

SOUTH DAKOTA

STATE GEOLOGICAL SURVEY

E. P. Rothrock, State Geologist

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REPORT OF INVESTIGATIONS

No. 13

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A QUARTER CENTURY

OF

MINERAL PRODUCTION

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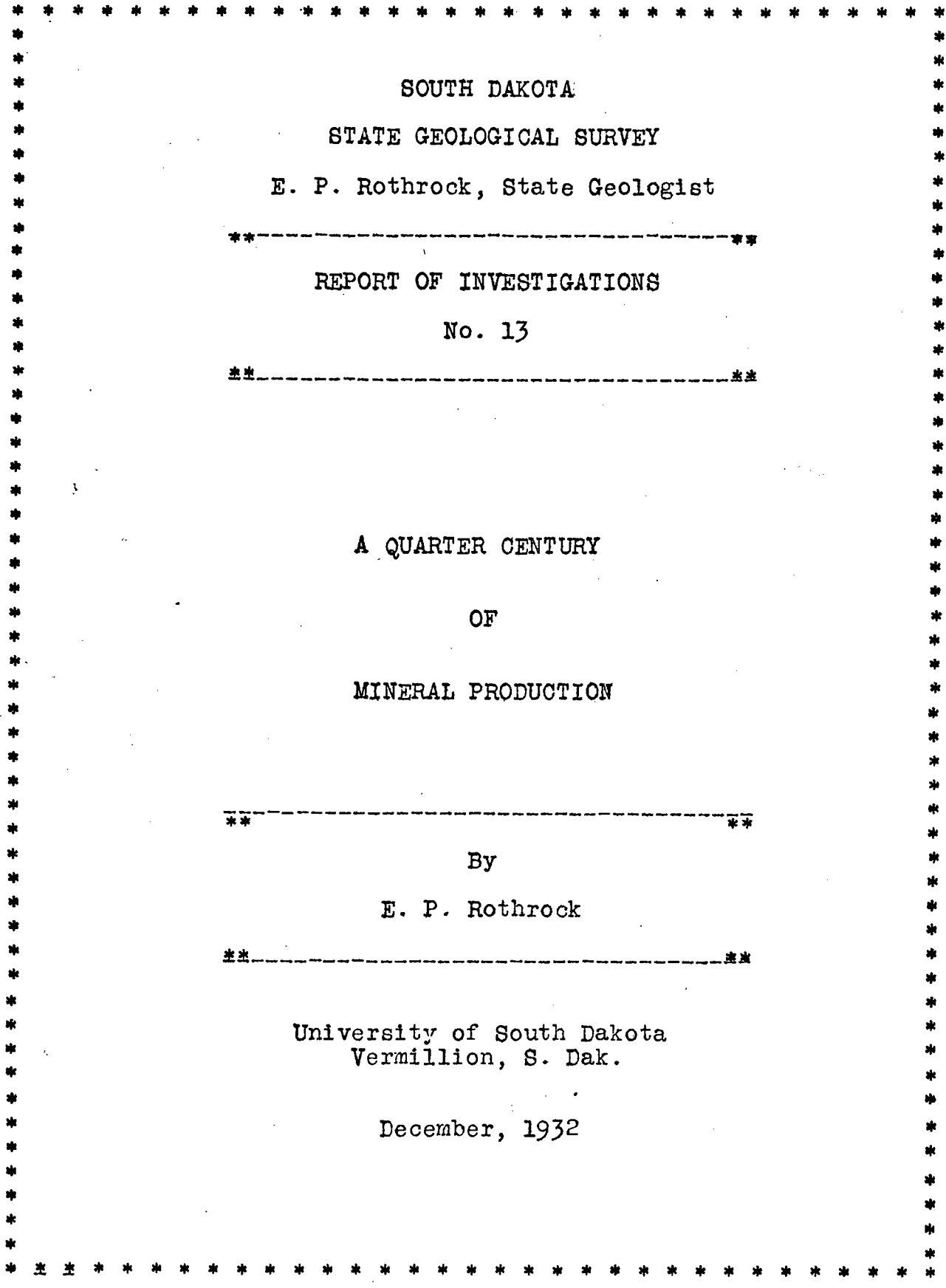
By

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December, 1932



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# A QUARTER CENTURY OF MINERAL PRODUCTION

## IN SOUTH DAKOTA

### GENERAL STATEMENT

A great deal has been written and said about the mineral resources of South Dakota, but most of it has dealt with rather vague generalities and has caused considerable confusion in the minds of most laymen. The following compilation of production statistics, therefore, is offered as an attempt to give a picture of the mineral industry in South Dakota during the quarter century just past. It is hoped that it will bring out the importance of this industry as a factor in the economic life of the state during this period and throw some light on its possible future.

The figures used in the tables and as bases for the graphs were collected by the United States Geological Survey and the United States Bureau of Mines, the South Dakota Geological Survey cooperating during the past few years. In a few instances figures from other sources were used. In these cases the sources are given in footnotes. The figures are as complete as it was possible to collect them at the time, and though some breaks appear in the earlier records, there are none of sufficient magnitude to seriously affect the conclusions of this report.

During this period (1905 to 1931 inclusive) South Dakota has produced twenty-nine different mineral products in sufficient quantities to be classed as commercial production. Thirteen of them have been produced continuously and a fair but intermittent business was done in several others. Attempts were made to place a number of others on the market with partial success.

These products include a large variety of materials which for convenience have been grouped under two main heads, non-metallic products and metallic products. The non-metallic products include fuels, structural materials, ceramic materials, and a group of miscellaneous products which do not fall under the above heads. The principal metallic products were gold and silver. These were followed by a miscellaneous list of metals which included lithium, lead, tungsten, tantalum, tin, copper and a very minor production of anti mony, pyrite, manganese, arsenic and iron.

Mineral production has not been confined to any section of the state. The largest production of structural materials has come from the eastern part. Fuels have been produced from the central and northwestern parts. Metals came entirely from a small area in the heart of the Black Hills. Ceramic materials have come from various scattered localities, including the extreme north-eastern, the north-central, and the western part of the state. In the case of such products as metals and stone, the location of the industry was determined by the fact that the material does not

occur in other parts of the state. Structural and ceramic materials, however, are widely distributed. These industries are located largely by considerations of transportation and market facilities. No attempt can be made to show the mineral possibilities of South Dakota in this report, but the accompanying maps indicate the parts of the state from which commercial production has come.

### TOTAL PRODUCTION FIGURES

The total value of the minerals produced in South Dakota during the years 1905 to 1931 inclusive as shown by the Federal statistics is \$212,669,133. This is an average annual production of about \$7,876,635. As shown by the curve on the following graph, however, the general trend of this value has been upward during the period. Starting with a total production of \$7,500,000 in 1905 the curve reaches a high point of nearly \$12,000,000 for the year 1931. There is considerable deviation from the average, but a study of the curve will show that the high points have continued to rise while the low points have failed to fall to previous low records. The years 1905, 1908, 1912, 1916 and 1931 can be pointed to as the progressive high spots, while the low points reached in 1907, 1910, 1919, 1924, and 1929 represent a progressively rising minimum. The most severe drop occurred during the late war, 1916 to 1919, when the production dropped in value from \$8,600,000 to \$5,500,000. This is the lowest point reached since 1906. Since 1919 there has been a steady rise, characterized by minor fluctuations, which has continued to the present (1932) in spite of the general financial depression.

An analysis of this condition is beyond the scope of this report. Part of the answer, however, probably lies in the increase of the state's population and part in the fact that South Dakota's mineral products are staples. The chief metal is gold, which has an unchanging value and therefore an increased production when other industries are at a low ebb. The other products are those for which there has been a fairly steady demand as the state has developed. Structural materials are examples. With these generalizations the problem will be left to the economist.

TOTAL VALUE OF MINERAL PRODUCTION

IN

SOUTH DAKOTA

1905--1931

<u>Year</u>	<u>Value</u>
1905	\$7,571,573
1906	7,509,907
1907	4,983,829
1908	8,528,234
1909	7,604,487
1910	6,093,434
1911	8,047,259
1912	8,436,240
1913	7,909,059
1914	7,861,601
1915	8,093,670
1916	8,696,680
1917	8,348,684
1918	7,441,981
1919	5,842,704
1920	5,951,138
1921	7,498,656
1922	7,278,694
1923	7,372,368
1924	6,925,676
1925	7,971,650
1926	7,595,358
1927	8,463,952
1928	9,443,488
1929	8,914,344
1930	10,975,888
1931	11,308,579

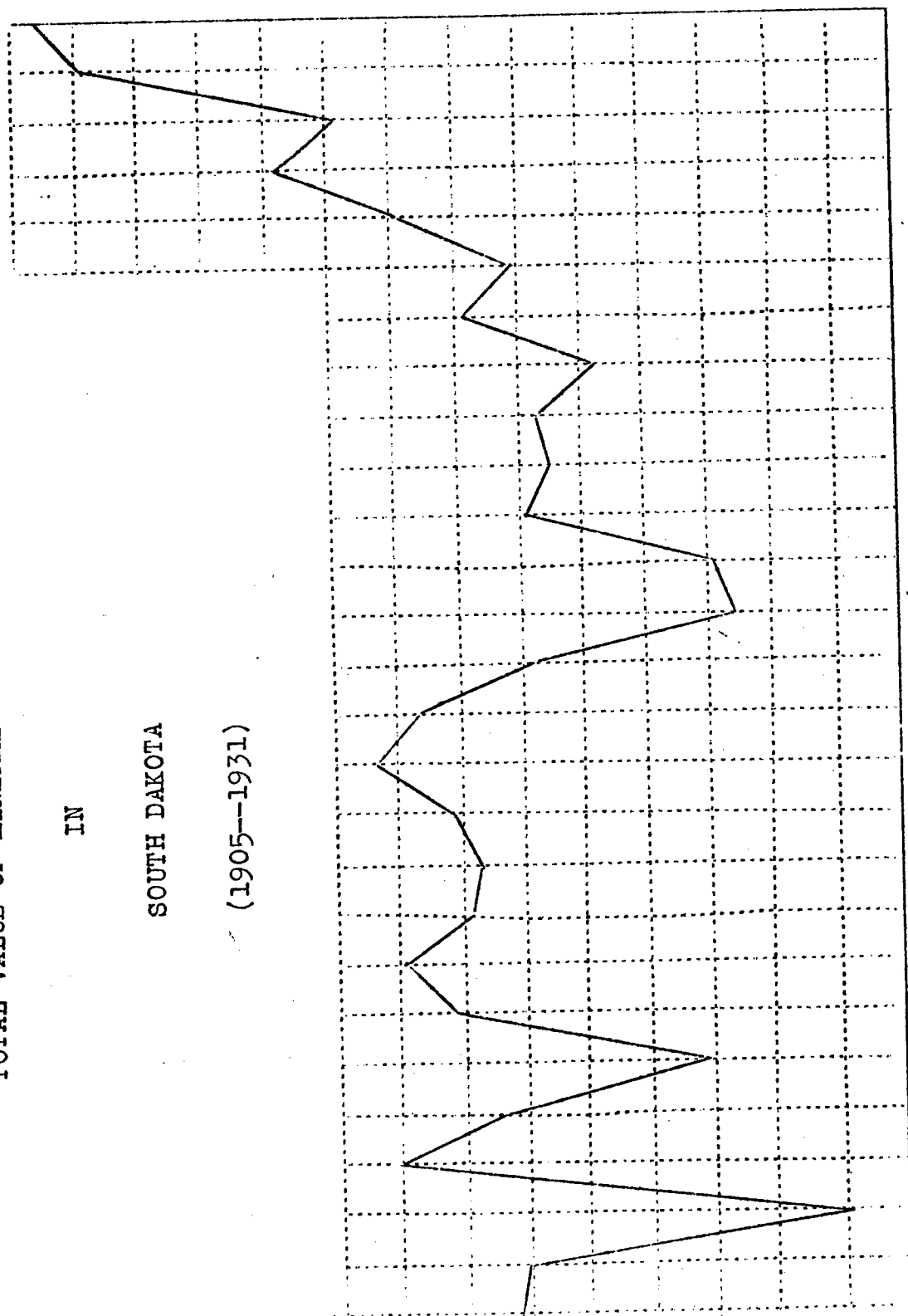
TOTAL VALUE OF MINERAL PRODUCTION

IN

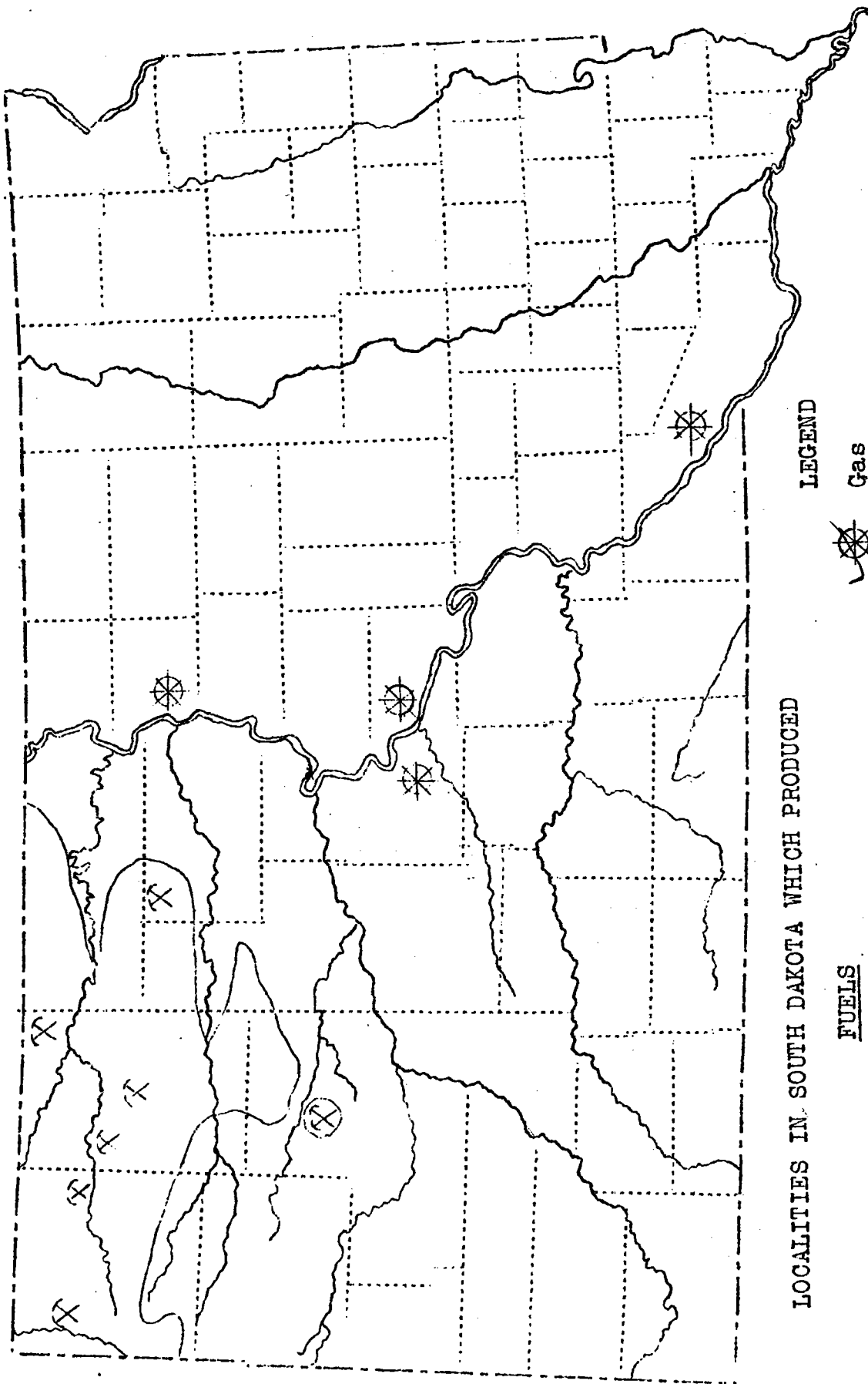
SOUTH DAKOTA

(1905--1931)

\$11,500,000  
11,000,000  
10,500,000  
10,000,000  
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9,000,000  
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1930  
1931



LOCALITIES IN SOUTH DAKOTA WHICH PRODUCED

FUELS

1905--1931

LEGEND

⊗ Gas

X Coal

— Limit of Coal Producing Area



## FUELS

Both coal and natural gas have been produced for some years in South Dakota and there have been shows of oil capable of a small production by pumping. No oil has been produced commercially however. Though neither coal or gas has developed a great industry, they have both been important in the state's development because they lie in regions where fuels have been costly.

