-old baby. Thompson preached in New York for about four years, baptized about 200 converts, ordained elders and teachers, and organized there what was called the "Genesee Conference of Latter Day Saints." In 1841 he published a book on the "Evidence in Proof of the Book of Mormon." In 1843 he came back from New York and under direction of Joseph Smith settled at Hancock, Illinois, 20 miles from Nauvoo, and the following year was ordained a High Priest. After the death of Joseph Smith he removed to Nauvoo and assisted in voting the power of the church into the hands

of the twelve apostles, and at first had confidence in them, but September 1st, 1845, he had one of those visions so conveniently common to Mormons in that day, in which he says, "He saw all the tribulations the Mormons had passed through, and that it was a punishment for their errors. Then he saw into the future; that the Lord's Hosts, under new methods, triumphed in the West." He did not then understand the vision, and in fact it was not published for several years. He was married again in 1846 and sealed for time and eternity under what the twelve apostles called "The Endowment." When the twelve apostles started west on their journey that finally ended in Utah, Thompson began to have doubts, and regarded them as apostates and tried to agree with the faction that followed Mr. Strang, known as the "Strangites," but soon regarded him as an imposter, and went off by himself to St. Louis and went to work at the tailor's trade again. In January, 1848, he claimed to have received a revelation or proclamation from "Baneemy," a spirit successor to Joseph Smith, by whom he was appointed agent, and in 1849 he claimed to have received the "Grand Key" which qualified him to act as "Chief Teacher of the Schools of Preparation," and in 1850 he organized what he called his first class in the covenant. About January 1st, 1851, he commenced to publish a small monthly magazine of eight pages, which he styled "Zion's Harbinger and Baneemy's Organ." This paper was full of Mormon theology and treated of the different views of the numerous factions into which the Mormon body had been divided after the death of Joseph Smith. It contained letters from numerous correspondents and subscribers. In it Thompson published his claims as Chief Teacher under his visions and revelations from Baneemy and gathered something of a following. His spiritual claim was that Joseph Smith was only a spiritual teacher, and by assuming temporal authority had provoked divine wrath and that there was no spiritual successor to Joseph Smith direct, but under the authority as set out in the Book of Mormon, the Lord would raise up in time someone to take up the work, and that so by revelation the Spirit "*Baneemy*" had received such authority, and in like man-

ner Thompson was his (Baneemy's) duly authorized agent on the earth. When interrogated as to what Baneemy was before he was revealed in his present character and name, Thompson replied that the answer was withheld for a wise purpose by Jehovah, and would only be revealed to those found worthy to receive the key words of the Holy Priesthood.

As an illustration of Thompson's classical ability in derivation of language, word making and general style of theological writing, I give his own definition of this word.

"BANEEMY."

"Why is the successor of Joseph Smith called Baneemy? First, because his mission is to give public notice of the rejection of the church, and to make public proclamation interdicting its continuance, which is a curse upon the Gentiles; for 'Ban' signifies a proclamation or edict; a public order or notice, mandatory or prohibitory. Second, to say unto Zion, 'Behold your God reigneth,' and to Jerusalem, 'Behold your warfare is accomplished and your iniquity is pardoned, for you have received of the Lord's hand double for all your sins'—for 'ee' is the initials of 'ecce' (Latin) 'Behold.' Third, to cry in the name of the Lord, 'Behold my curse, interdiction, and notice of future work'—for 'my' is an affix to 'Banee,' and is a personal pronoun in the possessive case, and stands in this affix for Jehovah, our father in Heaven; whom Baneemy personates as the Father of Zion, which his name signifies in the Adamic or pure language. But as it stands in English 'Baneemy,' signifies, the voice of him that crieth in the wilderness, and giveth notice of God's curse upon the Gentiles, in the rejection and interdiction of the church among them, and also of that which is to come, proclaiming the day of vengeance of our God, and the preparation necessary to be made for the restoration of Israel and their salvation in 'that day.'"

Ten years later in testifying in the litigation that followed, Thompson had evidently forgotten the foregoing definition, for he then said that the word "Baneemy" is composed of two Hebrew words *Bene* and *Emmi*, signifying my mother's sons, or my brothers.

In February Thompson published a notice, that thereafter there would be three solemn assemblies of his organization which he called "Schools of Preparation of Jehovah's Presbytery of Zion," to-wit: on April 15, August 29th, and December 27th of each year, the first one to be held April 15, 1852, at St. Louis. This assembly met at Thompson's house, and this appears to have been its first regular organization. Thompson was Chief Teacher and they elected one man a Chief of Quorum of Travelling Teachers, and another Second Chief of Travelling Teachers.

Wm. Marks, Richard Stevens and Harry Childs, "having been appointed by revelation," as Thompson puts it in his records, were *accepted* as a committee to locate a present place of gathering for the "Schools of Jehovah's Presbytery of Zion," and they were directed to report to Thompson as soon as they had selected a place. At this meeting these travelling teachers were sent on their mission to the eastern states, from New York and Pennsylvania to Missouri and Iowa. The committee on location, who were not all present at this meeting, conferred by letter, and were to meet and start on their journey for selection the latter part of June, 1852. A part of the committee got as far as St. Joseph, Mo., in August, 1852, but one was sick, and land was so high priced there, they reported they would be compelled to go farther north.

The Solemn Assembly again met at Thompson's house in St. Louis, August 29, 1852, with greatly increased numbers, and all during this year their teachers were active and had organized schools and churches in many states, and Thompson's paper was given an increased circulation. His organization seemed to be gathering in the Mormons who had been scattered by the breaking up of the Nauvoo colony, or who refused allegiance to the new Brigham Young faction which preached polygamy, or had not gone with the Rigdonites to Pittsburg, or with the Strangites to an island in Lake Michigan.

September 1, 1852, Wm. Marks and Harry Childs, of the location committee, reported by letter from Kaneshville, Iowa, (Council Bluffs) that they had selected the

region around Kaneshville in Pottawatomie county, Iowa, as the place for their colony, that many land claims were vacant there because of the Brigham Young colony migration west, that the country north was mostly vacant, but no specific spot was selected.

Thompson duly published this in his paper, the "Harbinger and Organ" for October, 1852, and advised those that could to go that fall, and when there to appoint a committee to select lands for those who might write to them, and Thompson also asked for contributions to move himself and his paper to Kaneshville that fall. Owing to lack of funds Thompson was unable to move that year, but notified his followers in his paper that Kaneshville was the place where the *Church*, meaning the old organization of Mormons went to pieces, and that it was exceedingly proper that there "Jehovah's Presbytery of Zion" should take its place. A branch Solemn Assembly of Thompson's followers was held at the house of Job V. Barnum, near Kaneshville, December 27, 1852, at which about twenty-five persons were present.

The committee on location had bought a house and lot at Kaneshville, but no funds were coming to Thompson to enable him to move there, and in the February, 1853, number of his paper, he took his followers to task for their neglect, in a long article, and did what before and after that was characteristic of him, when not supported when he wished; laid down the law of special revelation and commandment and for the first time published such revelation in detail, though he assumed it had actually been given months and years before. In this case he published the recorded command given to this committee to be: "To search out a location and to let them make provision for Chas. B. Thompson and his family that he may be speedily located in a proper place to qualify my servants in their great and last mission, etc. That the time set by revelation for the opening of the second department of the School of Works was December 23, 1853, and that Thompson must be there by that time, or the curse would rest on them."

In the March, 1853, number of his paper, Thompson published a revelation made by Baneemy the previous January 28, 1852, as to their assemblies and feasts, and

saying, "I appoint Chas. B. Thompson Chief Steward of my house * * * and to receive, hold and manage and direct all the sacred Treasures of my house, the obligation gifts, tythings and sacrifices of my people, that he and his family shall dwell in my house, eat at my table, and be clothed in my raiment."

At their Solemn Assembly held at St. Louis, April 15, 1853, they voted to "*recommend* to their committee on location, *selected by revelation*, to re-consider their action and select a more suitable place than Kanessville, but near there, and to make the selection quickly," and they appointed a sub-committee of three to act with them.

Finally Thompson and his family on September 9, 1853, with a new printing press, left St. Louis on the steamer El Paso and arrived at Council Bluffs, as he then names it, on the 16th. The brethren had to raise part of the money to pay the freight. A location had in the meantime been selected at a place they named Preparation, near the south line of Monona county, Iowa, near the stream called the "Soldier." A house for Thompson was in course of construction and he moved to this November 4, 1853, and set up his printing press there, and November 26th published the September number of his paper there, and his colony was fairly started.

The town was laid out into acre lots and all the timber within six miles was pre-empted by members of the colony under United States laws, and at first this timber and the town were all that was contemplated to be held by the Church, or Presbytery. Thompson held the claim to the town plat. The form of the town organization was much the same that had been formerly adopted by the Mormons in their settlements, especially at Nauvoo: to give each settler a block or lot of one acre for a home, and the farming to be carried on outside by those living in the town. By the time of the important Solemn Assembly, December 27, 1853, the colony had its settlement established at Preparation, and at this meeting upwards of one hundred persons were present, though not all members of the colony, and a religious service was held and a feast given on each of the three days and the real business and organization of Jehovah's Presbytery of Zion began.

Thompson claimed to be commissioned by Baneemy as Chief Teacher in the Schools of Preparation; and there were also to be Schools of Faith and Schools of Works, several degrees of each, but up to this time there have been but three degrees in the Schools of Faith and only two degrees established in the Schools of Works. There were long formal covenants to be entered into by the members of each, and officers and teachers were elected to the subordinate positions in these schools.

There was also a travelling department in the Schools of Faith, the members of which acted as missionaries, and these were divided into quorums or groups of fifteen men, who were assigned to different sections of the country.

So the School of Works had its quorum or groups of men to whom duties were assigned in the nature of the civil government or business management of the colony, and one of the early things attended to was to enclose about 1,500 acres of tillable land in the vicinity of the town for the next year's cultivation in which portions would be set off for each one according to their needs or ability to farm, as each member was then working financially for himself. The law of tything was established, by which each gave to the Presbytery one-tenth of all he or she possessed, money, clothing, cattle and all, and also one-tenth of their annual income, and one-tenth of their labor besides so giving one-tenth of their time, and one-tenth of the products of the other nine-tenths.

Thompson's paper, "The Harbinger and Organ," continually warned his followers of the necessity of being faithful to the covenants if they expected to progress in these Schools of Faiths and Works, and be ready for the third degree in the school of works, which was to be opened at the Solemn Assembly in August, 1856. He warned them to observe the law of tything and also the law of gift obligations which had been in force for some time. This seemed to be the making of donations by the brethren in other districts, towards the common cause, as well as by the members of the colony. Books of account had been opened and the several gifts and tythings were set down in detail.

Thompson seems to have had prepared at St. Louis a blank book in which had been written in a good legible hand some of his revelations and covenants, and in the back part if this he entered the names and contributions under the various tythings, gifts and sacrifices, and many of the members subscribed their names to some of the covenants written there, and this book, which I have examined, was regarded by them as the chief record of the Presbytery. The book commences with a title page and the three following leaves were written in a fine copy hand setting out the revelations of April 15, 1850, and one or two covenants, and the rest is mostly in Thompson's writing. The revelation of April 15, 1850, while good enough for the purposes of that period was hardly explicit enough to sustain Thompson's authority at later periods when he was managing his colony at Preparation, and one significant interlineation in Thompson's poor hand writing, as it stands beside that other fine penmanship is characteristic of his whole career. It had been written originally as follows:

"And now behold I send unto you my servant Baneemy in the spirit and name of Elias to write in your heart my law," etc.

Thompson interlined and corrected it so as to read:

"And now behold I send unto you my servant *Charles B. Thompson in whom is regenerated my dear son Ephraim my first born with the voice of Baneemy in the name and spirit of Elias,*" etc.

Baneemy was evidently in his spiritual authority not quite potent enough to control a frontier settlement, and Thompson found it necessary to have a direct revelation as to his own personal authority.

One of the early acts of the quorum of Works, which acted as a sort of town council, was to forbid hogs from running at large under penalty of forfeiture at the pleasure of the Chief Steward, Chas. B. Thompson. He was impatient for the success of his town, and published the following invitation:

"Let all those who desire to be instructed in the things pertaining to their salvation and deliverance with Israel come on speedily with their tythes, gift obligations, and sin offerings to the House of God that they may be justified from sin and receive an inheritance, *

* * *"

In the early spring of 1854 Thompson seems to have conceived the possibility of a great enlargement of his spiritual and temporal organization, and through his paper outlined his plans for gathering in the followers; and his system of organization for his quorum of traveling teachers in his schools of faith were as elaborate in its detail of organization and names of officers as a large army. At the Solemn Assembly in April this year and in the subsequent issue of his paper, he explained the financial arrangements under the law of tything, gift oblations and conducting the colony; as now that the work was actually begun, those who joined, wanted to know how it was to be carried on, and just what the plan was. When a convert joined the colony, the practical question arose, what amount of tything he had to pay down, and what he should do with his family, and on what land he should labor, and what he should get for it.

A record had been kept of the gift oblations, chiefly in small sums, but when they became members of Jehovah's Presbytery of Zion at Preparation, an inventory of all their worldly possessions was taken, and one-tenth of this was paid into the Lord's treasury, that is, to Chas. B. Thompson, generally in kind even to their clothing, and in the first year each one who could work was expected to labor one day in ten for the Presbytery (Thompson).

Most of those who joined had very little property beyond tools, stock and furniture, only seven, as shown by the tything record, had over one thousand dollars worth of property each, though it cropped out later that some who had money, discreetly gave it to their children, and so were enabled to honestly take the oaths and covenants, and so had a little money for emergencies.

Thompson's explanation as to the disposition that would be made of the tythings was, "that it ought to be sufficient to know that it would be used as directed by the Lord. He had appointed as agent (Thompson) to receive it and manage it, and this ought to be a sufficient guaranty." That but one person was ever appointed by revelation to receive and manage the tything." "If the Word of God is not sufficient assurance to any man that his tything will be prudently managed and used where most needed if *payed* into

the hands of the Lord's Steward, he had better not pay it." "That it was to be used, first, to create a capital for the establishment of the House of the Lord, etc.; second, to create a capital to be expended in establishing schools among the Indian tribes; third, to create a fund to purchase Mount Zion."

Thompson was profuse in his promises as to the great results that were to come from this organization. By the spring of 1854, twenty families were already established at Preparation, and at the April Solemn Assembly one hundred and twenty partook of the feast, and they were all from the vicinity. Monona county, Iowa, was organized in April of that year and Thompson was elected to the chief office, that of County Judge, and a majority of the county officers, and all the township officers for that township were members of the Presbytery. There was only one other township. So for the time the civil government of the township and county was in their hands, and soon after, when the postoffice was established, Thompson was appointed postmaster.

Thompson seems also to have carried on a mercantile business as he advertises that "Flour, meal, pork and butter were for sale at the Lord's storehouse in Preparation," and under the head of "Wanted, at the Lord's storehouse, on tything and gift oblations, all kinds of country produce, money, dry goods and groceries, young stock, cows, horses, oxen, harness, wagons and farming tools." He also republished in his paper some of the early proclamations or revelations that came to him in 1848. He also had a new revelation in June, 1854, which begins as follows:

"The word of the Lord by the voice of Baneemy, came unto Chas. B. Thompson, Chief Steward of the Lord's House, in June 1854, saying: 'Behold I say unto you, my son, I have beheld the works which thou hast done in Preparation, and am well pleased,' etc.

Then followed a review of what had preceded, and a scathing rebuke on some who had evidently held back, who had been expected to join the settlement, and had not paid their tything, and of these he says, "Wo unto them, for their reward lurketh from beneath and not from above, for they have lied unto me," etc.

During this summer Thompson went to St. Louis to buy more printing material and a mill, going by team to southeastern Iowa, and the rest of the way by boat, stopping at Nauvoo to moralize over the sins that had caused the downfall of that settlement; he returned by the same route.

Affairs at Preparation were not at all harmonious. The first year a new settlement is hard at best, and add to this a sort of surrender of independence and an acknowledgement of Thompson's authority and the paying in of one-tenth of all one's earthly possessions and services, required the spirit of a saint; and those that had paid in would criticise those who had not, and some who had been prominent in organizing the colony seceded, and in the Kanessville paper denounced Thompson as an impostor and tyrant, and that none but fools would allow themselves to be controlled by him.

An unexpected difficulty had presented itself in the matter of the land; when they first came to Preparation the land there had been surveyed by the United States authorities, but was not all subject to private entry and could only be taken by actual settlers under pre-emption laws, and they intended to claim two congressional townships and had filed pre-emptions on the pieces that were timbered, but the General Land Office had ordered the land thrown into market and it would be publicly offered for sale in September, 1854, when speculators would enter the land. At that time, this was sure to be the case, especially as bounty land warrants for soldiers in the Mexican and other wars, had been issued by the United States and were bought up for this purpose by capitalists who located on such lands, and the land would have to be taken in some valid form to hold it, for this colony.

So Thompson announced that while it had not been originally intended to open up the third degree in the school of work until the August Solemn Assembly of 1856, yet he now advised all to anticipate that period and to enter a new order of sacrifice, which, while not strictly obligatory, and would not exclude from the Presbytery those who did not join it, yet would sanctify those who entered it. The order of sacrifice was that each one should surrender to Thompson, the Chief Steward, all their property and enter into bond to work for him two

years, and he to furnish them with board, lodging and clothing not exceeding in value a specific sum per year, and written bonds from the husband and wife of each family were entered into in August, 1854, by thirty families, nearly every family that remained faithful.

They were organized into a quorum, as it was called, and the work of the colony was apportioned among specified ones to do the sowing, reaping, grist and saw-mill work, logging, and a head cook was appointed, and thereafter, until August, 1855, they were all fed as one community. An inventory of this property thus put into the Chief Steward's hands, exclusive of the saw and grist mills, printing establishment, agricultural and mechanical tools and household goods, was as follows: 27 horses, 300 cattle, 61 hogs, 80 sheep.

At the Solemn Assembly in August, 1854, several were expelled for apostacy, heresy, misrepresentation and lying to immigrants on their way to Preparation, and calumniating the chief teacher, Chas. B. Thompson. For some cause the order for public sale of the lands by the government was not carried out, and they were not obliged to buy all the land or prove up on the pre-emption, but Thompson bought some, including the townsite. There can be no doubt that these members who thus sacrificed their property to the common cause were sincere and devout and of more than ordinary self-denial.

In September, 1854, Thompson started a weekly newspaper called "The Preparation News," after the plan of an ordinary country weekly religious and family newspaper. His former monthly "Zion's Harbinger and Baneemy's Organ" had been irregularly published and at times was not issued till three or four months after its ostensible date. The December, 1854, number of this magazine contained news under the date of May, 1855. In the spring of 1855 this magazine was consolidated with the Preparation News which later paper was called Preparation News and Ephriam's Messenger. His "Organ and Harbinger" he was to publish thereafter three times a year immediately after each Solemn Assembly, which was to be the grand channel of promulgating the Ecclesiastical Laws of Jehovah through Baneemy to Ephriam and to make known the decrees of Heaven unto men.

After the trials and tribulations encountered in managing the small colony already there, Thompson seems to have lost interest in the great hopes he had entertained of making it an organization of all the Mormons to take the place of what was expected of the Nauvoo settlement; and he decided not to send out missionaries, and that proselyting was all wrong and that it was the cause of Joseph Smith's downfall.

After the colony had thus gone into the order of sacrifice for two years, Thompson became a sort of dictator in a communistic settlement and the utmost economy of living was observed. They were instructed in the healthfulness of a vegetable diet. Rich foods were an abomination and for their spiritual welfare and physical health plain food was required; meat was forbidden. At one time butter was regarded as a useless and unknown luxury, and though an extensive dairy of 40 cows was carried on, the butter and cheese were all sold at Council Bluffs. Some pork and beef fattened for meat was killed and sold with the butter to increase the fund to buy the land for an inheritance.

It was claimed by the irreverent that the Chief Teacher, Thompson, did not share in all this self-denial. He taught that this abstemiousness was not to be perpetual, but was essential in those two years to sacrifice themselves for the common good of themselves and others who might join so that in the end after purification they would all come again into their inheritance in the spiritual and good things in store for them.

Some became discontented and left without settling with Thompson and left their sacrifices, tythings and oblations with him. Others would make a settlement, and get some of their property back and exchange receipts, for Thompson was getting to be careful in putting his dealings in writing, and only by a show of fairness to those who had left, was he able to hold those who remained; but he grew more cautious and sought to get renewed binding contracts according to accepted business forms at every possible opportunity. At and after the Solemn Assembly of August, 1855, Thompson prepared to put his business on a legal basis. He organized two corporations, one called the "Sacred Treasury of Jehovah's Presbytery of Zion," and the other the "House of Ephriam."

The first was a corporation of a single individual, Chas. B. Thompson; as he expressed it in the article "incorporating that portion of my individual prosperity which has been obtained by my labors and by the voluntary gifts, tythings and sacrifices of the members of Jehovah's Presbytery of Zion for that purpose." Its object was, "To establish schools of preparation for the intellectual, moral and physical culture of the members of his colony, to publish books and papers, to buy land and improve it for the future inheritance of the saints who shall be found worthy; and to erect the necessary edifices for schools, colleges and temples." The capital was to be \$10,000.00 to be increased indefinitely.

The funds of the corporation were to be the individual property of Chas. B. Thompson and he to be the manager and director of the business. Any person who wanted, whether a member of Jehovah's Presbytery or not, could contribute to the funds by gift oblations, tythings or sacrifices; but such donations can never return to donors nor were they to be entitled to any pecuniary remuneration therefor, but must abide the final issue of the work of Jehovah's Presbytery of Zion for their reward."

The other corporation, the "House of Ephriam," was composed of members of Jehovah's Presbytery of Zion; its capital stock was \$6,000.00 in shares of \$5.00 each, which might be indefinitely increased, and certificates of stock were to be issued. Its purpose was to carry on farming, milling and mechanical business. Its affairs were to be managed by Chas. B. Thompson, and from one to seven patriarchs appointed by him, and Thompson for his compensation was to receive one-tenth of the annual increase of its capital stock. Dividends of the annual increase could only be drawn by the shareholders in case of their actual need thereof for the necessaries of life.

All persons, whether Jew, Gentile or Ephriamites, who should pay into his other corporation, "The Sacred Treasury of Jehovah's Presbytery of Zion," one-fifth of all their worldly possessions should be eligible to take stock in this House of Ephriam to the amount of all their remaining surplus property.

