



State  
University  
of Iowa  
Libraries

557.77

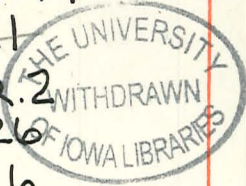
Ib.1

Ser. 2

v. 26

1916

cop. 5



IOWA,  
GEOLOGICAL SURVEY  
VOLUME XXVI

---

ANNUAL REPORT, 1915  
• WITH  
ACCOMPANYING PAPERS

---

GEORGE F. KAY, Ph. D., State Geologist  
JAMES H. LEES, Ph. D., Assistant State Geologist



DES MOINES  
Published for Iowa Geological Survey

---

Published by  
THE STATE OF IOWA  
Des Moines

---

ROBERT HENDERSON, STATE PRINTER  
J. M. JAMIESON, STATE BINDER  
1917

---

Geol  
557.77  
Ib.1.  
ser.2  
V.26  
1916  
cop 5

# Geological Survey Organization

## GEOLOGICAL BOARD

HIS EXCELLENCY, GEORGE W. CLARKE.....GOVERNOR OF IOWA  
HON. FRANK S. SHAW.....AUDITOR OF STATE  
THOMAS H. MACBRIDE.....PRESIDENT STATE UNIVERSITY OF IOWA  
RAYMOND A. PEARSON.....PRESIDENT IOWA STATE COLLEGE  
HARRY M. KELLY.....PRESIDENT IOWA ACADEMY OF SCIENCE

## ADMINISTRATIVE OFFICERS

GEORGE F. KAY.....STATE GEOLOGIST  
JAMES H. LEES.....ASSISTANT STATE GEOLOGIST  
NELLIE E. NEWMAN.....SECRETARY

## GEOLOGICAL SECTION

GEORGE F. KAY.....GEOLOGIST  
JAMES H. LEES.....GEOLOGIST, PHYSIOGRAPHIC GEOLOGY  
W. H. NORTON.....GEOLOGIST, UNDERGROUND WATERS  
S. W. BEYER.....GEOLOGIST, ECONOMIC MATERIALS  
B. SHIMEK.....GEOLOGIST, AREAL GEOLOGY  
M. F. AREY.....GEOLOGIST, AREAL GEOLOGY  
JOHN L. TILTON.....GEOLOGIST, AREAL GEOLOGY  
J. E. CARMAN.....GEOLOGIST, PLEISTOCENE GEOLOGY  
A. O. THOMAS.....GEOLOGIST, STRATIGRAPHIC GEOLOGY  
F. M. VAN TUYL.....GEOLOGIST, STRATIGRAPHIC GEOLOGY  
STUART WELLER.....CONSULTING GEOLOGIST, STRATIGRAPHIC GEOLOGY  
M. M. LEIGHTON.....GEOLOGIST, PLEISTOCENE GEOLOGY  
A. J. WILLIAMS.....GEOLOGIST, STRATIGRAPHIC GEOLOGY  
S. L. GALPIN.....GEOLOGIST, ECONOMIC GEOLOGY  
DAYTON STONER.....ZOOLOGIST, RODENTS  
M. P. SOMES.....ENTOMOLOGIST, INSECTS  
T. C. STEPHENS.....ZOOLOGIST  
B. H. BAILEY.....ZOOLOGIST

## TOPOGRAPHIC SECTION

W. H. HERRON.....GEOGRAPHER  
W. L. MILLER.....TOPOGRAPHER  
E. L. McNAIR.....TOPOGRAPHIC ENGINEER

## WATER GAGING SECTION

R. H. BOLSTER.....HYDROGRAPHIC ENGINEER  
C. HERLOFSON.....STREAM GAGER

## CONTENTS

	PAGE
ADMINISTRATIVE REPORT, BY THE DIRECTOR.....	1
MINERAL PRODUCTION FOR 1915, BY GEORGE F. KAY .....	9
RIVER WATERS IN IOWA, A PRELIMINARY REPORT, BY GEORGE A. GABRIEL .....	29
THE IOWAN DRIFT, A REVIEW OF THE EVIDENCES OF THE IOWAN STAGE OF GLACIATION, BY WM. C. ALDEN AND MORRIS M. LEIGHTON.....	49
PLEISTOCENE DEPOSITS BETWEEN MANILLA IN CRAWFORD COUNTY AND COON RAPIDS IN CARROLL COUNTY, IOWA, BY GEORGE F. KAY.....	213
THE PLEISTOCENE GEOLOGY OF NORTHWESTERN IOWA, BY J. ERNEST CARMAN....	233

