

## INDEX.

- Ackley well, 219.  
    Record, 219.
- Adams, F. D., 87.
- Adequacy of artesian supply, 407.
- Aftonian beds, 464.
- Aftonian stage, 465.
- Afton Junction, 463.
- Albertan, 464.
- Albertan stage, 465.
- Algona well, 196.  
    Record, 196.
- Algonkian, 139, 179, 203, 240.  
    Areas, 177.
- Allamakee county, 21, 41.  
    Mines in, 53.
- Altamont moraine, 348, 436, 437.
- Alteration of diabase, 98.
- Amana well, 286, 407.  
    Analysis, 286.  
    Record, 287.
- Ames anticline, 236.  
    Well, 252.
- Ammonia, 358.
- Analyses of artesian waters—  
    Amana well, 286.  
    Belle Plaine well, 370.  
    Boone well, 254.  
    Britt well, 195.  
    Calmar well, 192.  
    Cedar Rapids well, 248.  
    Centerville well, 327.  
    Clinton well, 244.  
    Colfax wells, 293.  
    Council Bluffs well, 340.  
    Davenport wells, 274.  
    Des Moines well, 299.  
    Dubuque wells, 209.  
    Dunlap well, 257.  
    Emmetsburg well, 196.  
    Fort Madison well, 321.  
    Glenwood well, 342.  
    Grinnell well, 288.  
    Homestead well, 283.  
    Jefferson well, 256.  
    Keokuk wells, 324.
- Luzerne well, 370.  
    Manchester well, 215.  
    Mason City well, 194.  
    McGregor well, 187.  
    Monticello well, 266.  
    Monona well, 188.  
    Mount Pleasant well, 320.  
    Nevada well, 250.  
    Ottumwa well, 318.  
    Sabula well, 259.  
    Sanborn well, 198.  
    Sioux City well, 225.  
    Vinton well, 267.  
    Washington well, 304.  
    Webster City well, 220.  
    West Bend well, 230.  
    West Liberty well, 281.  
    Wilton well, 280.
- Analysis of drift waters, 369.  
    Erosion curves, 449.  
    River waters of Iowa, 366.  
    St. Peter sandstone, 21.  
    Waters of shallow wells,  
        367.
- Anamosa well, 262.  
    Cost of, 412.  
    Record, 263.
- Anticline, Ames, 236.
- Apatite, 96.
- Aragonite, 29.
- Archean rocks, 58.
- Archibald, J., 262.
- Archimedes screw, 47.
- Area of supply, 151.
- Argentine, 29, 31.
- Arizona, 14.
- Art of drilling, 421.
- Artesian areas, basin form of, 134.  
    Illustrations of, 134.
- Artesian basin, lacustrine, 134.
- Artesian conditions, Clinton - Dunlap  
    section, 240.  
    Davenport - Des  
    Moines section,  
    271.