Thompson had blank bills of sale printed with blank spaces for the enumeration of horses, cattle, sheep, swine, grain, tools, vehicles, furniture, clothing and credits, and he had each one of the colony make one or more bills of sale to him personally enumerating the specific property, which included the houses in which they lived, and their wearing apparel, and from the price the houses were very simple affairs, as for instance one enumerates a "cave" of the value of ten dollars.

For the Sacred Treasury he had formerly taken a tything of one-tenth, but the change to one-fifth at this time was, as he told them, that in order to make it equal to cash, he took another tenth. The remaining four-fifths of their property was conveyed to him for stock in the House of Ephriam. He also had title before this to much of the common property, as the mills, printing press, and the gifts and their proceeds. So now Thompson had title to everything they had, even to the clothes on their backs. For some balances of property Thompson gave them a due bill or certificate for a small specified amount in goods or grain out of the House of Ephriam and took from each a receipt in full for the certificates.

In the spring of 1856 Thompson proposed to buy their stock in the House of Ephriam and pay for it in script to be given by him in the House of Ephriam, which script they should exchange in turn for such property as he might sell them from that owned by this corporation, which proposition, being compulsory, was accepted, and they all assigned their stock to Thompson and took his script for it and gave a receipt for the script, and published notice that they had all sold out, but the business of the corporation would be carried on as usual by Thompson. These corporations were a sort of legal myth to cover the personal transactions of Thompson, as under these forms he got all the stock in both corporations.

Their land had not come into the market in the fall of 1854 as expected, but did so come in the spring of 1856, and they would be compelled to enter it from the United States, or take pre-emptions upon it which would need to be proved up on and paid for within a year, and a great strain was put upon the financial resources of the colony, for if they did not get the land, the object of all

their labor and sacrifices would be lost. As many as legally could took pre-emptions; and as in law it would be necessary for each one to take these pre-emptions in their own name, and build houses and reside on them, there was danger that when they got full title it might be hard to control them.

So the most solemn rites and ceremonies were gone through at the August Solemn Assembly in 1856; a full and complete sacrifice was called for. It was argued by him that as every one had for the past two years been in the "order of sacrifice" and hence were incapable of taking or holding title to anything, that everything acquired during that period went under the law of sacrifice into the Chief Teacher's, Thompson's, control, to be laid up for their future inheritance. So each again gave Thompson a bill of sale of everything for the House of Ephriam, including growing crops, clothing, and a list of these things were written on a piece of paper, and they came into a darkened room and Thompson poured alcohol on this paper and burned it over the fire in token of their complete sacrifice of all they had and they all, men and women, were required to go through the ceremony of a sacrifice and consecration of their bodies to the Lord.

The two chiefs, right and left supporters of Thompson, Guy C. Barnum and Rowland Cobb, came into the room stripped naked and surrendered their clothing in token of complete surrender and sacrifice of their bodies, and they were then given a single coarse cotton garment or frock, coming below the knees like a nightshirt, such as used to be worn in early days as an over garment by New England farmers, called a smock frock. This Thompson named the "Garment of Holiness." Barnum and Cobb then seated themselves on either side of Thompson, and the rest of the members, men and women in turn, came into their presence and went through a like ceremony. This garment was worn for a little time, but was not retained as a permanent fashion, but they retained only such clothing as was barely necessary, in fact, this had been the case for some time, but practically all their clothing and jewelry was given into the custody of Thompson, and he had large quantities stored in chests and boxes in his house. In consideration of the actual necessary clothing given back to them, which he nomi-

nally valued at ten dollars for each family, and five dollars for single persons, he again took a receipt and release from each, discharging Thompson and his two corporations from all demands to date; and from many who had had money for any purpose, and especially from those heads of families who were again living by themselves on pre-emptions, for the value of the very property sacrificed, such as furniture, teams, and tools needed to farm, which he then re-sold to them, or let them use, on that date he took their notes or bonds payable seven years thereafter, with interest at ten per cent. per annum, and thus had the title to the property, and their note for its value besides. The inventoried value of the whole property sacrificed at this time as recorded in his official record book by families, was the sum of \$11,174.26 from forty-four persons.

In August, 1856, Thompson and Butts commenced publication of another paper called the "Western Nucleus and Democratic Echo," which supported James Buchanan's claim to the presidency, though many of Thompson's religious writings were against slavery.

In the spring of 1857 it became necessary to pay up for the land and the winter had been very severe and 100 head of cattle died worth about \$2,000.00, which had been an expected source of getting money to pay for the land, and some were unable to prove up. Directions were given to prove up the best claims and to some extent individuals were allowed to use such property as could be converted into money for that purpose. But as entries of the land were made, Thompson demanded that each one should convey the land to him, for the reasons given before that it was all taken while they were on the sacrifice and hence belonged to the Sacred Treasury. In some cases the money to enter was borrowed of money lenders to whom the land was conveyed for security and a time bond taken back and later paid for, and deeded to Thompson. Much dispute afterwards arose over just what was agreed on at this time when the deeds were given.

The people afterward claimed it was all to be deeded back to them when they were out of the sacrifice, the period of which Thompson had prolonged beyond the time at first set of two years from August, 1854, giving

the principal reason therefor that it was necessary to include the time for the entry of the land, and that divine commands were authority therefor. At any rate Thompson got deeds for most of the land; in some instances giving back bonds for deeds at largely increased prices, in which time of payment was made the essence of the contract, and with conditions of forfeiture if not paid for, and then in some instances getting the bond surrendered. Thompson also entered in his own name from the United States considerable more land with the money that came into his hands from the proceeds of sales of stock and produce, also borrowing some on short time.

It was not always harmonious in the colony and the management by Thompson of so many persons was difficult and some were not very energetic to labor and took life easy.

February 17, 1857, Thompson had another opportune proclamation or revelation by the voice of Baneemy, concerning the treasures of the Kingdom of Zion which ordered in substance, "That the funds were to be expended under the direction of the Steward in purchasing land for the future inheritance of the Saints who shall be found worthy." No one could receive their inheritance until there was sufficient land owned by the Chief Steward to furnish an inheritance for each family entitled thereto. "That the title should be vested in Chas. B. Thompson in whom Ephriam the first born of Israel is regenerated." This revelation was a very full and long creed minute in details of church government indicating a return to missionary work.

After Thompson had secured title to the land early in 1857 he planned a reorganization of the colony for the purpose of either keeping their minds employed with new thoughts or the better to confirm his title to the property and to prepare for a winding up of his connection with it.

April 15, 1857, what he called the "Congregation of the Jehovah's Presbytery of Zion," was organized of which Guy C. Barnum was appointed Bishop and Chief Scribe. This seems to have been intended as a sort of return to a mere church organization. The unmarried ones seemed to have stayed in Thompson's household and

to have worked in common, as did all in 1854. But the married heads of families had gone out onto their pre-emptions, and paid to Thompson one-third the crop as rent.

At the Solemn Assembly in August, 1857, Thompson declared the schools of Preparation, Faith and Works, closed and called on all to settle up the affairs of the schools preparatory to the organization of what was called the "Travelling Ministry of the Congregation of Jehovah's Presbytery of Zion." This was organized at this Solemn Assembly, but only four settled up at that time, and three only were ordained Travelling Presbyters and started on missions to the Eastern States.

This settling consisted in giving Thompson a new bill of sale of property to which each might possibly have a claim, followed in a day or so by a written release by each to Thompson for all demands, and then a turning back to each head of family some of the property named in the bill of sale, such as furniture to enable them to carry on the farms under family stewardship which he then organized, under which they paid rent for such land as they cultivated. They did not all settle till in February, 1858, but in August, 1857, Thompson made a change in the temporal management evidently intended to allay the growing dissatisfaction. He appointed a number of the most reliable men as stewards and gave them each farms to manage. Stewardship was a great honor and each one of these gave his personal bond in the sum of Fifty Thousand Dollars, conditioned to perform the duties of family assistant steward of the Ecclesiastical Kingdom of Jehovah's Presbytery of Zion, and account to Chas. B. Thompson, Chief Steward, for all property that came into their hands. And later, when he settled with them, as above stated, Thompson delivered to them household goods and clothing with which to carry on this stewardship, and he took their receipts for it as held under their bond. It is noticeable that this receipt and bond say nothing of the two corporations which nominally held title to all the property; but as before stated just before giving them such property under their stewardship he took the precaution to take from each this new release to Thompson and to both of his corporations for all demands for a sum named equal to the stock they had before had in the House of Ephriam.

Thompson in 1857 published a book of about 210 pages entitled "The Law and Covenants," which contained all the proclamations, revelations and covenants, including those for his new congregation. It was divided into chapters and sections, the latter numbered up to 746. It had an index. It was pocket size, its pages about $2\frac{1}{2}$ inches by 4 inches. This book is a veritable medley, a combination of the writings of the Bible, the Book of Mormon, church government, orders and decrees, and is hopelessly entangled, and judiciously interlarded with commands as to the authority of Chas. B. Thompson in things spiritual and temporal.

After he made his settlement under the old order of schools of Preparation, his new plan was to be in force. Hitherto it had only been preparation; now his disciples were fully educated in these schools and were graduates in the ministry, and were fully ordained in the order of the "Travelling Ministry of the Congregation of Jehovah's Presbytery of Zion," and each were "Travelling Presbyters" ready to go out on missions, chiefly to organize new congregations of Jehovah's Presbyteries of Zion, the people at Preparation forming the first of such congregations. Then on paper Thompson had got the title to and possession of all the personal property except household goods and such tools and teams as were in the hands of the family stewards and they were paying rent for the land to all of which he had title.

Most of the parties after proving up on their claims had moved back into Preparation, preferring to live in town, so the religious congregation composed of his tenants could go on, but they still clung to his oral promises that after these sacrifices of the fast they should come into their inheritance and something had to be done to divert their minds.

Thompson still found it hard to control them all, from what he said in confidence to some, as appeared from their testimony later in the suits, it seems probable that he thought it advisable to send the leaders out on their missions to different parts of the country, while he managed affairs at home getting ready for departure. It is said these commands to go on these missions were

sent suddenly to each by a messenger telling them they were commanded to go instantly, just as they were, to the places named to them and to take no money.

Take two instances, as related by two of the parties afterward. Rowland Cobb, about 70 years old, one of the chief stewards, was coming home from towards the Missouri river with a load of lumber, and was met by a messenger from Thompson, telling him he was commanded by the Lord to start without an instant's delay, without money or change of clothing, and go to Virginia I think it was, to the Legislature in session there, and pronounce the vengeance of the Lord upon them if they did not free the slaves. Cobb at once gave his team to Thompson's messenger to take home, and started across the country on his mission and actually went to Virginia, and delivered his message to the state officers. They treated him decently, and from his dress and the strangeness of his mission evidently thought him insane, or what we would now call a crank, and most likely from his relation of it afterwards he had himself lost faith in the likelihood of his mission being successful.

He then wrote Thompson for permission to visit his old home at Elliottville, N. Y., where he had been once a leading business man. He got such permission in due time, and made the visit, and while there received a letter from J. J. Perrin, one of the leading stewards of Preparation, which indicated that all was not harmonious there, and Cobb at once hastened home.

Another chief man, Thomas Lewis, a well educated and intelligent man, originally from Kentucky and very devout, who was ploughing in the field, had taken off his boots and stockings, coat and vest, and left them at one end of the field, was met by a messenger from Thompson with the same command for Kentucky that Cobb had for Virginia, and he at once started instantly in his straw hat, shirt and pants, without crossing back to get his other clothes, and without money, went to the Kentucky Legislature. His advent seems to have been regarded as a huge joke, and the members of the Legislature and state officers treated him with mock distinction. He was allowed to address the Legislature either in or out of official session. They got up a supper for him; raised quite a purse with which they got him new clothes, and

money for expenses, but there is no record in their proceedings that they acceded to the demand of a message from so potential an individual even as Charles B. Thompson.

Thompson had started another newspaper in Onawa, which town had become the county seat. This he called the "Onawa Advocate," and in 1858 Thompson moved to Onawa, and his head man, Guy C. Barnum, was with him there more or less.

Thompson corresponded with his missionaries, but somehow or other the people had become suspicious. He had deeded some property in the summer to his wife and Barnum. These leaders sent out to preach, seemed by contact again with the world to have recovered their mental balance, and took a different view of matters than they had when under the immediate influence of Thompson, and some of them came back sooner in 1858 than was anticipated, and disconcerted Thompson's plans for getting his property disposed of, if he had formed any. It was afterwards asserted that Thompson had said that by his numerous bills of sale, bonds, receipts, corporations and other papers, he had got them all so tied up they could do nothing in law, and that he would sell the personal property and deed the land to some one else and go away. That Guy C. Barnum advised the better course would be to settle with the dissatisfied ones on some cheap basis, give the others, faithful ones, some land, and keep the rest for Thompson and Barnum. Thompson, however, stood upon his rights, and when a few leaders made trouble, he refused to settle, and turned them out of his Presbytery, especially Rowland Cobb, Charles C. Perrin and George Rarisk.

But this only started the trouble as it provoked discussion among the rest; and others, who had left before, came back to Preparation, and most of the people met and canvassed the situation, and expecting Thompson to come from Onawa on a certain day in October, 1858, were there intending to demand of him to settle with the people. The crowd had assembled in anticipation of his coming, and had posted sentinels on the bluffs who saw him coming with Guy C. Barnum in the distance over the Missouri bottom lands, but one, Melinda Butts, a daugh-

ter of one of the colonists, who lived in Thompson's family, was probably sent by Mrs. Thompson along the road to warn him of the possible danger, and she met Thompson and Barnum, and told them of the crowd assembled, and they immediately turned their team around and started at full speed to Onawa.

News of this return soon came to Preparation and several men at once started on horseback to follow them, and did so closely that Thompson and Barnum unhitched their team and fled on horseback, and the two did pursue them to Onawa. It was getting towards night when they started. Thompson sought protection among the citizens of Onawa, and that night fled to Sioux City, staying a week; negotiations were had seeking a settlement, but Thompson made only promises, and worked for delay. The men returned to Preparation the next day and went to Thompson's house and took possession of the household goods and clothing that had been put into the sacrifice, and in Mrs. Thompson's presence opened up the trunks and boxes in which they were stored, and returned the articles to the original owners of them who were there to identify them. No property was destroyed except a collection of Thompson's printed books, tracts and papers, and some pork and mutton killed for food. The sheriff of the county, and Judge Whiting came over from Onawa to keep the peace, and witnessed much of this last day's proceedings. Mrs. Thompson, with much of her furniture and goods was moved that day to Onawa. Suits were begun in replevin to get possession of the farming tools and other property. Thompson had conveyed away all but 40 acres of land, that being his homestead; about 1,000 acres to his wife, who afterwards deeded it to his brother, D. S. Thompson in St. Louis, and 1,360 acres in trust to Guy C. Barnum, this part for settlement with those who had remained faithful, in case anything might be due them, and to allay the excitement, as Thompson said, and 320 acres to Barnum personally, and later 320 acres to Thompson's brother, so Thompson held about 3,000 acres.

The report of the mob had reached Thompson, who kept himself in hiding for several days in the attic of Judge Addison Oliver's house in Onawa; the judge was then acting as his attorney. Mrs. Thompson stopped

there also, and it was said she had a small bag of jewelry, presumably that which had been given up in the sacrifice by the women. She seemed to set great value on this collection, much beyond its real worth. When Thompson took a drive up to Sioux City and Sergeant Bluffs, Woodbury county, Iowa, at all times he seemed to be in great fear of personal violence, and would start at every sound.

This ended the unity of the colony and the religious organization. A suit was brought in behalf of the colonists against Thompson and those to whom he had conveyed the property in the nature of a bill in equity, to declare the colony a partnership, and Thompson a trustee, holding the title in trust for the members, and to set aside the conveyance from him to his wife, brother and Barnum.

Thompson's defense was that so far as the people had put any property in his hands it was in payment for his services as chief teacher and that this was expressly understood between them and that the written contracts he made with them established these facts.

The case went to the Supreme Court of Iowa, and the people won, and there was an order for an accounting between the members as to what they had put in, and a division of the property was had. Addison Dimmock and Isaac Parrish, of Onawa, and Pat Robb and Wm. L. Joy, of Sioux City, represented the people, and in different stages Addison Oliver, B. D. Holbrook, of Onawa; Wakely & Test, Polk & Hubbell, and Thos. F. Withrow, of Des Moines, appeared for the defendants.

J. C. C. Hoskins was appointed under the order for apportionment, (Mr. Hoskins being from Sioux City), as referee to take the evidence as to what each one had contributed, and report the facts, and finally a distribution was made among the numerous persons entitled to it. Though the litigation began in 1859 it did not end until about 1867. The decision of the Supreme Court of Iowa is found in 21 Iowa Supreme Court Reports, page 599, Scott vs. Thompson.

In the trial of this cause the records, the newspapers, publications, contracts, bonds, notes, bills of sale, during the continuance of the colony with much oral

testimony were offered in evidence and were thus preserved, and it is from these that the definite detail of this Mormon settlement at Preparation has been obtained.

With the meeting of the people at Preparation when they forcibly divided the clothing and personal property in sight in October, 1858, the colony or organization of Jehovah's Presbytery of Zion under its many names, ended. Many remained in that vicinity until they got their lands by suit, and they and their descendants are living in Northwestern Iowa, many scattered like any western people. Only three or four finally remained faithful to Thompson; many of them, though denouncing him as a false prophet, remained believers in the general Mormon religion.

In all, about one hundred and fifty persons were connected with the colony, men, women and children; it endured for five years. Thompson, in that time, had, with the pre-emptions taken by the settlers, and his own entries, got title to over three thousand acres of land, at a cost primarily of \$1.25 an acre, but with the expenses of the sums borrowed at high rates to enter part of it, it must have cost over \$4,500.00 in money, besides the improvements. The gifts, tythings and sacrifices nominally inventoried amounted to about \$15,000.00, but considerable of this in clothing, tools and teams was practically kept by the people, while most of the money raised went into the buildings, mills, printing material and living expenses, but on the other hand, the increase of the cattle, and the sale of the crops provided quite an income.

It was said that their flock of sheep increased rapidly and that under Guy C. Barnum's direction these had been taken across the river into Nebraska, on the representation that they would not be so much annoyed by other settlers, and that they were driven farther away, and finally converted by Barnum, and this same man Barnum seems to have been the chief leader and business manager for Chas. B. Thompson. He was much shrewder and had more directness in business matters, and less sanctimoniousness. He went to Columbus, Neb., became a member of the state senate, and later for a time went insane. I am yet unable to trace Thompson's later career; he resided in St. Louis for several years.

It was said that only one of the people failed to convey his land to Thompson, and that was Andrew G. Jackson, an erratic crank, who was chief editor after 1854 of the various papers published. He brought no money to the colony, and he absolutely refused to deed his land. He made no hostile demonstrations. It was one of Jackson's theories that we all are affected by the food we eat, and he aspired to be a long distance jumper among the younger athletes, and so went through a training course on a diet of grasshoppers, but in the outcome was badly beaten. He afterwards went insane.

The most of these colonists were sincere, honest, upright, devout citizens, with strong religious convictions, and lived up to their beliefs and hoped and expected much from their long season of sacrifice and self-denial, having accepted the divine authority of Thompson, felt compelled to yield obedience to it, and were more easily deluded by his plausible promises.

It is hard to measure Thompson's motives. From the beginning he was undoubtedly a combination of a fanatic and knave. So long as they yielded obedience to his commands and leadership, he was apparently working to build up his Presbytery, and knew that so long as he held ownership to the property he could better control them, but when any of them became dissatisfied, he was revengeful and wished to get rid of them as cheaply as possible. He had been poor all his life, and the possession, even as the Lord's Steward, of the little property that came into his hands at first, seems to have excited his cupidity, and he was, as time progressed, more and more reluctant to part with it, and convinced himself that it should all belong to him.

He was a man of very ordinary ability, and the times and circumstances were not calculated to insure such a man success. He could only control for a time such a limited number of persons as were pure minded and faithful; had he had the ability of Brigham Young and contented himself with a less avaricious financial policy, he might have filled Northwestern Iowa, which was then entirely unoccupied by settlers, with the so-called followers of Mormonism, who were opposed to polygamy.

The times were then ripe for it, but he was not the man, and his colony scarcely made an impression on the large number of them that were even then in Southwestern Iowa. His followers remained chiefly those whom he had attracted by the publication of his paper at St. Louis. He never really had any clear idea of what his belief and mission was, and could not make plain to others that which was a fog on his own mind, and he concealed his thought in a great mass of words, prophecies, revelations, proclamations, orders, decrees and systems which were ever being changed.

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THE OUTLOOK FOR CONSTITUTIONAL PROGRESS IN THE UNITED STATES.

By J. HERBERT QUICK.

The above title might be capable of being interpreted in a much broader way than I use it. I do not wish to be understood as using the word "constitutional" in the sense in which it might be taken by the student of English history, meaning the entire body of laws and institutions, but in its narrower American sense with reference to our written constitution, and the body of adjudications related to it. I exclude also all consideration of the written constitutions of the states, confining myself to the Constitution of the United States, and the present probability of its amendment.

Our Federal Constitution is in many respects unique among the written constitutions of the world. It was the first of them in point of time. It has been a splendid success in binding together the states adopting it, and their later-born sisters, into one of the greatest nations of any age. It endured for some eighty years in about the form in which it was adopted, during which time it was the model on which the world formed analogous instruments while written constitutions were becoming the fashion. Thus it has been the mother constitution among the nations.

These considerations, as well as the inherent excellence of the great document itself, have inspired for it the highest respect and veneration. For more than a generation the storms to which its earlier years subjected it have been stilled and it has had well-nigh universal acceptance as the great code of finalities for the people of these United States. The original uncertainties in it were made certain by amendment and judicial interpretation. Those who clung to the idea that it was a mere pact between sovereignties, which, as it was en-

tered into voluntarily, could be dissolved at will, staked their theory on the issue of a war, and lost. Those who regarded it as an indissoluble union won; and not content with their victory as to the construction of the instrument, forced into the constitution certain amendments of the most revolutionary nature, which, added to the work of the courts along broad construction lines have effectively remodeled it, and, it has been hoped, made it over to a degree which renders further change unnecessary. Indications are multiplying, however, that we are coming upon another era of demand for institutional change, and assuming this to be the fact we at once look to the constitution for possible barriers to change: we, having for many years enjoyed the benefits of a written constitution in certainty of rights and immunities, are now confronted with one of its drawbacks, inflexibility to change.

That changes will be soon demanded may be taken for granted. While the constitution has been greatly changed since its adoption, the conditions of life in the nation have been, in many most vital respects, completely revolutionized. The Constitution, statesmanlike document that it was, was the reflection of the national life of 1787, in so far as there was at that time any national life. Its defects grew out of the mutual suspicions and jealousies, the fear of the large states on the part of the small ones, their isolation from each other, and the lack of that national feeling which their history of dependence upon Britain and independence of each other had not been able to engender in them.