### Coal

Coal production began with the early settlement of the state. No records of early production are available, but it is known that the cattle ranchers who first settled in the northwestern part of the state secured their fuel supplies from the seams of coal outcropping in the region. The first report of coal in South Dakota was made by the geologist Winchell who accompanied the Custer Expedition in 1874 and made a side trip into the vicinity of the Slim Buttes and Cave Hills. Todd mentioned a "Florans Coal Camp" located near the Slim Buttes in Section 23, Township 18, North of Range 17 East which was in operation in 1895.<sup>1</sup>

No figures for commercial production are available until 1913, when a production of 10,540 tons with a value of \$20,648 is reported. Production has continued to be primarily for local consumption largely because of the lack of railroad facilities. The Milwaukee Railroad crosses the northeastern part of the area between Thunderhawk and Lemmon and reaches the eastern edge at Isabel, Firesteel and Faith. While most of these towns are near the coal region, Isabel and Firesteel are the only ones immediately surrounded by coal of workable quality and thickness. Some of the oldest mines in the state are near them, and the largest commercial production has been developed there.

The production of coal has varied from 7,500 tons to 27,485 tons a year during the time for which figures are available and has averaged about 10,000 tons. The tonnage during the earlier years of the record had reached a maximum of 12,000 tons (1914), but by the close of the late war had dropped to 7,900 tons (1918). With the exception of the years 1921-1922 the annual tonnage has been constantly above 10,000 since 1918.

Three high points occur in the curve showing the annual value of the coal produced. One occurs in 1919-1920, immediately after the world war, when production value reached \$46,000. A second occurred in 1925-1926 when the value rose to \$42,000. The third peak occurred in 1931 with a value of \$64,000. The money value of the production does not parallel the tonnage production because of the fluctuation of coal prices. This can be readily seen by comparing the two curves which follow. For instance a

production of 7,942 tons brought \$22,230 in 1918 while only \$20,456 was obtained from 11,850 tons in 1914. In the years 1929 and 1930 a difference of 44 tons in production made a difference of \$7000 in value.

The figures for the quarter century under consideration are contained in the following table:

<u>Year</u>	<u>Short Tons</u>	<u>Value</u>
1905	(No report)	
1906	(No report)	
1907	(No report)	
1908	(No report)	
1909	(No report)	
1910	(No report)	
1911	(No report)	
1912	(No report)	
1913	10,540	\$20,648
1914	11,850	20,456
1915	10,593	16,384
1916	8,886	18,021
1917	8,042	23,346
1918	7,942	22,230
1919	14,417	45,707
1920	12,777	46,000
1921	7,553	21,200
1922	7,752	22,000
1923	10,379	25,000
1924	12,043	36,000
1925	14,447	42,000
1926	14,428	42,000
1927	12,507	38,000
1928	13,929	39,000
1929	12,854	38,000
1930	12,810	31,000
1931	27,485	64,000

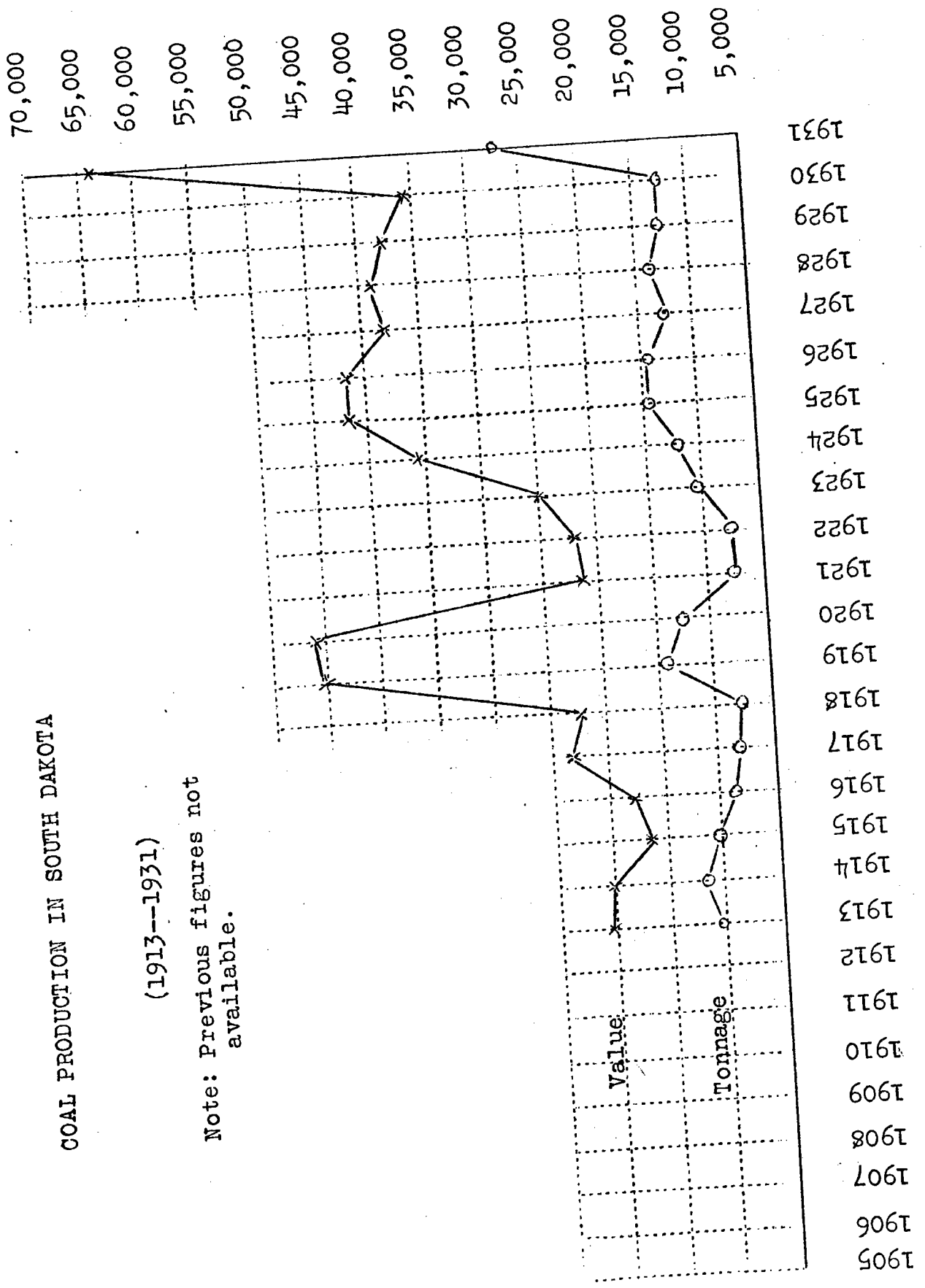
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1.--(Page 6) Todd, J. E., Bulletin 2, South Dakota Geological Survey, 1898, Pp. 54, 59, 63.

COAL PRODUCTION IN SOUTH DAKOTA

(1913--1931)

Note: Previous figures not available.



## Gas

A small but very persistent flow of gas has been encountered along the Missouri River. Most of these flows have come from artesian water wells where the gas rises with the water and has to be separated from it before being piped to the consumer. Some of this gas is used by the well owners. In the cities of Pierre and Fort Pierre a small commercial production has been obtained.

Production figures date from 1897 when \$20,000 worth of gas was used and sold in the state. By 1901 the production had dropped to \$7,225. By 1905 it had raised to the value of \$15,000. From that time the production has remained above this figure. Part of the variation in annual productions, shown in the following table and on the graph, is due to the difficulty of collecting figures on the scattered domestic consumption.

South Dakota gas has all been consumed within the state and most of it within a very short distance of the wells producing it. Until 1928 this composed the only source of gas used in the state. In 1928, however, a pipe line was laid into the Black Hills from Baker gas fields of Montana and consumption increased greatly. A year later, 1929, gas was also piped into Sioux Falls from the Mid-continent fields. In 1929 the state produced 99,000,000 cubic feet of the total 1,717,000,000 cubic feet consumed. In 1930 the difference was still greater, the state producing 98,000,000 cubic feet and consuming 2,905,000,000 cubic feet.

NATURAL GAS

IN

SOUTH DAKOTA

1897--1931

<u>Year</u>	<u>Production Cubic Feet</u>	<u>Value</u>	<u>Consumption Cubic Feet</u>	<u>Value</u>
1897		\$20,000		
1898		20,000		
1899				
1900		9,817		
1901		7,225		
1902		10,280		
1903		10,775		
1904		12,215		
1905		15,200		\$15,200
1906	22,900,000	15,400	22,900,000	15,400
1907	37,500,000	19,500	37,500,000	19,500
1908		24,400		24,400
1909		16,164		16,164
1910		31,999		31,999
1911		16,987		16,987
1912	54,320,000*	30,412*	54,320,000*	30,412*
1913	66,492,000*	31,166*	66,492,000*	31,166*
1914	60,781,000*	27,220*	60,781,000*	27,220*
1915	58,132,000*	25,809*	58,132,000*	25,809*
1916	77,478,000"	31,573"	77,478,000"	31,573"
1917	59,666,000"	25,213"	59,666,000"	25,213"
1918	42,186,000	19,101	42,186,000	19,101
1919	32,807,000	16,900	32,807,000	16,900
1920	19,900,000	12,260	19,900,000	12,260
1921	9,700,000	4,000	9,700,000	4,000
1922	15,600,000	6,400	15,600,000	6,400
1923	33,000,000	16,600	33,000,000	16,600
1924	3,000,000	2,500	3,000,000	2,500
1925	4,200,000	2,300	4,200,000	2,300
1926	10,000,000	14,000	10,000,000	14,000
1927	92,000,000	136,500	92,000,000	136,500
1928	54,000,000	53,000	214,000,000	212,000
1929	99,000,000	40,000	1,717,000,000	696,000
1930	98,000,000	32,000	2,905,000,000	340,000
1931	12,000,000	3,996	1,142,000,000	262,000

\*---- North and South Dakota

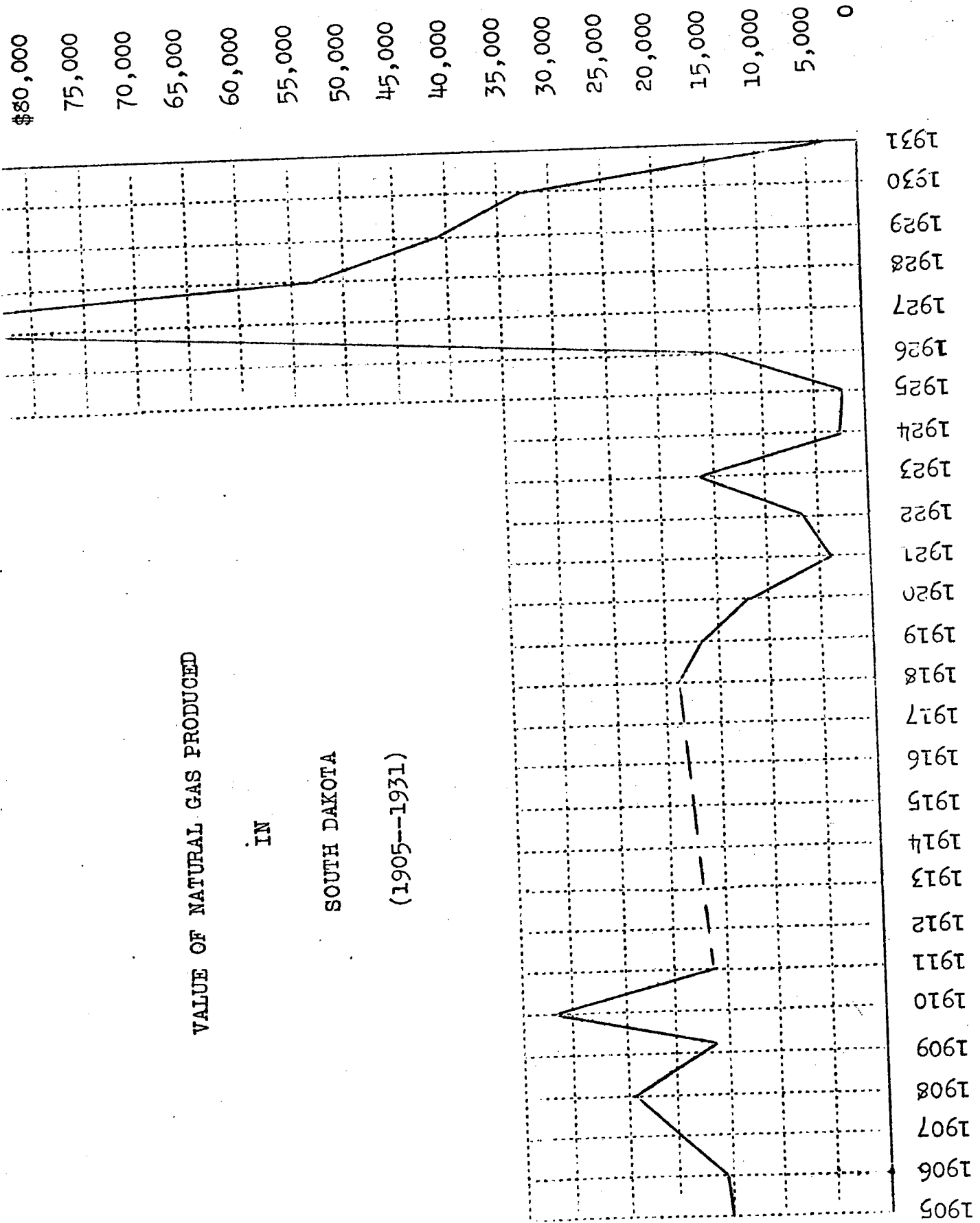
"---- North and South Dakota and Alabama.