- Southeastern Ia., 303.  
 Southwestern Ia., 334.  
 Artesian field of Iowa, 136.  
   Area of supply, 151.  
   Conditions of supply, 153.  
   Rainfall, 155.  
 Artesian flow, 169.  
 Artesian supply, adequacy, 407.  
   Dubuque - Sioux City section, 206.  
   Purity of, 413.  
 Artesian supply of Iowa field, 151.  
 Artesian waters as a boiler supply, 400.  
   As a public supply, 407.  
 Artesian waters, classification, 371.  
   Industrial qualities, 399.  
   Ingredients, 357.  
   Medicinal properties, 386.  
   Qualities, 386.  
   Wholesomeness, 390.  
 Artesian wells, cost, 411.  
   Definition, 122.  
   Early hypotheses, 127.  
   Hydrostatic theory, 130.  
   Illustration of structure, 130.  
   In glacial drift, 347.  
   Requisite conditions, 128.  
   Rock pressure theory, 132.  
   Theories of, 126.  
   Total output in Iowa, 158.  
 Artesian wells of Iowa, 113.  
 Artois, province of, 122.  
 Ascension theory, 62.  
 Assistants, 4.  
 Associated minerals, 28.  
 Atlantic Coal & Mining Co., boring, 336.  
 Atlantic well, 336.  
   Record, 336.  
 Atlee well, 321.  
 A., T. & S. Fe Ry. Co. well, 321.  
 Augite, 88.  
   Alteration of, 91.  
 Austria, 13.  
**Babcock, T. F.**, 192.  
**Bain, H. F.**, 122, 305, 314, 326, 429.  
 Bank and Insurance Building Co. well, 208, 405, 406.  
   Analysis, 209.  
   Sanitary analysis, 210.  
**Barnes, C. M.**, 281.  
**Barrois, Ch.**, 85.  
 Basal sandstone, 140, 206, 270.  
**Bagley, W. S.**, 82.  
**Beach, Horace**, 185.  
**Beach, Jas.**, 208.  
 Beach phenomena, 77.  
**Bearce, C. L.**, 202.  
 Beaver creek, 460.  
**Becke, F.**, 90.  
**Becker, G. F.**, 89.  
 Belgium, 13.  
 Belle Plaine well, 350.  
   Analysis, 370.  
 Berwick gravel pits, 444.  
**Beyer, S. W.**, 69, 122, 434.  
 Bibliography, 426.  
 Biotite, 95.  
 Black Hawk purchase, 16.  
 Black jack, 27.  
**Blair, A. S.**, 214.  
**Blake, W. P.**, 60.  
**Bleiberg, I.**, 13.  
**Boeckh, E.**, 200.  
 Boiler scale, removal of, 403.  
**Boomer, W. M.**, 199.  
 Boone county, 433, 436.  
 Boone well, 252, 380, 381, 407.  
   Analysis, 254.  
   Record, 253.  
 Boring at Lincoln, Nebraska, 330.  
**Briggs, G. H.**, 250.  
 Britt well, 195, 406.  
   Analysis, 195.  
**Brodie, Dr. Benj.**, 396.  
 Broken Hill mines, 14.  
 Brunskill furnace, 17.  
 Buchanan stage, 465.  
 Buena Vista mines, 51.  
 Butchers' Association well, 208.  
**Calamine**, 27.  
 Calcic magnesian alkaline water, 373.  
 Calcic waters, 387.  
 Calcite, 29.  
 Calcium sulphate, 402.  
 California, 14.  
**Call, R. E.**, 168, 332, 347, 437, 446.  
 Calmar well, 191, 407.  
   Analysis, 192.  
   Record, 191.  
**Calvin, S.**, 56, 122, 305, 434, 463, 465.  
 Camp creek, 471.  
 Cap rock, 38.  
 Capitol Hill, 442.  
 Carbonated waters, 390.  
 Carboniferous, 268.  
 Carbon dioxide, 361.  
 Carroll county, 433.  
 Cartagena, 13.  
**Carton, J. A.**, 195, 219.  
 Casing of wells, 425.  
 Cedar Rapids wells, 246, 406.  
   Algonkian in, 140.  
   Water Works Co. well, 246.  
   Y. M. C. A. well, 246.

- Analysis, 248.  
Cost of, 412.  
Centerville wells, 326, 380, 381, 405, 406, 407.  
Analysis, 327.  
Cereussite, 26, 56.  
Chalk, 75.  
Chalybeate waters, 385, 390.  
Chamberlin, T. C., 42, 59, 118, 172, 352, 434, 467, 469.  
Charles, J. H., 224.  
Chemical composition of diabase, 99.  
Chemistry of artesian waters, 353.  
Cherokee well, 232.  
Record, 232.  
Chert, 20.  
Chief sources of lead and zinc, 13.  
Cholera, mortality from, 415.  
Circulation of water, 154.  
Clarinda well, 339.  
Classification of artesian waters, 371.  
Clayton county mines, 51.  
Clinton, J. W., 266.  
Clinton-Dunlap section, 235.  
Clinton water, 375.  
Clinton wells, 241, 378, 405, 406.  
Analysis, 244.  
C. & N.-W. Ry. Co. well, 241.  
Lamb & Son well, 241.  
Cost of, 412.  
Paper Co. well, 241.  
Record, 245.  
Water Works Co. well, 241.  
Analysis, 244.  
C., M. & St. P. Ry. Co. well, 340.  
C. & N.-W. Ry. Co. well, Clinton, 241.  
Coad, N. G. O., 199.  
Coal measures, 203, 236, 330.  
Thickness of, 329.  
Colfax wells, 293, 381.  
Analyses, 293.  
Frye's Hotel well, 293.  
Hotel Colfax well, 293, 385.  
Mason House well, 293.  
Mineral Water Co. well, 293.  
M. R. Springs, 381, 385, 407.  
Analysis, 293.  
O. M. C. Spring, 381, 385.  
Analysis, 293.  
Colorado, 14.  
Columbia Straw Paper Co. well, 321, 407.  
Analysis, 321.  
Record, 322.  
Concave curve, 457.  
Conditions of supply, 153.  
Coon Rapids, 437.  
Consumption of water, 409.  
Contracts, 418.  
Correlation of Kansan drift, 461.  
Corson, S. D., 112.  
Cosgreaves, C. A., 193.  
Cost of artesian wells, 411.  
Council Bluffs wells, 340, 378, 405, 406.  
Analysis, 340.  
C., M. & St. P. Ry. Co. well, 340.  
School for the Deaf well, 340.  
Analysis, 340.  
Cresco well, 201.  
Cretaceous, 150, 183.  
Crevice openings, 38.  
Crevices, 37.  
Filling of, 62.  
Formation of, 61.  
Crocker, 441.  
Crofts, G. M., 322.  
Croton water shed, New York, 156.  
Crystal Ice Co. well, 272, 378, 381, 385, 406.  
Analysis, 274.  
Culver, G. E., 81.  
Curve of normal erosion, 457.  
Cushing well, 208, 406.  
Analysis, 209.  
Dallas county, 433.  
Dana, J. D., 32.  
Davenport-Des Moines section, 268.  
Davenport, W. C., 224.  
Davenport wells, 272, 381.  
Analyses, 274.  
City Park well, 272.  
Crystal Ice Co. well, 272, 378, 381, 385, 406.  
Analysis, 274.  
Gas Co. well, 272.  
Glucose Factory well, 272, 281, 406.  
Analysis, 275.  
Record, 279.  
Kimball House well, 272, 405.  
Malt and Grain Co. well, 272.  
Records, 277.  
Schmidt Bldg. well, 272.  
Tri-City Packing & Provision Co. well, 272.  
Witts Bottling Wks. well, 272, 378, 381, 385, 406.  
Analysis, 274.  
Woolen Mills well, 272.  
Dean, F. M., 255.  
Dean, Seth, 336, 425.