The conditions in the convention of 1787 are now hard to realize. We cannot imagine the state of Missouri or Nebraska in the attitude of encroaching upon Iowa, seeking to annex her territory, erecting tariff walls against her, subjugating and making of her a dependency, or exercising any authority over her. Our century-and-a-quarter of constitutional history have completely extirpated all that old thirst for dominion of one state over another from among us. But the thirteen colonies were still less able to realize any such condition as we have happily arrived at. Their view of history disclosed little but a succession of struggles between states for supremacy over one another. The view then current as

to the nature of commerce, by which all trade was supposed to be gain for one party and loss to the other, resulted in a great desire for dependencies which might be forced to trade with the dominant country, on profitable terms. The colonies dreaded each other, suspected each other, disliked each other, but were drawn together by a powerful if imperfect conception of their common needs and common destiny.

When it came to a union, they were all in favor of it, but were afraid of it. They met in convention and worked out the constitution as the only plan on which they could agree. And when it was done, none of them, perhaps, would have accepted it, bitter as their need was, without some assurance that by no chicanery, no combination, no possible means could the terms of this pact be changed without the consent of the states to a degree practically unanimous. So it was that Article V. of the Constitution went into effect without any objection, so far as I have been able to learn, on the ground that it made amendment too hard. In fact it was regarded as an innovation in the other direction. It took unanimous consent to amend the old Articles of Confederation. And I know of no prior constitution or federative pact in history which contained any provision for amendment. Most of them were concessions wrung from monarchs, and were supposed to be the final word on the subject, and guaranteed against change for all time. So the Article providing for amendments was regarded as a venture into an untried field, promising relief from universally conceded evils, but yet not containing much danger to the little sovereignty of the little state which chose to stand for the original bargain.

Some spoke hopefully of the probability of amendments, others saw very little chance of them. Samuel Adams, for instance, in a speech in the Massachusetts constitutional convention, said in discussing the matter: "Suppose, sir, nine states accept the constitution, without any conditions at all; and the four states should wish to have amendments, where will you find the nine states to propose, and the legislatures of nine states to agree to the introduction of amendments? Therefore, it seems to me that the expectation of amendments taking place in the future will be frustrated."

The history of the next few years, however, seemed to support the judgment of those who hoped for change. The first ten amendments were passed easily, and within a short time after the constitution went into effect. The eleventh came soon after. The twelfth was adopted after only a very few years. It seemed to those who regarded amendability as a good thing that the constitution was working most admirably in this respect. As a matter of fact, however, the adoption of the first twelve amendments could have been obtained about as well had the old rule of unanimous consent been in force. The first eleven were in the nature of a Bill of Rights,—a thing which many regarded as a prime necessity, and to which no one seriously objected. The twelfth was adopted to cure a flaw in the original scheme, and all admitted it to be necessary as soon as the defect appeared in the actual working of the government. The real test of amendability had not yet been made. That could come only when some question arose which could not be relegated to the states, and which stirred the passions of men by affecting their consciences and their material interests.

The slavery agitation brought this test. Here was a vested right in property, which grew upon the consciences of men as thought revealed its true character as a vested wrong against human rights. In such cases the wrong stands behind the law and resists to the death. Institutions become the forts and barricades behind which ancient evil finds refuge from the assaults of the spirit of liberty. So it was in the slavery agitation. The slave states stood upon their bond, demanding the human flesh which was theirs by its terms. If you refuse it, said they, fie upon your law!

To the north the question was a nightmare which pressed down upon the public heart and would not let the public conscience rest. It became terrible in its poignancy. Moreover, it seemed an unsolvable question. Constitutionally regarded, it was none of the business of the north whether the south were slave or free. The law could not reach the question. But as a matter of fearful fact, the pain that racked the nation showed that the

eighty years of federal life had knit us together into one body. It was an individual organism which was in torture. The days of our multiplicity of lives was over. But to the old constitution we were still the thirteen sovereign states with their newer sisters added. Like a shell which protects the germ but must be burst by the growing plant the old constitution hampered the national life and was burst asunder by it. It is true, no doubt, that no provision for amendment would have been accepted by the south at that time. The question of secession or no secession had to be fought out. Having been fought out and decided against secession, the amendability of the constitution becomes more than ever important. When the union was one which all were free to abandon at will, the character of the instrument of federation was, perhaps, a matter of great importance, but not of such transcendently great importance as now, when it binds us irrevocably, for better or for worse. The significant thing about the slavery agitation, so far as this discussion is concerned, is this: that slavery could never have been abolished by constitutional means. When it came to the test of actual trial of strength between two strong parties, the provision for amendment failed to accomplish its object.

I have hinted at the enhanced importance of amendability in the constitution by reason of the centralizing effect of the war; but the war has not been the only nor the greatest centralizing influence. We have been gradually growing nearer to each other by the enormous activities of the life of the nation in the past half-century. State lines and state government have dwindled in importance as they have been overpassed and trampled out of sight in the onward march of nineteenth-century development. River courses, telegraph lines, the trade territory of great cities, and more than all, the sphere of influence of railway systems, mark the boundaries of the community-life of today. These pay no attention to state lines. The state as a sovereignty exists; but in the condition of a fossil. Every sweep of the great life-current of the nation makes for the abolition of the state except as a mere political division of the nation a little higher than a county.

The original provision of the constitution granting in every state, to citizens of any other state the same privileges and immunities enjoyed by the citizens of such state, had something to do with stimulating this process of integration of the nation. The provision for free trade among the states had vastly more to do. Some additional factors in this process now demand our attention.

The federal judiciary seems to have been regarded by the public men of the time of the adoption of the constitution as a branch of the government of secondary importance. This was not the universal opinion but it was almost so. Yet, within a few years of the beginning of our life as a nation, under the guidance of John Marshall, began that march over the whole field of jurisdiction which has made of the federal judiciary the most important department of the government. The doctrine of implied powers which was developed from that clause of the instrument granting the power of Congress "To make all laws which shall be necessary and proper for carrying into execution" the powers expressly given to the government, was the opening which received the thin end of the wedge of jurisdictional growth. No one denies to Marshall the meed of intellectual greatness. His was, perhaps, the most capacious intellect devoted to the law since the time of Bacon. But it seems that he was a bitter partisan, and has been accused of some of Bacon's unscrupulousness. However that may be, there can be no doubt that his master passion was devotion to the principle of the extension of the powers of the Federal government. He seized upon the Supreme Court, a tribunal composed of men holding power for life, and therefore removed from the control of the people, as the means of carrying forward this work. He used the doctrine of implied powers as the legal tool for accomplishing this, and ruthlessly marched on over all obstacles. To those who regard the term "ruthlessly" as too strong, I beg to submit in justification the fact that Judge Marshall went so far as to decide in some cases, that the Convention of 1787, and the states in ratifying its work, gave to Congress in the way of *implied powers*, the authority to do things the *express power* to do which was denied in the Convention by repeated vote!

Whether or not this work of Judge Marshall and those who sat with him was good or bad is not the question now before us. The point is, that the Federal Courts did make decisions which enormously extended their power and that of the Federal government, and have operated powerfully to make the amendability of the constitution important to us, as the instrument under which we are chiefly governed. One of these was the Dartmouth College decision, which took from the States the power to abolish or amend the charters of corporations which they were free to grant. This made the corporation a thing never known to English law, where the government always retained the visatorial power over them. The American State might repeal any law for the government of individuals; but when it made a law erecting a corporation, the charter so made was decreed by the Supreme Court of the United States to be a contract the obligation of which could not be impaired by any subsequent act. Under this and similar rulings, it is no wonder that the corporation has come to dominate American life. The corporation looks to the Federal Courts for protection against any serious meddling with charters, and that protection, the courts are now bound to give.

Favor to corporations was shown, too, in another decision which has become the law, under which corporations are held to be citizens of the State in which they happen to be incorporated. That a corporation, a purely artificial entity, could ever be regarded as a citizen of any state or nation, or in any sense a citizen at all, is, it seems to me, a startling doctrine. Yet, under this fiction, all the great corporations are able to remove to the United States courts all important litigation in every state except that of their domicile. This fact coupled with the enormous growth of corporations puts more and more of the judicial power of the land in the courts of the general government.

These are only two lines of decisions, and are cited by way of illustration only. One or two factors more must be referred to, and with this branch of the inquiry I am done. I cannot leave the consideration of the growth of Federal power, and especially of the increasing power of the Federal Courts without a reference to

the vast influence of the Fourteenth Amendment to the constitution. This provides, among other things, that: "No state shall make or enforce any law which shall abridge the privileges or immunities of citizens of the United States, nor shall any state deprive any person of life, liberty or property without due process of law, nor deny any person within its jurisdiction the equal protection of the laws." This provision, adopted for the protection of the freedmen of the south, has been the means of adding, to an astounding degree, to the power of the general government and especially to that of the judicial branch. For whenever any rule of taxation, or any law for the control of corporations or any statute for the regulation of its own affairs, is adopted and sought to be enforced by any state, the corporation, (held to be a "person" as well as a citizen), aggrieved, or the individual concerned flees to the United States courts on the ground that there is a federal question involved; so that questions arising under the Fourteenth Amendment make up one of the most important titles of the law.

In addition to these questions, there has been a rapid growth of jurisdiction under the head of the exercise of the power of injunction, so that "government by injunction" is an important political question. Exerted in labor disputes largely, and emanating to a great extent from the Federal Courts, because of the fact that corporations which are non-residents of the state where the causes of action arise are usually involved, this extension of the use of the extraordinary writ of injunction has made many fear for the liberties of the people. Under it men are imprisoned for violation of the mandates of courts, instead of statutes, and that in cases to which they have never been made parties by any service of process. Be this right or wrong, it is certainly important. The point made here is that this momentous development of government is largely Federal, is exerted in modes which can be controlled only under the constitution, and therefore should be considered as enhancing the importance of the power of amendment.

The case then stands thus: A constitution which was adopted as the basis of a government exceedingly limited in its functions, and affecting the people only slightly more nearly than our treaties with foreign gov-

ernments affect us, has become by judicial decisions, by amendment, and by the very evolution of our national life, a thing which must be reckoned with as our supreme law, and which deals with the most important questions of our every-day life. Let us now consider what is the outlook for its amendment.

Article V. of the constitution is as follows: "The Congress, whenever both houses shall deem it necessary, shall propose amendments to this constitution, or, on the application of the legislatures of two-thirds of the several states, shall call a convention for proposing amendments, which, in either case, shall be valid, to all intents and purposes, as part of this constitution, when ratified by the legislatures of three-fourths of the several states, or by conventions in three-fourths thereof, as one or the other mode of ratification may be proposed by the congress: *provided* that no amendment which may be made prior to the year one thousand eight hundred and eight shall in any manner affect the first and fourth clauses in the ninth section of the first article— and that no state, without its consent, shall be deprived of its equal suffrage in the senate." The first clause of the proviso has become obsolete by lapse of time and the abolition of slavery. The second retains the rule of unanimous consent as to all amendments looking to a change of representation in the senate.

Let us now imagine that the sentiment in favor of amendment has grown to an issue. Congress has once passed an income-tax law in which probably nine-tenths of the people of the United States believed; but it was declared unconstitutional by the Supreme Court in a decision which renders it improbable that any income-tax law can ever escape the veto of that tribunal. The vast majority of the voters of the United States are at this time in favor, I think, of the election of United States Senators by popular vote, and some twenty states have passed resolutions applying for a constitutional convention to propose such an amendment. There is a growing sentiment in favor of public ownership of the railways; a subject which cannot be dealt with in any adequate way by the several states and as to which the constitutional authority of the general government, without a constitutional amendment, is, to say the least, very doubtful. In

view of the enormously enhanced and growing power of the Federal judiciary, and its lodgment in a tribunal which holds by the same tenure as that of the hereditary monarchs of the world—the life tenure—it is not at all strange that many are coming to regard its removal from the control of the people as oligarchical, and we may confidently look for an increasing demand for an amendment reforming the judiciary in the direction of republicanism. The great fight of the future is likely to turn on problems of taxation. Indirect taxation as a means of securing the maximum of revenue with the minimum of consciousness of sacrifice on the part of those paying will not forever survive the search of the publicist, and when its wastefulness and injustice once become generally understood, a strong and general demand for direct taxation must be regarded as likely to arise; and no mode of just direct taxation seems to be constitutional. We probably need uniform divorce laws, uniform laws regarding land titles, uniform laws of business generally. It seems that we cannot have these without constitutional amendments. Scientifically, it seems to be proved that the ideal tax as one not bearing upon production, and exempting all product of human endeavor, is the tax upon land values, exclusive of improvements. The experience of New Zealand in a partial application of this principle, as well as that of several other governments seems to indicate that it is the taxation of the future. It is already in practical politics in Great Britain. Its more enthusiastic advocates claim for it the virtue of being the solution of the great labor problem. We can scarcely hope for the full application of it here in the present state of the constitution. There is growing up an international movement for the co-operative commonwealth under the name of socialism. A democratic people have the right to try this when they deliberately come to the conclusion that they want it. That the constitution at present will permit such a form of government cannot be believed. Some of these things are no doubt very remote; and some of them are now past the stage of being believed in by the majority; but all are well within our range of anticipation as live issues. So that our proposal to imagine the sentiment in favor of amendment grown to an issue is a reasonable one.

Moreover, most or all of these measures strongly affect the interests of the capitalistic classes, as slavery did. We may therefore expect that all the expedients which wealthy interests resort to for the purpose of controlling legislation will be brought into play in resisting the popular demand for amendment. Any sensible consideration of the outlook must take this fact into consideration.

The party seeking to amend the constitution must first do one of two things: secure the proposal of the amendment by the congress; or obtain applications to the congress for a constitutional convention, from the legislatures of two-thirds of the several states.

If the first procedure be adopted, the proposal must be made by a two-thirds vote of both houses of congress. This is most difficult. On any mooted question a two-thirds vote of the house might be supposed to indicate a sufficient popular conviction. But in addition a like vote in the senate must be secured. This involves carrying, not only two-thirds of all the congressional districts, but two-thirds of the state legislatures as well, so as to control the United States senate. In these state legislatures, each lower house must be carried and held, until the slower-changing upper house is secured, thus greatly increasing the difficulty. Furthermore this proposal must come from states, the small states having equal influence with the great, and the fifteen smallest states in the union might permanently stand in the way of the desires of all the other thirty. These states have now a population of less than 5,000,000, and a bare majority in each of these, which might easily be made up of 2,500,000 souls, might balk the will of the rest of the 84,000,000.

Assuming, however, that all these things have been done, and that none of the votes for the measure have been diverted from the obedience to the people's will which pure representatives give, the fight has only begun. A constitutional convention must now assemble, over the personnel of which the states would exercise complete control. Each state would decide for itself whether or not it would be represented in the convention, and how its delegates should be chosen, if at all. Here would be a fruitful field for the operation of all the forces of corruption, and the political wiles which balk

and turn aside the will of the people, and the work of such a convention could not well fail to fall far short of the popular mandate. But assuming that the amendment were passed by the convention, this method only brings us to the same point at which we should have arrived by the more direct method of securing the proposal by a two-thirds vote of both houses of congress: the whole thing must now go before the several state legislatures for ratification, and must be ratified by three-fourths of these before the amendment can become effective. No state is obliged to take any notice whatever of the matter, and inaction counts against the proposal.

If favorable action on the part of two-thirds of the state legislatures be difficult to attain that of three-fourths is doubly so. Men will always differ, and as to almost any public question there is an irreducible minimum of opposition. To require the advocates of any measure to reduce this, is to ask what is tantamount to unanimity,—which is impossible. I believe the three-fourths rule of amendment falls dangerously near the line, if not within this principle.

There are forty-five states in the union. Three-fourths of this number are $33\frac{3}{4}$, and, therefore, the ratification of a constitutional amendment must be by 34 states. Twelve states standing out may defeat it. One state counts as much as another. Nevada is as strong as New York; Rhode Island wields as much power as Pennsylvania. The twelve smallest and most insignificant states in the union might block the way of progress, perhaps forever. These twelve smallest states in population are as follows:

Nevada -----	42,335
Wyoming -----	92,531
Idaho -----	161,772
Delaware -----	184,735
Montana -----	243,329
Utah -----	276,749
North Dakota -----	319,146
Vermont -----	343,641
South Dakota -----	401,570
New Hampshire -----	411,588
Oregon -----	413,536
Rhode Island -----	428,556

These states have a total population according to the above figures, which are those of the census of 1890, of but 2,890,932, and comprise but one-thirtieth part of the people of the nation. A bare majority in each of them might be made up of less than one-fiftieth of our people.

But the persons who have the decision in their hands are the voters; and a consideration of these in the twelve smallest states may be worth while. In the New York Tribune almanac for 1903 is given as the total vote of these states in 1902, the following:

Nevada -----	11,358
Wyoming -----	25,052
Idaho -----	61,544
Delaware -----	38,161
Montana -----	55,360
Utah -----	84,716
North Dakota -----	50,396
Vermont -----	69,927
South Dakota -----	68,559
New Hampshire -----	79,173
Oregon -----	87,719
Rhode Island -----	57,548

Thus all the votes ordinarily cast in these states at a general election number but 709,513, and a majority in all of them might easily be made up of less than 400,000 votes, requiring the action of less than one two-hundredth of the people.

But it is the legislature, in each state, after all, and not the voters, which must take final action, and which is subjected to the pressure which the opposition may bring to bear. One of the most important of present day political phenomena is the manner in which state legislatures are handled by large financial interests. It is a rather ominous fact that the fight which any class interested in opposing constitutional reform would regard as its last-ditch struggle, would take place in a field now thoroughly understood by the great corporations, and where they are supposed to be possessed of the strongest and most sinister influence. The control of almost any state legislature is regarded in many well-informed quarters as merely a matter of money. It is to be hoped that

this view is incorrect, or that in so far as it is true, it applies only to times when the masses of voters are not acutely interested in matters of legislation, or not well informed. Yet it cannot be doubted that money is powerful in popular elections, and still more powerful in legislatures; and it is important to know what it would have to do in order to prevent constitutional reform.

The legislatures of the twelve states in the union having the smallest number of legislators are made up as follows:

Nevada	-----17	Senators,	34	Members of Lower House				
Utah	-----18	"	45	"	"	"	"	"
Idaho	-----21	"	46	"	"	"	"	"
Delaware	----17	"	54	"	"	"	"	"
Wyoming	----23	"	50	"	"	"	"	"
Oregon	-----30	"	60	"	"	"	"	"
Colorado	----36	"	59	"	"	"	"	"
Montana	-----26	"	71	"	"	"	"	"
Rhode Island	39	"	72	"	"	"	"	"
New Jersey	--21	"	60	"	"	"	"	"
South Dakota	45	"	87	"	"	"	"	"
Michigan	----32	"	100	"	"	"	"	"

From the above table it appears that the twelve state legislatures to stand out against amendment might comprise but 1,072 men, and that 560 might constitute a majority in all of them.

However, no interest seeking merely to prevent action need go to the trouble of securing the control of more than one house in each of the twelve states. The state senates are small bodies of men, farther removed from the people, by virtue of longer terms of office, and the retirement of only a part at a time, in most states, than are the lower houses. Any organization of lobbyists would naturally, all things being equal, turn to the senates first, and as we are now seeking the least number of our fellow citizens vested with the power of stopping all constitutional reform, let us turn to the twelve smallest senates in the union, and we find them made up as follows: Delaware, 17 senators; Nevada, 17; Utah, 19; Idaho, 21; New Jersey, 21; Wyoming, 23; Connecticut,

24; Montana, 26; Oregon, 30; Michigan, 32; Alabama, 35; Arkansas, 35. These twelve senates, made up of only 300 men, might be controlled by 162, and the United States balked of its dearest hopes of constitutional reform.

Such a reform will sometime demand amendment, and on some point which will threaten the very existence of the monopolies the possession of which have built up the wonderfully powerful aristocracy of privilege which has now taken the place left vacant by the elimination of hereditary aristocracy of the historical sort in the formation of our institutions. A very few men now control our highways, our deep-water and city terminals, (and by means of them our steamships), our fuel, gas, oil, iron and steel. In fact there is now probably no great field in production or transportation, except agriculture, which they do not dominate. And as to agriculture, their control of transportation enables them to say whether the producer shall make a profit or not. Merchandising they control through the arbitrary fixing of prices, and by the terrorism of freight favors. Banking was in the year 1900 so far under their control that the Chicago Tribune in that year pointed out the fact that nearly one-half the entire circulating medium of this country was in the deposits of the banks and trust companies controlled by the Standard Oil Company. No reform leading up to legislation vitally affecting privilege can fail to provoke the most desperate opposition from these interests.

It may, therefore, be worth our while to take note of the fact that the usual annual dividend of the one trust, the Standard Oil Company, representing only its profits, and therefore easily applicable to any such contests, would be enough to enable that institution to pay a majority of all the voters in the twelve states having the smallest population, \$150.00 each for their votes against legislators favorable to amendment. It might pay to each of a majority of both houses of the legislatures of twelve states, over \$70,000, without any hardship except the passing of one dividend. It might purchase the control of the twelve pivotal senates at

the price of \$250,000 per vote, without impairing its capital. If one business institution has the power to do this, how easy would it be for all the allied interests so to appeal to human selfishness and human need as to defy change! They might easily make of a majority of the voters of twelve states, their employes, and pay them higher salaries than any like number of employes in the world receive. Such a class of voters would almost of necessity regard the support of their employers at the polls, not only as excusable, but as praiseworthy. Such states might be given governments which would be models in the matter of meeting the wants of the people, so that fidelity to the corporations, like the faith of the feudal vassal of old, would seem the truest patriotism. And in the matter of plain, bald, corruption, in which these men are now past masters, could needy, greedy, human flesh and blood endure the temptations which would be offered when it came to legislative action in the pivotal states?

I have left out of the reckoning, the easiest mode of controlling states now in existence, that of getting the government through the boss. Yet I think there is no doubt that twelve states may be named where single men in their capacity of bosses hold state governments as in the hollow of their hands. As a tentative list, I offer the following: Delaware, under the boss-ship of Addicks; Rhode Island, under Aldrich; Florida, Flagler; Pennsylvania, Quay; North Dakota, Hansbrough; Montana, Clark; Washington, Ankeny; Nevada, Stewart; West Virginia, Elkins; South Dakota, Kittredge; New York, Platt; Ohio, Hanna. If, as I apprehend, one or two of the above might be disputed, I think it would be on the ground, not that the office of boss has been abolished, but that the wrong man has been named. To make up for any shortage, I may be permitted to offer New Jersey, which is bossed directly from the general offices of the trusts in New York.