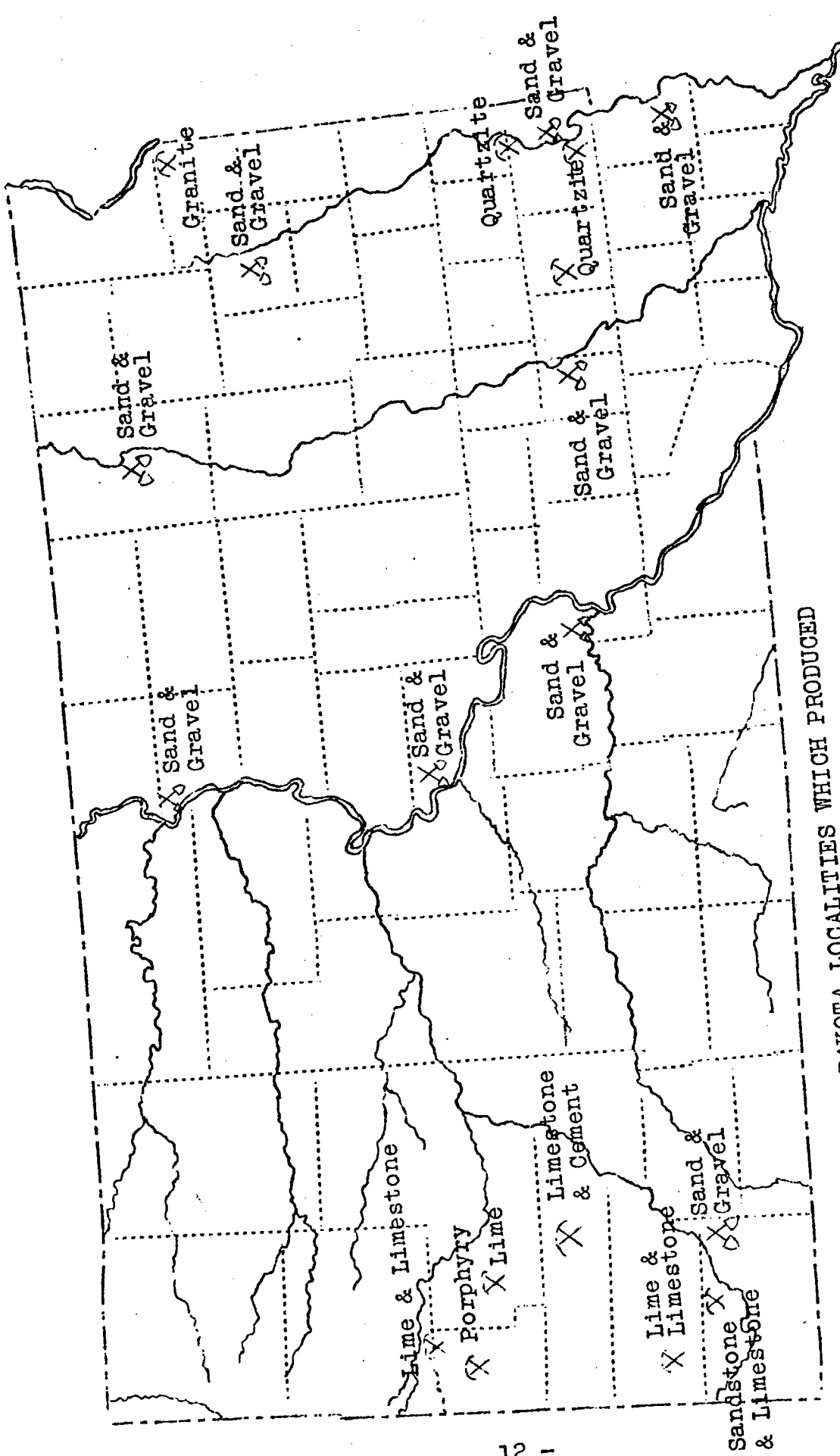
VALUE OF NATURAL GAS PRODUCED

IN

SOUTH DAKOTA

(1905--1931)





SOUTH DAKOTA LOCALITIES WHICH PRODUCED

STRUCTURAL MATERIALS

1905--1931

Note: Roadside and temporary gravel pits not included.

## STRUCTURAL MATERIALS

Structural materials include those products used in various kinds of construction. Building stone, concrete materials and road metals have formed the bulk of this production but there has been a valuable supplement of ornamental stone. Structural materials as a group are widely scattered over the state. The various members of this group, however, are rather segregated with the possible exception of sand and gravel. As indicated on the accompanying map, hard rock materials are confined to the extreme eastern and western ends of the state. Soft limestone (chalk), however, can be found in the southern part of the Missouri Valley and in most of the James Valley south of Redfield. This distribution has made gravel one of the most important materials in the development of the state since it is the most widely distributed. It occurs in the valleys of all the large rivers and in a great many localities outside of these valleys. The list of materials which have been produced on a scale large enough to be reported as commercial, is as follows:

- Stone (building and ornamental)
  - Granite
  - Quartzite
  - Sandstone
  - Limestone and chalk
  - Porphyry
- Sand and Gravel

The value of structural materials quarried in the state has increased steadily during the quarter century though there are many spurts and set-backs due to increases and reductions in the amount of building that has been undertaken. An examination of the figures will show for the first few years of the period an average annual value of about \$175,000. The average annual value for the last few years of the period reached more than two million dollars. This rise in value is well brought out in the following table and graph.



TOTAL VALUE OF STRUCTURAL MATERIALS  
PRODUCED IN SOUTH DAKOTA

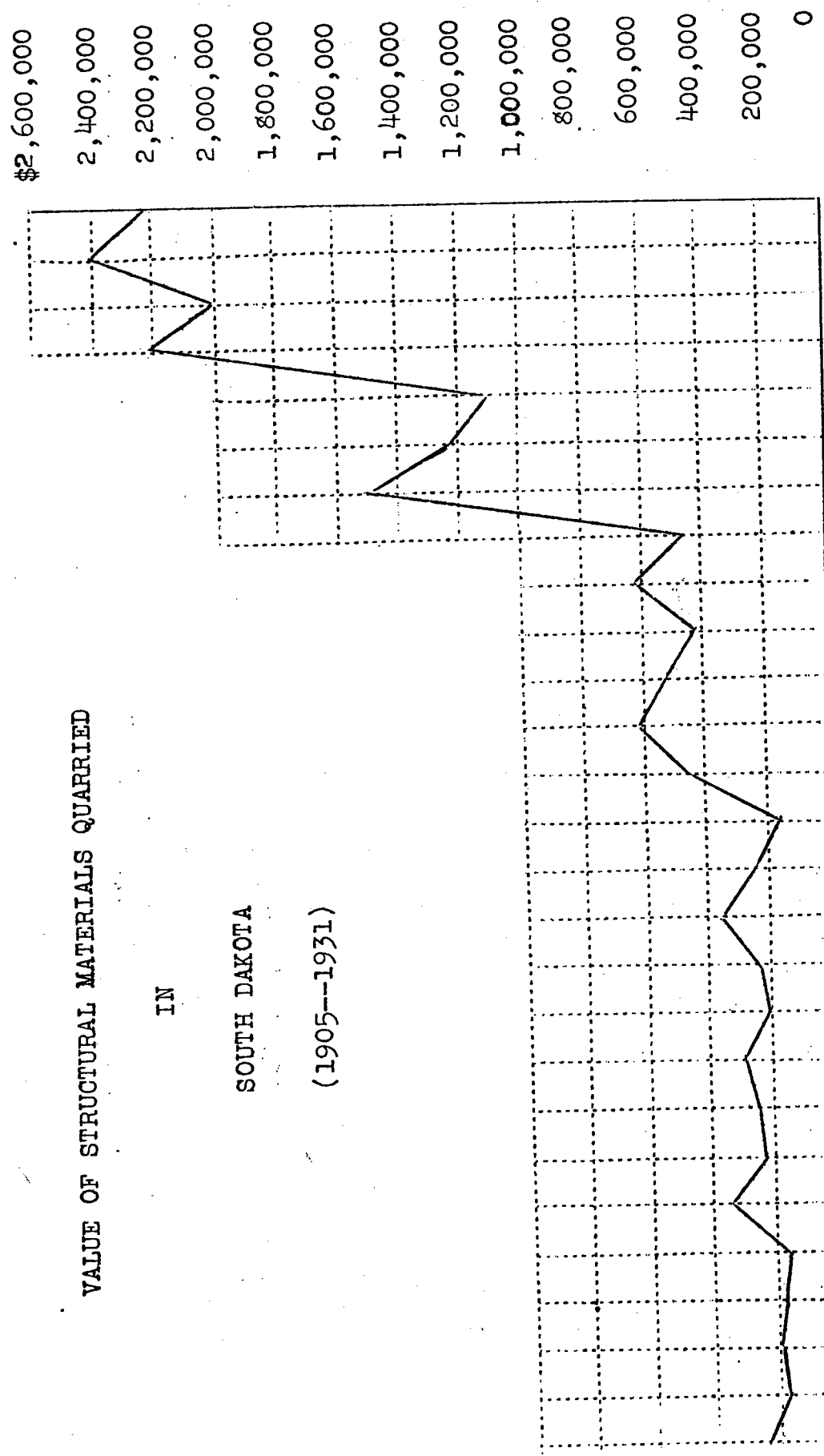
<u>Year</u>	<u>Value</u>
1905	\$226,369
1906	169,896
1907	180,770
1908	162,622
1909	154,011
1910	356,863
1911	226,724
1912	247,728
1913	285,179
1914	216,092
1915	239,534
1916	360,958
1917	250,157
1918	166,403
1919	458,661
1920	623,998
1921	523,058
1922	437,832
1923	636,202
1924	476,110
1925	1,507,731
1926	1,222,084
1927	1,167,743
1928	2,224,538
1929	2,081,161
1930	2,406,606
1931	2,213,983

VALUE OF STRUCTURAL MATERIALS QUARRIED

IN

SOUTH DAKOTA

(1905--1931)



## Granite

The production of true granite in South Dakota has been confined to the vicinity of Milbank in Grant County, where it has been quarried for many years. Stone masons had been using "top stone" for foundations and other building for some years when the first commercial quarry was opened in 1908. This quarry was operated by Mr. Robert Hunter, and the first dimension stone was used in building the State Capitol at Pierre. The so-called pink granite quarried around Sioux Falls is not a true granite and is therefore listed under the figures for sandstone. Granite also occurs in the Black Hills in large quantities but has never been produced on a commercial scale.

Milbank granite is a dark colored dense rock which takes a high polish. Because of its color it is known to the trade as "mahogany" granite. Two grades have been sold, the ordinary mahogany and a grade which is called "royal mahogany" in that it has a deep reddish cast.

Before 1921 production reports are scattered due either to non-production or to the small size of the production. In the latter case the figures are often included in those of other states. The first figures for granite alone appear in 1904, with a production valued at \$900. A second report in 1907 shows a decline to \$690, and after a gap of seven years the figures for 1915 show a remarkable jump to \$22,379. Another gap occurs from 1916 to 1920, but after 1920 the record is continuous. The general increase in production in the commodity is strikingly shown on the following table and graph.

VALUE OF GRANITE PRODUCED

IN

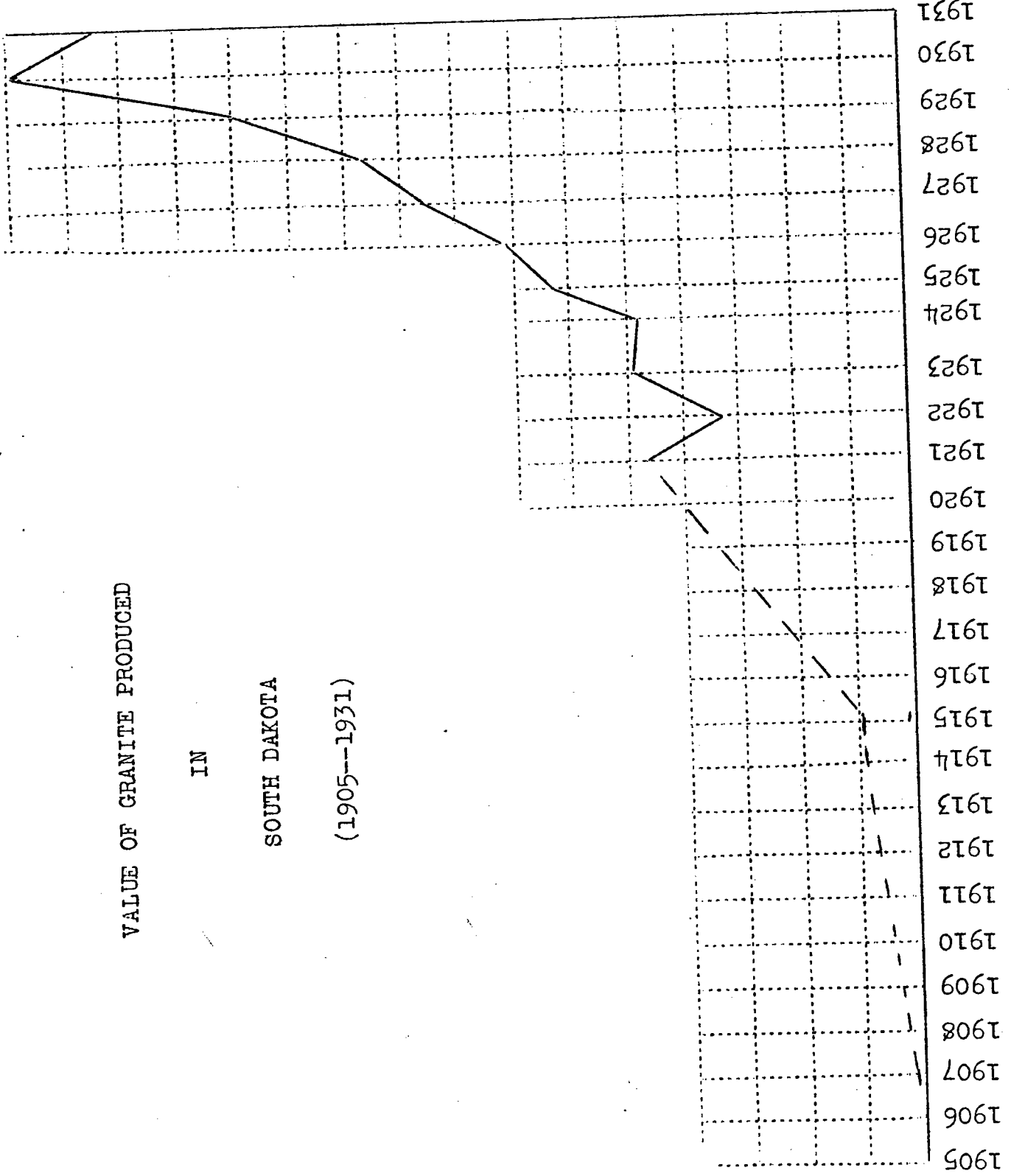
SOUTH DAKOTA

1905--1931

<u>Year</u>	<u>Short Tons</u>	<u>Value</u>
1905		
1906		
1907		\$690
1908		
1909		
1910		
1911		
1912		
1913		
1914		
1915		22,379
1916		
1917		
1918		
1919		
1920		
1921	15,890	117,688
1922	10,800	84,954
1923	11,310	121,400
1924	6,110	120,395
1925	1,480	157,967
1926	1,830	177,299
1927	4,450	215,168
1928	12,700	243,148
1929	11,950	300,134
1930	5,340	398,917
1931	6,730	360,463

\$400,000  
 375,000  
 350,000  
 325,000  
 300,000  
 275,000  
 250,000  
 225,000  
 200,000  
 175,000  
 150,000  
 125,000  
 100,000  
 75,000  
 50,000  
 25,000  
 0

VALUE OF GRANITE PRODUCED  
 IN  
 SOUTH DAKOTA  
 (1905--1931)



## Limestone

Nearly all the limestone which has been quarried in South Dakota comes from the Black Hills where several outcropping formations offer a dense, high grade stone. Their use, however, has been restricted to that of crushed stone, rip rap, cement materials, and burned lime, probably because other stone suitable for building was plentiful. Small quarries equipped with crushers occur at many places in the Black Hills; one cement plant & 3 lime kilns have been built and operated.

Though a limestone outcrops in the lower Big Sioux Valley and chalk (a variety of limestone) has extensive outcrops in the lower James and Missouri Valleys, the only exploitation of limestone outside of the Black Hills was at Yankton where a cement plant was operated during the years 1890 to 1908. The raw material used was chalk.

The annual value of limestone, burned lime and cement materials mined in the state are shown in the following table. It must be remembered, however, that these figures represent the value of burned lime and cement on the market. In the case of cement it will include clay and a little gypsum. Thus the value of the limestone itself is somewhat concealed, the table showing the value of the lime-using industries, which is perhaps more important.