- Death rate from typhoid fever, 415.  
 Deep wells grouped, 176.  
 Definition of terms, 434.  
 Des Moines lobe, 434, 436.  
     Valley, 460.  
 Des Moines wells, 294.  
     Analysis, 299.  
     Greenwood P'k well,  
     294.  
     Record, 295.  
     Polk County Court  
     House well, 299,  
     380, 381.  
     Analysis, 299.  
     Record, 295.  
 Devonian, 148, 183, 204, 237, 269, 300.  
 Dexter & Hird Co., 66.  
 Diabase, 79.  
     Alteration, 98.  
     Chemical composition, 98.  
     Structure, 100.  
     Weathering, 81.  
 Dissolved gases, 357.  
     Solids, 363.  
 Dike, C. T., 193.  
 Dolomite, 36.  
 Drift artesiains, 347.  
     Border, 440.  
     Series, classification of, 464.  
     Waters, analysis of, 369.  
 Drift-plain topography, 437.  
 Driftless area, 19.  
 Drilling, art of, 421.  
 Dry bone, 27.  
 Dubuque, Julien, 15.  
     Lead Mining Co., 28, 48, 65.  
     Lead and zinc are, 43.  
     Water, 375.  
     Zinc & Lead Mining Co., 65.  
 Dubuque-Sioux City section, 202.  
 Dubuque wells, 208.  
     Analyses, 209.  
     Bank & Ins. Building  
     Co. well, 208, 405, 406.  
     Analysis, 209.  
     Sanitary analysis,  
     210.  
     Butchers' Association  
     well, 208.  
     Cushing well, 208, 406.  
     Analysis, 209.  
     Hemmi well, 208.  
     Julien House well, 208.  
     Record, 213.  
     Linwood Cem'ry wells,  
     208.  
     Lorimer House well,  
     208.  
     Malting Co. well, 208,  
     406.  
     Analysis, 209.  
     Packing & Provision  
     Co. well, 208.  
     Records, 211.  
     Schmidt Brewery well,  
     208, 272.  
     Record, 212.  
     Steam Heat'g Co. well,  
     208, 406.  
     Analysis, 209.  
     Record, 211.  
     Water Works Co. well,  
     208.  
 Dunlap well, 257, 381, 407.  
     Analysis, 257.  
     Record, 257.  
 Durango zinc mine, 46.  
 Eagle Point, 22.  
 Earhart, R., 265.  
 Emmetsburg well, 196, 406.  
     Analysis, 196.  
     Record, 197.  
 Emmons, S. F., 63.  
 Epsom salt, 389.  
 Erosion curves, analysis of, 449.  
 Eruption rocks, petrographic descrip-  
     tion of, 82.  
 Evaporation of rainfall, 157.  
 Ewing Diggings, 45.  
 Fair Ground Ridge, 442.  
 Falls of St. Anthony, 475.  
 Farmington well, 320.  
 Farnsworth, P. J., 241.  
 Feldspar, 83.  
     Alteration of, 87.  
 Fellows, A. R., 266.  
 Filling of the crevices, 62.  
 Fissures in Galena limestone, 22, 30.  
 Float lead in Allamakee county, 57.  
 Forest bed, 444.  
 Formation of crevices, 61.  
 Ft. Madison wells, 321, 381.  
     Analysis, 321.  
     Atlee wells, 321.  
     A., T. & S. Fe Ry.  
     Co. well, 321.  
     Columbia Straw Pa-  
     per Co. well, 321,  
     407.  
     Analysis, 321  
     Record, 322.  
 Fossils in loess, 447.  
 Fox, C. J., 246.  
 France, 14.  
 Frye's Hotel well, 293.  
 Furnace, cupola, 17.  
     Hearth, first in Iowa, 17.  
 Gaass, J. D., 310.  
 Galena, 25.  
     Limestone, 19, 22.