Such being the case, it seems to me that the minds of citizens may well be directed to an anxious consideration of the amendability of the constitution of the United States. I have long believed that the only avenue of

progress is to be found through the way of a direct movement for amendment of Article V. once for all, to the end that future amendment may be made easier. I believe that such a measure should provide for amendment of our national constitution, by the same means we have found satisfactory in changing our state constitutions—a referendum vote of the whole people. As all amendments may be supposed to be stronger than any single one, this seems to me the only manner in which constitutional progress has any chance to succeed in the United States.

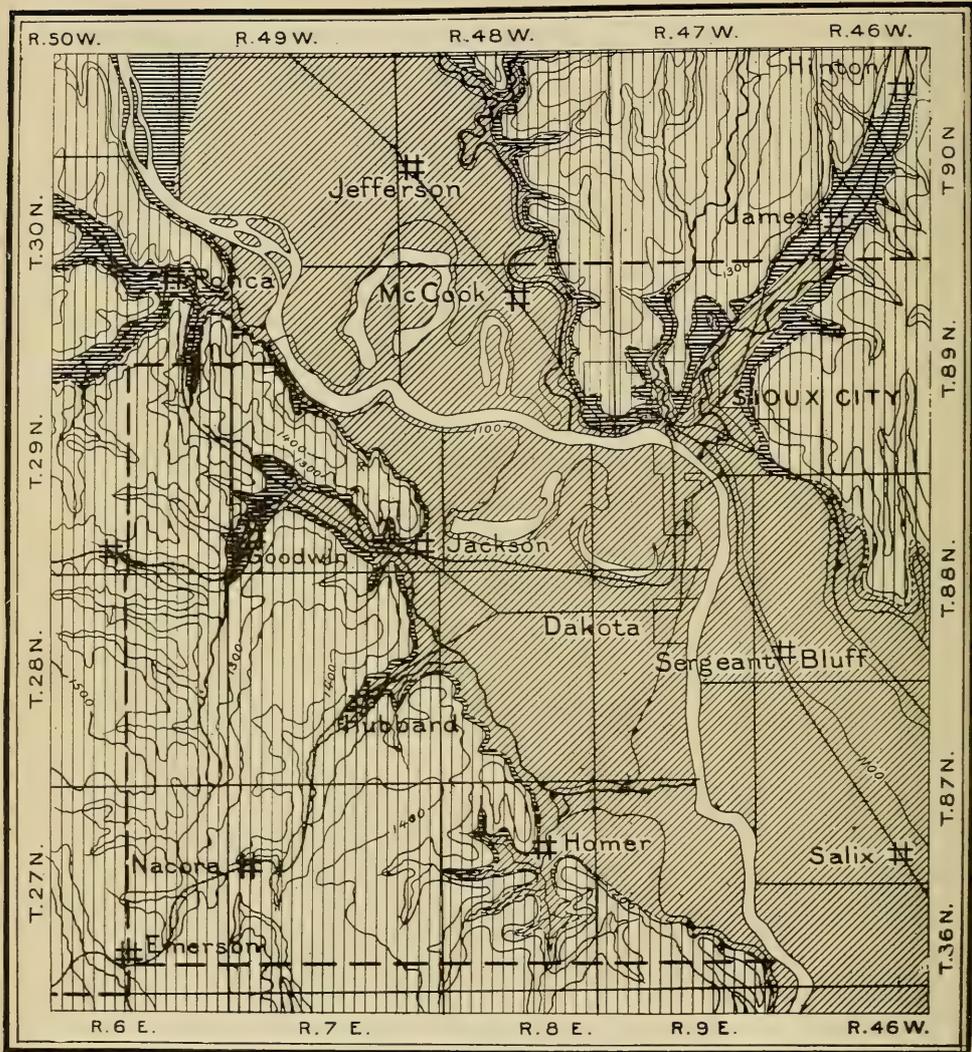
If any think the views expressed herein pessimistic, I wish to disclaim all such philosophy. To my mind, the most hopeless thing in the world is the fool's paradise of the professional self-styled optimist. The truest optimism is found in facing any situation which may exist, not in assuming some other situation. As expressing my view on this branch of the subject, as well as in justifying my estimate of the lions in our path, I quote from that most conservative magazine "The Independent," of the issue of December 3rd, 1903, in an editorial entitled, "Facing the Ultimate Issue," which says: "If the corporations created by the state have become superior to the state, or, to speak in language technically correct, if they have wrested sovereignty from the people, and have themselves become the state, let us by all means have an authoritative declaration of the fact * * *. There are thousands of sincere and intelligent minds that have been slow to see that a third time popular sovereignty is being openly challenged and contemned."

In the same journal of a recent issue, the French statesman Alfred Naquet, in speaking of the present French constitution says: "But that the present Constitution should be revised, there can be no doubt. Consequently a scheme for easily amending it should be introduced. The American procedure in this matter is too slow and too beset with obstacles for its adoption here." Elsewhere, in the same article, he says: "In a word, a Supreme Court in France instead of being an element of peace would be a source of revolution."

Revolution is a hard word, and one to the use of which we are very properly more averse than are our Latin brethren. I have pointed out the extreme difficulty of change in our constitution, and have raised the question as to its possibility. Whichever way that question is resolved, I cannot do better in conclusion than to make my own, the language of the great Judge Story, whose Commentaries on the Constitution have been studied by every American lawyer. "A government," says he, "which in its own organization, provides no means of change, but assumes to be fixed and unalterable, must, after a while, become wholly unsuited to the circumstances of the nation; and it will either degenerate into a despotism, or, by the pressure of its inequalities, bring on a revolution. It is wise, therefore, in every government, and especially in a republic, to provide means for altering and improving the fabric of government, as time and experience, or the new phases of human affairs, may render proper to promote the happiness and safety of the people. The great principle to be sought is to make the changes practicable, but not too easy; to secure due deliberation and caution; and to follow experience, rather than to open the way for experiments suggested by mere speculation and theory."

TOPOGRAPHIC AND GEOLOGIC SKETCH MAP OF MISSOURI
RIVER VALLEY AT SIOUX CITY, IOWA.

BY ERNEST F. BURCHARD, 1902.



SCALE
0 1 2 3 4 5 6 Miles
Contour interval 100 feet

- | | | |
|--|--|--|
| 
DAKOTA SANDSTONE
(overlain by alluvium in valleys) | 
GRANEROS SHALE
& Lignite Prospects | 
GREENHORN LIMESTONE
(overlain by loess on uplands) |
|--|--|--|

FIG. 1.

GEOLOGY OF DAKOTA COUNTY, NEBRASKA,
WITH SPECIAL REFERENCE TO THE
LIGNITE DEPOSITS.

BY ERNEST F. BURCHARD.

INTRODUCTION.

A study of the areal and economic geology of Dakota County, Nebraska, was made by the writer in the field and laboratory during the Spring and Fall of 1902. A topographic map of the county was made on a scale of 2 miles to the inch with 100-foot contour interval (fig. 1), also a topographic map of one of the lignite areas on a scale of 8 cm. to the mile with 20-foot contour interval (fig. 2), and the geology was mapped directly on these bases. Prior to this work no geologic mapping had been done immediately to the west of Missouri River in this vicinity, although many geologists had visited the region and were familiar with its general geologic relations.

The distinct objects borne in mind in this work were: To study the physiographic features, and the relation of the rocks of the west side of Missouri River Valley to those of the east side; to determine if possible, whether Tertiary deposits are present this far east on the Great Plains; and to investigate thoroughly the lignite deposits.

Dakota County, Nebr., is situated at the extreme northeast corner of the State, where Missouri River bends from a southeast to a more southerly course, and opposite the mouth of Big Sioux River. At this junction the states of Iowa, Nebraska, and South Dakota border on one another. The greatest length of the county from north to south is 24 miles and from east to west is 19 miles. Its area is about 290 square miles. The proxim-

ity to Sioux City, Iowa, a city of over 40,000 inhabitants, has precluded the growth of any large cities within the county, although the prospects for considerable manufacturing development are good in the case of South Sioux City, owing to the abundance of level land for factory sites adjacent to the railways—a condition not shared by the larger city across the river—and to the demands of the great agricultural territory tributary to this natural distributing point.

Two railroads cross the county from Sioux City southwestward, the Northwestern Line and the Great Northern, and the Northwestern Line branches near the center of the county, one branch going northeast to Newcastle, the other southward to Omaha. Along these railroads are several small settlements each of a few hundred inhabitants, important as trading posts, points for the shipment of cattle, grain, etc., and as postoffices. Chief among these are Dakota City, the county seat, Jackson, Hubbard, and Emerson.

The soil is of three varieties, that of the upland, a loess deposit, that of the river bottoms, a black alluvium or “gumbo” and that immediately bordering the river or filling recent channels, a sand or silt. All of the soil except the sand is of extreme fertility. The average rainfall being 24.75 inches, and the heaviest fall occurring during the crop season, the region is well watered and large crops of corn and wheat are raised in the uplands, and corn, oats, hay, sugar beets, potatoes, and small vegetables are raised in the bottom land. Stock feeding is an important industry, especially in the uplands immediately bordering the river valley where the surface is too intricately dissected to admit of cultivation but well adapted for grazing purposes.

PHYSIOGRAPHY.

General statement.—In mapping and describing the topography of this area it has been sought from a study of the outward forms to interpret the reasons for their existence and the processes by which they have been produced. If the present conditions are understood the questions concerning earlier stages of geologic history may be approached with greater assurance.

GENERAL PHYSIOGRAPHIC RELATIONS.

The Great Plains Province in which Dakota County lies extends from north to south through the middle United States. It merges insensibly on the west into the higher, broad Plateau Province which lies between it and the Rocky mountains, and blends in like manner to the east into the lower Prairie Region of the Mississippi Valley.

TOPOGRAPHY.

General description.—To the casual observer the surface of northeastern Nebraska and northwestern Iowa does not at first suggest a plain. Missouri River is seen flowing in a monotonously flat valley, 8 to 20 miles wide, bordered by irregular bluffs that rise 150 to 300 feet. At intervals of a few miles smaller streams emerge from either side on this flat through shallow valleys and disappear in swamps or wind sluggishly across to the greater stream. Between the valleys of the smaller streams many steep, narrow ravines cut the faces of the bluffs, and in several places isolated hills or peaks stand out abruptly as though detached from the bluffs, while at others, narrow points or spits extend out into the flat from the higher land in the background.

From a view point on one of the higher bluffs on either the Nebraska or the Iowa side the scene presents a different aspect. Here also the casual observer does not readily see the resemblance to a plain in the treeless surface so intricately carved into sharp, winding ridges, crooked, V-shaped valleys, and graceful peaks grouped in wild confusion as far as the eye can see on either side of the flat, trough-like depression through which the river meanders.

The marked uniformity, however, in the heights to which the ridges and peaks rise suggests to the imagination that to fill all the intervening depressions including the great flat river valley to the level of the higher points would produce a great high plain. This would in truth be a restoration of a former physical condition of the surface.

That the dissection of this plain is due to erosive forces is particularly well illustrated during every rain storm or at times of melting snows. At such times the

bottom of every tiny furrow contains a trickling, turbid stream; the gullies carry an amount of run-off proportioned to the area they drain, and, emptying into the minor streams, they help swell them into torrents. With this movement of water down the slopes soil is cut and washed down so rapidly that one can almost see the wasting of the land.

That the great rock-bound trough of the Missouri is the work of the stream flowing in it is not immediately so clear, but given time, that element so potent in geologic reasoning, increased velocity due to greater elevation of the land, and increased volume and carrying power at the time when the ice sheet to the north was melting, and the relation of the present river to its valley is no longer doubtful. No lake hypothesis is necessary to explain the great width of the flat bottom of the valley, and indeed it is easily demonstrated by the parallelism in slope of the bottom of the trough and the plain above, and their relative elevations that no lake could have occupied this valley. A study of the other great rivers and their valleys but confirms the idea that this river has excavated its trough according to well-known laws of stream erosion.

The elevation of the valley floor above sea level is a little over 1,100 feet, the river itself ranging between 1,076 feet at low water to 1,099 feet at high-water mark at Sioux City. The valley floor where widest has a very gentle slope laterally to the escarpment of 3 or 4 feet to the mile, and the escarpment rises abruptly to a general level of nearly 1,400 feet. That the original level has already been somewhat lowered is indicated by the fact that isolated points attain an elevation of nearly 1,500 feet, standing perhaps 50 feet above the present general level of the divides, but possessing the same characteristics of sculpture.

The smaller tributary streams have not brought their valleys down to the level of the main valley floor except for a comparatively short distance back from the escarpment line, their profiles showing still considerably more of an inclination than that of the Missouri.

In some respects, physiographically, the region presents the aspect of one that is nearing maturity, and some of its characteristics are those of a region that has

passed maturity and is advancing toward old age. Its main streams meander broadly, and its general level has begun to be lowered, while yet it has many sharp, narrow divides, and steep, narrow, crooked valleys. This condition is the result of the erosive forces acting upon the surface in conjunction with the peculiarities of the underlying materials.

Materials on which Topography has been developed.—

The former plain, perhaps gently undulating, sloped very slightly to the southeast. Its surface was treeless, the material covering it being a mantle of loess, 30 to 60 feet thick. Underlying this loess is a clay, gravel, or sand, and in some places a shale or soft, friable sandstone, below which alternate clays, sandstones, and shales for more than 500 feet. A vigorous drainage has been actively at work upon this plain, and, finding that the surficial materials were easily cut and removed, the major stream has reached a depth at which it is "graded" and is widening its valley, co-operating with its tributaries in the removal of the waste that is gradually being brought down from the upland plain.

The loess is noted for its characteristic ability to cleave vertically and to remain standing thus for a considerable time if not undermined by erosion or solution. It is thus capable of receiving and retaining every line and curve of the carving of its drainage. An experiment that illustrates the capability of the loess to stand vertically may be performed with loess itself or with flour or some such fine, homogeneous material, by packing a heap of it upon two adjoining pieces of cardboard, 8x12 inches, lying upon a table. If the cards be moved cautiously apart, the mass will separate, and except for a slight avalanche of material from the looser top parts, the divided portions will retain almost perpendicular faces where broken apart.

The sides of the broad trough that the Missouri has cut into the plain remain throughout much of the extent as almost perpendicular bluffs or as an abrupt escarpment, rather than as a broad, open flare such as would result in a valley cut in easily broken down materials. It is to the characteristic properties of the loess that are due the narrow, crooked divides, the sharp, narrow spits extending out into the bottom land, and the

narrow, V-shaped ravines that sometimes terminate in abrupt escarpments which rapidly recede up the valleys.

The rapidity with which such an earth water-fall escarpment recedes, with the formation of potholes of great depth, is often a serious menace to farmers who not only lose considerable land in this way, but are obliged to rebuild fences and roads which are thus destroyed. In Sioux City, this feature presents a serious problem in engineering, viz, the preservation of paving, sidewalks, railway tracks, and underground pipes from the encroachment of "washout" gullies.

Such ravines as these where cut back into the escarpment from the river floodplain are usually short, steep, heavily wooded, and with sides almost too steep for climbing.

At the edge of the great escarpment the lateral drainage has at many places nearly cut off and isolated points or hills, which stand as outliers, connected to the upland by low ridges and saddles.

These buttresses have been developed on the heavily bedded sandstone, which, in the southeastern part of the county and again a little north of the middle, rises high above the flood plain. Above the massive sandstone the clay weathers more easily, giving more gradual slopes except where protected by an overhanging cap of limestone. In such cases the high cliffs are formed that occur near the Dixon County line, and along Big Sioux River north of Sioux City. Toward the south end of the county these limestone beds once rose much higher than at present, and erosion has removed them to such an extent that they no longer project over the clays and a more rounded brow has been developed along the escarpment. The sandstone beds, however, rising high and being separated from the limestone by a less thickness of clays, maintain the steepness of the lower face of the escarpment south-east of Homer.

From almost any point along the top of the escarpment in Dakota County a survey of the dissected upland reveals a striking and picturesque succession of views—the hills, ridges, and peaks standing out sharply, with beautifully flowing lines and concave slopes, "well illustrating the remarkable characteristics of the loess to retain the delicate tracery impressed upon it," as Bain

has said of the topography of Woodbury County, Iowa. In winter, when snow covers the ground, the landscape presents the appearance of a series of gigantic snow-drifts, beautiful to behold.

Topographic divisions.—Within Dakota County are two definite types of topography, the dissected upland, and the Missouri River flood plain.

The dissected upland has but few nearly level areas left to represent the once continuous rolling prairie, and these are for the most part in the west and southwest parts of the county remote from where the upland joins the lowland. It is along the edge of the upland that the maximum intensity of relief has been developed.

Drainage.—The drainage of the upland all ultimately reaches Missouri River, although but little of it flows directly from the upland down the escarpment toward the river. The main tributary of Missouri River in the county is Elk Creek, which flows northward in the west part of the county to within $2\frac{1}{2}$ miles of the Missouri, where it makes a broad sweep almost reversing its direction and flows to the southeast, emerging on the flood plain near Jackson. Here it swerves to a more southerly course for a few miles along the border of the escarpment, finally cutting away across the flood plain and joining the Missouri at a point about 5 miles from the south border of the county. Elk Creek has several tributaries not far from its own size, notably Pigeon and Omaha creeks, and a very great number of minor tributaries that normally are only trickling drains, but which after heavy rains or during the season of melting snows are roaring brooks, each receiving the waters from innumerable rain rivulets that have cut nearly parallel furrows on each side of every small valley at intervals of a few rods apart. Thus a complete and vigorous system of drainage is at work, rapidly degrading the upland.

From the highest points in the bluffs above the river in sec. 15, T. 29 N., R 7 E., (about 3 miles north of Jackson) it is seen that the drainage of the upland is nearly all in a direction away from the river, except that of a small strip immediately along the escarpment, which has been cut into by numerous short, steep-sided ravines whose profiles would in many instances show a

fall of 250 feet in 1,000. The drainage away from the river is not precipitous, but a traverse from the point mentioned south to the creek in the south half of sec. 22 reveals a descent of over 200 feet in $1\frac{1}{2}$ miles. The opposite side of this creek has a steeper slope. The drainage of this locality is typical. (See fig. 2.) It reaches the Missouri via Elk Creek after a course of over 16 miles, whereas a direct course across the flood plain to the river would be less than one-eighth that distance. Structural causes for this system of drainage are hard to discover. As is explained later the locally underlying rocks dip slightly toward the northwest, so that a much simpler form of drainage would have been developed had the dip of the strata influenced the surface flow of waters.

The divide between the upland streams and the ravines opening on the flood plain was formerly farther from the escarpment than it now is. On the unstable surface a continuous stream such as Elk Creek is able rapidly to enlarge its basin. Though developed on a loess-covered plain underlain by almost horizontal rocks which do not differ greatly in hardness each small creek or wet-weather stream with its parallel branches joining it nearly at right angles forms a trellis or grapevine drainage system. The lateral branches of Elk Creek where it parallels the Missouri flood plain are continuously cutting backward up their slopes and pushing the divide toward the escarpment. The ravines from the flood plain are themselves cutting backward, though more slowly, and the next stage of topography that will result will be a more ragged escarpment line marked by many such outliers or prominences as Prospect Hill in Sioux City.

From the point on the bluffs, previously mentioned, may be observed the whole course of the Missouri bordering Dakota County. As the eye follows the escarpment on the Nebraska side of the river beginning at a point above the north county line where the southeasterly course of the river changes to due east the river is seen to be there cutting into the bluffs from which it swings out into the lowland, making a series of loops in its broad alluvial valley until it reaches the bluffs at the mouth of Big Sioux River on the Iowa side. It comes

TOPOGRAPHIC MAP
OF A PORTION OF
DAKOTA COUNTY, NEBRASKA.

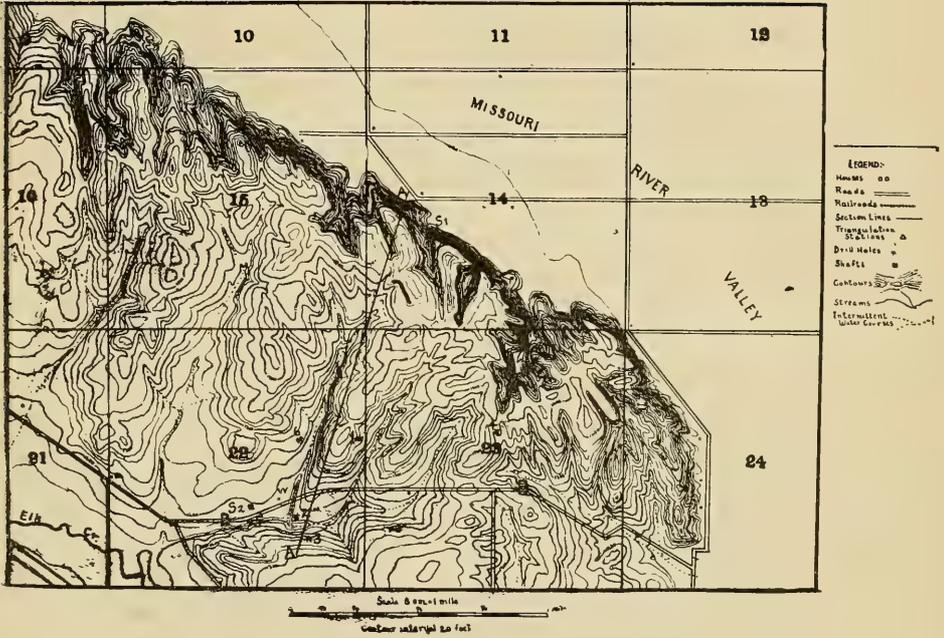


FIG. 2.

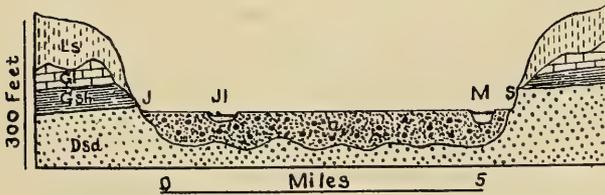


FIG. 3.

nowhere near the Nebraska escarpment again until it reaches the south line of the county. This escarpment after continuing to the southeast for $6\frac{1}{2}$ miles bends back just north of the town of Jackson, leaving a steep promontory pointing out into the flood plain and makes a wide embayment, in which is built the town of Jackson. The escarpment then makes a long, graceful curve toward the southeast and once more meets the river near the south line of the county. This leaves the northeast quarter of Dakota County entirely in the river bottoms, which are extremely flat and unbroken save by a few low ridges of sand and by a few cut-off lakes that mark previous channels of the river. These lakes are still filled with water, probably supplied by the underflow from the river and by seepage from the underlying water-bearing sandstone. Crystal and Jackson lakes are the largest examples.