## ILLUSTRATIONS

PLATES	PAGE
I. Topographic map of a portion of the dissected Kansan drift plain, to face .....	60
II. Topographic map of a portion of the Iowan drift plain, to face....	62
III. View of dissected Kansan drift plain in northeastern Washington county, Iowa .....	63
IV. View of eroded Kansan drift plain in Union county, Iowa.....	65
V. A. and B. Compared topographies of the typical Iowan drift plain and the dissected Kansan drift plain.....	69
VI. A. and B. Compared topographies of the typical Iowan drift plain and the dissected Kansan drift plain.....	75
VII. Drift in Johnson county, Iowa, near Iowa river.....	119
VIII. A. Glacial bowlder in Floyd county, Iowa. B. Exposure of loess near Bertram, Iowa.....	123
IX. Loess ridges bordering North Liberty plain.....	147
X. Topographic map of a portion of the Iowan drift plain showing paha, to face .....	150
XI. View of drift exposed in Chicago, Milwaukee & St. Paul railway southwest of Rhodes, Iowa .....	159
XII. View of eroded Illinoian drift plain in Rock Island county, Illinois	165
XIII. Topographic map of a portion of the eroded Illinoian drift plain in Fulton county, Illinois, to face.....	168
XIV. Map of Iowa showing drift sheets .....	Pocket
XV. Map of the Pleistocene deposits of Northwestern Iowa.....	Pocket
XVI. Map of parts of Freeman and Logan townships of eastern Clay county .....	263
XVII. Map of southwestern Minnesota and eastern South Dakota showing the course of the Altamont Moraine.....	289
XVIII. Map of the Sioux Falls-Canton region.....	299
XIX. Map of Iowa showing the drainage basins.....	309
XX. Profiles of railways crossing northwestern Iowa, to face.....	310
XXI. Lehatchka and Pattengill pit near Rock Rapids, Lyon county, Iowa	383
XXII. City gravel pit at Sibley, Osceola county, Iowa.....	387
XXIII. Chicago, Rock Island and Pacific Railway pit at Sibley.....	389
XXIV. Gilleas pit near Cherokee, Cherokee county, Iowa.....	399
XXV. Map of central Cherokee county showing location of exposures of Nebraskan till .....	417
FIGURES	PAGE
1. Northeast-southwest section near Anamosa and Monticello, Jones county, Iowa .....	68
2. Diagram of percentages of cuts and borings showing different depths of leaching of the uppermost till at various places in the area of the Iowan drift .....	82
3. Diagram of valley slope in Kansan area showing relations of the leached zone to the topography.....	85
4. Diagram of drift exposed in railway cut west of Vining, Tama county, Iowa .....	86
5. Diagram showing relations of super-Kansan gumbo and loess to remnants of the original Kansan drift plain .....	89

FIGURES	PAGE
6. Diagrammatic section across ridge south of Langworthy, Jones county, Iowa .....	93
7. Diagram of drift exposed in railway cut northeast of Gladstone, Tama county, Iowa .....	106
8. Diagram of drift exposed in electric railway cut northwest of Marion, Linn county, Iowa .....	115
9. Diagram of drift exposed in railway cut east of Martelle, Jones county, Iowa .....	116
10. Diagram of drift exposed in electric railway cut northwest of Iowa City, near Iowa river .....	117
11. Diagram showing the distribution of big granite boulders as related to probable directions of movement of ice sheets in Iowa.....	122
12. Diagram showing terraces on Upper Iowa river near Freeport, Winneshek county, Iowa .....	131
13. Diagram of drift, sand, and loess exposed in electric railway cut near Bertram, Linn county, Iowa, showing relations to an included boulder .....	153
14. Diagram of drift exposed in railway cut east of Rhodes, Marshall county, Iowa .....	191
15. Diagram of deposits exposed in railway cut near Oelwein, Fayette county, Iowa .....	207
16. Outline map of Iowa showing location of Crawford and Carroll counties, Iowa .....	215
17. Sketch map of parts of Carroll and Crawford counties showing route of the Chicago, Milwaukee and St. Paul railway.....	216
18. Railroad cut on Chicago, Milwaukee and St. Paul railway, west of Templeton, Carroll county .....	220
19. Divide cut between Aspinwall and Manilla, Crawford county.....	222
20. Railroad cut, known as Green's cut, on the Chicago, Milwaukee and St. Paul railway west of Dedham, Carroll county.....	223
21. Railroad cut on the Chicago, Milwaukee and St. Paul railway two miles east of Dedham .....	224
22. Railroad cut west of Manning, Carroll county.....	226
23. Railroad cut one mile east of Aspinwall, Crawford county .....	228
24. Railroad cut east of Templeton, Carroll county.....	230
25. Outline map of northwestern Iowa showing counties and principal towns .....	239
26. Map showing the extent of the Des Moines and Dakota lobes of the Wisconsin ice-sheet .....	243
27. Map of northwestern Iowa made by compiling the Pleistocene maps in the county reports .....	246
28. Map by Professor Macbride showing the location of the Altamont moraine in northwestern Iowa.....	249
29. Sketch map of part of Barnes township, Buena Vista county, Iowa, showing immature drainage on the Wisconsin drift.....	262
30. Profile across the Little Sioux valley in Herdland township, Clay county .....	265
31. Map of the region around Milford, Dickinson county.....	273