### Total Value of Limestone, Lime and Cement Materials

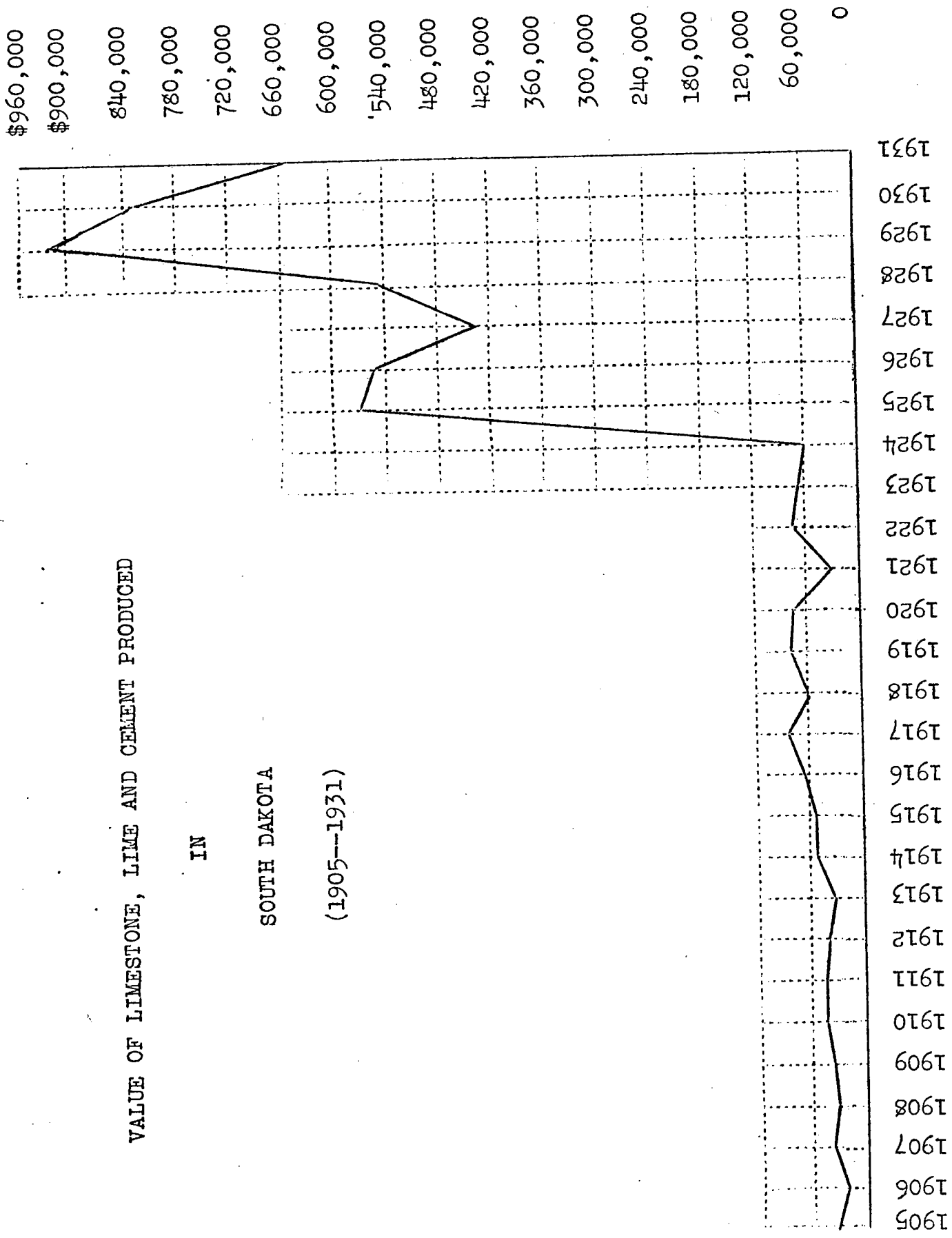
1905	\$32,965
1906	23,930
1907	36,495
1908	34,068
1909	35,982
1910	42,549
1911	43,823
1912	39,213
1913	32,708
1914	49,464
1915	52,213
1916	63,468
1917	83,718
1918	59,315
1919	80,529
1920	75,274
1921	42,000
1922	76,785
1923	70,190
1924	60,713
1925	573,021
1926	558,078
1927	435,554
1928	548,952
1929	922,580
1930	848,296
1931	653,325

VALUE OF LIMESTONE, LIME AND CEMENT PRODUCED

IN

SOUTH DAKOTA

(1905--1931)



The figures for the production of limestone used as rock (crushed rock, rip rap, etc.) fluctuate greatly. The first report appears in the year 1897 with a production value of \$3,895. Five years later, 1902, a value of \$86,905 makes a maximum production value which has been equalled only once since that time, namely in the years 1925 and 1926. An analysis of this situation is not within the scope of this report. It is interesting to note, however, that since 1905 the general trend of the production curve has been upward.

The figures for the total value and tonnage as far as they were recorded are given below:

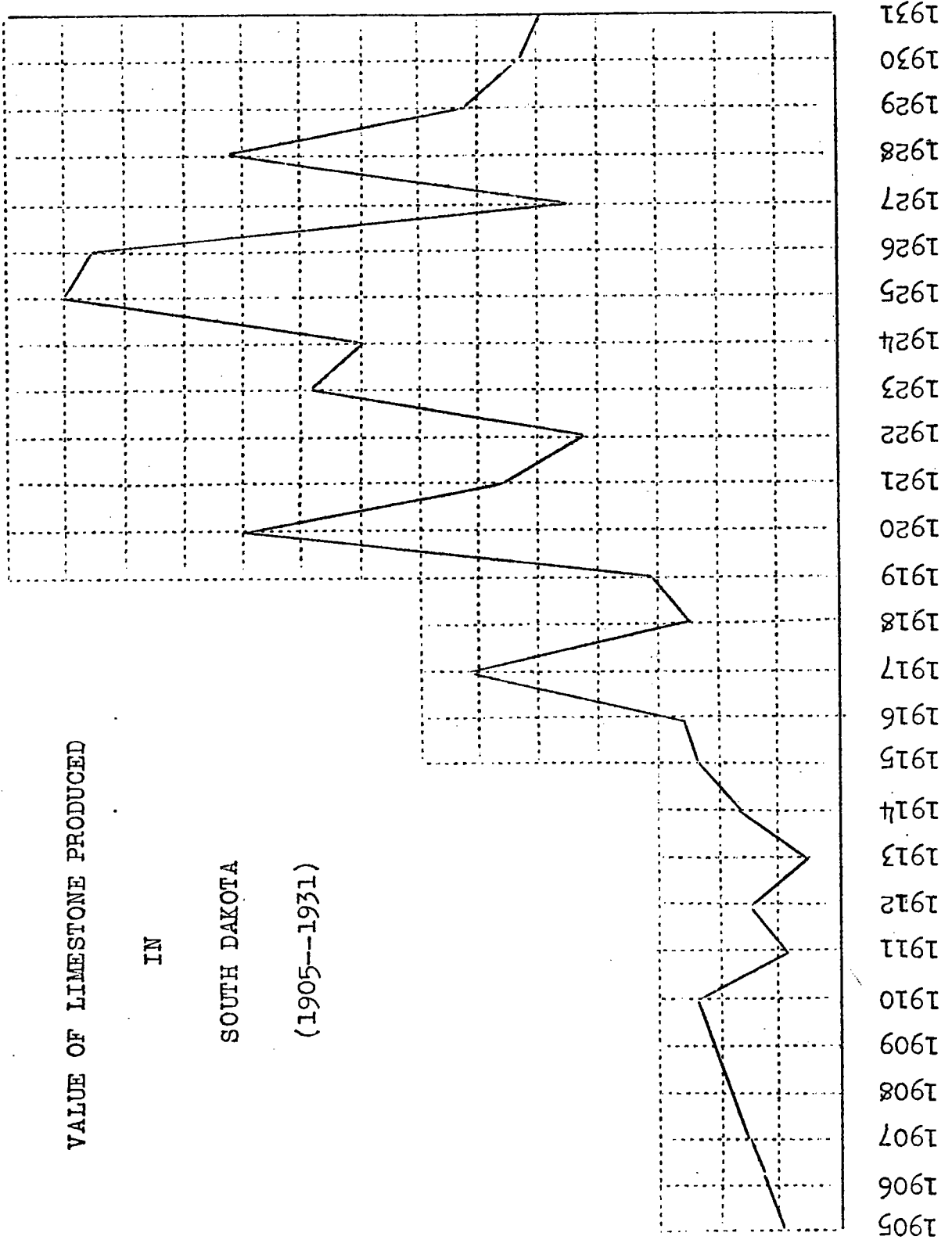
#### VALUE OF LIMESTONE PRODUCED IN SOUTH DAKOTA

<u>Year</u>	<u>Short Tons</u>	<u>Value</u>
1897		\$3,895
1898		26,858
1899		45,808
1900		47,762
1901		53,780
1902		86,605
1903		39,266
1904		27,914
1905		6,653
1906		
1907		11,600
1908		
1909		
1910		17,150
1911		6,250
1912		10,628
1913		4,098
1914		12,488
1915		17,485
1916		19,435
1917		46,130
1918		18,825
1919	17,750	23,989
1920	43,350	75,274
1921	24,880	42,000
1922	19,340	32,795
1923	43,280	70,190
1924	39,360	60,713
1925	73,080	97,880
1926	72,570	94,617
1927	32,360	34,261
1928	60,940	77,358
1929	40,590	55,513
1930	36,770	39,705
1931	39,370	37,320



\$105,000  
 97,500  
 90,000  
 82,500  
 75,000  
 67,500  
 60,000  
 52,500  
 45,000  
 37,500  
 30,000  
 22,500  
 15,000  
 7,500  
 0

VALUE OF LIMESTONE PRODUCED  
 IN  
 SOUTH DAKOTA  
 (1905--1931)



## Sandstone and Quartzite

The quarrying of quartzite is perhaps the oldest stone industry in South Dakota. The first production reported by the Federal government was in the year 1889 when the Minnehaha quarries produced stone to the value of \$304,000, while twelve quarries in the Black Hills produced \$93,570. A gap of nearly a decade follows in which no reports are available except for the year 1891, which shows a \$100,000 production for Minnehaha County and \$25,000 for the Black Hills. From 1898 to the present the record is continuous but never again does the value reach that shown in 1889. The reason for this initial production lies partly in the fact that the Minnehaha County quarries furnished the only hard rock available for building in eastern South Dakota at the time. All large buildings in and about Sioux Falls were made of it and many buildings in cities and towns as far away as Sioux City contain the same stone. It was even shipped as far as Chicago where it was used for paving blocks. It was also polished and used as an ornamental stone for interior and exterior decoration. With the lowering of freight rates, wood became more popular as a building material since the dressing of quartzite was a rather difficult and expensive matter. The coming of concrete did not stop the use of quartzite since it makes an excellent material for aggregate. It has affected its production, however, in that its use as building block and ornamental stone has now entirely ceased and its production rest primarily on its use as crushed rock.

The early quarries were in the neighborhood of Sioux Falls, East Sioux Falls and Rowena. At present the East Sioux Falls and Rowena quarries are inactive, the industry centering around Sioux Falls, Dell Rapids, and Spencer. The formation which furnishes this rock outcrops in a great wedge shaped area with its apex at Mitchell, the north and south edges leaving the eastern quarter of the state in the vicinity of Flandreau and Canton respectively. This confines the rock to a relatively small part of the state. The accessible rock covers an even smaller area due to the cover of glacial debris which is too deep to strip economically over much of the area.

With the increased use of concrete, production of this stone can see a continued activity. It is surrounded by a large area where hard bedrock does not exist and its only rival is gravel, which is not in as high favor as a concrete aggregate.

In the Black Hills a number of sandstone quarries have been opened and operated for local markets but of these only one has been in continuous operation. This is the Evans Quarry at Hot Springs which was opened about 1889 as a project in the development of the city of Hot Springs. This quarry produces an excellent grade of sandstone which has been much used in the vicinity. The product has been used entirely for building blocks and outside stone ornaments.

The list of production figures follows.

VALUE OF THE QUARTZITE AND SANDSTONE PRODUCTION

IN

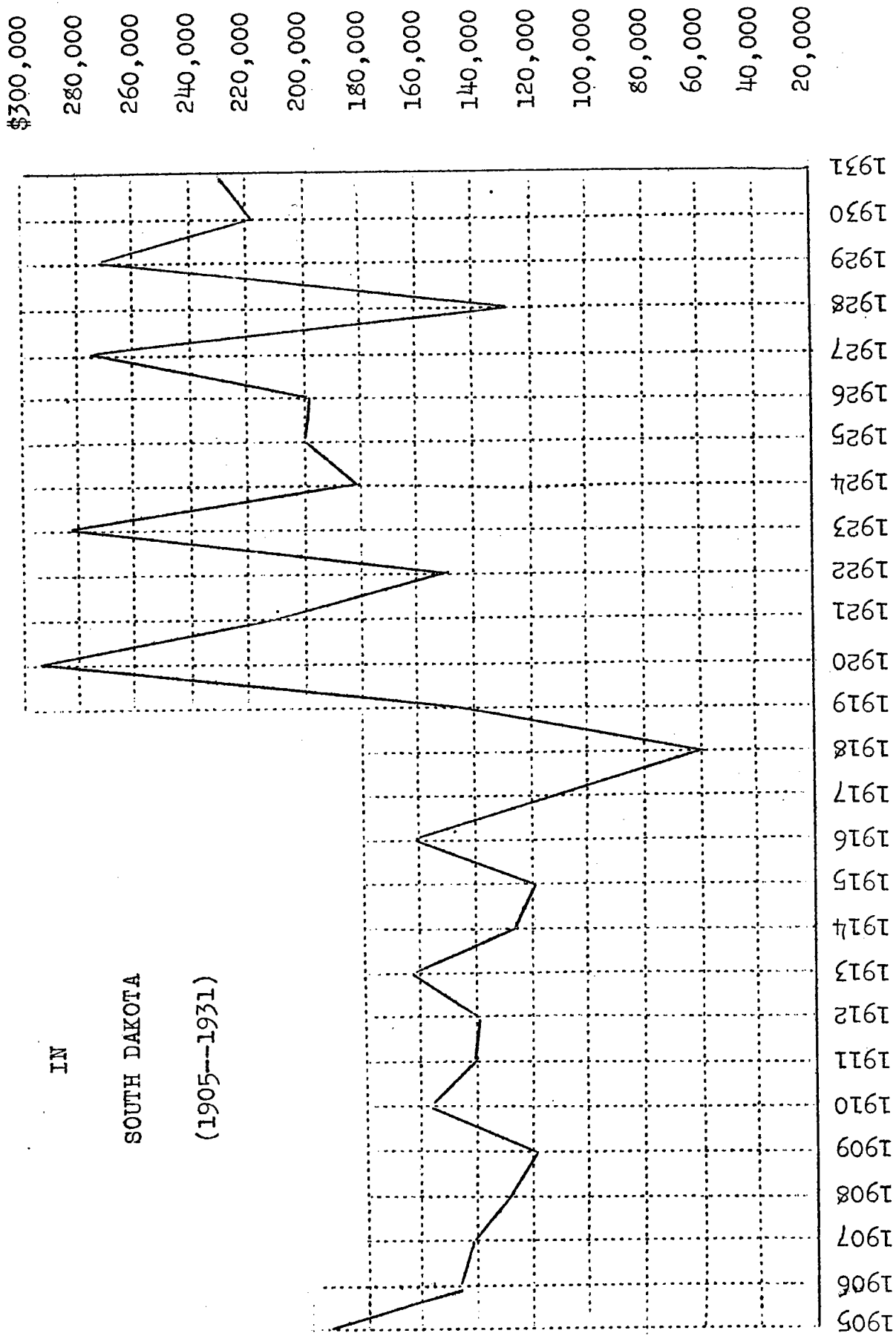
SOUTH DAKOTA

1889--1931

<u>Year</u>	<u>Short Tons</u>	<u>Value</u>
		\$398,243
1889		
1890		125,000
1891		
1892		
1893		
1894		
1895		
1896		68,961
1897		26,443
1898		109,374
1899		126,790
1900		117,588
1901		110,789
1902		163,067
1903		338,970
1904		193,408
1905		145,966
1906		143,585
1907		128,554
1908		118,029
1909		156,576
1910		141,615
1911		139,167
1912		163,165
1913		126,413
1914		119,225
1915		163,735
1916		116,785
1917		58,726
1918		146,742
1919	119,360	295,110
1920	146,750	213,235
1921	129,890	148,723
1922	99,780	284,127
1923	191,740	181,400
1924	121,500	196,607
1925	134,800	196,231
1926	133,530	275,615
1927	210,500	127,313
1928	94,380	274,482
1929	193,470	218,908
1930	91,550	229,288
1931	168,590	

VALUE OF SANDSTONE AND QUARTZITE PRODUCED

IN  
SOUTH DAKOTA  
(1905--1931)



## Miscellaneous Stone

This includes a variety of stones which have been produced for road metal and concrete aggregates. Most of them are porphyrys and other igneous and metamorphic rocks of the Black Hills which have been used on local projects. Production figures for these stones are available only since 1921 and are given in the following table.