Besides shifting from one side of its broad valley to the other the river has doubtless during the past time removed the rock material from the whole width of its valley to a depth of in places 80 to 100 feet below the present water level, and possibly to a greater depth, especially when the region was more elevated than at present. The entire trough has been refilled to the level of the flood plain with the exception of the irregular, sandy channel through which the river shifts and eddies from pool to pool over bars of silt and quicksand. A heavy underflow is present in this filled valley as is evidenced by the abundance of water in many shallow wells which persistently maintain a constant level relative to that of the river. One farmer is reported to have driven a sand point down 125 feet without encountering any solid material, but such records are scarce because of there being no necessity for deep drilling to find a water supply. In building the two bridges at Sioux City it was found that the rock underlies the river at a depth of from 35 to 80 feet and that river deposits extend to a depth of more than 120 feet in places. The rock lies nearly parallel to the bottom of the water, but at the west bank begins sloping toward the west.

Mr. L. E. Cooley^a has shown that the trough of the Missouri may be still deepening during periods of heavy cutting and scour.

^aCited by J. E. Todd, Bull, 158, U. S. Geol. Survey, p. 150.

Valleys of minor streams.—Into the embayment at Jackson and out along the foot of the escarpment to the southeast flows Elk Creek, previously mentioned, and at other points, notably near Hubbard and Homer, the escarpment gives away to gently sloping valleys through which Pigeon and Omaha creeks emerge on the flood plain and unite with Elk Creek. The valley of Elk Creek is comparatively broad, and base leveled below the village of Goodwin, with a well-developed flood plain through which the creek meanders. That this valley suffered a deep erosion similar to that of the Missouri is indicated by a drill hole on the north bank of the creek on the farm of Mr. Ryan in sec. 27, about 2 miles above Jackson. (See fig. 4.) No consolidated material was encountered within 100 feet, and between 75 and 90 feet stream gravel or interloessal till was passed through, while drillings made on one side or the other of the valley just within the edge of the flood plain indicate the normal occurrence of the strata at depths of 30 to 40 feet.

Terraces.—The modern flood plains of the Missouri and Elk Creek are strictly recent terraces of those streams. Todd^a has differentiated in the region farther up Missouri and Big Sioux rivers a higher bowldery terrace (earliest), a lower bowldery terrace (later), and a few silt terraces of still later date. On the Iowa side of Missouri River southward from Sioux City may be recognized remnants of several terraces, but on the Nebraska side through Dixon and Dakota counties there are no good traces of terraces along the escarpment. Erosional dissection has proceeded farther on the west than on the east side of the valley but not to such an extent as to have obliterated all evidences of former terraces.

Ox-bow lakes.—Much of the land adjacent to Missouri River is considered of very uncertain life owing to the tendency of the stream rapidly to erode its banks wherever the current is deflected against them, and to erode, overflow, and cut the narrow necks between the curves of a loop. Many square miles of land have been lost in this way, and much more has gone from the jurisdiction of one State to that of another by the erratic course of the river. Land is of course formed to a certain extent by

^aTodd, J. E., *The Moraines of southeastern South Dakota and their attendant deposits*; Bull. U. S. Geol. Survey, No. 158, 1899, pp. 128-140.

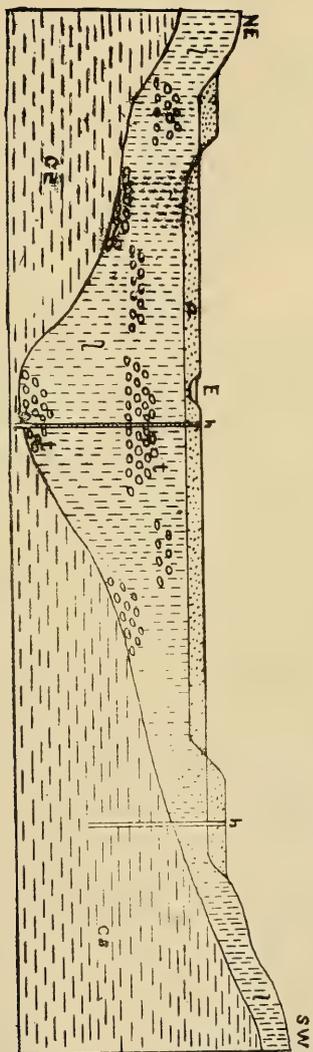


FIG. 4.

these shiftings of channel but not enough to compensate for that removed, and such made land, as for instance, that formed by the silting up of the ends of ox-bow lakes, is slow in attaining a state in which it becomes of value to man.

Recent examples of such processes are McCook and Goodenough lakes in Union county, which were formerly a part of the river channel, the land lying within the loops having been then in the State of Nebraska. The latter neck was cut through in the spring of 1900, after having been first ditched by the farmers of the locality.

GEOLOGY.

Historical statement.—The study of the general geology of the middle and upper Missouri Valley dates from the expedition of Lewis and Clark in 1804-5. These explorers noted the exposures of sandstone in the Black-bird Hills and at Ponca, Nebraska. As early as 1820 fossils were collected from this region that a dozen years later aroused a lively interest in the age of the rocks. Henceforth for many years the visits of American and European geologists to this locality were frequent, and resulted in an extended discussion relating especially to the age of the basal sandstone of the region. It was not until 1856 that Meek and Hayden constructed a definite section of the rocks. In 1861 this section which was so long a standard of comparison was further revised and names were given to its five members.

Among the official reports that deal with the geology of the region are: First Annual Report of the United States Geological Survey of the Territories, embracing Nebraska, by F. V. Hayden, 1867; Geology of Iowa, Vol. 2, 1870, by C. A. White; Iowa Geological Survey Reports, Vol. 1, 1892, and Vol. 3, 1893, by S. Calvin; and Vol. 5, 1895, by H. F. Bain; The Moraines of southeastern South Dakota and their attendant deposits, by J. E. Todd, Bull. U. S. Geol. Survey No. 158, 1899; The Colorado formation and its invertebrate fauna, by T. W. Stanton, Bull. U. S. Geol. Survey No. 106, 1893; Preliminary report on the geology and underground water resources of Nebraska west of the One Hundred and Third Meridian, by N. H. Darton, Prof. Paper U. S. Geol. Survey No. 17, 1903.

Dr. Bain^a gives a most complete historical summary of the work in this region prior to 1895 and of the famous discussion through which the age of the rocks became agreed upon.

Although so much has been written regarding the general geology of the region and the broader stratigraphical relations have been so long understood, no detailed mapping of the formations throughout Dakota County appears to have been done heretofore. It is therefore thought best to summarize the general relations together with features observed in the field, although such summary may add nothing to the facts already known.

STRATIGRAPHY.

The exposures of rock best available for study in Dakota County occur along the escarpment which traverses the county from southeast to northwest. This escarpment presents for the most part, however, steep slopes covered with loess and grassed over. On such slopes are many small steps or minute fault terraces caused by the loess settling and slipping down to lower levels after some of its calcareous content has been leached by solution. At both the lower and upper ends of the county the river has cut into the bluff so recently as to undermine the upper strata which have broken off in precipitous cliffs sometimes slightly overhanging. Usually the base of the escarpment is concealed by a heavy talus.

The indurated rocks underlying Dakota County are of upper Cretaceous age. The oldest formation exposed is the Dakota, which comprises sandstones, clays, and shales, with interbedded seams of lignite. Above the Dakota lie the basal shales of the Benton Group, which also contain a thin seam of lignite. Above this shale which is here provisionally called the Graneros, as suggested by Mr. N. H. Darton, of the U. S. Geological Survey, is a limestone member very probably corresponding to the Greenhorn limestone of the Benton group in Colorado.^b

^aBain, H. F., *Geology of Woodbury County*: Iowa Geol. Survey, Vol. 5, 1895, pp. 265-273.

^bGilbert, G. K., *Underground waters of the Arkansas Valley in eastern Colorado*: Seventeenth Ann. Rept. U. S. Geol. Survey, pt. 2, 1896, p. 564.

The following table classifies the formations according to order and age and indicates their salient features:

GEOLOGICAL COLUMNAR SECTION FOR DAKOTA COUNTY, NEBR.

	CENOZOIC			FORMATION	COLUMNAR SECTION FIG. 5.	CHARACTER	RANGE IN THICKNESS, FT.	
	SYSTEM	SERIES	GROUP					
MESOZOIC	QUATERNARY	Recent		Alluvium		Sand, silt, loam and gravel in valleys, talus on slopes.	0-100	
		Pleistocene		Loess		Fine, sandy loam, of pale brownish buff color. Contains many small calcareous concretions.	5-90	
				Glacial Greenhorn		Clays, bowlders, gravel and sands.	2-20	
				Graneros		Fossiliferous slabby limestone with an admixture of clay and some sand. <i>Inoceramus labiatus</i> present.	15-25	
	CRETACEOUS	UPPER CRETACEOUS	COLORADO	BENTON		Dakota	Dark to bluish clay, grading above into bluish shale and below into yellowish shale. A few <i>Inoceramus labiatus</i> present.	30-60
							Coarse, friable sandstone light to rusty brown color, interstratified with beds of blue, gray, and yellow clay and shale. Many leaf and plant remains present.	(Exposed) 15-80
								(Penetrated by drill) 350

Lying unconformably over the eroded surface of these sediments are unconsolidated Quaternary materials consisting of a heavy covering of loess with thin and scattered deposits of glacial till and sands as its base.

No igneous or metamorphic rocks outcrop in Dakota County and no sedimentary beds of pre-Cretaceous age. The well at Sioux City, Iowa, 2,011 feet deep, probably reached the base of the Cretaceous sandstones at 540 feet, and, passing through Paleozoic limestones, shales, and sands to a depth of 1,510 feet encountered a pre-Paleozoic rock 15 feet thick that resembled the Sioux quartzite, below which it entered a micaceous schist. The quartzite has been referred to the Algonkian system, while the schist is regarded as Archean. ^aThe well at Ponca, Nebraska, 698 feet deep, entered at 455 feet limestone, which is probably pre-Cretaceous, and may belong to the Pennsylvanian series of the Carboniferous system. ^b These records indicate that Cretaceous strata continue to a depth of between 250 and 350 feet below the present bottom of Missouri River, and that the surface on which the Cretaceous strata rests is very uneven.

DESCRIPTION OF FORMATIONS.

Dakota.—The lowest beds of this formation exposed within the county appear at the Homer quarry and along the bluffs to the southeast. The top of the formation is about 80 feet above Missouri River at the south line and about 20 feet above at the north line of the county. Just south of Jackson a slight anticline carries the beds down to about the same level as they occupy at the north county line.

The following sections have been observed:

SECTION OF DAKOTA SANDSTONE ABOUT 4 MILES
SOUTHEAST OF HOMER.

	Thickness Feet.
Loess, grassed over slope.....	
2. Sandstone and clay, thin bedded, iron stained.....	16
1. Sandstone, massive, cross-bedded, from loose and friable to quartzitic. Colors light to rusty.....	20

^aBain, H. F., Geology of Woodbury County: Iowa Geol. Survey, Vol. 5, 1895, pp. 265-273.

^bDarton, N. H., Geology and underground water resources of the Central Great Plains: Prof. Paper, U. S. Geol. Survey, No.—, 1904, (in preparation).

SECTION IN QUARRY NORTH OF HOMER, NEBR.

		Thickness Feet.	
Dakota	9.	Loess exposed .....15	15
	8.	Clay, shaly, yellowish and weathered.....	1½
	7.	Sandstone, massive, friable, light color.....	8
	6.	Clay, light buff, containing concretions.....	2
	5.	Sandstone, massive, soft, containing plant remains	11
	4.	Clay, sandy and shaly, light buff	10
	3.	Sandstone, ferruginous plate, dark brown.....	1
	2.	Clay, yellowish with thin ferruginous plates....	20
	1.	Sandstone, massive, cross-bedded, light to rusty brown, containing clay in thin seams, exposed	20

Beds 1 to 8 are probably all Dakotan.

SECTION IN QUARRY AT JACKSON, NEBR.

		Thickness Feet.	
Dakota	7.	Loess, thickening above on slope.....	3
	6.	Clay and sand (Glacial till)	3
	5.	Sandstone, soft, light to rusty.....	3
	4.	Sandstone, soft, gray to yellow, thin bedded and interstratified with thin seams of clay and hard ferruginous plates	5½
	3.	Clay, shaly, light color	1½
	2.	Sandstone, friable, gray.....	1½
	1.	Sandstone, soft, with clay and ferruginous plates	3

Elevation of bottom, 1135 feet.

SECTION OF BLUFF, SEC. 14, T 29 N., R. 7 E., DAKOTA COUNTY, NEBR.

		Thickness Feet.	
Recent	7.	Loess, thickening back on slope to 90 feet, exposed	10
Glacial	6.	Sand, gravel and clay.....	15
Greenhorn	5.	Limestone, slabby, and fossiliferous above, massive and chalky below, pale-straw color ...	30
	4.	Shale, bluish, argillaceous, with iron pyrite concretions	45
	3.	Sandstone, soft, gray and yellowish, with hard, ferruginous plates	1½
Graneros	2.	Clay, dark, carbonaceous	1
	1.	Shale, yellowish to bluish	3

Elevation, 1214 feet, below which a talus extended to flood plain.

SECTION AT SIDE OF RAVINE, SEC. 14, T. 29 N., R. 7 E.

		Thickness Feet.
Recent	{ 6. Loess slope at elevation of 1210 feet.....	
Graneros	{ 5. Shale, gray, fissile	2
	{ 4. Sandstone, friable, gray to rusty, with plant remains	6
Daokta	{ 3. Sandstone, hard, yellowish	3
	{ 2. Clay, sandy, light buff to yellow, some hard layers	25
	{ 1. Shale, yellow, fissile, "soapstone"	22
Elevation at base, 1155 feet.		

Other excellent sections were studied farther north, in Dixon County, near the mouth of Aowa Creek, where the beds appear to have more than their ordinary dip to the northwest. Beyond the mouth of Aowa Creek the beds continue nearly horizontal for a short distance, after which they disappear below the level of Missouri River.

The individual beds of the Dakota do not seem to be sufficiently persistent for correlation over any considerable distance. At the top is a bed of porous, friable sandstone containing leaf and plant remains, and below it a thin series of interstratified clays, sands, and lignite seams is fairly constant. Below this lies a thin series of clays, sandy shales, and ferruginous, siliceous seams, and the horizon of massive, cross-bedded sandstone still lower down is somewhat distinct at the south end of the county. Drillings in various parts of the county substantiate the above general order of the beds, but drill holes within a few rods of each other show a remarkable diversity between the smaller divisions of the strata. The thickness of the Dakota can be estimated only from the data afforded by the wells at Ponca, Nebraska, and at Sioux City, Iowa, where it has been passed through. The Sioux City well, considering that 25 feet of the sandstone has been removed by erosion from the topmost beds now visible, indicates a thickness of 325 feet. At Ponca a thickness of 375 feet is shown.

Benton group.—Lying conformably on the Dakota are dark-gray to dark-bluish shales and clays. These represent the base of the Benton, and are here called the Graneros shales in the belief that they correspond to that

member of the Benton group in southeastern Colorado. The dividing line between the Dakota and the Graneros is clearly marked by the plant-bearing sandstone bed. While lithologically the lower shale of the Graneros somewhat resembles the shales in the Dakota, paleontologically the two formations differ widely. The Benton possesses a fauna distinctly marine while the Dakota presents what have been considered both fresh-water and marine animal forms together with many plant remains.

The Graneros shale is about 50 feet thick in the bluffs in Sec. 14, T. 29 N., R. 7 E. It thickens to the northwestward, but it appears to thin toward the southeast and may entirely disappear in that part of the county southwest of Homer, where the fossiliferous Greenhorn limestone appears to lie very close to if not directly on the Dakota sandstone. The upper part of these shales yielded a few *Inoceramus labiatus*, and the lower shale has yielded reptilian remains, notably near Ponca, Nebraska, where more than 40 feet of the vertebrae of a mosasaur were found. The fossil lay below the *Inoceramus* beds and above the Ponca lignite seam, according to Mr. J. C. C. Hoskins, of Sioux City.

The Graneros shale merges above into chalky beds which are overlain by slabby, sandy limestones, crowded so full of the fossil *Inoceramus labiatus* that the rock splits easily along the planes formed by the shells. These limestone beds, now known as the Greenhorn limestone, form the ledge so prominent at Cedar Bluff on the Iowa side of Big Sioux River, and in Dakota County they extend nearly the whole length of the escarpment, forming the tops of the hills between Hubbard and Homer, where part of their thickness has been removed by erosion. They partake of the general northwest dip and in Dixon County just above Ponca landing are only about 50 feet above Missouri River, passing below the water northwest of Newcastle.

Relations of Greenhorn limestone formerly misunderstood.—The slabby, fossiliferous limestone beds in Dakota County, Nebraska, and in Woodbury County, Iowa, have long been mistaken for the upper formation of the Colorado group, the Niobrara, owing to their chalky content and their resemblance in general to the latter. The fact that the true Niobrara beds first appeared in north-

western Dixon County about 10 miles northwest of where the Greenhorn beds pass below the Missouri, and overlies the thick shale member (Carlile) that overlies the Greenhorn is sufficient stratigraphic evidence for differentiating the two limestone formations. While both are characterized by the presence of *Inoceramus labiatus*, the Niobrara beds contain in addition great numbers of *Ostrea congesta* which are found in many instances attached to the *Inoceramus* shells. Fossils collected by the writer were submitted to Dr. T. W. Stanton, of the U. S. Geological Survey, who pronounced them from the Greenhorn limestone horizon. The thickness of the Greenhorn member including the shaly and chalky beds is from 15 to 25 feet.

Mr. N. H. Darton, of the U. S. Geological Survey was the first to recognize the relations of these limestones. The facts became apparent to him through a study of well records from southeastern South Dakota.

Since the distinction between the Niobrara and Greenhorn limestones has become understood it is evident that a slight revision is necessary in the geology of Woodbury and Plymouth counties as mapped by the Iowa geological survey and in the standard section of the Cretaceous along Big Sioux River. In the south part of this area the Greenhorn has been called Niobrara.

Quaternary deposits.—Since the loess has been discussed to a certain extent in connection with the topography and will be taken up again together with the glacial deposits in the section on geologic history, it is not thought necessary to devote much space here to these two formations. Over the eroded and uneven surface of the Cretaceous is spread this mantle. In many places the glacial till is wholly absent; in others there is but a few feet of it, and it has not been observed to be above 20 feet thick. The till is the result of the earlier or Kansan ice sheet and of the streams and drifting ice floes from the Wisconsin ice sheet which lay to the north of this region. The drift consists of irregular masses of boulder clay and beds of sand and gravel and a few scattered bowlders. At a few exposures along the escarpment in the north part of the county may be seen the glacial material, and it has been found in well drilling, especially in stream valleys.

The loess overlies the drift where it is present or else lies directly on the Cretaceous strata. Its thickness varies from a few feet to nearly 100 feet. In texture the loess resembles a deposit of fine river silt. It shows no stratification, but rather a vertical striation on fresh faces. The loess contains many small, irregular-shaped concretations nearly white, composed principally of calcium carbonate, and shows the presence of calcium carbonate upon treatment with hydrochloric acid. The greater part of the material is, however, insoluble. To an oxide of iron is probably due the characteristic buff color.

Although small shells, usually of land forms not yet extinct are found in the loess there are many facts which indicate that it is of aqueous origin. This point will be again considered.

Alluvial deposits make up the great Missouri River flood plain and are accumulating in all the valleys that have been graded. Alluvial cones or fans have been built on the Missouri flood plain at the mouths of some of the smaller gullies, notably south of Hubbard.

Talus deposits consisting of loess and rock debris line the escarpment throughout the county.

STRUCTURE.

The strata lie nearly horizontal, but the slight dip to the northwest, averaging 6 feet to the mile, is sufficient, together with the upstream slope of the Missouri in the same direction, to carry in succession the Dakota sandstone, the Graneros shale, and the Greenhorn limestone below the water within a distance of about 35 miles from the south line of Dakota County. The rocks have been but little disturbed since deposition. A succession of broad undulations may be traced in the escarpment section from southeast to northwest through the county. (See fig. 6.) This structure probably corresponds to the gentle synclines and anticlines that have been observed in Woodbury County, Iowa, and, if so, the axes trend in a northeast-southwest direction or at right angles to the seaward direction *from which* the pressure probably came. Aside from these faint folds the slight northward inclination of the strata might be regarded as their initial dip.

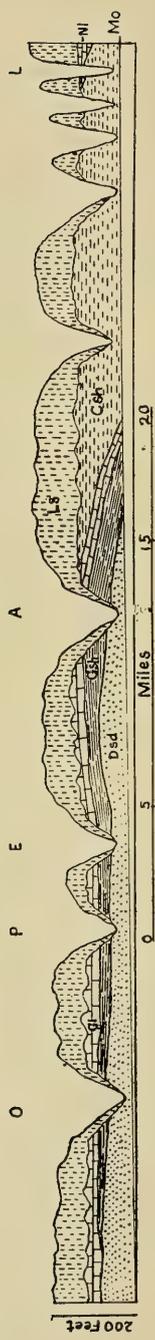


FIG. 6.

200 Feet

GEOLOGIC HISTORY.

The rocks exposed in Dakota County furnish few and disconnected chapters of the geologic record and it is necessary to trace the missing stages of sedimentation in the rocks of surrounding localities. Less than 100 miles to the north, in the vicinity of Sioux Falls, South Dakota, are numerous exposures of a hard, siliceous rock pink in color, known as the Sioux quartzite. Deep borings radiating from Sioux Falls as a center have shown that the surface of the quartzite is exceedingly irregular, but that a broad underground ridge of the rock extends northeast-southwest through Pipestone, Minnesota, and Sioux Falls, South Dakota. This quartzite is in all probability of pre-Paleozoic age and it has been referred to the Algonkian. Its derivation has been traced to a probable Archaean land surface composed of granite and schist in central Minnesota which possibly extended westward to South Dakota. From this land surface material was derived by stream action and wave erosion and laid down as shore deposits of sand and thin clay beds. Slight volcanic disturbances seem to have occurred with igneous outflows after the deposition of the Algonkian sandstone, as the presence of a dike or quartz-porphry has been noted at Hull, Iowa, a dike of olivine-diabase at Corson, South Dakota, and the presence of what was thought to be similar rock in borings at Yankton, and Alexandria, South Dakota.