- Galena-Trenton, 145, 182, 205  
 Garner, J. W., 319.  
 Gary moraine, 436, 437.  
 Gas Co. well, Davenport, 272.  
 Gaseous waters, 372.  
 Gates, A. G., 292.  
 Gates, W., 250.  
 Geological distribution of lead and zinc, 24.  
     Formations, 74.  
     Structure Iowa artesian field, 137.  
 German Empire, 13.  
 Giesler, J. L., 280.  
 Gilbert, G. K., 76, 475.  
 Gilman, H. A., 320.  
 Glacial period, 435.  
 Glauber's salt, 389.  
 Glenwood well, 340, 378, 385, 388, 405, 406.  
     Analysis, 342.  
     Cost of, 413.  
     Record, 343.  
 Glucose Factory well, 272, 381, 406.  
     Analysis, 275.  
     Record, 279.  
 Goenisch, F. Z., 322.  
 Goitre, 393.  
 Gordon, C. H., 323.  
 Gould, C., 261.  
 Gravel trains, 442.  
 Great Britain, 13.  
 Greece, 13.  
 Greene county, 433.  
 Greenwood Park, 446.  
     Well, 294.  
     Record, 295.  
 Grinnell well, 287, 381, 407.  
     Analysis, 288.  
     Record, 289.  
 Ground water, 153.  
 Guthrie county, 433.  
 Guttenburg, 42.  
     Mines, 25, 52.  
 Gypsum, 36, 301, 380.  
 Hall, C. W., 195.  
 Hall, J., 111, 434.  
 Hall, M. E., 255.  
 Hancock county, 436.  
 Hardness of water, 377, 391.  
 Harpers Ferry well, 201.  
 Harris, Sherland, 193.  
 Hartz, 13.  
 Hathorn Springs, Saratoga, 378.  
 Hay, Robert, 132.  
 Hayden, F. V., 111.  
 Hayes, G. B., 266.  
 Haynes, E. C., 326.  
 Hawes, G. W., 84.  
 Healthfulness of hard water, 397.  
 Hemmi well, 208.  
 Hetherington, H. S., 208.  
 Highland Park, 443.  
 Highlands, S. M., 241.  
 Hird, James & Son, 66.  
 History of lead and zinc mining in Iowa, 14.  
 Holmes mine, 52.  
 Holstein well, 222.  
     Cost of, 412.  
     Record, 223.  
 Homestead well, 283, 372, 407.  
     Analysis, 283.  
     Record, 284.  
 Hornblende, 96.  
 Hotel Colfax well, 293, 385.  
 Howe, Alexander & Sellers Co. mine, 50, 66.  
 Hubinger & Co. wells, 323.  
     Record, 325.  
 Hubinger Tile Works well, 323.  
 Hull well, 199, 381.  
     Algonkian in, 140.  
 Huronian quartzites, 109.  
 Hydrogen sulphide, 361.  
 Idaho, 14.  
 Illinois, 14.  
     Drift, 464.  
     Stage, 465.  
 Immature drainage, 453.  
 Impure water, deaths from, 415.  
 Incrusting solids, 405.  
 Interglacial stages, 470.  
 Iowa, lead in, 14.  
 Iowa artesian field, 136.  
     Aquifers, 170.  
     Conditions of transmission, 165.  
     Containing beds, 171.  
     Fountain head, 173.  
     Reservoir, 169.  
 Iowan drift, 462.  
     Stage, 465.  
 Irving, R. D., 78, 109, 111.  
 Italy, 14.  
 Jasper county, 433.  
 Jefferson well, 255, 380, 405, 406.  
     Analysis, 256.  
     Record, 256.  
 Johnson, Dr. W. M., 398.  
 Jointed structure in diabase, 79.  
 Joints, 76.  
 Jones, A. J., 287.  
 Jordan sandstone, 141, 206.  
 Julien House well, 208.  
     Record, 213.  
 Kames, 440.  
 Kansan drift, characteristics, 447.  
     Correlation, 461.  
     Topography, 449.  
 Kansan stage, 465.  
 Kansas, 14.