### VALUE OF MISCELLANEOUS STONE PRODUCED

IN

SOUTH DAKOTA

1921--1931

<u>Year</u>	<u>Short Tons</u>	<u>Value</u>
1921	10,940	\$13,983
1922	4,000	5,680
1923	3,400	3,571
1924		3,888
1925	2,510	3,885
1926	3,410	10,188
1927	17,190	4,050
1928	4,340	5,761
1929	4,430	8,671
1930	32,360	9,770
1931	17,820	

## Sand and Gravel

Sand and gravel production has been made important by the increased use of concrete and the rapid expansion of all-weather roads throughout the state. Where crushed rock is not readily obtainable, as is the case over more than three quarters of the state, gravel makes a very acceptable substitute for concrete aggregate. It has been much used for this purpose since it is widely distributed and hence readily obtainable.

During the era of rapid road improvement there was great demand for a cheap, readily accessible material for road surfacing. Gravel has answered this purpose very well, as it could be obtained from many roadside pits within easy hauling distance of the highways. It required very little preparation before applying to the road and makes a surface which will carry the traffic on all highways except a few where it is unusually heavy. A large proportion of the six thousand miles of state highways has been surfaced in this manner and in parts of the state a large mileage of country highways has been similarly treated. These roads took large quantities of gravel since it requires fifteen hundred to two thousand cubic yards to surface a mile of highway. The amount of gravel necessary for maintaining these roads exceeds the amount used in building them as they must be patched and resurfaced frequently.

Much of the exploitation of gravel and sand has been temporary in character. Pits were opened and used for the building or surfacing of a stretch of highway and then abandoned. Other construction has followed a similar course where the character of materials available was not a prime object. This has made complete tallies of production difficult and may account for some of the fluctuation seen in the production figures.

Permanent plants offering a superior product of washed and screened gravel, however, have been in operation for a number of years. The largest of these plants are in the Big Sioux Valley at Watertown and Sioux Falls. Small washing plants with portable or semi-portable equipment are located near Madison, Mitchell, Rapid City and at some other points in the state. In 1931 washing and screening plants produced 1,015,378 tons of "prepared" material which was valued at \$826,599. This was about one half of the tonnage produced in the state and eight-ninths of the total value since the figures for the year read: 2,369,279 tons valued at \$931,137.

The price paid for sands and gravels has varied greatly at different times and different places. Its fluctuation seems to have been caused by differences in demand, available supplies, and competition. The lack of uniformity between tonnage figures and the value figures reflect this fluctuation. In 1915 a production of 256,270 tons was valued at \$45,717, and average about 17¢ per ton, while in 1928 a production of 2,461,963 tons was valued at \$1,301,075, an average of about 53¢ per ton. The same thing can be noticed in a comparison of the figures for 1928, 1929, 1930 and

1931. During this time the tonnage production remained fairly constant, but the value varied considerably. It will be noted that on the whole the value of sand and gravel production has been increasing during the quarter century here recorded.

VALUE OF SAND AND GRAVEL PRODUCED

IN

SOUTH DAKOTA

1905--1931

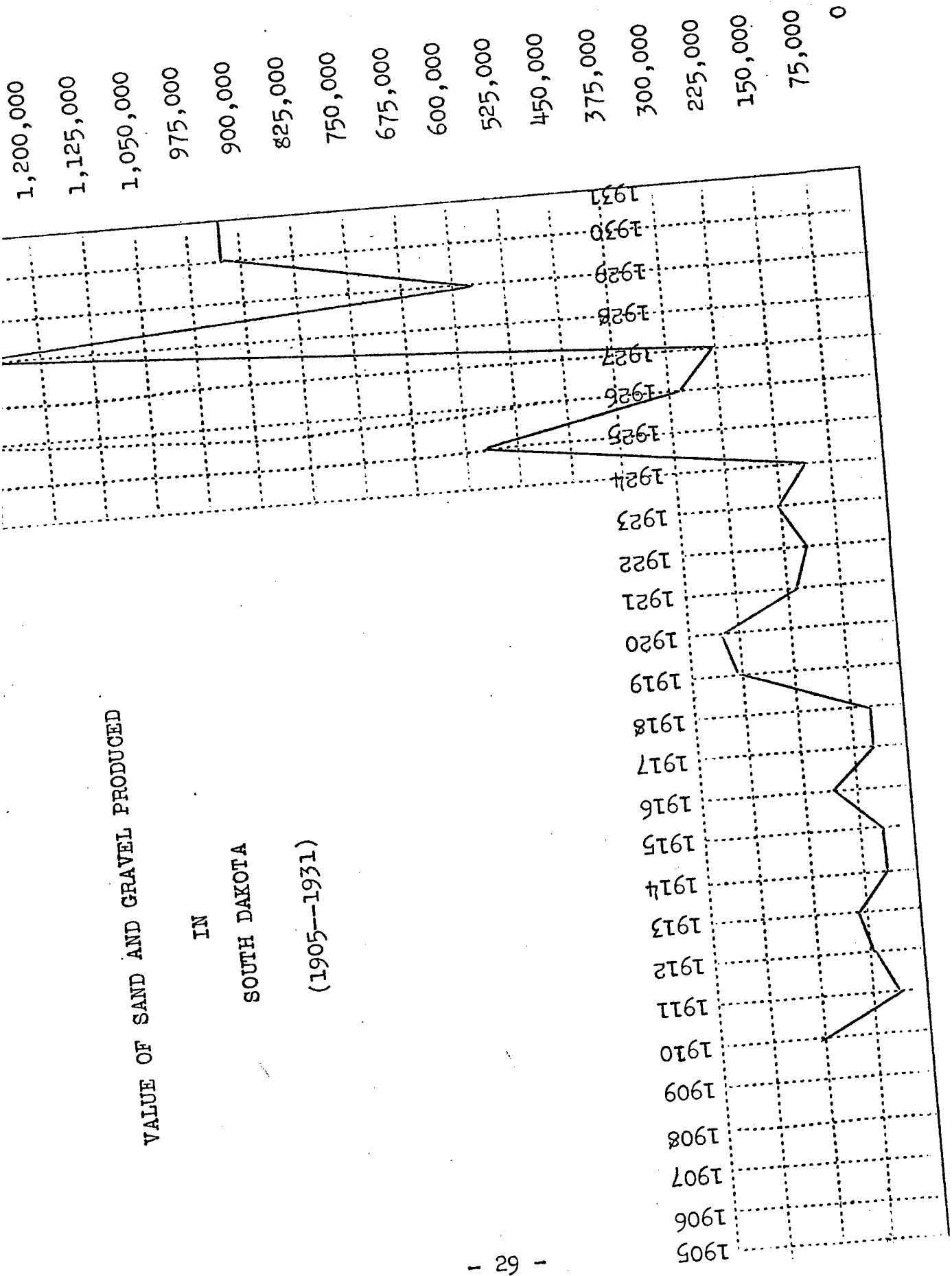
<u>Year</u>	<u>Short Tons</u>	<u>Value</u>
1905		
1906		
1907		
1908		
1909		\$157,738
1910	849,800	41,286
1911	92,757	69,348
1912	545,622	89,306
1913	1,068,833	40,215
1914	232,395	45,717
1915	256,270	133,755
1916	1,095,594	49,654
1917	194,520	48,362
1918	229,787	231,390
1919	648,939	253,614
1920	572,259	136,152
1921	185,639	121,690
1922	200,408	156,914
1923	304,768	113,602
1924	323,303	576,248
1925	1,769,922	386,591
1926	2,013,350	231,218
1927	1,162,823	1,301,075
1928	2,461,963	578,204
1929	2,729,271	931,814
1930	2,419,441	931,137
1931	2,369,279	

VALUE OF SAND AND GRAVEL PRODUCED

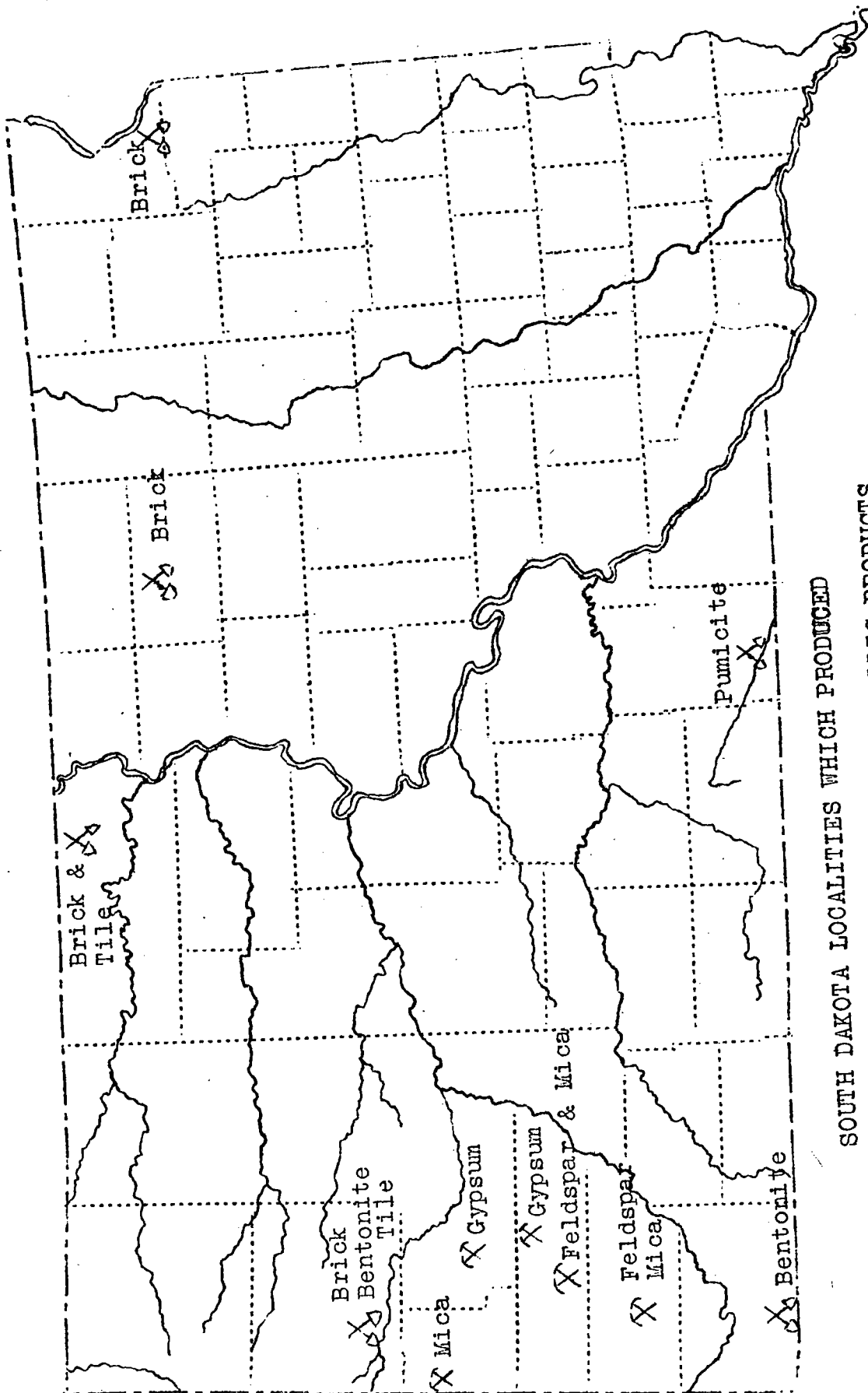
IN

SOUTH DAKOTA

(1905--1931)







SOUTH DAKOTA LOCALITIES WHICH PRODUCED  
CERAMIC AND "MISCELLANEOUS" NON-METALLIC PRODUCTS.

1905--1931

## CERAMIC MATERIALS

Under this head are included clays and all products which are used in the making of clay products. Some of the more common industries based on these materials have to do with the making of china, porcelain ware, brick, terre cotta, etc. Some of the materials have other than strictly ceramic uses but as this is an attempt to show the production of crude mineral products, no effort will be made to separate them according to uses.

### Clays

Besides brick and tile clays, South Dakota has produced fire clays, bentonite and fuller's earth. The production has been small in most of these, however, brick clays and bentonite being the only two which have produced consistently. Bricks were made at many points east of the Missouri during the early history of the state. Glacial clays were used, which, in most places, gave a "soft" brick. Soft brick served a useful purpose until the lower price of lumber drove them out of business. In recent years three plants have continued to operate, one at Milbank, one at Watauga and one at Belle Fourche. Fire clays and fuller's earth were never quarried and sold commercially but bentonite has been produced and refined since 1918 at a plant in Ardmore. Bentonite pits have also produced at Buffalo Gap and Belle Fourche.

Unfortunately, official figures are not available for the total production for the entire quarter century, due to the fact that the canvass made by the Federal bureaus did not include the value of clays used in products which were manufactured at the pit after the year 1920. This arbitrarily ruled out the value of clays used as bricks and tiles unless such clay was dug and shipped to another state, which was not the case in South Dakota. The following figures, therefore, are given in two groups. The group from 1905 to 1920 representing the entire production sold or burned in the state, and the list from 1918 to 1931 including the raw clays only.

## CLAY PRODUCTS PRODUCTION

<u>Year</u>	<u>Value</u>
1905	\$58,271
1906	58,175
1907	40,107
1908	63,847
1909	68,660
1910	71,200
1911	61,365
1912	41,496
1913	46,685
1914	57,711
1915	36,342
1916	115,474
1917	47,213
1918	32,161
1919	73,571
1920	69,237

## RAW CLAY PRODUCTION

<u>Year</u>	<u>Tons</u>	<u>Value</u>
1916	390	\$390
1917		1,000
1918	100	
1919		
1920	900	9,000
1921	100	1,000
1922	400	4,000
1923	500	3,850
1924	1,045	9,680
1925	1,810	17,800
1926	1,056	4,194
1927	1,066	10,660
1928	1,275	5,100
1929	960	3,840
1930		2,700
1931		

## Feldspar

The presence of mineable quantities of feldspar in the igneous rocks of the Black Hills has been recognized for a long time, but due to the distance from market it has only been within the last few years that it could be marketed profitably. A rapid increase in production has taken place since that time which has moved South Dakota up to the fourth place among feldspar-producing states in the United States. The first mention of South Dakota's feldspar deposits in official production reports is in Mineral Resources of the United States for 1915, published by the U. S. Geological Survey which states that: "In the vicinity of Harney Peak, Custer County, in the Black Hills region of South Dakota, there are many pegmatite dikes. These have been mined for tin and lithium bearing minerals and for mica but have not been worked as a source of feldspar."

No production is reported, however, until 1924 when South Dakota is mentioned as the eighth of the twelve feldspar producing states in point of quantity produced. In 1928 it had crept up to seventh place which position it also held in 1929. In 1930, however, it jumped to fourth place.

