N49753

U. S. DEPARTMENT OF CO
R. P. LAMONT, Secretar
BUREAU OF MINE
SCOTT TURNER, Director

MINERAL RESO
OF THE
UNITED STA
1927

FRANK J. KATZ
Chief Engineer, Division of Minera

PART I—METALS

UNITED STATES
GOVERNMENT PRINTING O
WASHINGTON : 1930

For sale by the Superintendent of Documents, Washingto

LEAD

By Lewis A. Smith

STATISTICAL SUMM

Lower prices for lead in 1927 resulted
production in the tri-State area but on the
affect the domestic situation as regards proc
Instead of being stimulated by the reduction i
of primary metal actually decreased more
salient statistics of the lead industry in the
and 1927 are compared in the following tabl

Salient figures of the lead industry in the United

Production of refined primary lead:	
From domestic ores	sho
From domestic and foreign ores	
Average selling price per pound of refined lead	
Value of refined primary lead produced from domestic ores	
Imports of lead in ore, base bullion, etc.:	
General	sho
For consumption	
Exports of lead:	
From domestic ores	
From foreign ores	
Stocks of lead in bonded warehouse:	
Jan. 1	
Dec. 31	
Total supply of refined primary lead	
Lead withdrawn	
Apparent consumption of refined primary lead [1]	
Antimonial lead produced	
Recovery of secondary lead	

[1] Exclusive of foreign lead exported in manufactures and upon wh

The production of refined primary lead fr
decreased 1.8 per cent from 1926, but the de
lead from domestic and foreign sources was v
selling price of lead decreased 1.7 cents per
from 1926 and accounted largely for the ma
$25,000,000 in the value of refined lead produ
Most of the smelter production from dome
States, ranking as follows in importance: M
the total), Utah (22.7 per cent), Idaho (2

[1] The statistics on domestic production were prepared by H. M.
exports were compiled from records of the Bureau of Foreign and D
both of the Bureau of Mines.

(9.6 per cent), Colorado (5.4 per cent), and Montana (3.4 per cent). These six States account for nearly 94 per cent of the total of 684,165 tons from domestic sources; only Idaho and Utah showed substantial increases. The total imports of lead in 1927 were nearly 14,000 tons in excess of those in 1926, and the exports were 53,000 tons more than in 1926. Practically all of the lead recovered from ore produced in the United States is used at home; only about 2,500 tons of lead from domestic ores was exported in 1927.

GENERAL FEATURES OF LEAD INDUSTRY IN 1927

The production and the apparent use of lead both declined in the United States in 1927 but probably did not in the rest of the world. Available figures for world output and consumption indicate a slight increase over those for 1926, a record year. No new factors appeared in the situation. The competition of substitutes for lead and the return of secondary metal continued to trouble producers, but even along these lines that would tend substantially to alter the trend that has been under way for several years there were no outstanding developments. There is reason to believe that the apparent drop in domestic demand represents in part at least nothing more than the adoption of hand-to-mouth buying policies on the part of certain consumers who, in view of market conditions and improved transportation services, considered it no longer necessary to maintain as large stocks as formerly. Flotation, notably selective or differential flotation, made further advances, yielding richer concentrates and higher extractions at lower costs.

CHANGES IN USES

For several years the American Bureau of Metal Statistics has published a table that shows the approximate amounts of lead consumed in the various uses in which that metal is required. By translating these figures into percentages an idea may be gained as to the relative changes in distribution according to the various outlets for lead.

Percentage of total lead consumed in the United States, 1923–1927, by uses

Use	1923	1924	1925	1926	1927
Storage batteries	18.62	20.93	21.02	21.09	20.81
Cable coverings	17.06	17.00	18.21	20.63	19.15
White lead	16.93	18.47	15.29	13.32	14.98
Building	9.76	10.23	10.32	10.40	10.46
Litharge and red lead	5.99	4.19	4.90	4.00	4.52
Solder	3.91	3.69	4.09	4.11	4.16
Ammunition	5.21	3.32	3.68	3.55	4.04
Bearing metal	3.65	3.04	3.97	4.00	3.69
Foil	4.34	4.31	3.80	3.89	3.87
Calking	3.26	3.26	3.50	3.55	3.57
Castings	1.95	1.85	2.10	2.00	2.02
Type metal	1.56	1.60	1.75	1.78	1.90
Automobiles	1.35	1.32	1.49	1.85	1.43
Terneplate	.60	.50	.53	.45	.16
Railway cars	.78	.55	.52	.42	.32
Locomotives	.27	.14	.09	.11	.08
Shipbuilding	.01	.02	.01	.01	.02
Miscellaneous	4.75	4.68	4.73	4.94	4.82