Most recently there has been discovered at Sioux Falls, South Dakota, an exposure of gabbro or diabase containing much magnetite. Its relation to the quartzite has not yet been ascertained but it is thought to be intrusive.^a

Subsequently the sandstone underwent metamorphism by silicification to an intensely hard and vitreous quartzite, and the clay beds were changed into pipestone and siliceous red slate, both of which are found in southwest Minnesota. Microscopic examination of the quartzite shows that silicification was effected by crystallization of quartz around the separate grains, filling all intervening spaces and producing so compactly cemented a material that in breaking the rock the fracture divides

^aTodd, J. E., The newly discovered rock at Sioux Falls, S. Dak.: *Am. Geol.* Vol. 33, No. 1, 1904.

a grain of sand as easily as it separates the grains from their matrix.

Elevation of this quartzite above the sea must have followed, and while a land area it suffered great erosion as is evidenced by many buried valleys and the generally uneven surface revealed by drilling. While a land area this quartzite formed a high peninsula or island, which in addition to being degraded by erosion slowly sank into the sea so that of the sedimentary deposits surrounding it, the younger are nearest the center. The depth of this pre-Paleozoic quartzite in Dakota County is approximately the depth at which it was encountered in the deep well at Sioux City, where a thickness of 15 feet was found lying upon a micaceous schist at a depth of 1,525 feet.

Paleozoic history in this immediate vicinity is still shrouded in uncertainty. Toward the east the limestones and associated beds of the Carboniferous and earlier Paleozoic appear. Twenty-five miles to the south of the county rocks of the upper Coal Measures pass beneath the Cretaceous. That there must have been at some time during Carboniferous times a shore line bordering the Sioux peninsula is probable, and a series of limestones, shales, and sandstones between the lower limit of the Cretaceous and the upper limit of the quartzite has been found in borings at Ponca, Nebraska, and Sioux City, Iowa. Whether these beds represent a portion of the Carboniferous system or still earlier beds of the Paleozoic can not definitely be stated. The opinion, however, is growing that they represent the upper Coal Measures or Des Moines beds of the Iowa geologists. No traces of Paleozoic rocks other than these have been noted as underlying northeast Nebraska, and no Triassic or Jurassic formations, so it is assumed that between late Paleozoic and middle Mesozoic time the region was a land area which suffered heavy erosion. By this erosion the greater part of the Carboniferous beds, if they were once present, would have been removed.

In the Black Hills more than 300 miles northwest of this area several hundred feet of strata of marine origin representing nearly all of Paleozoic time are present, which indicates that a shore line of the Paleozoic sea must have extended north and south somewhere east of the Hills.

With the subsidence of the land surface during Mesozoic times the sea began to advance from the west over eastern Nebraska and South Dakota into western Iowa. The first deposits appear to have been sediments of Dakota time. These, being mainly sands, were deposited on beaches and in estuaries, with also deposits of clays formed in deeper and quieter waters. The sands were doubtless derived largely from the disintegration of the quartzite along the shore, and the clays came from the limestones and soils of the land area to the east.

An interesting discussion relating to the age of the Dakota sandstone was waged among distinguished American and European scientists from 1855 to 1870 with also a controversy regarding its origin—whether it is a fresh water, or brackish water, or brackish water and marine deposit. The great areal extent of the beds, from north to south and east to west, practically coextensive with the interior Cretaceous sea, the presence of marine forms, the predominance of sandstones and their cross-bedded character, the presence of lignites and the gradual transition upward into marine beds all are indicative of marine shore conditions, and it is now generally considered that such were the conditions of its deposition.

At the close of Dakota time the sea overspread the region as far as eastern Iowa and southeastern Minnesota and in the deeper waters deposition of the Benton shales began. Shallower waters may have prevailed for short periods during which local layers of sand were carried seaward by currents and spread out over the clays, and at one period near the middle of the Benton, the waters were deep and clear and contained abundant life. It was at this time that the fossiliferous Greenhorn limestone was deposited.

The Greenhorn limestone beds are the topmost beds of the Cretaceous present in Dakota County, the Carlile shale appearing above them in eastern Dixon County, the Niobrara beds above the Carlile shale in northwestern Dixon County and the Pierre shale still farther to the northwest and west.

From the evidence it seems uncertain whether these later formations once overlaid this area and were removed by the pre-Glacial erosion or whether their present boundaries represent approximately their eastern limit

of deposition. From their beveled condition and the evidence of great pre-Glacial erosion over the region the view is strengthened that they were once present, and that there may even have been a thin edge of Fox Hills sandstones deposited here in shallow ocean waters. During Laramie times when great areas to the west and northwest contained brackish and fresh-water lakes, northeastern Nebraska was probably a land surface, and probably it so continued through the Tertiary.

Undoubted Tertiary outliers are found in Holt County 75 miles west of Dakota County. These are mapped by N. H. Darton as the Arikaree formation, and are overlain in some places by Equus beds.

No positive evidence has yet been brought forth that the Tertiary deposits of Nebraska were laid down as far east as Missouri River. Professor Todd^a has endeavored to show that Lake Cheyenne continued to the Glacial epoch and that its eastward extension occupied portions of Western Iowa, southeastern South Dakota and eastern Nebraska. He cites a number of instances of the presence in this region of fine sands, containing fossil bones, overlain in places by lead-colored clay without pebbles, also the presence of fossil silt in many places at levels lower than those of the drift. The fossil claw of a megalonyx was found in sand below the drift in Mills County, Iowa, about 100 miles south of Dakota County. Professor Todd also cites the occurrence of stratified volcanic ash, apparently deposited in still water just preceding the deposition of the drift in some parts and succeeding it in others.

H. F. Bain^a in his survey of Woodbury County, Iowa, also gave considerable attention to the Tertiary question in this region. He found above the Cretaceous and below the Glacial deposits at Riverside, Sioux City, beds of fine to coarse, white sand containing small pebbles mainly granitic. The pebbles were waterworn and not striated. They may have come from the west or north, but they were not distinctly of northern derivation. The sand bore a general resemblance to that of the Miocene or Pliocene beds to the westward in Nebraska. The only fos-

^aTodd, J. E., Evidence that Lake Cheyenne continued till the Glacial epoch: Proc. Am. Assoc. Adv. Sci., Vol. 37, 1889, pp. 202-203.

^bBain, H. F., Geology of Woodbury County; Iowa Geol. Survey, Vol. 5, 1895, pp. 276-278.

Notes on the geology of Northwestern Iowa: Proc. Iowa Acad. Sci., Vol. 1, pt. 2, 1892, p. 14.

sils found in these beds were pronounced by Professor E. D. Cope to be "three left superior molars of the horse, *Equus major* Dek., of Pleistocene age,—entirely restricted to that horizon." The megalonyx remains found in Mills County while not restricted to the Pleistocene (they may also be Pliocene) are somewhat characteristic of that formation so that although it is not known that the beds in Mills County and Woodbury County are connected, paleontologic evidence does not strongly indicate the Tertiary age of these particular deposits.

In the work of the writer in Dakota County no evidence could be found for the presence of Tertiary deposits. However, artificial sections are not so numerous as in Woodbury County, Iowa, and it is possible that sand pits may be opened in the future in beds bearing the same relation to the drift as those at Riverside. Professor Todd has based some of his evidence as to the distribution of the sands in question on drill records. The writer hesitates to rely upon such records, especially in discriminating between classes of deposits so closely related both in character and position. In personally supervising the drilling of a tubular well in Dakota County a pre-Glacial valley was discovered, which proved to have several alterations of sands, gravels, and clays below the loess. All of the gravel was water worn and some of it showed distinct evidence of ice action. The sand was fine, white, and compact, characteristic of a stream deposit.

In the absence of evidence of Tertiary deposits there is added evidence of an elevated land area over what is now the middle Missouri Valley and to the eastward, following the orographic movements at the close of the Cretaceous. Subsequent to this and prior to Glacial conditions there may have been a slight subsidence during which this region was covered by a shallow lake in which the doubtful sands and gravels were deposited as shore and estuary materials, followed by an elevated condition of stream cutting in which the greater part of these deposits were removed by erosion. The height to which the land was raised was doubtless considerably greater than its present elevation. In the interval between this upward movement and the advent of the ice Missouri River began to cut its present trough. The depth eventually reached was at least 100 feet below the present

river level in Dakota County, and it carried down many of its tributary streams with it. Thus the doubtful sands may represent stream or terrace deposits of that stage, which failed to be removed and were subsequently covered by glacial deposits.

The true Pleistocene record is found in the deposits left by the Kansan ice sheet. These deposits are thin and scattered, as the area lies outside that affected by the Altamont moraine. The loess is intimately associated with the drift deposits and thickly covers the region except in the trough of the Missouri Valley, everywhere conforming to the surface topography in such a way as to suggest that the ice sheet which extended over the region was either too thin or occupied the surface too short a time to obliterate the pre-Glacial topography.

The Altamont moraine presents a gap of about 9 miles in Clay County, South Dakota, about 30 miles northwest of this area. Through this gap an ice lobe extended down the valley of Vermilion River to within 20 miles of the mouth of Big Sioux River. Another lobe extended down the Big Sioux south of Canton. The drift south of the moraine is thin and patchy, being usually not over 15 feet thick and underlain by beds of fine sand and clay showing no signs of disturbance. This indicates that the region has not been covered by heavy land ice.

In the few exposures along the Missouri River escarpment in Dakota County showing glacial material there was the normal order, beginning at the top, of loess, clay, gravel, and sand. An interesting occurrence of interloessal till may be seen on the Iowa side near the mouth of the Big Sioux. It is described by Todd and Bain,^a who give the following section:

INTERLOESSAL TILL NEAR BRUGHIER BRIDGE, SIOUX CITY,
IOWA.

	Thickness Feet.
5. Loess, usual character, thickening back on hills to 100 feet or more	20
(Contains according to Todd, fresh-water shells, <i>Lymnea</i> and <i>Cyclas</i> , and <i>Helix hirsuta</i> .)	
4. Till, brownish, with northern pebbles and bowlders. Blends with loess	12
3. Loess, compact, whitish, silt-like, containing <i>Succinea</i> and other living forms	6
2. Gravel, coarse, with northern bowlders.....	10
1. Talus of loess	12

^aTodd, J. E., and Bain, H. F., Interloessal till near Sioux City, Iowa: Iowa: Proc. Iowa Acad. Sci., Vol. 2, 1895, pp. 20-23.

The position of this lens of till well up in the loess and separate from any known drift precludes its being the deposit from an ice sheet advancing over loess already deposited around its margin. The theory that it was deposited from a floating iceberg has been suggested by the authors as offering the most rational explanation for the occurrence. This involves the suggestion of the contemporaneous origin of this till and loess, and indicates that some of the till in this region and to the south is not older than the loess, and that the basal till may not be of much earlier data. The higher bed of till is very similar to the lower one, suggesting a probable common origin of both deposits. The presence of the lower till some 20 feet above the present river level suggests that the river trough existed in early Glacial times much as at present. Probably the greater volume of water carried by the river from the melting ice accomplished an enlargement of the channel both in depth and breadth. If the iceberg theory be correct the flood at one time passed over the tops of the bluffs, and this fact may account for the thinness of the deposit of bowlder clay in this region and its wide distribution farther down the Missouri. Some interloessal till may possibly exist in buried valleys, such as that of Elk Creek. (See fig. 4.)

The presence of a very large granite bowlder about midway up the bluff in Dakota County north of Jackson, affords further evidence of the probable presence of drift-laden icebergs floating over the region.

If the loess of this region were deposited as a fine silt in the quiet waters of the expanded Missouri, as suggested by Bain, it is necessary that these waters should have been quiet. Such a condition seems somewhat doubtful in view of the fact that the stream was at this time carrying off the waters from the melting glacier to the north and was evidently not ponded by any obstruction in its lower course. The fall of the river was greater at that time than it is now and yet the current flows at a rate of over 7 miles an hour at low water. However, the waters may have been so heavily overloaded with silt and fine material that deposition resulted notwithstanding the rapidity of the current. But these deposits show no evidence of stratification nor of cross-bedding.

Todd^a has suggested that much of the loess material may have been derived from western tributaries of the pre-Glacial Missouri, as well as from beds stirred up by the Dakota glaciers, with the possibility that these beds may have formerly extended eastward to the present James River Valley where the Missouri flowed in pre-Glacial times, and thus have been eroded and pushed southward by the action of the ice sheet.

Whatever the origin and mode of deposition of the loess may have been it is evident that lying above the glacial till it covered the surface so thickly that much of the pre-Glacial topography was obliterated and the landscape may have presented after the recession of the ice and the draining off of the swollen streams somewhat the aspect of a mud-covered plain with the great trough of the Missouri filled nearly to its brim with silt. Toward this nearly filled trough the plain sloped from the east and from the west, while the whole had a southerly slope. On this plain the post-Glacial drainage has worked, Missouri River rapidly re-eroding its trough down to the level of its present flood plain on account of having not much consolidated rock material to remove, while the minor streams have more slowly restored the old topography by working downward along and into the former lines of drainage. During recent time the formation of soil has continued through the action of weathering, erosion, vegetation, the settling of dust, and the burrowing of animals. Alluvial soil has been spread over the Missouri flood plain and short distances up those of its minor tributaries. The great river has frequently changed its meandering course, even within the memory of inhabitants of this region.

ECONOMIC GEOLOGY.

Dakota County contains no metalliferous ores and but few nonmetalliferous minerals of economic value.

CLAYS.

Undoubtedly the Cretaceous clays of the county are the most important of these resources. Beyond ascer-

^aTodd, J. E., The Moraines of southeastern South Dakota: Bull. U. S. Geol. Survey No. 158, p. 99.

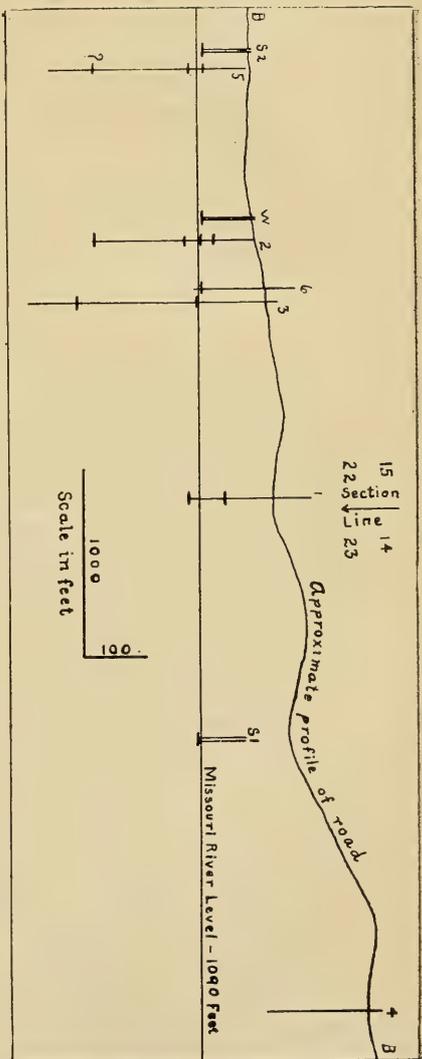


FIG. 7.

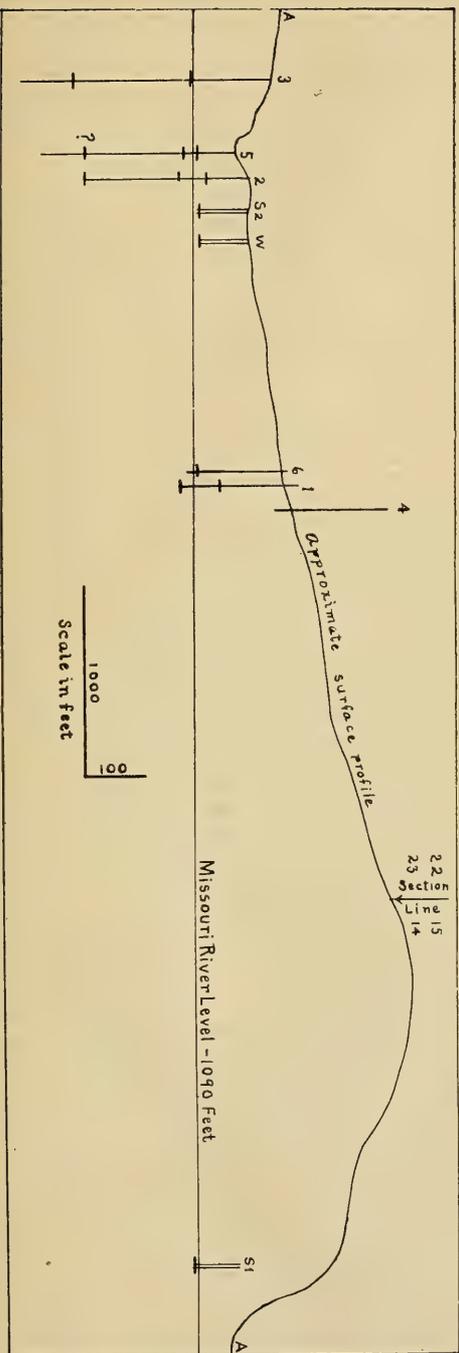


FIG. 8.

taining that these clays are the equivalent of those across the Missouri in Woodbury County, Iowa, mapping them on the areal geology map, and making an investigation of the fire clay in connection with the lignite deposits, no detailed study of these clays was deemed necessary at present. The great development of the clay industries at Sioux City and Sergeant Bluffs, Iowa, has demonstrated the value of these clays and at the same time it has so preoccupied this field that for many years there will be no opportunity for successful competition in the manufacture of staple clay goods in Dakota County. The possibility of making fire brick will be mentioned later.^a

CEMENT.

One industry, the manufacture of Portland cement, as yet untouched in this immediate vicinity, is a possibility in Dakota County. At Yankton, South Dakota, an excellent grade of Portland cement is made from 4 parts of Niobrara chalk to 1 part of the overlying Pierre clay. The Pierre clay does not extend as far south as Dakota County nor does the Niobrara chalk, but the chalky beds of the Greenhorn limestone in connection with the underlying dark argillaceous Benton shales near Sioux City have been found by analysis to contain the requisite ingredients for a good cement. Experiments^b showed that the use of 5 parts of one kind of clay to 1 of chalk, or 2 parts of another clay to 1 of chalk, would be the proper proportions for the mixture. Dakota County contains an inexhaustible supply of the chalk and clays, especially along the bluffs north of Jackson. There is no railroad nearer than at Jackson, but a spur 3 or 4 miles long from either of the two roads at Jackson could very easily be constructed over the flat bottom land right to the very center of the deposits.

Cement will eventually be made in this vicinity, for the plant at Yankton can not supply the demand from this rapidly improving part of the country. Whether the industry will be located in Nebraska or in Iowa depends upon where the first start is made.

^aFor fuller notes on the clays of this region see Bain, H. F., *Geol. Woodbury County, Iowa Geol. Survey*, Vol. 5, 1895.

^bLonsdale, E. H., *Cement materials in Iowa: Proc. Iowa Acad. Sci.* for 1894, Vol. 2, 1895, p. 173.

BUILDING STONE.

The rocks of Dakota County are usually too soft to be suitable for building. Certain beds in the Dakota sandstone at Jackson and at Homer have been quarried for local use. Foundations and chimneys were formerly very frequently constructed of the stone, but now the cheapness of bricks from the Sioux City kilns has almost driven the sandstone into disuse. In the northern part of the county the slabby limestone of the Greenhorn member were likewise used to a small extent.

LIME.

At the base of the bluffs in the northern part of Dakota County are the remains of several lime kilns. The Greenhorn chalks and limestones were there burned for lime in the early days, but the industry has been inactive for years owing to better grades of lime coming into the market from the east.

SAND AND GRAVEL.

Sand is abundant along Missouri River and beds of gravel are occasionally uncovered there. Pits of sand and gravel will doubtless be opened high in the escarpment above the Greenhorn limestone beds when the demand for such material warrants prospecting for it.

LIGNITE.

At various times during the history of Sioux City, Iowa, has the "coal fever" seized a few local business men who hoped to open a field nearer at home than that of south central Iowa. Reports handed down by the earliest settlers of outcrops of coal having been discovered by Lewis and Clark, and by Owen, Hayden and others, although these explorers themselves speak very disparagingly of the character of the fuel they noticed, have given rise in many minds to the belief that good coal should be found at a depth within a few hundred feet. Prospecting has therefore been done from time to time in pursuit of this fancy, to the extent of digging wells and cutting shallow drifts into the hills. This belief was further strengthened by the outcroppings of thin seams of charcoal-like, carbonaceous material, often lignitic in character, from the bluffs bordering the Big Sioux north of Sioux City, and at Sargent's Bluffs, on the Missouri about seven miles below the city, and by the occasional finding of similar material in digging sand pits and wells.

No encouragement has ever been given to the idea of the existence of coal by men of the vicinity who are acquainted with its geology, nor by the early Government and State survey reports, and in the latest of these Dr. H. F. Bain^a dismisses the matter as being highly improbable, after having shown that the coal measures, if they ever overlaid the region must have been almost entirely removed by erosion before the present deposits were laid down, and that if any such outliers yet existed below the several hundred feet of Cretaceous strata and later deposits that the expense of finding such by drilling would far exceed the returns that might be expected. Dr. Bain also makes brief reference to the lignites that are known to occur in the Cretaceous at this locality, and makes very accurate predictions as to their general worthlessness.

^aBain, H. F., *Geology of Woodbury County: Iowa Geol. Survey, Vol 5, 1895, pp. 296-297.*

Occurrence.—Seams of lignite outcropping from the bluffs near Ponca, in the southeastern part of Dixon County, and near Homer, in the southeastern part of Dakota County, have intermittently furnished a limited supply of fuel to residents of those localities. The finding of a seam at a depth of 91 feet while drilling a well on the farm of Mr. C. H. Goodfellow, in sec. 22, T. 29 N., R. 7 E., late in 1899, together with the careless report of the drillers that it had a thickness of 6 feet, led to the prospecting on this property. While this material was being brought up by the drill, samples of it were burned on a shovel, and some was sent to the University of Nebraska for analysis. Prof. Nicholson reported the following results:

ANALYSIS OF LIGNITE FROM GOODFELLOW WELL, NEAR JACKSON, NEBR.

	Per Cent.
Moisture	4.57
Volatile, Combustible Matter.....	31.97
Fixed Carbon	40.24
Ash	23.22
	100.00

Extent as evidenced by prospecting.—The following summer some parties of Jackson, Nebraska, sunk a shaft in the bottom of a ravine in sec. 14, a few rods back from its mouth. The elevation of the top of this shaft was 1,155 feet or 65 feet above the mean level of Missouri River. The shaft was 4 by 8 by 80 feet, and at 60 feet it passed through a bed of lignite reported to be nearly 3 feet thick. Water entered the shaft in such a volume that a steam pump was necessary to keep the water low enough that the vein might be worked. The vein was roofed by several feet of light, sandy clay, and was underlain by 8 feet of good white fire clay. Lignite taken from the shaft was burned in the engine which operated the pump and the hoist.