No figures for tonnage or volume were published in the official report except in combination with other states. Some tonnage estimates given by Drs. J. P. Connolly and C. C. O'Harra on page 249, Bulletin 16, South Dakota School of Mines, may be of interest in showing the trend of this production. This report says the first commercial production was in 1923 and gives the following table.

1923	150 Tons
1924	1800 Tons
1925	2000 Tons
1926	4400 Tons
1927	4400 Tons
1928	6400 Tons
	<hr/>
Total	19150 Tons

In the summary of mineral products in the same publication, on page 401, it is stated that the total feldspar production up to 1928 has been 111,000 tons.

The official figures were given for the year 1931 and showed a production of 11,061 tons at a value of \$39,013. Although most of these figures are only estimates they are doubtless accurate in showing that the production of feldspar has been on the increase since its inception in 1923 and judging from the last figures available the increase is due to continue.

## MISCELLANEOUS NON-METALLIC PRODUCTS

During the period under consideration South Dakota has produced several non-metallic products that cannot be included in the foregoing classification. These include gypsum, mica, pumicite, flint for lining tube mills, pebbles for tube mills, gem stones, and water. Of these gypsum has been produced continuously. The rest have had either periodic or a very short-lived production.

### Gypsum

Though gypsum can be found widely scattered over the state, the only workable deposits lie in a narrow belt surrounding the Black Hills. These deposits have been quarried and calcined since 1893. The first plant was put into operation at Hot Springs in 1893, the second one at Spearfish and the third one at Rapid City. All these have been abandoned after a period of production lasting from 8 to 15 years. Their places have been taken, however, by a plant at Black Hawk and one at Piedmont which are now in operation. The earlier plants operated for local market almost entirely but those now in operation depend largely on more distant markets.

According to J. P. Connolly and C. C. O'Harra in Bulletin 16, of the South Dakota School of Mines, on Page 284, the total production of gypsum from South Dakota between the years of 1893 and 1929 was 400,000 tons, valued at \$1,800,000. Official figures for yearly production are not available since they were included in totals published by the Federal Government. The State Mine Inspector published figures for the years 1912 to 1926 inclusive, which will give some idea of the trend of the industry during that time. The value curve shows a high point during the war with a slow decline following. The present depression has doubtless affected the industry though figures for this are not available. The material is present in abundance and plants are already in operation so that with the return of business activity the value of South Dakota's gypsum production may return to post-war figures.

VALUE OF GYPSUM PRODUCED

IN

SOUTH DAKOTA

1912--1926

(Figures published by State Mine Inspector)

<u>Year</u>	<u>Tonnage</u>	<u>Value</u>
1912		\$31,000
1913		61,735
1914		59,000
1915	12,293	24,586
1916	4,070	24,000
1917	7,915	47,500
1918		45,160
1919	12,456	86,704
1920	7,604	50,109
1921	12,156	72,936
1922	13,557	85,580
1923	9,621	76,968
1924	5,149	41,192
1925	10,031	57,891
1926	6,447	58,032
		Year ending Nov. 1, 1912
		Year ending Nov. 1, 1913
		Year ending Nov. 1, 1914
		Year ending Dec. 31, 1915
		Year ending Dec. 31, 1916
		Year ending Dec. 31, 1917
		Year ending Dec. 31, 1918
		Year ending Dec. 31, 1919
		6 Months ending June 30, 1920
		Year ending June 30, 1921
		Year ending June 30, 1922
		18 Months ending Dec. 31, 1923
		Year ending Dec. 31, 1924
		Year ending Dec. 31, 1925
		Year ending Dec. 31, 1926.

Mica

The production of mica was one of the most important mineral industries in the state during the early days of mining. This mineral was found in the volcanic rocks of Custer County, most of the mining being located in the vicinity of Custer. The first mine was opened about 1879 and from that time until 1884 there was a lively business in producing sheet mica, which was in demand by the manufacturers of electrical apparatus. The output for 1884 was valued at about \$50,000. Production suddenly ceased after that year, however, due to outside competition and has never been fully revived. Though there has been some sale for scrap mica, most of which has been produced as a by-product from the pegmatite mines at Custer, Keystone, and Tinton. Complete figures for this production during the quarter century covered by this report are not available, but the scattered information which is available indicates a rather erratic production.

VALUE OF SCRAP MICA PRODUCED

IN

SOUTH DAKOTA

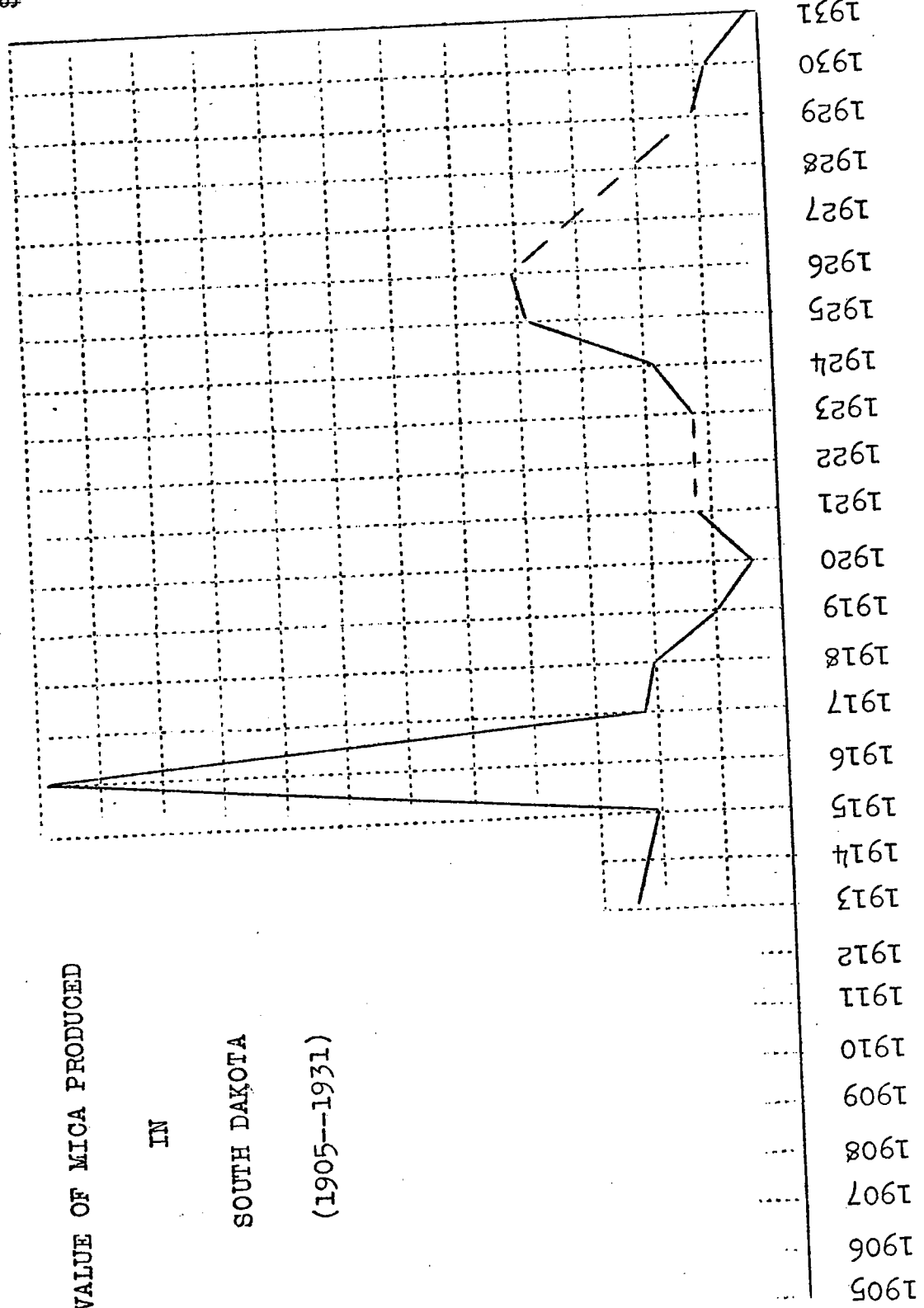
1913--1931

<u>Year</u>	<u>Short Tons</u>	<u>Value</u>
		\$12,609
1913		
1914		10,914
1915		59,770
1916		11,008
1917		10,464*
1918	249	5,245*
1919	330	
1920		2,290
1921	92	
1922		6,480
1923	324	9,267
1924	458	19,220
1925	996	20,330*
1926	1,070	
1927		
1928		
1929 )		
1930 :-		11,913
1931 )		

\*Figures taken from the State Mine Inspector's Reports

\$60,000  
 55,000  
 50,000  
 45,000  
 40,000  
 35,000  
 30,000  
 25,000  
 20,000  
 15,000  
 10,000  
 5,000  
 0

VALUE OF MICA PRODUCED  
 IN  
 SOUTH DAKOTA  
 (1905--1931)





## Pumicite

Pumicite is the trade name often applied to volcanic ash. Beds of this material have been known to occur in the south-central and southwestern parts of South Dakota for a long time, but no attempt has been made to exploit them until 1929 when a pit was opened near Winner in Tripp County. There are a number of uses for pumicite, the chief of which is as abrasives. It is for this purpose that most of the South Dakota production has been used. This quarry has been opened too short a time to plot a curve which would indicate the future possibilities of the production, but it is significant in that it marks the exploitation of a new resource of the state.

## Gem Stones

A small production of gem stones is reported from 1906 to 1914, and again in 1921. The report might have been extended to the present for there has been a little scattering business in semi-precious and ornamental stones. The canvass has not been carried on consistently, but the following figures may be of interest.

	\$4,000
1906	5,200
1907	
1908	2,520
1909	2,537
1910	1,644
1911	642
1912	162
1913	404
1914	385
1921	

## Others

There have been attempts to produce a number of other non-metallic materials commercially, but most of this production has been short-lived and did not reach sufficient proportion to be counted in the official figures. In 1929 a production of flint for lining of tube mills was reported. The figures show an output of 2,400 tons, valued at \$30,000. About the same time there was an attempt made to substitute local pebbles for the imported Danish pebbles used in ball mills for grinding the metallic ores of the Black Hills. A production was reported in 1924 but no figures given. In 1926 a production of 1900 short tons valued at \$22,000 was reported. That closed this industry so far as official figures show.

Mineral and potable waters have been sold in the state, but the canvass of their production has not been carried on continuously. Figures are available for the years 1911 and 1914 to 1923 only.

MINERAL WATER PRODUCTION

IN

SOUTH DAKOTA

1911--1923

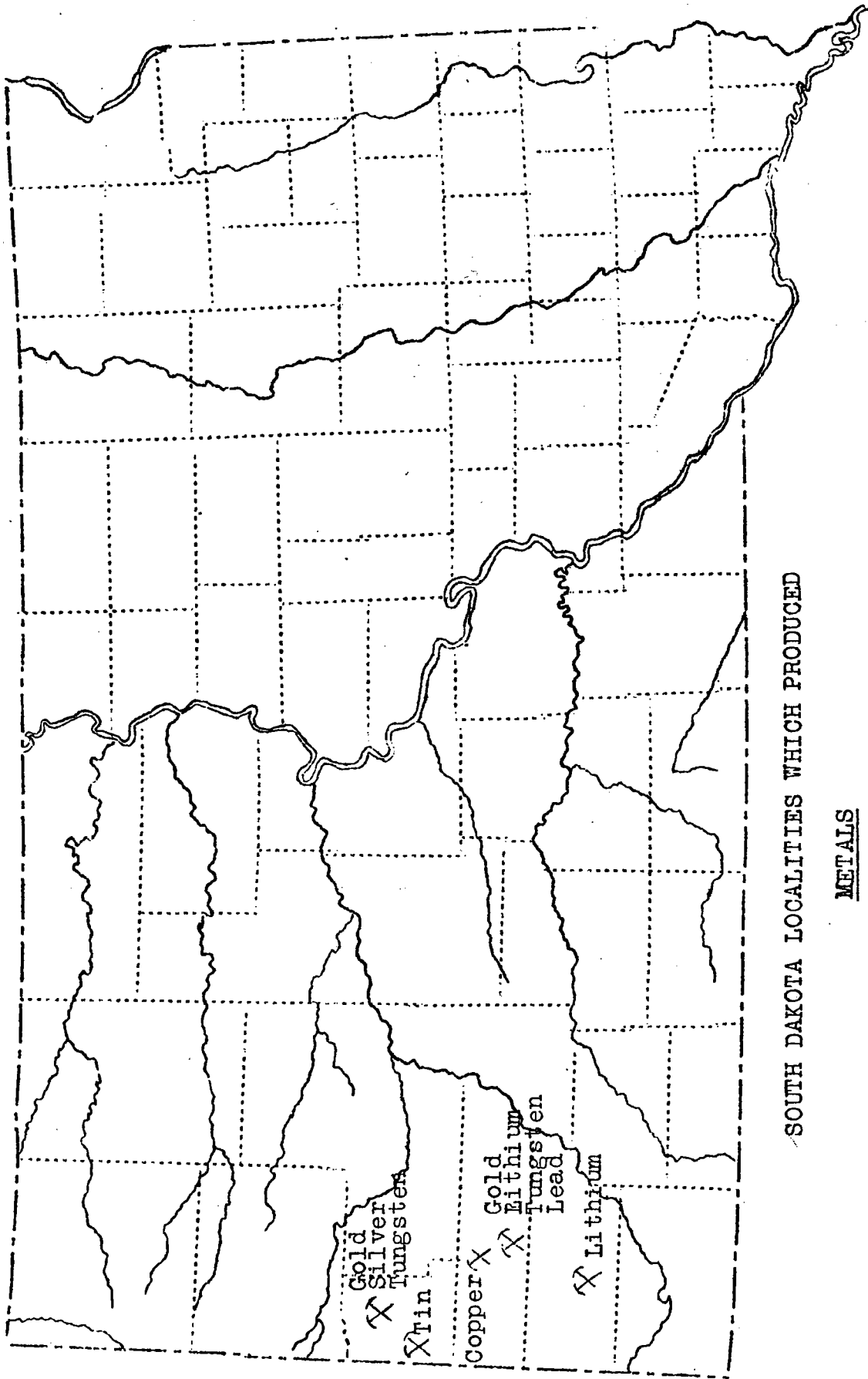
<u>Year</u>	<u>Gallons Sold</u>	<u>Value</u>
1911	13,400	\$2,140
1912		
1913		
1914	145,647	8,999
1915	176,000	9,360
1916	470,725	20,512
1917	443,167	13,545
1918	454,865	17,269
1919	785,404	23,961
1920		
1921		
1922	796,500	32,850
1923	780,500	29,610

Canvass discontinued after 1923.

## METALS

South Dakota has long been famous as a gold producer. It was the lure of gold which first brought white men into the Black Hills. Though gold has been reported from the gravels of the Big Sioux Valley, and one attempt at least has been made to exploit silver east of the Missouri, and though manganese occurs in the shales in the lower part of the Missouri Valley, no metals have been produced commercially outside of the small area of crystalline rock which forms the heart of the Black Hills. In this small region, however, there occurs an unusually long list of metals which have been mined and sold at one time or another.

Gold and silver have shown a continuous production during the quarter century. Lithium has enjoyed a more limited but fairly continuous production. These are followed by tungsten, lead, tin, copper, and a few rare metals such as niobium, caesium, and beryllium which have been mined largely as by-products or sporadically when the demand was created.