Four of the outlets alone, it will be noted, acc
thirds of the total consumption. As prepare
Bureau of Metal Statistics the estimates of cons
1927 add to only 840,950 tons, or almost 100,00
total lead available for consumption in the Unite
by production and trade figures now available.
relative proportions of lead used for the various
but using the larger figures for indicated co
required by these principal consuming industr
estimated at approximately 195,000 short tons
180,000 tons for cable coverings, 141,000 ton
98,000 tons in building.

Four years is scarcely long enough for defini
established, but the percentages in the foregoin
relative to other uses, the consumption of lead
cable coverings and on the decrease in the manu
In building there is a consistent though slight up
storage batteries, on the other hand, the upw
years seems to have reached its climax. The
lead for the last-named purpose is affected by
use of "socket power" for radio receiving sets
available, thus eliminating a large number of
more important factor, however, is the recovery
part (estimated at about 95 per cent) of the lea
teries is returned to the industry within two to
initial utilization in this way. Hence, despite
of automobiles and radio receivers in use, th
lead required in storage battery manufacture
However, the extent to which old battery
virgin metal is not revealed by available figure
given in the table are based upon estimated
including lead of both primary and secondary
lead.

As compared with 1926 there was a drop in
coverings in 1927. Nevertheless, the outlook f
in this field, the second largest use of the metal, i
favorable. Although undersea cable covering
place for many years, land cable and transmissi
being raised, enlarged, and replaced. The le
reclaimed; but, since new and larger lines
added as the use of electricity becomes more
consumption in this field should increase, pro
substitutes to replace lead are not found.

In the manufacture of white lead, formerl
outlet for the metal, there was an apparent s
sumption in 1927, offsetting in part the dov
recent years. In Europe the use of white lea
has been unfavorably affected by legislation th
particularly for interior painting, because of al
workmen applying it. In the United State
pigment has failed to share in the fast-growi
products is simply the result of active co
substances, notably zinc-white, lithopone, bari
oxide, and cellulose lacquers. Of these substit

which now find such extensive use in the automobile industry, and titanium oxide are newcomers in the field. The latter after becoming moderately well established abroad has made steady advances in this country. The importance of this new competition may be gauged by the fact that the National Lead Co., a leading manufacturer of lead pigments, has purchased the properties and business of one of the largest titanium pigment companies in Europe and has obtained control of one of the largest producers of such pigments in this country. It is evident that the prospects for the wider use of white lead are not bright.

As regards the use of primary lead in the building industry the competition from reclaimed lead and substitute materials is likewise apparent. Because of its resistance to corrosion and its workability lead is used in roofing sheets, cornices, electric cables and wiring, drainage and sewerage pipes, plumbing fixtures, etc. Brass, copper, and zinc are all finding increased application in building, and the brass manufacturers especially are advertising extensively and effectively. However, the American people are beginning to demand more permanence in their buildings. For this reason, even though lead may be replaced by other materials for some purposes, it is likely to hold its own and possibly may find further uses in the construction industries.

In the numerous minor fields of use the only recent development that calls for special comment seems to be the replacement of solid bearings by roller bearings. Even some of the railway companies have equipped their rolling stock with these new bearings which, though much more expensive in initial cost, are deemed advantageous because they reduce friction and consequently contribute to greater operating economy.

Lead is relatively a cheap metal, and for this reason even a decrease in its price does not tend largely to encourage its use to replace other metals. Increases in the price of other metals, however, do tend to encourage the substitution of lead therefor. In the manufacture of foil, for example, either (1) pure tin, (2) pure lead, (3) lead covered with tin on both sides, or (4) aluminum may be used. When the price of tin advances to 50 cents or over per pound, foil manufacturers are disposed to replace it as far as possible by lead. Since ordinary solder contains lead and tin in equal proportion, other solders, such as cadmium solders, which contain 85 to 95 per cent of lead, or "amaloy," a new invention containing 98 per cent or even more of lead and only 1 per cent or less of tin (a small amount of phosphorus being added to produce the desired properties), tend to be used when tin becomes relatively more costly.