Unforeseen accidents and delays caused by careless methods of men inexperienced in mining, soon permitted the water to become too difficult to control, and this, together with a shortage of funds, finally caused the owners to abandon this shaft. They report that the

vein was becoming thicker and of a better and more uniform quality as they drifted under the bluff. At the time of these investigations, this shaft was nearly full of water. The dump still contained much of the lignite which was identical with that farther south.

Notwithstanding these unsuccessful investigations, and the unfavorable predictions of scientific men, a movement of some magnitude was started in the fall of 1901 by business men of Sioux City. Numerous reports had reached the public of the discovery of "coal" in drilling wells on the farms among the hills of Dakota County, Nebraska. This induced these capitalists to lease several hundred acres of land in Dakota County for the purpose of prospecting for and mining of coal, and drilling was begun on the farm of Mr. C. H. Goodfellow in secs. 22 and 23, T. 29 N., R. 7 E., in March, 1902. At least 8 drill holes were sunk on the Goodfellow tract, ranging in depth from 85 to 400 feet. Many of the drillings were apparently random shots, and no very careful record of the holes was kept at first, and had a line of levels been run to determine the relative elevations of the tops of the holes, considerable fruitless work might have been avoided on the part of the prospectors. The drill was at first operated by means of horses, later by gas-engine power.

Sections of the last five drill holes were recorded by the writer, two from personal observation, the others from an examination of the drillings and notes of Mr. Goodfellow. They are graphically represented in figs. 7 and 8. (See also map, fig. 2.) These records indicate the presence of lignite at three horizons:

(1) A fragmentary bed, 6 to 10 inches thick exists in places and is absent in others. With reference to the mean level of Missouri River as a datum plane, this bed lies at +25 to +50 feet, the difference in elevation being due to the broad undulations of the strata.

(2) A bed of lignite at a depth corresponding to that found at 91 feet in the well underlies several square miles, with a thickness of $1\frac{1}{2}$ to 2 feet. Referred to datum this lies at -20 to +10 feet.

(3) A bed 42 inches thick was reported in one of the first holes drilled, at a depth of 275 feet, or at —190 feet. datum. For a time all efforts were directed toward establishing the continuity of this third bed, but it was encountered in only one other place, a drill hole 20 rods to the south where it was only 6 inches thick.

In August, 1902, a shaft 7 by 14 feet, that would have done credit to a valuable coal mine, was sunk in the Goodfellow tract, sec. 22, the N. W. $\frac{1}{4}$ of the S. E. $\frac{1}{4}$, and it was the writer's privilege to be on the scene shortly after the second bed of lignite was reached. The section passed through in sinking the shaft bore out the neighboring drill records. The first bed of lignite was but a few inches thick and of a soft, charcoal-like material. A great deal of water began to enter the shaft at 35 feet, and a two-inch pump had to be kept in operation day and night to keep the shaft dry enough for work to be carried on.

When the second bed of lignite was reached at about 82 feet deep and part of it cut through, the work was stopped. The roof over the bed would not have remained in place without timbering, which circumstance, together with the heavy water, and the low value of the fuel, made the mining of it at that time impracticable, and the indications of a more valuable bed at a greater depth were not sufficiently encouraging to warrant sinking the shaft deeper.

A second locality prospected is in the southeast corner of Dakota County, about 16 miles southeast of the Goodfellow tract. This work was carried on by Sioux City capitalists. Three miles southeast of the village of Homer, in sec. 20, T. 27 N., R. 9 E., in a ravine about one-half mile back from its mouth and at about 50 feet above the level of the river flood plain, a bed of lignite was found to outcrop. This bed is about 22 inches thick, and lies between beds of yellow shaly clay. A fresh sample from this vein was analyzed before any prospecting was done in that locality. (Table II—No. 5.) Prospecting was soon afterward begun in sec. 28, the N. W. $\frac{1}{4}$ of the N. W. $\frac{1}{4}$, at one side of a long hollow about one-half mile up from its mouth, at an elevation of about 1,200 feet. Drilling to a depth of 190 feet was done here by the same

drill that had prospected the Goodfellow tract, a seam of lignite of uneven thickness being struck at a depth of 42 feet. In the N. W. $\frac{1}{4}$ of sec. 27, a hole 279 feet deep was drilled at an elevation of about 50 feet above that in sec. 28, and a bed of lignite about 14 inches thick was found at 99 feet. In sec. 28 the bed was uncovered by digging a well 4 feet in diameter. This shaft laid bare a succession of clays, shales, and sandstones with one bed of lignite, 5 to 7 inches thick, at a depth of 26 feet, and another bed of pure lignite at 40 feet, only 6 inches thick, below about a foot of black, carbonaceous, earthy material, somewhat shaly. The drillings from this material had evidently been mistaken for the genuine article, and had given it its false thickness. The lignite may have been somewhat thicker at other places in the vicinity, but the continuance of the drillings in the washings after the seam was passed probably caused the drillers to overestimate its thickness. Above the carbonaceous matter was a grayish shale familiarly known as "soapstone" to the drillers, and below the lignite was a gray, sandy clay which was penetrated for only 2 or 3 feet below the lignite.

Very little water was encountered in this shaft. Its elevation is above that of the heavy water horizon farther north in the county, but a spring flowing a steady one-inch stream emerges from the middle of the ravine at a level above that of the bottom of the shaft, probably flowing on the upper thin bed of lignite. The lignite at the bottom of the shaft was drifted into for about 10 feet, but in this distance it did not vary much in character or thickness. This development was carried no farther, the fruitlessness of such work becoming readily apparent.

Correlation.—Owing to the considerable distance of 16 miles in an air line separating the two localities where lignite is known to exist, and the absence of intermediate outcroppings, it is plainly impossible to state with positiveness that there is a continuity of the beds from one locality to the other. The beds in the Homer locality are in the Dakota, which is there relatively higher than north of Jackson, and it is probable that the bed at 40 feet is the equivalent of the second bed north of Jackson. It is not improbable

that a seam of lignite at that horizon should be fairly constant over the whole strip of the country fringing the escarpment, but it should thin out toward the west. It is represented at Sargent's Bluffs, on the Iowa side of the river, 11 miles north-northeast of this point.

Further well drilling will shed more light on this question, and it is likely now that some interest has been aroused in the matter that such data will be preserved by the drillers more carefully in the future.

Age.—Bain^a considers that the bed of lignite less than a foot thick, outcropping from the bluffs near the mouth of Ayowa Creek, and near the Ponca landing, is near the base of the Benton. Professor Todd has stated to the writer that the lignite throughout this locality is generally called Dakota. It would appear from the stratigraphic position, at least, of this bed that it is in the Benton near its transition to the Dakota. A few miles to the southeast in sec. 14, T. 29 N., R. 7 E., no such bed of lignite situated in the same relation to the Greenhorn limestone is known to outcrop. Prospecting in secs. 22 and 23 has disclosed the presence of lignite at that horizon and its absence at others. This bed is evidently fragmentary, and in the opinion of the writer it disappears altogether to the southeast with the thinning out of the Graneros shale.

In the shaft in sec. 14, T. 29 N., R. 7 E., lignite was found at a depth of 60 feet, or more than 175 feet below the Greenhorn limestone. Obviously this is not at the same horizon as the Ponca lignite. The drillings and shaft in secs. 22 and 23 have disclosed the constancy of this bed, which, from its relative position, and the character of the clays, sandstones, and shales accompanying it, is to be referred to the Dakota. Farther southeast, in the vicinity of Homer, and on the Winnebago Indian Reservation, the main lignite bed is above the level of the flood plain. Here only the character of the accompanying strata, not its position relative to the Greenhorn beds which are not far above it in the bluffs, proclaims it to be Dakotan. If the Graneros shale has thinned out in this vicinity as suggested by Bain for the south part of Wood-

^aBain, H. F., *Geology of Woodbury County: Iowa Geol. Survey*, Vol. 5, 1895, p. 297.

bury County, and the Greenhorn limestone rests directly on the Dakota, we have an explanation which admits of correlating these lignites with those of the northern part of the county. In Woodbury County at Sargent's Bluffs, across the river and a little north of the Homer locality is an exposure of Dakota sandstone containing a bed of somewhat earthy lignite, $1\frac{1}{2}$ feet thick. The writer considers that this bed is probably the equivalent of that outcropping in the Homer locality.

Conditions more favorable to the origin and development of a bed of lignite prevailed during the deposition of the Dakota beds, these rocks being characterized by the scarcity of remains of marine life, and by the abundance of impressions of fragments of wood and of leaves belonging to species of plants resembling our modern forest trees. Low swamps probably bordered the shore, delimited by higher land to the east and by deeper waters to the west.

With the subsidence and burial of such beds of vegetation through deepening of the sea during Benton times organic material, logs and drift wood such as might accumulate in estuaries of the sea would provide material for the formation of lignite deposits, and to such conditions may be ascribed the formation of the bed near Ponca and its fragments in Dakota County.

Physical properties.—During the period of prospecting the Goodfellow tract by use of the churn drill but little satisfactory information as to the physical character of the lignite could be obtained. It was impossible, although the drill holes were cased from the surface down nearly to the bottom of the hole, to keep the sand and loose wall material from mixing with the drillings from whatever stratum the drill was penetrating, and washing up with them in the sluice.

Chemical analyses made upon such drillings separated from most of the accompanying foreign material, and subsequently upon the lignite from the same bed, in lumps from the shaft, show approximate identity of composition, so that such analyses made of drillings can be considered reliable data in so far as indicating the proximate constituents of the material. As to the uniformity of the material in the bed, whether containing clay or

shaly partings; as to the presence of calcareous or siliceous concretions containing iron pyrites or as to their relative abundance; and as to the relative density and cohesion of the lignite, churn-drill prospecting is not capable of furnishing much definite information. A home-made core drill was tried without success at the Goodfellow place. The only core it brought up was one from the bed of fire clay beneath the lignite.

As soon as a shaft on the Goodfellow tract had reached the first important bed of lignite, opportunity was afforded for a thorough investigation of these points. The shaft first laid bare the bed at a depth of 82 feet and was sunk through it nearly the full size of the opening, 7 by 14 feet, penetrating a bed of fire clay, rather sandy at this point, and containing splinters and sticks of lignite material evidently the residue of branches and roots from the former bed of vegetation above. The bed averaged 22 inches, being mostly of that thickness, but narrowing in one place to 18 inches and thickening in another to over 24 inches. The top of the bed appeared to have a more undulating surface than the bottom. Over the bed was a stratum of buff, sandy shale, which, upon drying, easily crumbled and would have been of no value as a roof.

When freshly mined the lignite was so very moist that lumps weighed in the hand felt like heavy, wet clay. Its color is only a shade lighter than black, when fresh, but on drying becomes a trifle lighter, although much of it remains a dead black when dry. The lustre is dull along some of the joint planes, and in a few of the harder places where fractured a pitchy glint may be noticed, but the greater part of the material is so soft as to present only a rough, dusty surface incapable of reflecting much light.

The streak is very nearly black, and the powder appears only a shade less black than the powder of bituminous coal. The lignite exhibits a shiny, but not oily surface upon being scratched with a knife. The texture is not entirely uniform, there being many fragments and streaks of charcoal-like matter, softer than the rest and having a woody structure.

While removing the lignite from the shaft it was necessary to use heavy picks to loosen it, so compact

was the bed, but upon exposure to sunlight and air its jointed structure appears at right angles to the bedding, and along the joint and bedding planes the material is easily separated by hand into small cubes and rectangular prisms. These individual fragments do not become relatively softer, but they can easily be cut with a knife, and are much more easily crushed and ground than fragments of bituminous coal.

The lignite cleaves, where of a woody structure, in the direction of the grain, and also in the direction of the bedding planes, and has a rough, uneven fracture.

When the material has given up the greater part of its moisture to dry air, the consequent shrinkage of the particles and opening up of joints causes the material to lose its cohesiveness and to fall to pieces at the slightest jar. If exposed again to moist air, the movement between the particles consequent upon the rapid absorption of water still further aids the disintegration of the mass, so that after a few alterations of drying and wetting it can be carried only in dust-tight receptacles.

On plunging an air-dried piece of the lignite under water, a rapid rise of bubbles—almost an effervescence—of the gases held within the cracks and pores of the material is immediate, and of the softer pieces when wet few fail to fall to pieces like lumps of softened mud.

The specific gravity ranges between 1.28 and 1.35 for air-dried samples which is comparatively high for such a soft, loose material, but is accounted for by the presence of a high percentage of incombustible mineral matter, the ash of the chemical analysis.

SYNOPSIS OF TABLES SHOWING PHYSICAL PROPERTIES AND
CHEMICAL COMPOSITION:

Table I. Physical properties of lignites.

- “ II. Proximate analyses of Dakota County lignites.
- “ III. Proximate analyses of other lignites.
- “ IV. Proximate analyses of lignites and coals (comparative).
- “ V. Ultimate analyses of Nebraska and Wyoming lignites.
- “ VI. Ultimate analyses of lignites and coals (comparative).
- “ VII. Caloric power of Nebraska and Wyoming lignites.
- “ VIII. Calorific power of other lignites and coals (comparative).
- “ IX. Gas producing capacity of Nebraska and Wyoming lignites.
- “ X. Gas producing capacity of other lignites and coals (comparative).

I.

PHYSICAL PROPERTIES OF LIGNITES.

No.	SAMPLE AND LOCALITY	Specific Gravity	Loss of Water After Standing in Laboratory 130 Days. Per Cent.
1	Lignite, lumps from shaft Sec. 23, T. 29 N., R. 7 E., Dakota county, Nebraska.....	1.35	15.81
2	Lignite, lumps from shaft Sec. 29, T. 27 N., R. 9 E., Dakota county, Nebraska.....	1.28	17.32
3	Lignitic coal, Rock Springs, Wyoming.....	1.285	(Not tested)

II.

a PROXIMATE ANALYSES OF DAKOTA COUNTY LIGNITES
—AIR-DRIED BASIS.

No.	SAMPLE AND LOCALITY	Depth to Bed, Feet	Thickness of Bed Inches	PERCENTAGES				
				Moisture	Volatile Combustible Matter	Fixed Carbon	Ash	Sulph'r
1	Drillings, Hole No. 2, Sec. 22, 29 N., 7 E.....	80	26	4.99	41.63	27.14	25.72	1.20
2	Drillings, Hole No. 5, Sec. 22, 29 N., 7 E.....	65	22	4.03	51.40	33.66	10.91	b
3	Lumps from shaft, Sec. 22, 29 N., 7 E.....	82	23	6.85	31.05	45.08	16.15	.86
4	Lumps from shaft as No. 3.....	82	23	6.47	27.24 ^c	49.27	16.23	.86
5	Lumps from outcrop, Sec. 20, 27 N., 9 E.....	.....	22	17.85	44.27	26.00	10.91	1.14
6	Lumps from shaft, Sec. 28, 27 N., 9 E.....	36	6	6.77	54.16	28.66	8.65	1.75

a. Analyses by the writer.

b. Sulphur not determined. Specimen showed no iron pyrites.

c. Heated only to low red heat with Bunsen burner to expel volatile matter, instead of using blast-lamp.

III.

APPROXIMATE ANALYSES OF LIGNITES FROM OTHER LOCALITIES—AIR-DRIED BASIS.

No.	SAMPLE AND LOCALITY	PERCENTAGES				
		Moisture	Volatile Combustible Matter	Fixed Carbon	Ash	Sulph'r
1	From North Dakota (near Missouri River).....	5.58	39.43	52.70	1.48	.80
2	Rock Springs, Wyoming.....	6.77	38.41	53.21	1.06	.59
3	Rock Springs, Wyoming.....	5.64	40.89	52.01	.94	.52
4	Rock Springs, Wyoming.....	6.05	41.25	51.05	1.07	.55
5	Cannel coal, Kentucky.....	0.47	50.53	33.07	15.93	...

a. Analyses by the writer.

IV.

COMPARATIVE PROXIMATE ANALYSES OF LIGNITES AND COALS FROM VARIOUS SOURCES.

No.	CHARACTER AND LOCALITY	PERCENTAGES				
		Moisture	Volatile Combustible Matter	Fixed Carbon	Ash	Sulph'r
1	Lignite, air dried, Ouachita county, Ark.....	11.23	44.04	33.69	11.04	0.70
2	Lignite, air dried, Ouachita county, Ark.....	9.81	46.29	29.43	14.47	0.63
3	Lignite, freshly mined, Bowie county, Texas.....	11.55	37.70	42.30	7.55	0.90
4	Lignite, freshly mined, Robertson county, Texas.....	16.40	41.52	33.42	7.70	0.96
5	Lignite, air dried, Robertson county, Texas.....	8.70	39.16	40.16	10.45	1.38
6	Lignite, air dried, Medina county, Texas.....	13.25	40.62	36.47	8.40	1.26
7	Coal, air dried, Wapello county, Iowa.....	9.98	41.46	42.21	6.35	2.53
8	Coal, air dried, Davis county, Iowa.....	5.24	37.00	50.66	7.10	2.25
9	Coal drillings, Greene county, Iowa.....	5.94	35.20	41.20	17.66	2.43
10	Coals, average of 16 samples from Iowa.....	8.08	38.14	45.60	8.18	3.42
11	Coals, average of 22 samples from Illinois.....	10.00	31.60	46.72	11.49	3.09

V.

aULTIMATE ANALYSES OF LIGNITES—AIR-DRIED BASIS.

No.	SAMPLE AND LOCALITY	PERCENTAGES						
		Moist-ure	Carbon	Hydro-gen	Nitro-gen	Sul-phur	Oxygen	Ash
1	Lumps from shaft, Sec. 22, 29 N., 7 E., Dakota county, Neb.	6.47	58.90	2.70	1.48	0.86	10.41	19.18
2	Lumps from shaft, same as above.....	6.50	60.54	2.64	1.26	1.08	13.98	14.00
3	Lignitic coal, Rock Springs, Wyo.....	4.20	74.05	3.56	0.87	0.59	15.17	1.56

a. Analyses by the writer.

VI.

COMPARATIVE ULTIMATE ANALYSES OF OTHER LIGNITES AND COALS, COMPILED FROM VARIOUS SOURCES.

No.	LOCALITY AND CHARACTER	PERCENTAGES						
		Moist-ure	Carbon	Hydro-gen		Sul-phur	Nitro-gen and Oxygen	Ash
1	Texas, Bowie county, freshly mined lignite,	10.67	59.84	3.10	.....	1.00	26.97	9.10
2	Texas, Robertson county, freshly mined lignite.....	16.40	54.46	4.41	.....	0.96	16.07	7.70
3	Texas, Medina county, freshly mined lignite,	13.25	52.85	2.25	.....	1.26	21.99	8.40
4	Italy, air-dried lignite,	6.72	59.98	4.75	.....	0.94	29.42	5.85
5	Saxony, water free lignite.....	31.66	61.13	5.09	.....		31.95	1.83
6	Austria, water free lignite.....		58.29	4.68	.....	0.71	18.42	5.30
7	Texas, Kansas & Texas Coal Co., water free coal.....		74.70	3.25	.....	1.44	16.04	4.57
8	Cumberland semi-bituminous coal.....		80.55	4.50	.....	1.08	2.70	8.25
9	Cologne briquettes.....	17.85	53.50	3.90	.....	0.52	20.09	4.66

VII.

CALORIFIC POWER OF LIGNITES FROM NEBRASKA AND
WYOMING, BASED ON ULTIMATE ANALYSES, TABLE V.

No.	SAMPLE AND LOCALITY	Calories per Kilogram	B. T. U. Per Ton
1	Dakota County, Neb., (Table V, No. 1).....	5296.55	9533.8
2	Dakota County, Neb., (Table V, No. 2).....	5260.02	9468.0
3	Rock Springs, Wyo., (Table V, No. 3).....	6619.90	11910.4

VIII.

COMPARATIVE CALORIFIC POWER OF OTHER LIGNITES AND
COALS.

No.	SAMPLE AND LOCALITY	Calories per Kilogram	B. T. U. Per Ton
1	Lignite, Texas (Table VI, No. 1 ^a).....	4840.40	8712.7
2	Lignite, Texas (Table VI, No. 3 ^a).....	4202.30	7564.1
3	Lignite, Italy (Table VI, No. 4 ^a).....	5317.20	9570.9
4	Coal, Texas (Table VI, No. 7 ^a).....	6585.20	12753.4
5	Coal, Cumberland (Table VI, No. 8 ^a).....	7992.00	14385.5
6	Briquettes, Germany (Table VI, No. 9 ^a).....	4860.80	8749.4
7	Coal, Wapello Co., Iowa, Table III, No. 7 ^b).....	7259.00	13050.0
8	Coal, Davis Co., Iowa, (Table III, No. 8 ^b).....	6720.00	12097.0
9	Coal, Average 16, Iowa (Table III).....	6460.00	11626.0

^aBy calculation from elementary percentages.

^bBy physical methods, Iowa engineer, Ames, Ia., June, 1902.

IX.

aGAS PRODUCING CAPACITY OF NEBRASKA AND WYOMING
LIGNITES AND CANNEL COAL.

No.	SAMPLE AND LOCALITY	Cubic Feet Per Ton	Coke Per Cent.
1	Lignite, shaft Sec. 22, 29 N., 7 E., Dakota county, Nebr.....	12279.	71.2
2	Lignitic Coal, Rock Springs, Wyo.....	11069.	55.8
3	Cannel Coal, Kentucky.....	7661.	42.0

aExperiments by writer, assisted by Mr. Geo. Hicks, of the Sioux City High School, Class 1904.

X.

aCOMPARATIVE GAS PRODUCING CAPACITY OF OTHER
LIGNITES AND COALS.

No.	SAMPLE AND LOCALITY	Cubic Feet Per Ton	Coke Per Cent.
1	Lignite, Ouachita county, Ark.....	11386.	.....
2	Cannel, Beaver county, Pa.....	10160.	.....
3	Cannel, Kentucky.....	12540.	.....
4	Cannel, Scotland.....	12350.	.....
5	Cannel, (Stillman, Engr. Chem. p194).....	10144.	43.3
6	Bituminous coal, Newcastle, Eng.....	10760.	.....
7	Bituminous coal, Pittsburg, Pa.....	10000.	.....

a. Data (except No. 5.) from J. A. Taff's preliminary report on the Camden, Ark., coal field, Twenty-first Annual Report, U. S. Geological Survey, part 2, 1900, p. 329.