- Kellogg, J. J., 304.  
 Kelsey kame, 441.  
 Kemling's spar cave, 30, 32, 34  
 Kemp, J. F., 63.  
 Keokuk Pickle Co. well, 323, 381, 407.  
     Analysis, 324.  
 Keokuk Poultry Co. well, 323, 381, 407.  
     Analysis, 324.  
     Record, 324.  
 Keokuk wells, 322.  
     Analyses, 324.  
     City Park well, 322.  
     Hubinger & Co. wells,  
         323.  
         Record, 325.  
     Hubinger Tile Works  
         well, 323.  
     Keokuk Pickle Co. well.  
         323, 381, 407.  
         Analysis, 324.  
     Keokuk Poultry Co.  
         well, 323, 381, 407.  
         Analysis, 324.  
         Record, 324.  
     Kertz Brewery well, 323.  
         Records, 324.  
 Keosauqua well, 320.  
 Kerrick mine, 50.  
 Kertz Brewery well, 323.  
 Kettle moraine, 435.  
 Keyes, C. R., 326.  
 Keyes knob, 74.  
 Kimball House well, 272, 405.  
 Kinderhook, 149, 204.  
 Knowlton, W. H., 208.  
  
 Lacustrine artesian basins, 134.  
 Lamb & Son well, 241.  
     Cost of, 241.  
 Langworthy crevice, 15.  
 Lansing, 20.  
     Lead mine, 26, 28, 41, 55.  
     Mining & Smelting Co., 53, 65.  
     Well, 200.  
         Record, 200.  
 Lateral secretion theory, 62.  
 Laurium, 13.  
 Lead and zinc, chief sources, 13.  
     Deposits of Iowa, 13.  
     Geological distribution,  
         24.  
     Mode of occurrence, 23.  
     Ores of, 25.  
     Original source, 58.  
 Leech, Dr., 395.  
 Legislation, first in Iowa, 16.  
 Lehman, O., 86.  
 Le Mars well, 232.  
     Record, 232.  
     Algonkian at, 140.  
 Leonard, A. G., 9, 300, 434.  
 Le Sueur, 14.  
 Level range, 48.  
  
 Leverett, F., 321, 464, 467.  
 Levy, A., 87.  
 Lewis, C., 467.  
 Lewis, St. Clair, 304.  
 Limonite, 29.  
 Linares lead deposits, 13.  
 Lincoln, Nebraska, boring at, 330.  
 Lindin's spar cave, 31.  
*Lingula quadrata*, 23.  
 Linwood Cemetery wells, 208.  
 List of mining companies, 65.  
 Little Maquoketa, 22.  
 Localization of the deposits, 58.  
 Loess, age of, 461.  
     Relation of, to Wisconsin drift,  
         414.  
 London artesian basin, 135.  
 Lonsdale, E. H., 332.  
 Lorimer House well, 208.  
 Lorimer, Peter, 17.  
 Lovell, G. W., 265.  
 Lower Oneota, 142.  
 Luzerne well, analysis, 370.  
  