NEW USES

In addition to amaloy, which is being used for soldering work in the automobile industry and in the manufacture and installation of electrical equipment, a few other new uses have come into prominence lately, and some of these may develop into important items of consumption. In building construction interest is evoked by the use of lead mattresses to act as shock absorbers between the foundations and the steel framework of skyscrapers. In one building in New York about 55 tons of lead appears to have been used for this purpose.

In the pigment field a new lead preparation c[...]
been introduced. This preparation, which consi[...]
divided particles of lead suboxide (Pb_2O) suspen[...]
can be sprayed or applied with a brush upon a[...]
being applied it undergoes a slow transformation,[...]
of metallic lead held firmly as a protective coat by[...]

SELECTIVE FLOTATION

UNITED STATES

No important new lead districts have been di[...]
years, but the world's resources have been larg[...]
result of more efficient metallurgical processes. As[...]
and zinc are typically associated in nature. Ores[...]
mined together in many parts of the world, bu[...]
advent of the Wilfley table in the nineties the sep[...]
and zinc was incomplete and wasteful. In the[...]
lead and zinc have been separated with fair succes[...]
but in the western United States the lead and [...]
quently also copper and iron sulphides are so inti[...]
relatively fine grinding is necessary to liberate t[...]
erals. The development of methods of treating t[...]
the Rocky Mountain States is one of the most i[...]
in the history of ore dressing. The shaking ta[...]
economic operation of an enormous number of [...]
succeeded in effecting a thoroughly satisfactory[...]
blende in particular, being intermediate in speci[...]
the lead and the gangue minerals, was not reco[...]
The zinc that accompanied the lead concentrate[...]
in smelting, was not paid for, and if present i[...]
amount was penalized.

Even before the World War flotation was [...]
improve the recovery of sulphide minerals, partic[...]
sory process for the treatment of slimes, but it [...]
1918 that methods were devised whereby the[...]
present in complex ores of lead and zinc could be[...]
cially by flotation. In North America, the Sulli[...]
Columbia was the first to introduce selective fl[...]
zinc on a large scale, and it was not until 1924[...]
this new method became apparent in the product[...]
United States. The fact that a reasonably clea[...]
effected by this relatively simple process has mad[...]
itable operation of many mines that otherwise[...]
forced to close down as a result of the price level[...]
that prevailed during the greater part of 1927.[...]
has been to bring into the category of commerci[...]
was not previously workable.

In the Mississippi Valley and Eastern States,[...]
less complex, the effect of this new method has not[...]
In consequence, operators in these States have[...]
western competitors. The reasons for this are som[...]
By using selective flotation the mills in the [...]
making cleaner products and recovering more zinc[...]

penalized as formerly the zinc thus saved is now being paid for and contributes to the operating income of the mining companies. Moreover, much of this new western zinc, being refined electrolytically, is produced so cheaply that under existing conditions it introduces serious competition as against the product of retort smelting in Central and Eastern States. This situation relates primarily to zinc but nevertheless reacts upon the lead situation. To be sure, the Western States have increased lead production but did so essentially because they have been able vastly to increase their zinc output. In the Mississippi Valley, on the other hand, the considerable proportion of the lead production coming from small mines that are dominantly zinc producers has been curtailed. The fact that the Mississippi Valley ores do not contribute by-product credits in the form of gold and silver values is a further handicap, as it makes the eastern miners depend even more than the western operators upon the prices of lead and zinc. As noted elsewhere, the output of lead in the Mississippi Valley and Eastern States, as measured by smelter records, decreased from 313,891 tons in 1926 to 288,347 tons in 1927, or 8.1 per cent.

The American Bureau of Metal Statistics has canvassed the principal western producers to determine the amount of lead and zinc ores beneficiated by flotation. The following table shows the rapid increase in lead output by selective flotation and other flotation methods. The production of 220,000 tons of lead in flotation concentrates in the Western States in 1927, accounted for by the incomplete canvass above cited, indicates that at least 56 per cent of the lead from western ores was recovered by flotation.