SOUTH DAKOTA LOCALITIES WHICH PRODUCED

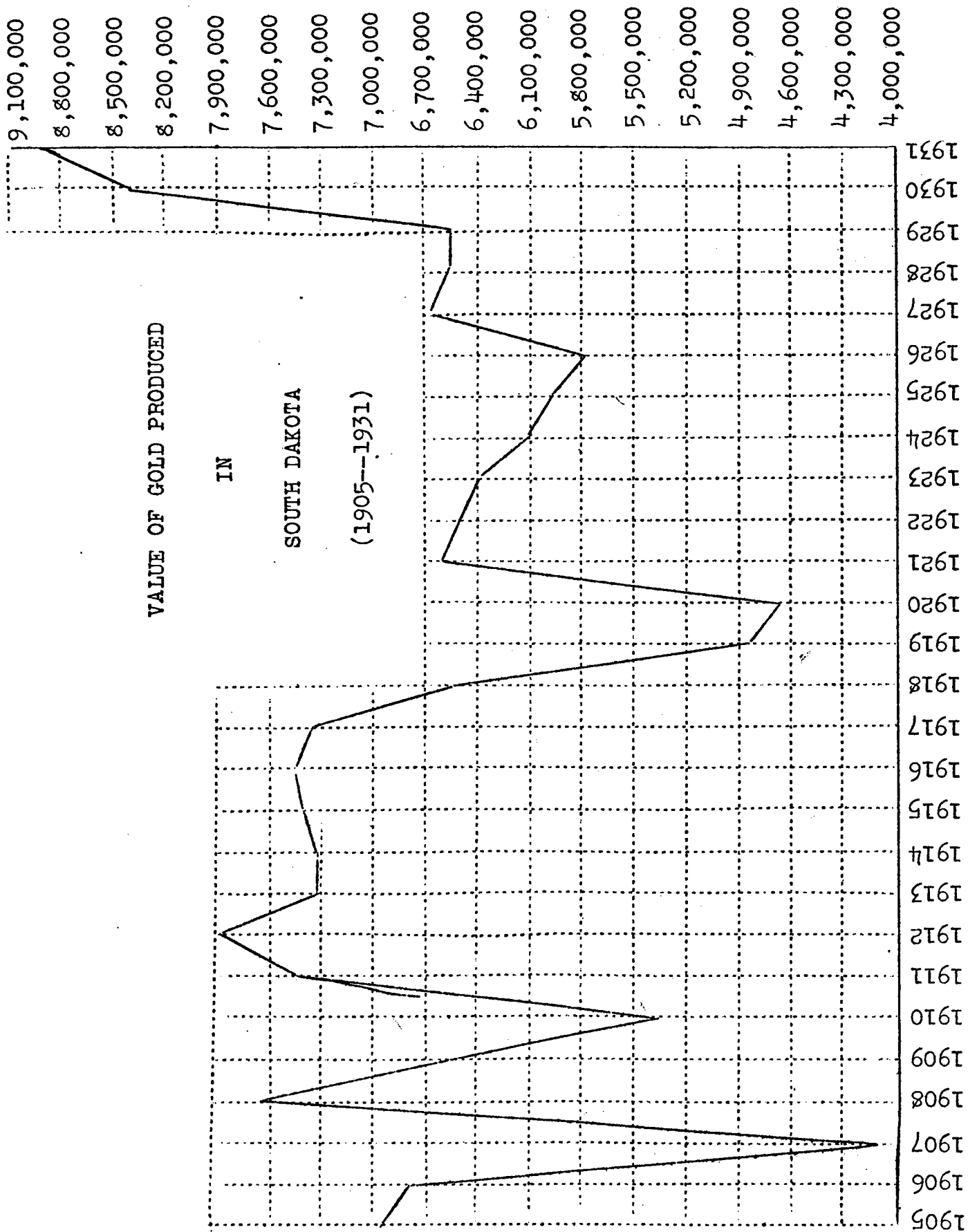
METALS

1905---1931

## Gold

Both lode and placer gold has been produced in South Dakota during the last quarter century, the value of the lode gold, however, far exceeding that obtained from placers. The largest single lode producer is the Homestake Mine at Lead which has been in continuous operation since 1877. Its output has been supplemented, however, by that from several other mines in the Northern Black Hills by the findings of a large number of small operators who have been working placer deposits. The total gold production for the quarter century is valued at \$180,497,890. A glance at the following table and graph shows a fairly steady but slow rise in the annual production from nearly \$7,000,000 in 1905 to nearly \$9,000,000 in 1931.

<u>Year</u>	<u>Troy Ounces</u>	<u>Value</u>
1905	338,116.70	\$6,989,492
1906	330,956.06	6,841,469
1907	200,185.00	4,138,200
1908	374,529.00	7,742,200
1909	317,998.00	6,573,600
1910	260,267.00	5,380,200
1911	359,904.00	7,439,874
1912	381,745.00	7,891,370
1913	354,071.00	7,319,294
1914	354,758.00	7,333,508.
1915	385,280.00	7,406,305
1916	360,909.00	7,460,644
1917	356,245.00	7,364,233
1918	317,598.00	6,565,337
1919	235,250.00	4,863,040
1920	226,224.00	4,676,470
1921	319,525.00	6,605,167
1922	315,298.00	6,517,788
1923	309,905.00	6,406,306
1924	295,930.00	6,117,421
1925	289,747.00	5,989,604
1926	279,529.00	5,778,376
1927	322,032.00	6,656,987
1928	317,379.00	6,560,805
1929	316,837.00	6,549,599
1930	406,297.00	8,398,900
1931	432,075.39	8,931,791



## Silver

The silver produced from the Black Hills has come almost entirely as a by-product of gold mining during the quarter century here considered. During the early history of mining in this region, however, some silver was produced from silver-lead ores, but these mines have been practically inactive for many years.

There has been considerable fluctuation in both production and value of silver mined and the two do not always change in the same direction. This is due to the variations in the market price of silver. Though the production has increased somewhat during the last six or eight years, the value has not kept pace with it. This is especially notable during the last four years, 1928 to 1931. During these years the production has increased 23,015 troy ounces due to the increased gold production but the value has fallen off \$21,596. The following table and graph will show the production and value fluctuation.

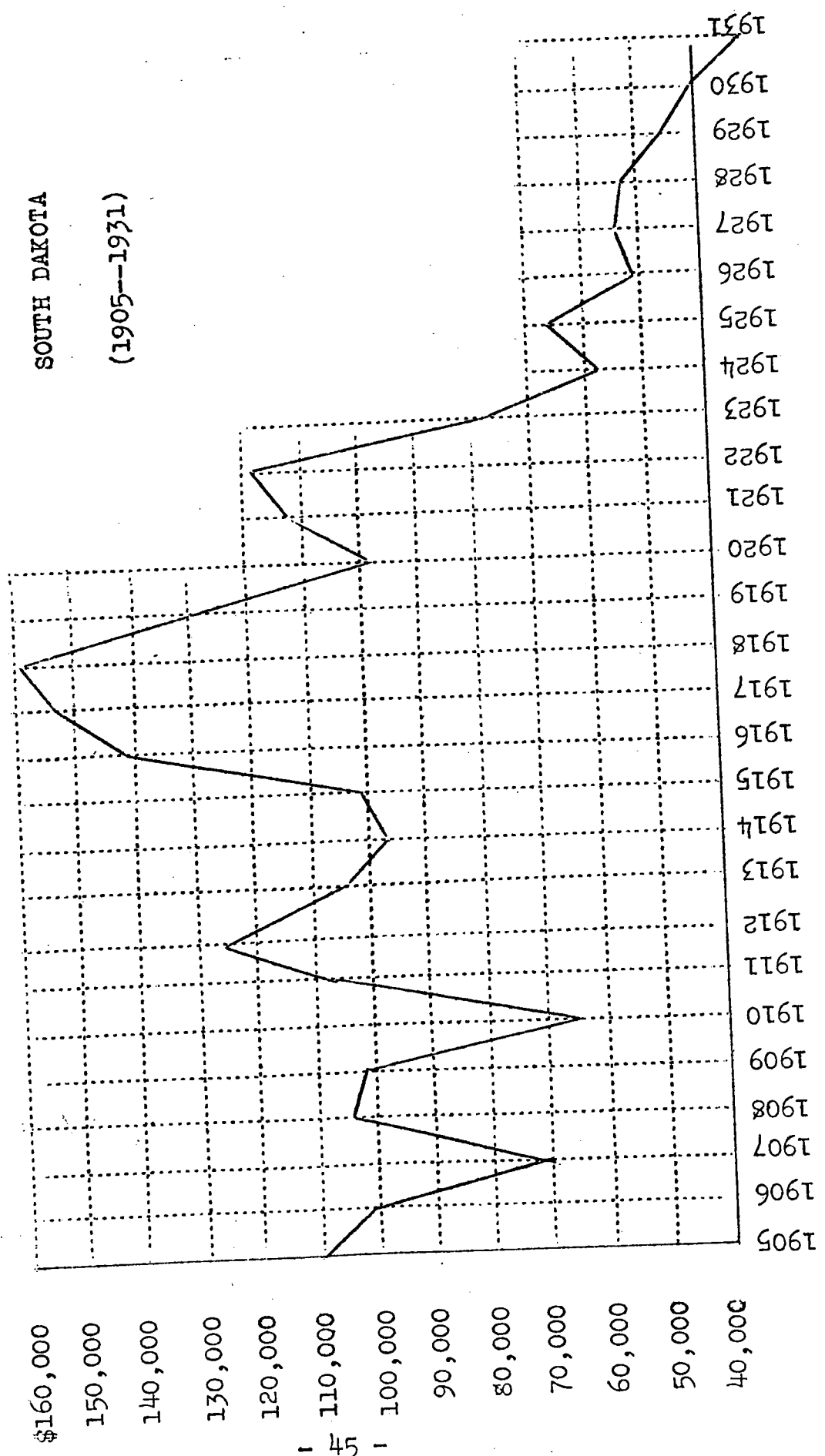
<u>Year</u>	<u>Troy Ounces</u>	<u>Value</u>
		\$110,381
1905	182,749	101,086
1906	150,875	70,400
1907	106,600	105,500
1908	197,300	102,100
1909	196,300	65,100
1910	120,600	107,990
1911	203,755	126,973
1912	206,460	104,312
1913	172,702	97,683
1914	176,642	101,331
1915	199,864	141,605
1916	215,205	153,894
1917	186,765	159,202
1918	159,202	130,472
1919	116,493	98,966
1920	90,795	112,464
1921	112,464	118,760
1922	118,760	78,592
1923	95,844	57,987
1924	86,548	66,716
1925	96,133	51,284
1926	82,186	54,529
1927	96,171	52,970
1928	90,547	45,402
1929	85,182	40,489
1930	105,166	32,933
1931	113,562	

VALUE OF SILVER PRODUCED

IN

SOUTH DAKOTA

(1905--1931)





## Lithium

Lithium bearing minerals were first mined in the Black Hills in 1883, the first shipment coming from the famous Etta Mine at Keystone. Commercial production really began in 1905 when this mine was purchased by the Maywood Chemical Company. Other mines at Keystone and Custer are producing this metal. Official production figures are available for only a few years but the following table has been compiled from various published sources. The reports for 1929, 1930, 1931 are not available.

1898--1913	\$143,000 <sup>1</sup>
1914	1,150 <sup>2</sup>
1915	5,120
1916	10,740
1917	25,620
1918	82,500
Jan. 1, 1919 to July 1, 1920	69,300
July 1, 1920 to July 1, 1921	43,250
July 1, 1921 to July 1, 1922	9,040
July 1, 1922 to Jan. 1, 1923	15,750
1923	39,125
1924	53,833
1925	40,900
1926	32,000
1927	13,140
1928	21,450
Total	<hr/> \$606,008

1./ Ziegler, Victor, "Mineral Resources of the Harney Peak Pegmatites" in Mining and Scientific Press, Vol. 108, Pp. 604-608, 654-656, 1914.

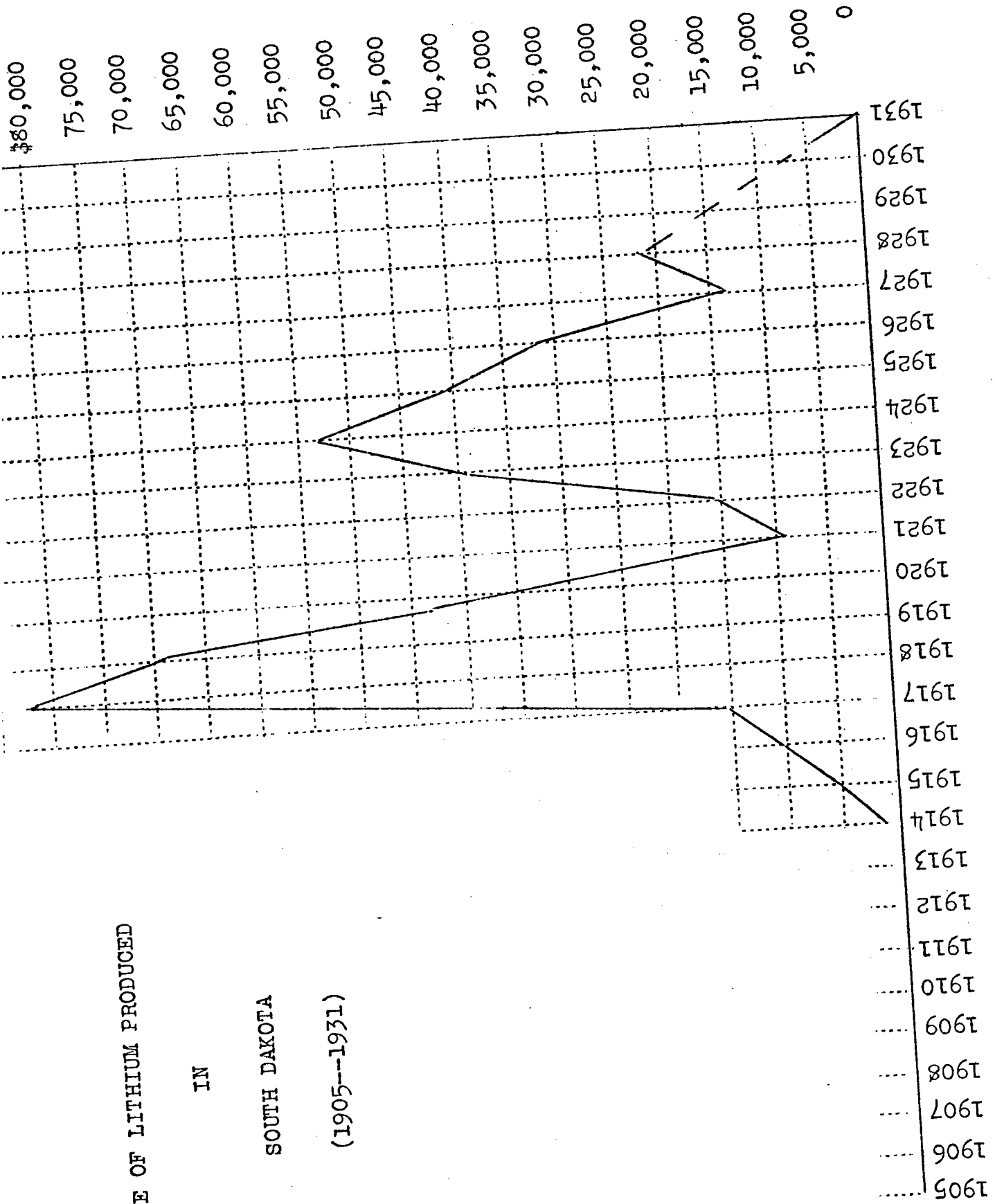
2./ Figures for 1914 to 1926, inclusive, are from the Annual Reports of the State Mine Inspector, Mr. Otto Ellerman.

VALUE OF LITHIUM PRODUCED

IN

SOUTH DAKOTA

(1905--1931)



## Lead

Lead production during the quarter century has been very erratic. It has been produced largely as a by-product of the silver-lead ores which have not been mined extensively. The following table shows this production.