 MacMurray, L. A., 220.  
 Magee, D. A., 224.  
 Magresian series, 270, 302  
 Magnesian waters, 387.  
 Magnetite, 97.  
 Malting Co. well, 208, 406.  
     Analysis, 209.  
 Malt & Grain Co. well, 272.  
 Manchester well, 214.  
     Analysis, 215  
     Cost of, 413.  
     Record, 217.  
 Maquoketa, 19, 23, 147, 182, 205, 239, 270,  
     301.  
 Marcasite, 28.  
 Marshall county, 433.  
 Marshalltown, Kinderhook at, 149.  
     Silurian at, 238.  
     Well, 249  
         Record, 249  
 Market of the ores, 66.  
 Mason City wells, 193, 406, 411.  
     Analysis, 194  
     Record, 194.  
 Mason House well, 293.  
 Mathews, E. B., 112.  
 Maximum discharge, methods of ob-  
     taining, 410.  
 McBride, W. S., 249.  
 McCoy, B., 308.  
 McGee, W. J., 142, 436, 446, 459, 467.  
 McGowan crevice, 48.  
 McGregor, 21.  
 McGregor-Fairview section, 177.  
     Artesian supply, 184.  
 McGregor Well No. 2, 405.  
     Wells, 185, 381, 406, 407.  
     Analysis, 187.  
     Record, 187

- McNulty mine, 18.  
 Medicinal properties of artesian water, 386.  
 Merrill, G. P., 35.  
 Metal-bearing solutions, 62.  
 Meteoric water, 153.  
 Methods of working the mines, 65.  
 Meyer, J., 292.  
 Miers, D., 257.  
 Miller, W. A., 397.  
 Mineral creek, 56.  
     Point, Wis., 66.  
     Ridge, 436.  
     Water Co. well, 293.  
 Minzes, G., 210.  
 Mississippian, 149, 183, 237, 333.  
 Missouri, 14.  
     Lead and zinc deposits, 24.  
     Ore deposits, 59.  
 Mitchell & Lynde's Building well, record of, 279.  
 Mode of occurrence, lead and zinc, 23.  
     Iowa ores, 36.  
 Modena, flowing wells at, 123.  
 Moershel, Wm., 283.  
 Moffit, J., 261.  
 Moline Paper Co. well, record of, 279.  
 Monoclinial artesian area, 136.  
     Fields, 135.  
 Monona well, 188, 406.  
     Analysis, 188.  
 Montana, 14.  
 Monticello, water, 375.  
     Well, 265, 406.  
     Analysis, 266.  
     Record, 266.  
 Morrell & Co. well, 317.  
 Morrison, B. S., 287.  
 Mortality from impure water, 415.  
 Mounds, 19.  
 Mount Clara well, 322.  
     Record, 322.  
 Mount Pleasant well, 320.  
     Analysis, 320.  
     Record, 320.  
 M. R. Springs, Colfax, 381, 385, 407.  
     Analysis, 293.  
 Mount Vernon, Silurian at, 238.  
 Nassau, 13.  
 Newell, F. H., 422.  
 New Galena mines, 57.  
 New Hampton well, 192.  
     Record, 192.  
 New Mexico, 14.  
 New Richmond sandstone, 142.  
 New South Wales, 14.  
 Newton well, 292.  
 Nevada, 14.  
     Well, 250, 385, 407.  
     Analysis, 250.  
     Record, 251.  
 New Jersey, 14.  
 Niagara, 19, 23, 182.  
     Falls, 475.  
 Nichols, W. R., 398.  
 Nicolett, J. N., 434.  
 Niobrara, 74.  
 Nobleton, 471.  
 Norris, H. W., 287.  
 Norton, W. H., 115.  
 Oake, W. R., 259.  
 Oak Park, 447.  
 Ocher, 29.  
 Oelwein, drift at, 466.  
 Ogden well, 255.  
 Ogston, Dr. Francis, 395.  
 Olivine, 93.  
     Alteration products, 94.  
     Diabase, 82.  
 O. M. C. Spring, Colfax, 381, 385.  
     Analysis, 293  
 Oneota, 181, 206.  
     Limestone, 20.  
     Lead in, 42, 54, 56.  
 Ore bodies, 42.  
     Localization of, 58.  
 Ore deposits, origin, 57.  
     Upper Mississippi region, 24.  
 Ores of lead and zinc, 25.  
 Original source of the lead and zinc, 58.  
 Origin of ore deposits, 57.  
 Osceola well, 339.  
 Oskaloosa well, 308.  
     Record, 309.  
 Ottumwa wells, 317, 380, 406.  
     Analysis, 318.  
     Artesian Well Co. well, 317.  
     Morrell & Co. well, 319.  
     Record, 319  
 Output of Iowa mines, 66.  
 Overwash plains, 442.  
 Owen, D. D., 16, 434.  
 Oxygen, 358.  
 Packing & Provision Co well, 208.  
 Palisades, 72, 102.  
 Panora, 441, 443.  
 Paper Co. well, 241.  
 Parker, E. A. D., 224.  
 Parkes, Dr. E. A., 394, 396.  
 Parkes, Dr. L. C., 394.  
 Patrick, G. E., 52.  
 Pease, I. L., 257.  
 Pella well, 310.  
     Record, 311.  
 Percolation increased by pressure, 166.  
 Permeable stratum, 165.  
 Philbrook, B. F., 257.  
 Phole Air Lift, 194, 411.  
 Phreatic water, 154.  
 Pictured Rocks, 21.  
 Polk City gravel pits, 444.