Lead and zinc concentrates directly obtained in Western States by use of flotation methods, 1921–1927

[Based on figures compiled by the American Bureau of Metal Statistics and published in its Year Book for 1927, p. 70]

Year	Lead concentrates							Lead content of zinc concentrates	
	Total produced			Lead content					
	Short tons	Increase		Per cent	Short tons	Increase		Short tons	Per cent
		Short tons	Per cent			Short tons	Per cent		
1921	107,237			41.87	44,904			4,457	11.60
1922	117,405	10,168	9.48	41.85	49,131	4,227	9.41	6,105	7.43
1923	166,777	49,372	42.05	42.07	70,166	21,035	42.81	11,181	6.60
1924	235,049	68,272	40.94	41.17	96,774	26,608	37.92	14,308	6.30
1925	320,513	85,464	36.36	43.45	139,264	42,490	43.91	11,004	4.36
1926	392,220	71,707	22.37	46.67	183,047	43,783	31.44	16,722	4.13
1927	451,617	59,397	15.14	48.77	220,236	37,189	20.32	12,293	2.46

The first significant feature is the increase of western concentrates being produced by flotation (mainly selective). The greatest absolute increase was made in 1925, when an increase of 85,464 tons of concentrates was obtained. Following that lesser increases of 71,707 tons in 1926 and 59,397 tons in 1927 were made. The increase of

1922 over 1921 was 9.48 per cent; of 1923 over
over 1923, 40.94; of 1925 over 1924, 36.36; of 1
and of 1927 over 1926, 15.14 per cent. Duri
1921 to 1927, the amount of lead in the concen
41.87 per cent in 1921 to 41.17 per cent in 192
to 48.77 per cent in 1927, a net increase of 6.
Such an increase indicates that much progress i
attained since 1921, and some further increase
future as more improved methods are found.
percentage of lead in the zinc concentrates has
from 11.6 per cent in 1921 to 2.46 per cent in 1

CANADA

The Canadian mills are likewise treating a lar
ores by selective flotation. The production fig
shown in the table that follows.

Flotation concentrates produced in Canada,

[Figures compiled by the American Bureau of Met

Year	Lead concentrates			Zi	
	Short tons	Lead content		Short tons	Zinc
		Short tons	Per cent		Short tons
1924	125,879	80,822	64.21	127,901	55,014
1925	161,103	101,908	63.26	168,252	75,454
1926	182,895	118,243	64.65	206,641	93,899
1927	204,754	137,789	67.29	206,867	99,909

Selective flotation in Canada has also materia
and lead output as well as the zinc or lead co
trates. The lead content of the zinc concentrat
reduced from 5.41 per cent in 1924 to 2.94 per cen
estimated that the Canadian production would
tons less if it were not for selective flotation.

MEXICO

Many of the Mexican mines have shown a
ores with increase in depth. Thus, a good pri
necessary to insure their continued operation
will probably have an increasingly beneficial infl
situation. This influence hitherto has been si
that in the United States and Canada. The
flotation in 1927 was more than three times tha
content is lower than in Canada, and the perc
lead is lower. The complexity of the Mexica
the large number of mines producing, has no dou
able recovery. The increased production of 1927
largely due to installations using selective flotat

The following paragraphs are quoted from the American Bureau of Metal Statistics statement of April 23, 1928:

The returns from 17 operations in this country [Mexico], beginning with 1925, give the following totals:

Flotation concentrates produced in Mexico, 1925–1927

Year	Lead concentrates			Zinc concentrates				
	Short tons	Lead content		Short tons	Zinc content		Lead content	
		Short tons	Per cent		Short tons	Per cent	Short tons	Per cent
1925	108,622	34,808	31.58	85,308	41,693	48.87	2,305	2.70
1926	142,160	61,124	43.00	190,893	96,686	50.65	2,687	1.41
1927	211,107	96,316	45.62	268,160	138,250	51.56	5,327	1.99

By comparison with the Mexican official statistics it appears that our totals as given above are only a little short of the total zinc production of Mexico.

Most of the zinc concentrate of Mexico is beneficiated pyrometallurgically, principally in Europe, but a small part of its ore is distilled domestically and a part is distilled in bond in the United States. Of the exportation of ore to Europe, a small part goes to electrolytic extraction there.

DOMESTIC PRODUCTION

RÉSUMÉ

Refined primary lead produced in the United States in 1927 from domestic ores amounted to 668,320 short tons, valued (at the average selling price of refined lead, 6.3 cents a pound) at $84,208,000. These figures represent decreases of 1.8 per cent in quantity and 22.7 per cent in value as compared with 1926. Refined lead produced in 1927 from foreign ores and base bullion amounted to 128,210 short tons, valued at $16,155,000. The total output of refined lead in 1927 from both domestic and foreign ores and bullion was 796,530 tons, valued at $100,363,000.