## LIST OF ILLUSTRATIONS

vii

FIGURES	PAGE
32. Wisconsin ground moraine in Freeman township, Clay county . . . . .	274
33. Morainic topography at north end of West Okoboji lake, Dickinson county . . . . .	277
34. The Little Sioux valley, looking west, in Okoboji township, Dickinson county . . . . .	278
35. Ocheyedan Mound, seen from the southwest, Ocheyedan township, Osceola county . . . . .	286
36. Map of part of Nobles county, Minnesota . . . . .	287
37. Map of part of eastern South Dakota and adjoining parts of Iowa and Minnesota . . . . .	295
38. View across the Little Sioux valley at Sioux Rapids . . . . .	315
39. View across the level Kansan drift-plain northwest of Hartley, north-eastern O'Brien county . . . . .	324
40. View of the Kansan drift topography along Broken Kettle creek, western Plymouth county . . . . .	326
41. Topography of the loess covered region north of Turin, Monona county	327
42. View showing the rugged topography in the lower course of Brooke creek, northwestern Buena Vista county . . . . .	328
43. Cross profile of a tributary of the Little Sioux . . . . .	329
44. Sketch of a road-cut, Washington township, Plymouth county . . . . .	345
45. Sketch of exposure showing thinning of loess toward crest of a slope, Little Sioux valley east of Cherokee . . . . .	346
46. View of road-cut on east slope of Little Sioux valley east of Cherokee	347
47. Sketch showing relation of loess and loesslike clay to underlying till and gravel, Cherokee township, Cherokee county . . . . .	348
48. Sketches showing cross-bedding and basin structure of sand in a pit in Liberty township, O'Brien county . . . . .	365
49. Cross section of a pit in Liberty township, O'Brien county . . . . .	366
50. Gravel hill on Willow creek, Liberty township, O'Brien county . . . . .	368
51. Columnar sections of exposures in bluff of Mill creek, Cherokee township, Cherokee county . . . . .	374
52. Contour map showing location of gravel pits in section 14, Cherokee township, Cherokee county . . . . .	378
53. Sketch of exposure in Sibley, Osceola county . . . . .	391
54. Profiles along Little Sioux valley from Milford to Spencer . . . . .	396
55. Sketch showing altitude of benches along Little Sioux valley from the north line of Cherokee county to Anthon, Woodbury county . . . . .	401
56. Profiles along Waterman creek valley from Hartley to its mouth . . . . .	403
57. Profiles along Murry creek valley from Sutherland to its mouth . . . . .	403
58. Profiles along Mill creek valley from central O'Brien county to its mouth . . . . .	404
59. Map of part of Cherokee county showing original extent of aggraded flat of Mill creek . . . . .	405
60. A grooved and striated contact plane between the Nebraskan and the Kansan tills . . . . .	425
61. An exposure of Sioux quartzite at Jasper Pool, Lyon county . . . . .	432
62. Geologic section from the northwest corner of Iowa to Sioux City . . . . .	433
63. Columnar sections of deep wells at Sanborn, Cherokee and Holstein . . . . .	435

