

**GEOLOGICAL SURVEY OF
MISSOURI: INDUSTRIAL REPORT ON
LEAD, ZINC AND IRON, TOGETHER
WITH NOTES ON SHANNON
COUNTY AND ITS COPPER DEPOSITS**

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Geological Survey of Missouri: Industrial Report on Lead, Zinc and Iron, Together with Notes on Shannon County and Its Copper Deposits by Charles P. Williams

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CHARLES P. WILLIAMS

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GEOLOGICAL SURVEY OF MISSOURI.

INDUSTRIAL REPORT

ON

LEAD, ZINC AND IRON,

TOGETHER WITH

NOTES ON SHANNON COUNTY

AND ITS COPPER DEPOSITS.

By CHARLES P. WILLIAMS, Ph. D.,
ACTING STATE GEOLOGIST.

JEFFERSON CITY.
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1877.

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EXSSION ACTS, PAGE 20.

That the sum of fifteen hundred dollars be and the same is hereby appropriated, out of any money in the Treasury not otherwise appropriated, chargeable to the Revenue Fund, for the printing of five thousand copies of the report of the Acting State Geologist.

REPORT.

To His Excellency, CHAS. H. HARDIN, Governor of Missouri:

SIR: I have the honor to forward herewith the report of the operations of the Geological Survey in the direction of an examination of the conditions surrounding certain of the prominent industries of Missouri.

The economical aspects presented in the production of two of the great staples of the State have been investigated with considerable detail by a study of the means, appliances, and the chemical problems connected with the manufacture of the metals, lead and zinc. Some attention has been given to the iron industry as well, but the general stagnation of this great business has manifested itself by such a decrease in the activity of the furnaces of this State, that facilities were wanting for the collection of sufficient data for anything approaching that comprehensive and thorough study which the importance of the subject demands. The production of charcoal iron is, however, presented with some degree of fullness.

In shaping the work intrusted to me by the Board of Curators of the State University, towards the attainment of the ends indicated, I have been influenced by the fact that while a large amount of the structural geology of the State, and the special geology of its mineral deposits had already been made public in the reports of Messrs. Swallow, Pumpelly, Broadhead and others, but little had been accumulated towards unfolding the history of the technology which the conversion of the raw materials from those mineral deposits into commercial products had created within the borders of Missouri. Further, the appropriation of five thousand dollars yearly was not adequate to keeping in the field a force sufficient for thorough and rapid work in those counties which had not before received special attention.

The material which could be collected under existing circumstances is not full enough for a geological history of those counties; however, as interesting copper occurrences have long been known to

exist within the limits of Shannon county, some space has been devoted to a geological history of those deposits, this course being regarded as in accord with the design of this report.

Notes on the supposed gold deposits of Northern Missouri have also been given in the appendix.

I must acknowledge, in this connection, the very efficient assistance rendered in the laboratory by Mr. A. W. Hare. His zeal and industry have enabled me to make a much fuller presentation of the chemical illustrations of the work than could have been done otherwise.

Other aid, whenever rendered, is acknowledged in the report.

Some of the notes on the St. Louis industrial district collected, by Dr. Adolph Schmidt, have been used with his sanction. These notes, having been taken as early as 1872, have lost much of their value in the lapse of time and the progress and growth of the industries, and their reproduction would only extend this report without presenting the actual conditions of the manufactures to which they relate. Much of present value is contained in Dr. Schmidt's notes on the iron deposits, but as an account of these was foreign to this present work, these notes have not been reproduced.

All of which is respectfully submitted.

Your obedient servant,

CHAS. P. WILLIAMS,
Acting State Geologist.

ROLLA, Mo., December 13, 1876.

LEAD INDUSTRY.

11. $\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$ 12. $\frac{1}{4} \times \frac{1}{5} = \frac{1}{20}$ 13. $\frac{1}{6} \times \frac{1}{7} = \frac{1}{42}$

14. $\frac{1}{8} \times \frac{1}{9} = \frac{1}{72}$ 15. $\frac{1}{10} \times \frac{1}{11} = \frac{1}{110}$ 16. $\frac{1}{12} \times \frac{1}{13} = \frac{1}{156}$

17. $\frac{1}{14} \times \frac{1}{15} = \frac{1}{210}$ 18. $\frac{1}{16} \times \frac{1}{17} = \frac{1}{272}$ 19. $\frac{1}{18} \times \frac{1}{19} = \frac{1}{342}$

20. $\frac{1}{20} \times \frac{1}{21} = \frac{1}{420}$ 21. $\frac{1}{22} \times \frac{1}{23} = \frac{1}{506}$ 22. $\frac{1}{24} \times \frac{1}{25} = \frac{1}{600}$