Refined lead produced and consumed in the United States, 1926 and 1927, in short tons

	1926	1927
PRODUCTION		
Domestic desilverized lead	366,413	378,889
Domestic soft lead	258,565	233,944
Domestic desilverized soft lead	55,707	55,487
	680,685	668,320
Foreign desilverized lead	118,256	128,210
Total refined primary lead [1]	798,941	796,530
Antimonial lead	22,524	24,347
Secondary lead [1]	277,300	276,000
CONSUMPTION [2]		
Apparent consumption of primary lead, refinery stocks disregarded	717,653	663,412

[1] "Primary lead," which is produced directly from ore, is here distinguished from "secondary lead," which is obtained by refining skimmings, drosses, and old metals. The statistics of secondary lead are given on p. 358. In this report the word "lead" used without qualification means primary lead.

[2] For method of calculating consumption see p. 371.

Refined lead produced in the United States from

Year	Short tons	Value	Y
1918	539,905	$76,667,000	1923
1919	424,433	44,990,000	1924
1920	476,849	76,296,000	1925
1921	398,222	35,840,000	1926
1922	468,746	51,562,000	1927

QUANTITY AND VALUE OF RE

The total refined lead produced in the U
1927, from domestic ores and from foreign
its value are shown in the following table:

Refined lead produced in the United S

Year	Short tons				
	Desilverized lead [1] [2]	Desilverized soft lead	Soft lead [2]	Total production [1]	From domestic ores and base bullion
1720–1912	7,176,497	326,991	2,929,180	10,432,668	8,545,38
1913	301,160	29,433	131,867	462,460	411,87
1914	340,397	43,506	158,219	542,122	512,79
1915	344,593	44,001	161,461	550,055	507,02
1916	335,375	68,244	167,515	571,134	552,22
1917	365,998	56,268	188,503	610,769	548,45
1918	382,314	47,418	210,463	640,195	539,90
1919	266,538	67,938	147,744	482,220	424,43
1920	273,135	66,668	189,854	529,657	476,84
1921	238,329	52,747	157,513	448,589	398,22
1922	249,107	74,305	209,250	532,662	468,74
1923	366,241	61,332	190,749	618,322	543,84
1924	423,429	63,449	203,615	690,493	566,40
1925	457,477	48,032	260,560	766,069	654,92
1926	484,669	55,707	258,565	798,941	680,68
1927	507,099	55,487	233,944	796,530	668,32
	12,512,358	1,162,426	5,799,002	19,473,786	16,500,05

[1] The lead content of antimonial lead is excluded; see page 357.
[2] Desilverized soft lead is excluded.

Details for years prior to 1913 are show
The value for years prior to 1917 is based
New York; beginning with 1917 the value
of each producing company.

PRODUCTION BY ST

SMELTER OUTPUT

The smelter production of primary lead
domestic and foreign sources for 1927 was
While the total output was essentially t
stantial decrease in the Mississippi Valley
tailments in the production from many of
a decreased output of by-product lead o
operations. This decrease was balanced, i
the output of the Western States. The
selective flotation methods applied to t
increased the output of lead there.

The St. Joseph Lead Co.'s output and sales in 1927 were as follows:

Lead produced and sold by the St. Joseph Lead Co. in 1927, in short tons

Ore	4,527,695
Lead concentrates	203,381
Lead content	151,045
Lead:	
Smelter output	140,875
Sales	193,255

Comparable figures for the National Lead Co. and the United States Smelting, Refining & Mining Co. are not available from the company reports.

SOFT LEAD

The lead ores of the Mississippi Valley are almost free from silver, and the lead produced from them is known as soft lead. The output of the lead pigment known as basic lead sulphate or sublimed lead is derived from these ores. The galena of southern Illinois, however, is notably argentiferous as compared with the rest of the Mississippi Valley ores, and the silver-bearing lead concentrates treated during the period 1918 to 1927 averaged 5.5 ounces of silver to the ton; lead in this district is now produced only incidentally in the concentration of fluorspar, and the output is small compared with that from other districts in the Mississippi Valley States. Lead ores from southeastern Missouri also contain a small amount of silver; over a series of years the silver-bearing lead concentrates smelted have averaged about 1 ounce of silver to the ton.

Zinc ores from Western States, that are made into zinc oxide, contain some lead which goes into the pigment; therefore it is not strictly accurate to speak of the lead content of pigments as wholly soft lead.

In some years small quantities of foreign lead have also been made into pigments in the United States. During the period covered by the following table, lead pigments were made from foreign ores in 1924 only, when the lead so recovered amounted to 545 tons.