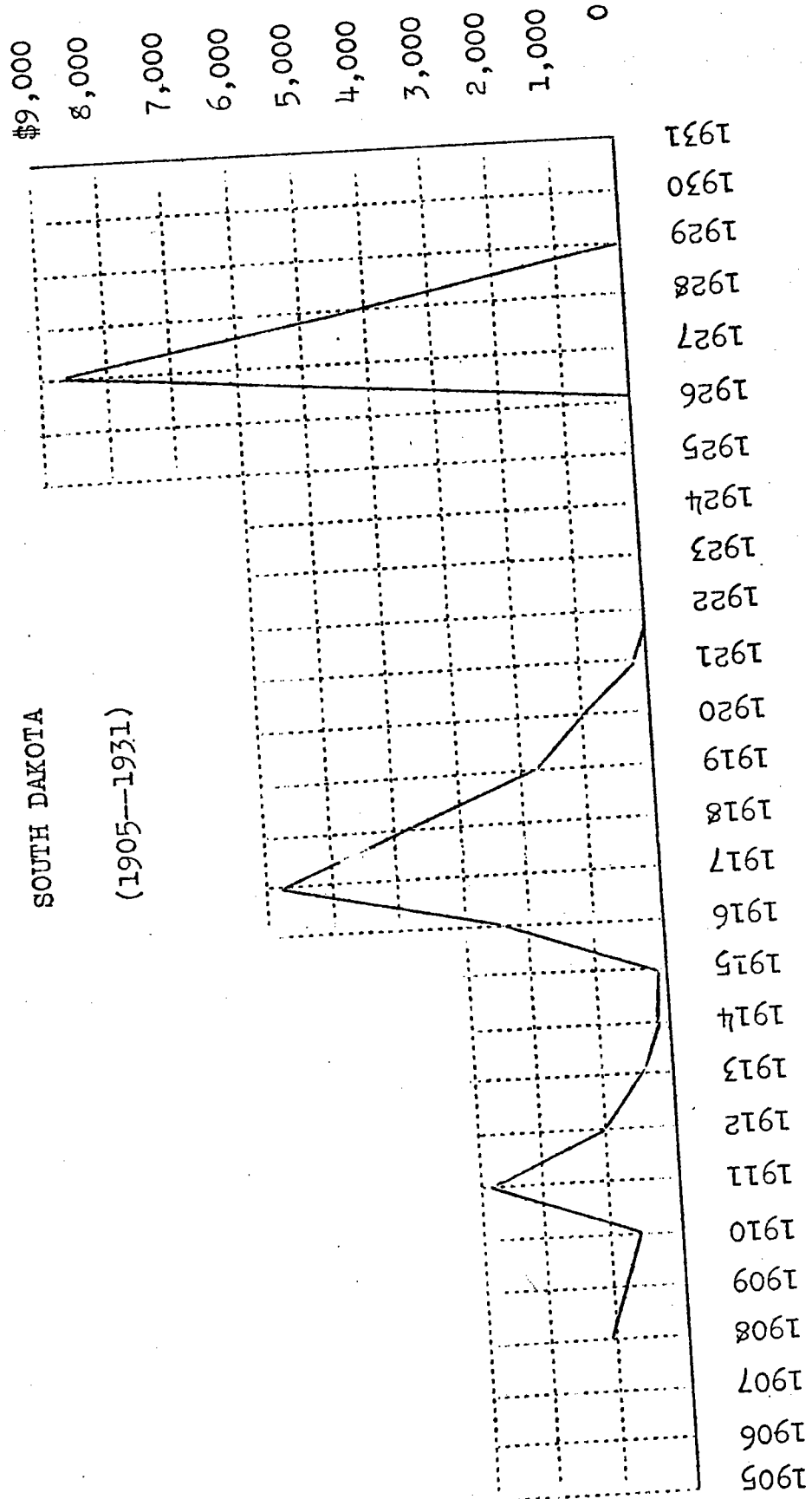
<u>Year</u>	<u>Short Tons</u>	<u>Value</u>
1908	13	\$1,092
1909		616
1910	7	2,970
1911	33	1,028
1912	11	449
1913	5	152
1914	2	146
1915	2	2,443
1916	18	5,855
1917	34	3,792
1918	27	1,725
1919	16	1,025
1920	6	180
1921	2	
1922		
1923		
1924		
1925		
1926		8,694
1927	69	4,292
1928	37	None
1929		None
1930		None
1931		

VALUE OF LEAD PRODUCED

IN

SOUTH DAKOTA

(1905--1931)



## Tungsten

Tungsten was discovered in South Dakota early in the eighties, the first shipment leaving the state in 1899. Its production, however, has been confined to two periods. The first occurred during the World War when there was a heavy demand for this metal which opened up a number of mines and made a large production from 1913 to 1918 inclusive. From 1919 to 1925, inclusive, no production was reported. The second productive period was of three years duration, 1926, 1927, 1928. All production stopped in 1929 and has not been resumed since.

### Tungsten Ore (60% Concentrates)

<u>Year</u>	<u>Short Tons</u>	<u>Value</u>
		\$64
1910		
1911		
1912		400
1913		
1914	140	181,089
1915	239	404,775
1916	270	299,644
1917	201	247,100
1918		
1919	No production	
1920	No production	
1921	No production	
1922	No production	
1923	No production	
1924	No production	
1925	No production	
1926	104.8	43,846*
1927	6,656 units	72,244*
1928	3,269 units	41,502*
1929	No production	
1930	No production	
1931	No production	

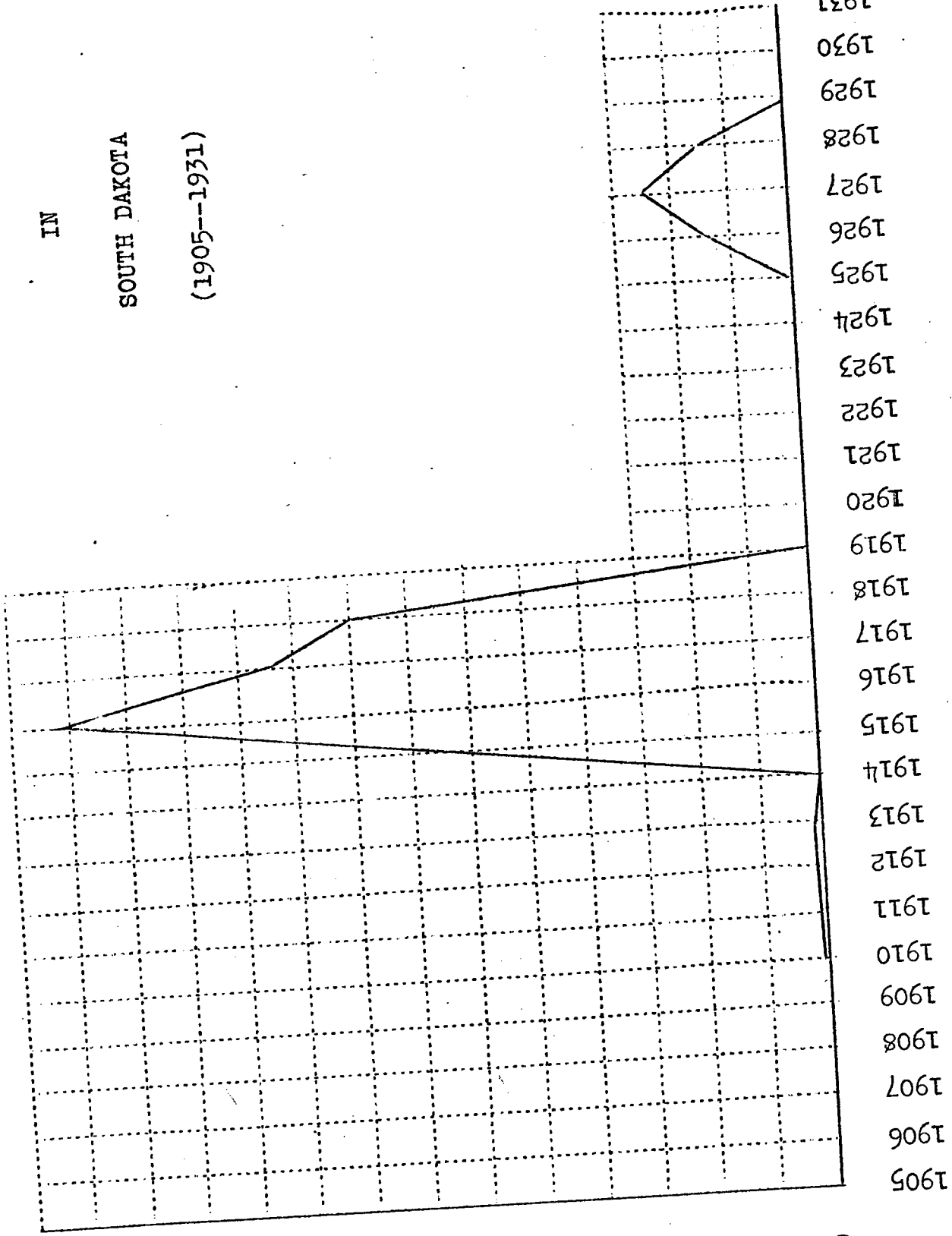
\*Figures for 1926, 1927, and 1928 were reported by J.P. Connolly and C. C. O'Harra in Bulletin 16 of the South Dakota State School of Mines, P. 208.

VALUE OF TUNGSTEN PRODUCED

IN

SOUTH DAKOTA

(1905--1931)



Tantalum

South Dakota has produced all the tantalum mined in the United States, at least since 1918. It is mined as the mineral columbite, which is found in the pegmatite mines at various places in the Black Hills. It is used in the making of certain alloys and for filaments in light bulbs and radio tubes. The production is limited and shows considerable fluctuation

COLUMBITE PRODUCTION IN SOUTH DAKOTA

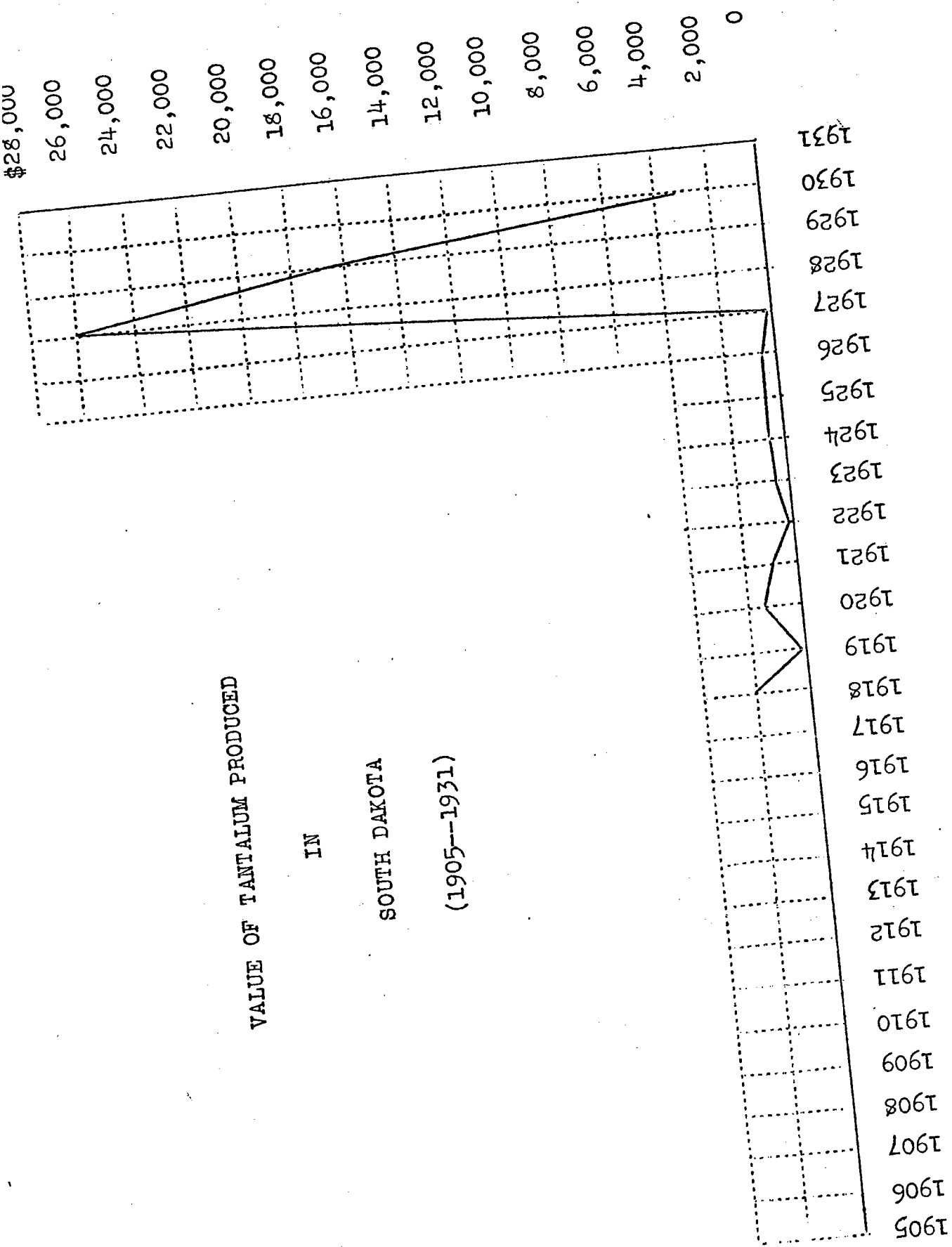
<u>Year</u>	<u>Pounds</u>	<u>Value</u>
1917	4,500	\$2,250
1918	300	90
1919	4,000	1,450
1920	3,400	1,150
1921	600	240
1922	1,350	540
1923	1,197	598
1924		
1925	2,100	650
1926	1,100	378
1927	34,899	26,332
1928	22,117	17,261
1929	5,100	3,350
1930		

VALUE OF TANTALUM PRODUCED

IN

SOUTH DAKOTA

(1905--1931)





Tin

A lively tin boom occurred in the Black Hills in the early days of mining but was rather short-lived. Production died with the boom but sporadic development work has been undertaken from time to time which has made a small production. The small figures and the number of gaps in the following table tell the story.

<u>Year</u>	<u>Short Tons</u>	<u>Value</u>
1905		
1906		
1907		
1908		\$4,832
1909	18	12,600
1910		
1911		
1912	1	660
1913		
1914		
1915		
1916	10	12,300
1917		200
1918		
1919	6	6,000
1920		
1921		
1922		
1923		
1924		
1925		200
1926	325 pounds	2,000
1927	$\frac{2}{3}$ Ton	200
1928	$\frac{3}{4}$ Ton	100
1929	$\frac{1}{2}$ Ton	50
1930		
1931		

Copper

Though fifteen or twenty copper prospects have been worked in the Black Hills, very little of the metal has been produced. A small production was reported during the first half of the quarter century and most of this came from stock which was collected in the course of development work. Just before and just after the World War there was some little activity but this had all died out by the close of 1918 and no production has been reported since.

## COPPER PRODUCTION IN SOUTH DAKOTA

<u>Year</u>	<u>Pounds</u>	<u>Value</u>
	38	\$ 6
1905		
1906		
1907		
1908	41,988	5,458
1909	43	5
1910	1,607	201
1911		
1912	1,793	278
1913		
1914		
1915		
1916	10,707	2,923
1917	64,806	16,007
1918	Development work only	
1919	Development work only	
1920		

### Miscellaneous Metals

A production of six other minerals has been reported during the quarter century, but none of these reports cover more than one year.

Antimony was produced in 1915, but no figures were given for tonnage or value.

Pyrite was reported in 1916. It amounted to 145 long tons valued at \$9661.00.

Manganese ore was produced in 1918. No value was published, but a production of 31 long tons was sold.

Arsenic was manufactured in 1924. A mill was built at Keystone in 1923. In 1924 a production of 83 short tons valued at \$6,659.00 is reported. No production occurred in 1925 or thereafter.

Iron production is reported in 1925 in the Report of the State Mine Inspector. This came from Iron Mountain and amounted to 500 tons at a value of \$1,875.00.