23. $\frac{1}{26} \times \frac{1}{27} = \frac{1}{702}$ 24. $\frac{1}{28} \times \frac{1}{29} = \frac{1}{812}$ 25. $\frac{1}{30} \times \frac{1}{31} = \frac{1}{930}$

26. $\frac{1}{32} \times \frac{1}{33} = \frac{1}{1056}$ 27. $\frac{1}{34} \times \frac{1}{35} = \frac{1}{1190}$ 28. $\frac{1}{36} \times \frac{1}{37} = \frac{1}{1332}$

29. $\frac{1}{38} \times \frac{1}{39} = \frac{1}{1482}$ 30. $\frac{1}{40} \times \frac{1}{41} = \frac{1}{1640}$ 31. $\frac{1}{42} \times \frac{1}{43} = \frac{1}{1806}$

32. $\frac{1}{44} \times \frac{1}{45} = \frac{1}{1980}$ 33. $\frac{1}{46} \times \frac{1}{47} = \frac{1}{2162}$ 34. $\frac{1}{48} \times \frac{1}{49} = \frac{1}{2352}$

35. $\frac{1}{50} \times \frac{1}{51} = \frac{1}{2550}$ 36. $\frac{1}{52} \times \frac{1}{53} = \frac{1}{2756}$ 37. $\frac{1}{54} \times \frac{1}{55} = \frac{1}{2970}$

38. $\frac{1}{56} \times \frac{1}{57} = \frac{1}{3192}$ 39. $\frac{1}{58} \times \frac{1}{59} = \frac{1}{3422}$ 40. $\frac{1}{60} \times \frac{1}{61} = \frac{1}{3660}$

41. $\frac{1}{62} \times \frac{1}{63} = \frac{1}{3906}$ 42. $\frac{1}{64} \times \frac{1}{65} = \frac{1}{4160}$ 43. $\frac{1}{66} \times \frac{1}{67} = \frac{1}{4422}$

44. $\frac{1}{68} \times \frac{1}{69} = \frac{1}{4692}$ 45. $\frac{1}{70} \times \frac{1}{71} = \frac{1}{4970}$ 46. $\frac{1}{72} \times \frac{1}{73} = \frac{1}{5256}$

47. $\frac{1}{74} \times \frac{1}{75} = \frac{1}{5550}$ 48. $\frac{1}{76} \times \frac{1}{77} = \frac{1}{5852}$ 49. $\frac{1}{78} \times \frac{1}{79} = \frac{1}{6162}$

50. $\frac{1}{80} \times \frac{1}{81} = \frac{1}{6480}$ 51. $\frac{1}{82} \times \frac{1}{83} = \frac{1}{6806}$ 52. $\frac{1}{84} \times \frac{1}{85} = \frac{1}{7140}$

53. $\frac{1}{86} \times \frac{1}{87} = \frac{1}{7482}$ 54. $\frac{1}{88} \times \frac{1}{89} = \frac{1}{7832}$ 55. $\frac{1}{90} \times \frac{1}{91} = \frac{1}{8190}$

56. $\frac{1}{92} \times \frac{1}{93} = \frac{1}{8556}$ 57. $\frac{1}{94} \times \frac{1}{95} = \frac{1}{8930}$ 58. $\frac{1}{96} \times \frac{1}{97} = \frac{1}{9312}$

59. $\frac{1}{98} \times \frac{1}{99} = \frac{1}{9702}$ 60. $\frac{1}{100} \times \frac{1}{101} = \frac{1}{10100}$

61. $\frac{1}{102} \times \frac{1}{103} = \frac{1}{10506}$ 62. $\frac{1}{104} \times \frac{1}{105} = \frac{1}{10920}$ 63. $\frac{1}{106} \times \frac{1}{107} = \frac{1}{11342}$

64. $\frac{1}{108} \times \frac{1}{109} = \frac{1}{11772}$ 65. $\frac{1}{110} \times \frac{1}{111} = \frac{1}{12210}$ 66. $\frac{1}{112} \times \frac{1}{113} = \frac{1}{12656}$

67. $\frac{1}{114} \times \frac{1}{115} = \frac{1}{13110}$ 68. $\frac{1}{116} \times \frac{1}{117} = \frac{1}{13572}$ 69. $\frac{1}{118} \times \frac{1}{119} = \frac{1}{14042}$

70. $\frac{1}{120} \times \frac{1}{121} = \frac{1}{14520}$ 71. $\frac{1}{122} \times \frac{1}{123} = \frac{1}{15006}$ 72. $\frac{1}{124} \times \frac{1}{125} = \frac{1}{15500}$

73. $\frac{1}{126} \times \frac{1}{127} = \frac{1}{16002}$ 74. $\frac{1}{128} \times \frac{1}{129} = \frac{1}{16512}$ 75. $\frac{1}{130} \times \frac{1}{131} = \frac{1}{17030}$