Soft lead produced in the United States from domestic ores, 1922–1927, in short tons

Year	Soft pig lead			Soft lead recovered in pigments	Total soft lead	Total domestic lead [1]	Soft lead percentage of domestic lead
	Undesilverized	Desilverized	Total				
1922	209,250	74,305	283,555	13,892	297,447	488,448	61
1923	190,749	61,332	252,081	13,612	265,093	567,247	47
1924	203,615	63,449	267,064	15,338	282,402	593,486	48
1925	260,560	48,932	309,492	17,547	327,039	684,968	48
1926	258,565	55,707	314,272	13,685	327,957	710,990	46
1927	233,944	55,487	289,431	13,136	302,567	695,500	44

[1] Includes domestic refined lead, domestic lead in antimonial lead, and domestic lead in pigments.

ANTIMONIAL LEAD

By-product antimonial lead, produced by lead refineries in 1927 from domestic and foreign argentiferous lead ores, amounted to 24,347 short tons. This amount is 8 per cent greater than the

production in 1926 and exceeds any previous annual
erable antimonial lead from secondary sources was a
the regular lead smelters in 1927; the figures coveri
tion are given in the chapter on secondary metals.
from which antimonial lead is obtained is produced
States and in Mexico.

By-product antimonial lead produced in the United State

Year	Total lead refined from base bullion (short tons)	By-product antimonial lead (percentage of total)	Antimonial lead				
			From domestic ore (short tons)	From foreign ore (short tons)	To		
					Short tons	Value	Anti Sh to
1918	382,314	4.9	10,777	7,793	18,570	$2,820,350	2,
1919	266,538	5.2	9,674	4,200	13,874	1,513,968	1,
1920	273,135	4.6	9,604	2,931	12,535	1,963,255	2,
1921	238,329	4.2	7,881	2,183	10,064	870,059	1,
1922	249,107	3.2	7,068	1,007	8,075	844,993	1,
1923	366,241	3.9	11,635	2,555	14,190	1,950,870	2
1924	423,429	4.9	13,593	7,194	20,787	3,376,713	2
1925	457,477	4.3	14,472	5,195	19,667	3,785,547	2
1926	484,669	4.6	18,909	3,615	22,524	3,916,714	2
1927	507,099	4.8	16,040	8,307	24,347	3,277,043	2
Average		4.5					

LEAD PIGMENTS

The amount of lead contained in pigments was
per cent of the total lead recovered from domestic
to 37 per cent in 1926. By far the largest part was
pigments manufactured from pig lead—white lead,
mineral, and litharge. In these pigments the lea
from about 80 to nearly 93 per cent. A smaller qu
recovered in the pigment known as basic lead sulp
white lead and sublimed blue lead, and a still sm
recovered from the zinc ores from which the zinc oxid

Lead in pigments,[1] 1922–1927, by sources, in sho

Year	Lead in pi	
	Domestic ore	Foreign ore
1922	13,892	
1923	13,612	
1924	15,338	54
1925	17,547	
1926	13,685	
1927	13,136	

[1] Includes also lead recovered in zinc oxide and leaded zinc oxide.

SECONDARY LEAD

The recovery of lead from waste material is a branch of the metal industry that has expanded notably in recent years. Lead is a relatively cheap metal; but for various reasons, one of which is that it does not rust, it is rather easily reclaimed. The main sources of secondary lead are old pipe, cable sheathings, battery plates, lead linings for acid tanks, and such alloys as babbitt, solder, and type metal. The most important of these sources now is old battery plates which, as stated elsewhere in this chapter, are likely to be returned within two or three years after being fabricated.

Secondary lead recovered in the United States, 1922–1927, in short tons

Year	Pig lead	Lead in alloys	Total recovered lead	Value
1922	75,480	84,080	159,560	$17,552,000
1923	96,430	98,060	194,490	27,220,000
1924	90,400	114,100	204,500	32,720,000
1925	112,420	114,460	226,880	39,477,000
1926	125,000	152,300	277,300	44,368,000
1927	119,000	157,000	276,000	34,776,000

A number of years ago the principal use for lead was in pigments, and lead consumed in this way could not be reclaimed. As time passes the increased tendency toward nondestructive uses is building up a large reserve of lead which will eventually become available for reuse. The quantity of secondary lead recovered in the United States has increased largely not only in actual tonnage but also relatively in respect to the primary production of lead. As the following table indicates, the ratio of secondary lead recovery to refined primary lead production in the United States has been increasing quite rapidly since 1918, amounting in 1927 to 41 per cent.