Chemical Composition.—Both proximate and ultimate analyses of the lignite were made by the writer, for the purpose of determining its relative commercial value. The proximate analyses were first made upon cleaned samples of the drillings washed up by the hydraulic drill, and later, upon samples averaged from the lumps of lignite removed from the outcrop and shafts. In connection with this work, proximate analyses of lignites from North Dakota, and Rock Springs, Wyoming, were also made, that a first-hand comparison might be made of results obtained under the same conditions.

In order to obtain a basis for the calculation of the heating value of the lignite ultimate analyses were made on two of the samples, and, as a check, the same was done on one of the Wyoming lignites.

Very elementary experiments were carried out with regard to arriving at an approximation of the relative gas-producing capacities of the Nebraska and Wyoming lignites and of cannel coal. A word should perhaps be inserted here in regard to the nature of this latter method of experimentation. The proximate and ultimate analyses were made strictly according to the standard accepted methods discussed by Stillman, Gill and other chemical engineers, but the work on gas production was of necessity somewhat improvised.

Weighed samples of the powdered coal were placed in porcelain combustion boats inserted in an iron tube of $\frac{1}{2}$ -inch internal diameter, sealed at one end and fitted with a gas-tight connection at the other. This was laid horizontally in a combustion furnace and heated to bright-red heat for several hours, or until the gas was practically exhausted from the lignite. This gas, in escaping, was cooled by passing through a set of glass condensing tubes, which cooled it and collected the tar, and was purified by passing through tubes of potassium and calcium hydroxides. It was finally collected in large bottles over water. The volume of the gas was accurately measured and reduced to standard conditions of temperature and pressure, and from the data obtained, the yield of gas in cubic feet per ton of the lignite is calculated. As a further check, the loss in weight was noted and compared with the percentages of volatile matter as indicated in the analyses. At least two deter-

minations were made with each sample, and the tabulated result is the average. Not enough gas could be generated in this way to make photometric tests possible, but the gas was burned in a dark room, with results that lead to certain conclusions mentioned later.

Classification.—Considered from a physical standpoint these deposits, where bedded, can not strictly be termed lignites. Lignites, by definition possess a much more woody structure, a generally lighter color, and are considered to have undergone less complete alteration than these materials. Brown Coal is defined by Zincken^a as follows: "Compact, more or less firm and solid masses, with traces of woody structure in parts. Structure compact, lustre, dull or slightly shining; color from brown to blackish brown, and with a greasy, shining streak. It is intermediate between earthy brown coal and pitch coal." The Nebraska materials might better be classified under the head of brown coal, so far as their physical properties are concerned. The distinction is however not a sharp one, the names lignite and brown coal being used synonymously by many geologists and chemists. It was thought at the outset by the writer that the word lignite would convey a much more definite conception of the true status of these deposits and divorce the same from any association with the word "coal" which from the start the enthusiastic producers proclaimed their fuel. The classification on the basis of chemical composition makes no distinction between brown coal and lignite. In general, if the ratio of fixed carbon to volatile, combustible matter is greater than 1 and less than 5, and when the water is less than 10 per cent., the coal is classed as bituminous. When the above ratio is less than 1, and the percentage of water is more than 10, the coal is classed as lignite. The analyses in Table II, Nos. 1, 2, 5, and 6 show the ratio of fixed carbon to volatile matter to be less than 1. No. 4 is apparently a better sample of fuel than the others, but in the determination of volatile, combustible matter it was treated in a different manner from the rest, only a low red-heat from a Bunsen burner instead of the heat from

^aCited by Dumble, E. T., in Report on the Brown Coal and Lignite of Texas: Geol. Survey of Texas, 1892, p. 50.

a blast lamp being applied, as recommended by Dumble in his treatise on the Brown Coals of Texas. In this work it was thought best to subject the lignites to the strictest tests applicable to bituminous coals in order to properly ascertain their true relative value.

The percentage of water in freshly mined samples would equal the percentage lost in dry air plus the percentage retained in dry air, and is seen from Tables I and II to average above 22 per cent. Manifestly, then, these fuels come within the strict chemical classification of lignites.

Comparison with Table IV, of analyses of lignites from other localities, shows that the Dakota County lignites are fair representatitves in so far as proximate composition is concerned.

It is evident that the ratio of 1 between the fixed carbon and volatile, combustible matter is too low a limit to establish as a minimum for a fuel that shall be classed as a bituminous coal, and there are many instances in which the percentage of fixed carbon is slightly greater than that of volatile, combustible matter, and yet the material is called a lignite. Table III shows that this is the case in all the instances. These, physically, are not lignites, nor are they brown coals. They are lignitic bituminous coals that are finding a wide use for domestic and steam purposes, and in the interests of finding the relative value of the Nebraska materials they were studied in the laboratory under the same conditions.

Proximate constituents.—The percentage of moisture retained by the Nebraska lignites in dry air is not excessive, but somewhat higher than that contained in good grades of bituminous coals. The percentage of volatile, combustible matter is as high as that usually found in highly bituminous coals. The percentage of fixed carbon, chiefly upon which the value of a coal as a fuel depends, is rather low, although as high as that of some of the Texas lignites which have been recommended as fuels. The percentage of ash is higher than that of most lignites or bituminous coals. This indicates the deposition of large quantities of mineral salts from solution in the water with which the fresh lignite is saturated.

Much of this residue is calcium carbonate, which is reduced to calcium oxide after ignition of the lignite. Calcium sulphate and iron pyrites are also present to a slight extent. The iron pyrites is not thickly disseminated throughout the body of the material as in some coals, but often a concretion as large as an egg is found, upon which a great segregation of iron pyrites has taken place, thus removing it from the surrounding material. The presence of iron oxide is noticeable in the ash. The source of the sulphur is the iron pyrite and the calcium sulphate, but the percentage of sulphur is low, and this fact is worthy of note.

Assays made upon some of the iron pyrites from the lignite in Sec. 28 that was shipped to Denver, Colorado, by Mr. T. A. Black, of Sioux City, showed slight traces of gold and silver.

Ultimate constituents.—From the results in Table V as compared with those in Table II it appears that the percentages of carbon are about what might be expected in each sample. The percentage of hydrogen seems to be a little low, but if in error the same condition has been maintained throughout the three determinations. Of nitrogen there is a little more than the normal amount in the Dakota County samples, and the oxygen, by difference, is lower than might be expected in a carbonaceous material at this stage of alteration.

Calorific power.—Taking these figures as they stand, the principles upon which they are made the basis of a calculation of the calorific power of the lignite may be explained as follows: A calorie, the standard heat unit, represents the heat required to raise the temperature of 1 kilogram of water from 4° C to 5° C. Berthelot and Bunte have determined that 1 kilogram of carbon (from wood charcoal) in burning to CO₂ produces 8,140 calories. One kilogram of hydrogen in burning to water (condensed) produces 34,500 calories. One kilogram of sulphur in burning water to SO₂ produces 2,220 calories.

If we let C=percentage of carbon in the lignite

H= " hydrogen " "

O= " oxygen " "

S= " sulphur " "

The heating power will be

$$8140C + 34500 \left(H - \frac{O}{8} \right) + 2220S.$$

Substituting the values from Table V, No. 1, we have

$$8140 \times .5890 + 34500 (.0270 - .0130) + 2220 \times .0086 = 5296.55 \text{ calories per kilogram of lignite.}$$

Converting to B. T. U. per pound of lignite:

$$5296.55 \times 1.8 = 9533.8 \text{ B. T. U. per pound.}$$

The same calculation made for the Wyoming lignite coal, using values in Table V, No. 3:

$$8140 \times .7405 + 34500 (.0356 - .0189) + 2220 \times .0059 = 6616.9 \text{ calories per kilogram or } 11910.4 \text{ B. T. U. per pound of lignite. (See Table VII.)}$$

Thus in heat giving power, on the basis of total combustion of actual combustibles, the Nebraska lignites possess 80 per cent. of that of the Wyoming material, which has stood the test of extensive use and is pronounced by many of its users to be the best medium-priced fuel on the Sioux City market. Compared with the calorific power of other lignites (Table VIII), the Nebraska product averages well—even a trifle higher—also with that of German briquettes, and with that of the average bituminous coals, it affords nearly 75 per cent. of heat.

As the evaporation of the moisture contained in the fuel results in a direct loss in the calorific power, since it absorbs heat, these results would be lowered considerably if the freshly mined coal were considered.

Gas-producing capacity.—The tests along this line are of interest. It is to be regretted that the available facilities and time for the work precluded a complete determination of all the by-products of commercial value besides the coke, such as tar and ammoniacal water, and of the deleterious products, such as carbon dioxide and hydrogen sulphide, but as these were removed from the gas they do not contribute any error to the volume of purified gas produced.

The high percentage of volatile, combustible matter suggested that the Nebraska lignite should be of value as a gas coal. The experiments seem to verify this idea. Table IX gives the results of these experiments, and Table X enables a comparison to be made between these and other lignites and various standard gas coals. The Nebraska lignite is superior in yield to the other lignites and bituminous coals and is almost equal to the best cannel coals. No photometric tests could be applied, but on burning the gas in a dark room that of the lignite was found to be much inferior in luminosity to that produced by the cannel coal, Table IX, No. 3. This weak illuminating power suggests that the gas consists largely of methane and other lightly carburetted hydrocarbons and hydrogen. The gas would doubtless have to be enriched to be made a good illuminant, but for fuel purposes it should prove satisfactory. The high percentage of coke in No. 1, Table IX, is compatible with the high percentage of ash contained in the lignite and which is included in the coke.

CONCLUSIONS AS TO LIGNITES.

The tenor of this article may have seemed enthusiastic. The enthusiasm, if any, proceeds solely from the scientific standpoint. We must now consider the practical side of the subject. It is a many sided question.

The distance of the Sioux City, northeast Nebraska and the Dakota markets from a coal supply assures a steady demand for a suitable fuel. This narrows the question down to (1) the fuel value of the lignite; (2) its extent, and (3) the practicability of mining it. Chemical analysis has shown that it is of equal fuel value with the brown coals of Europe, which are widely used, and with those of Arkansas and Texas, which have been the subject of extensive investigations by the geological surveys of the United States and of Texas, with the conclusion that such lignites are of considerable value for local use and that their production should be encouraged.

The physical properties of the Dakota County lignite, however, offer a fatal objection to its use over more than a very restricted local area. The tendency to disintegrate or slack while drying precludes its being

handled or transported without great loss, except when freshly mined, and then the high percentage of water that must be freighted would not prove economical.

If it could be satisfactorily delivered in Sioux City and sold at an advantageous price it might find extensive use as a steam coal in the many factories, but for its economical combustion, especially constructed grates would be necessary. This would be a handicap to it in its competition with the coals already in use.

As for immediate fuel value in the restricted local area in which it is found, this depends largely upon the cost of production, for this region along the escarpment is still well wooded and thus provided with a cheap fuel supply. Therefore, from a business view point, at the present time the value of the lignite as a fuel is extremely doubtful.

Second, as to the extent of the lignite, the bed at the second horizon may be said to have a sufficient areal extent, but its average thickness (22 inches) is not sufficient. Beds of good coal of this thickness are sometimes profitably worked, but in comparison with the lignites of Arkansas of 3 to 6 feet, with those of Texas of 4 to 6 feet—occasionally to over 15 feet, usually occurring as outcrops, and with those of Wyoming and North Dakota of over 20 feet, it is readily seen that the Nebraska lignite cannot well be considered in the same class.

Third, the practicability of mining the lignite depends upon all the preceding features in conjunction with such local conditions as affect the actual mining operations. In this region it is certain that only such beds as are above the heavy underground water horizon, or are above the level of the river flood plain so that they may be drained without pumping, can be worked at all. The nature of the roof over a bed of lignite is of the greatest importance. In this region, where lumber is comparatively expensive, if timbering must be done to support the roof of a tunnel, that item itself would cost nearly as much as the value of the fuel removed. No satisfactory roof has yet been found over any of the Dakota County lignites. So, without going further, we have two fatal hindrances to practicable mining of the material where below the level of the flood plain: Heavy underground water, and no roof, and taking a few other sig-

nificant points into consideration, such as its doubtful fuel value, and its limited quantity, there are good business reasons why at present and for a long time in the future, the lignites of Dakota County, Nebraska, may be considered as of no commercial value as a general fuel supply.

As to their future possibilities, there are certain suggestions which offer a field for many more pages of discussion for which there is no place here, and only by considerable study can the rationality of such suggestions be assured. It has already been pointed out that Dakota County is well situated for manufacturing and distributing purposes, and the lignite localities are shown to be easily accessible by railroad spurs. One suggestion is the possibility, at some future time when economic conditions demand it, of using the lignite in the manufacture of briquettes. Another is that the bed of fire clay might be mined in connection with the lignite, the latter being used on the spot to burn fire brick from the clay. It might thus be used directly as a fuel or converted into fuel gas. Likewise it might prove a suitable fuel for a nearby cement plant.

Some of the sands of the Cretaceous are perhaps well adapted for the manufacture of glass. A gaseous fuel is best adapted to such an industry.

Thus there are qualities possessed by the lignite which, by virtue of its location and associated deposits, suggest the possibility of great industrial development in the immediate vicinity of its occurrence.

BIBLIOGRAPHY OF SIOUX CITY AUTHORS.

By FRANK H. GARVER.

The reason for compiling this list of Sioux City authors and their published works was largely one of sentiment. Early in the year the editor of the Proceedings suggested that such a compilation would have at least a local value, in that we all might be interested in knowing who among our fellow townsmen and women had entered the field of authorship either seriously or maliciously. A second reason which the writer would suggest is the thought that were local bibliographies compiled in each county of the state the work of those compiling state bibliographies would be made comparatively easy. Hence such a compilation as this may some day be of permanent value.

The plan followed has been to list all histories, novels, short stories, essays, addresses, sermons or poems, published or privately printed, in book, magazine or pamphlet form. Articles printed only in newspapers, however great their merit, have been excluded for obvious reasons. This fact accounts for the absence of several well known names. Reports, with one or two exceptions, have been excluded.

The authors included have been actual residents of the city, or persons who, though absent at the time of authorship, were yet born or raised here. It was not the intention to include the works of former residents, written after their departure, unless such persons were real products of Sioux City.

In connection with each item we have, where the data was obtainable, listed the following points: Name of author, name of work, including sub-title; name of publisher, address of same; date of publication and number of pages, together with, oftentimes, a brief word of explanation as to the character of the work.

This first attempt to enumerate the authors of Sioux City, together with their published works, is necessarily incomplete, but a beginning has been made. When the second Proceedings is published it is planned to continue the bibliography. At that time an attempt will be made to present the names and the works of all authors omitted from this first list, in addition to listing the publications of the coming year.

In the meantime any and all information which may lead to the conviction of any Sioux Cityan of the offense of authorship will be gladly received.

While compiling this brief bibliography several of the persons herein mentioned have voluntarily presented their publications to the library of the Academy. It is needless to say that these gifts have been appreciated. The Academy would gladly receive copies of all the works of all Sioux City writers for its library.

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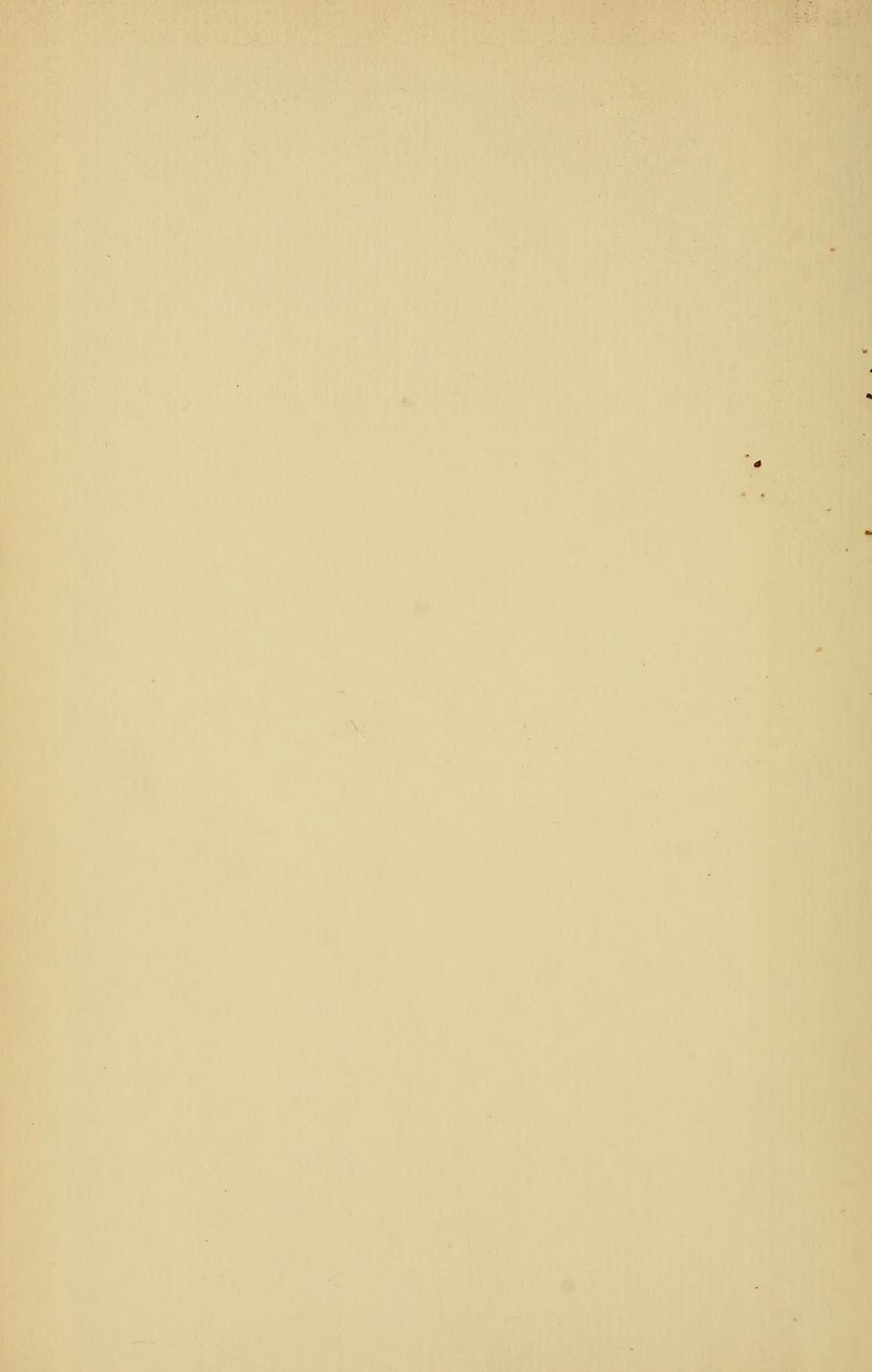
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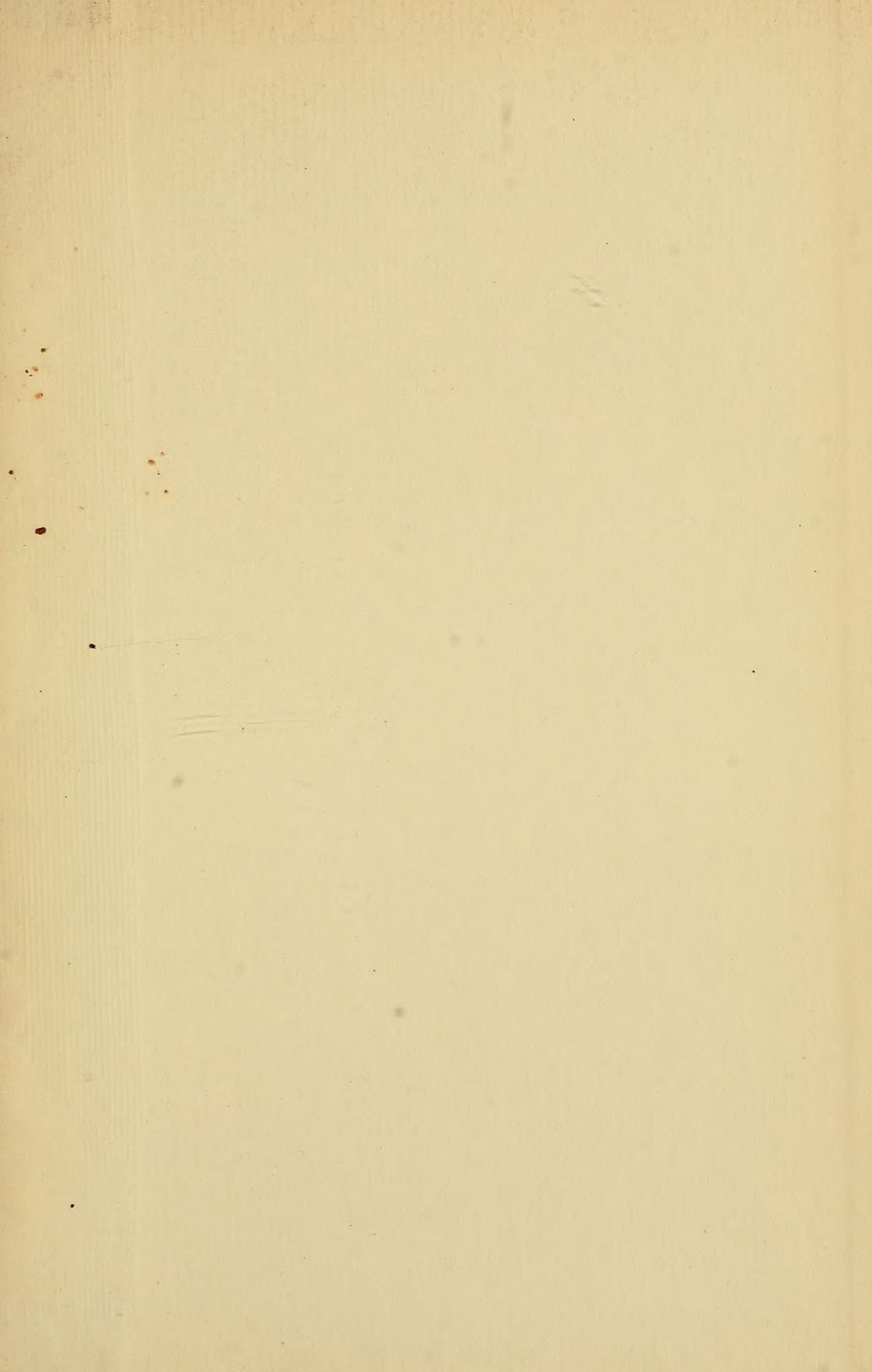
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