- Sardinia, 14.  
 Satin spar, 29, 31.  
 Saxony, 13.  
 Saylorville well, 300.  
 Saylor, well sections near, 447.  
 Scale-forming minerals, 400.  
 Schieferspath, 31.  
 Schmidt Brewery well, 208, 272.  
     Record, 212.  
 Schmidt Building well, 272.  
 School for the Deaf well, 340.  
     Analysis, 340.  
 Schuster, Max, 84.  
 Selenite, 36.  
 Selenitic waters, 380, 389.  
 Shallow wells, analysis of, 367.  
 Sherrill mound, 19.  
 Sigourney well, 305.  
     Record, 306.  
 Silurian, 147, 205, 238, 269, 301.  
     Sea, 58.  
 Silver, 26.  
 Simpson furnace, 17.  
 Sinsinawa mound, 19.  
 Sioux City well, 224, 372, 381, 407.  
     Algonkian in, 140.  
     Analysis, 225.  
     Record, 226.  
     Falls, 74.  
     Quartzite, area of, 71.  
         And certain related  
         rocks, 69.  
         Erosion in, 73.  
 Slate, origin of, 109.  
     Petrographic description, 105.  
 Slates, 77.  
 Smelting, early methods, 17.  
 Smith, E. B., 360.  
 Smithsonite, 26.  
 Sodic alkaline waters, 377, 388.  
     Magnesic sulphated waters, 383.  
     Sulphated waters, 384.  
 Soper, E. B., 196.  
 Southeastern Iowa, artesian conditions,  
     303.  
     Wells of, 315.  
 Southwestern Iowa, artesian condi-  
     tions, 334.  
     Wells of, 328.  
 Southe, C. B., 246.  
 Spain, 13.  
 Spar caves, 30.  
 Specht's ferry, 22.  
 Special description of the mines, 43.  
 Sphalerite, 27.  
 Spotted slates, 107.  
 Statistics, 65.  
 Stalactites, 32.  
     Formation of, 35.  
 Stanley, Orin, 193.  
 Steam Heating Co. well, 208, 406.  
     Analysis, 209.  
     Record, 211.  
 Stevenson, Dr. Thomas, 397.  
 Storm water, 153.  
 Story county, 433, 436.  
 Stream water, 153.  
 Subterranean crevices, 167.  
 Sulphated water, 381, 389.  
 Sutherland, Dr. John, 395.  
 Swan, W. E., 191, 197.  
 Swanson, S., 192.  
 Sweden, 14.  
 Syncline, Mississippian, 317.  
 Synclinal basins, 135.  
 Table mound, 19.  
 Terraces, gravel, 442.  
 Therapeutics of artesian waters, 386.  
 Thermal waters, 372.  
 Thickness of coal measures, 329.  
     Formations, methods of  
     determining, 329.  
 Thomas, B. F., 200.  
 Thomas, C. P., 230.  
 Tiffany, A. S., 272.  
 Timber range, 37, 45.  
 Time ratios, 467.  
 Tipton well, 261.  
     Record, 262.  
 Todd, J. E., 79, 111, 227.  
 Topography of Sioux quartzite, 72.  
 Toronto stage, 466.  
 Torrey, C. O., 214.  
 Treganza, J. A., 195.  
 Treichler, W. H., 261.  
 Trenton, 270, 301.  
     Limestone, 19, 21.  
 Trewin, J. H., 56.  
 Tri-City Packing & Prov. Co. well, 272.  
 Trueb, Southwell & Co. mine, 49, 66.  
 Tschermak, Gustav, 32.  
 Tyler, L. G., 257.  
 Typhoid fever, mortality from, 415.  
 Udden, J. A., 272.  
 Upham, W., 437, 467.  
 Upper Carboniferous, 150.  
     Mississippi lead and zinc region  
     18.  
     Oneota, 142.  
     Silesia, 13.  
 Utah, 14.  
 Van Hise, C. R., 81, 107, 112.  
 Van Hyning, T., 294.  
 Vertical crevice, 55.  
     Sheet, 40.  
 Vieille Montague, 13.  
 Vinton well, 266, 406.  
     Analysis, 267.  
     Record, 267.  
 Volcanic water, 154.  
 Waite, E. G., 265.  
 Wakefield, G. W., 224.