Ratio of secondary lead recovered to refined primary lead produced in the United States from domestic ores, 1913–1927

Year	Refined primary lead		Secondary lead	
	Short tons	Average price per pound (cents)	Short tons	Ratio to refined primary lead (per cent)
1913	411,878	4.4	72,834	18
1914	512,794	3.9	61,062	12
1915	507,026	4.7	78,900	16
1916	552,228	6.9	96,300	17
1917	548,450	8.6	93,500	17
1918	539,905	7.1	97,100	18
1919	424,433	5.3	122,100	29
1920	476,849	8.0	124,050	26
1921	398,222	4.5	103,780	26
1922	468,746	5.5	159,560	34
1923	543,841	7.0	194,490	36
1924	566,407	8.0	204,500	36
1925	654,921	8.7	226,880	35
1926	680,685	8.0	277,300	41
1927	668,320	6.3	276,000	41

LEAD SMELTERS AND REFINE

UNITED STATES

Arizona: Douglas—Phelps Dodge Corporation. (Smelte
California: Selby—Selby plant, American Smelting & R
and refinery.)
Colorado:
Durango—Durango plant, American Smelting & Re
Leadville—Arkansas Valley plant, American Sme
(Smelter.)
Idaho: Kellogg—Bunker Hill & Sullivan smelter. (Smel
Illinois:
Chicago—Great Western Smelting & Refining Co.[2]
Collinsville—St. Louis Smelting & Refining Works
(Smelter and refinery.)
Federal—Federal plant, American Smelting & Refini
Indiana:
East Chicago—International Lead Refining Co.[3] (I
East Chicago—U. S. S. Lead Refinery (Inc.).[4] (
electrolytic process.)
Kansas: Galena—Galena plant, Eagle-Picher Lead Co.
Missouri:
Granby—American Zinc, Lead & Smelting Co.[5] (Sm
Herculaneum—St. Joseph Lead Co. (Smelter and r
Joplin—Eagle-Picher Lead Co. (Smelter.)
Montana: East Helena—East Helena plant, American Sm
(Smelter.)
Nebraska: Omaha—Omaha plant, American Smelting & R
only. Betts electrolytic process.)
New Jersey:
Newark—Balbach plant, Balbach Metals Corporatio
ery.)
Perth Amboy—Perth Amboy plant, American Sm
(Smelter and refinery.)
Oklahoma: St Louis—Ontario smelter, Eagle-Picher Lea
Pennsylvania: Carnegie—Pennsylvania Smelting Co. (S
Texas: El Paso—Kansas City Consolidated Smelting &
ter.)
Utah:
International—International Smelting Co.[3] (Smelt
Midvale—United States Smelting, Refining & Minin
Murray—Murray plant, American Smelting & Refin

CANADA

British Columbia: Trail—Consolidated Mining & Sm
(Ltd.). (Smelter and refinery. Betts electrolytic pro
Ontario: Galetta—Kingdon Mining, Smelting & Manu
(Smelter.)

MEXICO

Chihuahua: Chihuahua—American Smelting & Refining
Coahuila: Torreon—American Metal Co. (Ltd.). (Cia. M
(Smelter.)
Nuevo Leon:
Monterrey—American Metal Co. (Ltd.). (Cia. Min
(Smelter and refinery.)
Monterrey—American Smelting & Refining Co. (S

[2] Smelters of secondary materials but treating some lead ores.
[3] Subsidiary of Anaconda Copper Mining Co.
[4] Subsidiary of the United States Smelting, Refining & Mining Co.
[5] Plant idle in 1927.
[6] Subsidiary of American Smelting & Refining Co.

San Luis Potosi: San Luis Potosi—American Smelting & Refining Co. (Cia. Minera Asarco.) (Smelter.)
Zacatecas: La Fé—American Metal Co. (Ltd.). (Cia. Minera de Peñoles—S. A.) (Smelter.)

WORLD PRODUCTION

The accompanying table shows the world smelter production of lead from 1923 to 1927, so far as statistics are available. Official figures are used wherever possible. For countries for which official data are not yet available the figures are taken from the yearbook of the American Bureau of Metal Statistics and other reliable sources, but in later reports the official statistics will be substituted as received.

There is always a possibility of duplication in figures showing world production, for some countries send "work lead" or base bullion to other countries for refining. Furthermore, secondary and antimonial lead are often included in the figures showing the foreign production, so that to put the United States on an equal footing in the statistics it would be necessary to include in its production the domestic output of secondary lead and antimonial lead. The figures for the United States represent refined lead that was smelted in this country, whatever the source of the ore.