76. $\frac{1}{132} \times \frac{1}{133} = \frac{1}{17556}$ 77. $\frac{1}{134} \times \frac{1}{135} = \frac{1}{18090}$ 78. $\frac{1}{136} \times \frac{1}{137} = \frac{1}{18632}$

79. $\frac{1}{138} \times \frac{1}{139} = \frac{1}{19182}$ 80. $\frac{1}{140} \times \frac{1}{141} = \frac{1}{19740}$ 81. $\frac{1}{142} \times \frac{1}{143} = \frac{1}{20302}$

82. $\frac{1}{144} \times \frac{1}{145} = \frac{1}{20872}$ 83. $\frac{1}{146} \times \frac{1}{147} = \frac{1}{21450}$ 84. $\frac{1}{148} \times \frac{1}{149} = \frac{1}{22036}$

85. $\frac{1}{150} \times \frac{1}{151} = \frac{1}{22630}$ 86. $\frac{1}{152} \times \frac{1}{153} = \frac{1}{23232}$ 87. $\frac{1}{154} \times \frac{1}{155} = \frac{1}{23842}$

88. $\frac{1}{156} \times \frac{1}{157} = \frac{1}{24462}$ 89. $\frac{1}{158} \times \frac{1}{159} = \frac{1}{25092}$ 90. $\frac{1}{160} \times \frac{1}{161} = \frac{1}{25730}$

91. $\frac{1}{162} \times \frac{1}{163} = \frac{1}{26376}$ 92. $\frac{1}{164} \times \frac{1}{165} = \frac{1}{27030}$ 93. $\frac{1}{166} \times \frac{1}{167} = \frac{1}{27692}$

94. $\frac{1}{168} \times \frac{1}{169} = \frac{1}{28362}$ 95. $\frac{1}{170} \times \frac{1}{171} = \frac{1}{29040}$ 96. $\frac{1}{172} \times \frac{1}{173} = \frac{1}{29726}$

97. $\frac{1}{174} \times \frac{1}{175} = \frac{1}{30420}$ 98. $\frac{1}{176} \times \frac{1}{177} = \frac{1}{31122}$ 99. $\frac{1}{178} \times \frac{1}{179} = \frac{1}{31830}$

100. $\frac{1}{180} \times \frac{1}{181} = \frac{1}{32544}$ 101. $\frac{1}{182} \times \frac{1}{183} = \frac{1}{33266}$ 102. $\frac{1}{184} \times \frac{1}{185} = \frac{1}{34000}$

103. $\frac{1}{186} \times \frac{1}{187} = \frac{1}{34746}$ 104. $\frac{1}{188} \times \frac{1}{189} = \frac{1}{35502}$ 105. $\frac{1}{190} \times \frac{1}{191} = \frac{1}{36270}$

106. $\frac{1}{192} \times \frac{1}{193} = \frac{1}{37050}$ 107. $\frac{1}{194} \times \frac{1}{195} = \frac{1}{37842}$ 108. $\frac{1}{196} \times \frac{1}{197} = \frac{1}{38646}$

109. $\frac{1}{198} \times \frac{1}{199} = \frac{1}{39462}$ 110. $\frac{1}{200} \times \frac{1}{201} = \frac{1}{40290}$

CHAPTER I.

MINERALOGY AND GENERAL METALLURGY OF LEAD.

The geological positions and modes of occurrence of the ores of lead throughout Missouri have been described in such detail in preceding reports, that this report is restricted to a discussion of the economical considerations connected with the conversion of those ores into marketable lead. The facts that the lead bearing formations occupy a very considerable part of the area of South Missouri, and that those formations contain concentrations of plumbiferous minerals, of which many have been strikingly remunerative, are known much more generally than are the character of the ores, the features of their metallurgical treatment or the commercial value of the product as a factor in the material wealth and prosperity of the commonwealth.

The pressure of a large and rapidly increasing production from the mines has left little time for examination or discussion of those smelting methods, which, adopted in the early development of the lead industry, have been reproduced with but trifling modifications at each new mining centre. At the present time when lead production has become a permanent industry in the State, and Missouri brands of metal are in competition with refined leads from other domestic, as well as from foreign establishments, in the markets of the east, it may be wise to scrutinize the common metallurgical practices of the State more closely than has heretofore been done, in order that the fullest possible advantage may be gained from them.

Among the various methods of lead smelting and the wide range of variations which local conditions and experiences have added to them, there are but few which have any extended use in the State, and it is these alone which need be examined in detail to ascertain how far the practice, which is in general adapted to the ores to be treated, is worked to its fullest capabilities or, in other words, how nearly its utmost advantages are realized. To reach this knowledge, some account must be taken of the experiences and results elsewhere, and the comparisons which will be thus instituted will not only explain the local practice, but furnish suggestions which may be adopted with advantage leading to cleaner work and closer economy.