- Walker, G. M., 322.  
 Walker, C. W., 185.  
 Washington-Des Moines section, 300.  
 Washington well, 304, 381, 406.  
     Analysis, 304.  
     Record, 305.  
     Sanitary analysis, 304.  
 Water analysis, 353.  
     Bearing stratum, 159.  
     Horizons at Clinton, 242.  
     Of imbibation, 161.  
     Of percolation, 161.  
     Of saturation, 160.  
 Waters' lead furnace, 16.  
 Waters, W. G., 66.  
 Watson, W., 208.  
 Waukesha springs, 375.  
 Waukon well, 202.  
 Way, J. T., 395.  
 Webster City well, 220, 381, 407.  
     Analysis, 220.  
     Record, 221.  
 Weems, J. B., 122, 357.  
 Well at Ackley, 219.  
     Algona, 196.  
     Amana, 286.  
     Ames, 252.  
     Anamosa, 262.  
     Atlantic, 336.  
     Belle Plaine, 350.  
     Boone, 252.  
     Britt, 195.  
     Calmar, 191.  
     Cedar Rapids, 246.  
     Centerville, 226.  
     Cherokee, 232.  
     Clarinda, 339.  
     Clinton, 241.  
     Colfax, 293.  
     Council Bluffs, 340.  
     Cresco, 201.  
     Davenport, 272.  
     Des Moines, 294.  
     Dubuque, 208.  
     Dunlap, 257.  
     Emmetsburg, 196.  
     Farmington, 320.  
     Fort Madison, 321.  
     Glenwood, 340.  
     Grinnell, 287.  
     Harper's Ferry, 201.  
     Holstein, 222.  
     Homestead, 283.  
     Hull, 199.  
     Jefferson, 255.  
     Keosauqua, 320.  
     Keokuk, 322.  
     Lansing, 200.  
     Le Mars, 232.  
     Manchester, 214.  
     Marshall, 249.  
     Mason City, 193.  
     McGregor, 185.  
     Moline, 279.  
     Monona, 188.  
     Monticello, 265.  
     Mount Clara, 322.  
     Mount Pleasant, 320.  
     Nevada, 250.  
     New Hampton, 192.  
     Newton, 292.  
     Ogden, 255.  
     Osceola, 339.  
     Oskaloosa, 308.  
     Ottumwa, 317.  
     Pella, 310.  
     Postville, 188.  
     Prairie du Chien, 187.  
     Redfield, 300.  
     Rock Island, 279.  
     Sabula, 259.  
     Sanborn, 198.  
     Saylorville, 300.  
     Sigourney, 305.  
     Sioux City, 224.  
     Tipton, 261.  
     Vinton, 266.  
     Washington, 304.  
     Waukon, 202.  
     Webster City, 220.  
     West Bend, 230.  
     West Liberty, 281.  
     Wilton, 280.  
 Wells, shallow, analysis of, 368.  
     Of southeastern Iowa, 315.  
     Of southwestern Iowa, 328.  
 West Bend well, 230, 407.  
     Analysis, 230.  
     Record, 231.  
     Water, 375.  
 West Liberty well, 281, 378, 405, 406.  
     Analysis, 281.  
     Record, 282.  
 Westphalia, 13.  
 Wharton crevice, 49.  
 White, C. A., 111, 434, 436.  
 Whitney, J. D., 59.  
 Williams, E. H., 467.  
 Williams G. H., 87, 112.  
 Wilton well, 280, 380, 406.  
     Analysis, 280.  
 Winchell, N. H., 197, 469.  
 Winslow, Arthur, 13, 59.  
 Wisconsin, 14.  
     Drift, border of, 440.  
     Characteristics, 438.  
     Early work, 436.  
     Relation to loess, 444.  
     Topography, 437.  
     Stage, 465.  
 Witts Bottling works well, 272, 378, 381,  
     385, 406.  
     Analysis, 274.  
 Woodard, C. R., 233.  
 Woolen Mills well, 272.  
 Wright, A. A., 467.

Wright, G. F., 467.

Yale, 444.

Y. M. C. A. well, Cedar Rapids, 246.  
Analysis, 248.  
Cost of, 412.

Yoran, M. J., 214.

Zinc, first in market, 18.

Zircon, 103.

Zirkel, F., 93.