World production of lead, 1923–1927, in metric tons [1]

[Compiled by L. M. Jones, of the Bureau of Mines]

Country [2]	1923	1924	1925	1926	1927
Australia	132,165	130,494	151,269	155,398	167,616
Austria	4,255	4,985	5,408	6,478	8,066
Belgium	65,680	77,950	87,480	87,876	(4)
Canada	46,801	75,503	104,303	123,644	135,854
Chosen	(4)	(4)	485	1,958	(4)
Czechoslovakia	2,462	2,264	2,212	2,316	2,394
France	17,413	18,881	20,543	19,500	24,900
Germany	56,110	67,427	89,458	96,200	[3] 81,800
Great Britain	6,815	5,387	4,811	4,334	6,182
Greece	4,235	5,106	5,366	5,059	4,800
India (Burma)	46,799	52,590	48,034	55,202	67,027
Italy	17,131	22,062	24,475	23,590	23,774
Japan	2,700	2,941	3,337	3,610	4,000
Mexico	150,028	133,440	163,236	170,723	227,870
Northern Rhodesia	11,197	5,909	3,406	3,897	6,042
Norway	242	642	406	385	(4)
Poland	17,195	20,223	28,631	27,924	28,863
Rumania	402	433	489	655	828
Russia [6]	307	685	1,021	1,342	1,850
South America	5,081	11,703	11,964	17,663	14,604
Southwest African Protectorate [7]	622	813	1,619	1,682	8,898
Spain	127,514	141,849	153,567	149,514	144,023
Sweden	119	477	723	522	330
Tunisia	14,090	14,291	16,013	18,106	10,662
Turkey	1,400	5,104	4,786	6,014	7,852
Union of South Africa	5,099	4,609	------	------	------
United States (refined)	515,395	555,913	636,700	661,239	635,651
Yugoslavia	9,260	11,487	10,956	9,809	3,185
Known production	1,261,000	1,373,000	1,581,000	1,655,000	1,703,000

[1] By countries where smelted but not necessarily refined.
[2] In addition to the countries listed, China smelts lead, but no reliable data of output are available. Official estimates of production in 1925 range from 1,500 to 3,500 tons. Indo-China, also, reported 1 ton of lead smelted in 1926, and 4 tons in 1927.
[3] Estimate included in total.
[4] Data not available.
[5] Exclusive of Upper Silesia.
[6] Data for year ended Sept. 30.
[7] Data for year ended Mar. 31 of year following that stated.

SUMMARY OF PRODUCTION AND COND CIPAL LEAD-PRODUCING REGIONS O

Despite its slight decrease in production fro United States remained in first position as a lea in 1927. In Spain and in a few of the less i countries production also decreased in 1927, bu the world as a whole showed an increase as c Mexico retained second place in 1927 and was Australia, Spain, Canada, Germany, India, decrease in Spain was due mainly to the loweri a serious situation was partly prevented by Gov Australia increased production through furth metallurgical efficiency, that Commonwealth is labor difficulties which again threaten a shutd properties in the Broken Hill district unless th substantially. The entry of the Anaconda Co was to no little extent responsible for the increas This company is now the main producer in Po producers were forced to curtail output somewha year, a condition brought about by a decided lead, coupled with an improvement in the value and France both report a substantial productior the ores from which it is obtained are importe Mexico, and Greece. France, however, produ departments of Gard and Lozère. Relatively obtained from mines in Argentina, Chile, Ru Turkey, and Rhodesia.

MEXICO

Mexico, even with the decreased price of lea tion of some of the mines, showed an increased 227,870 metric tons of lead in 1927 compared 1926, an increase of 33.5 per cent. Many of exhaustion of the bonanza ores and will in c work the complex sulphides that usually underli ore. This means that more effective mining methods must be adopted.

By far the greater proportion of the lead o come from limestone replacement deposits know great manta deposits of Santa Eulalia, Mapim Mojada continued their outputs, as did a nu mantas. The great lead region, comprising Chihuahua, western Coahuila, Durango, and ea reserves sufficient for a few years ahead, even th are very hard to estimate accurately. The m contain oxide ores, generally branch from a ce group of chimneys, in which the ores are comple lead, zinc, antimony, copper, and free gold. selective flotation are rapidly gaining a footh methods are decidedly applicable to the ores it i Mexico's production can be maintained at a co and under reasonably low market conditions. probably responsible for the added production