Zinc

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In 1978, both mine and metal production declined as mines closed and smelters cut back production to reduce stocks. However, consumption increased and imports of both concentrate and metal made up the shortfall. The closed mines were put on a care and maintenance status, primarily because of low zinc prices. Exploration and development continued in Tennessee, Kentucky, and Wisconsin, and a significant sulfide deposit was reported in Maine. Consumption of slab zinc was up over that of 1977. The decline in the amount of zinc used in diecastings, especially in the automotive industry, was offset by increased use of zinc in the galvanizing sector.

In 1979, mine production declined further to the lowest level since 1932, but metal production increased as a new smelter became fully operational. The largest smelter in the United States, and the world's fourth largest, closed in December. Imports of concentrate were higher to supply feed to the the smelters, but imports of slab zinc declined to about the 1977 level. Consumption of slab zinc declined as the economy

Table 1.—Salient zinc statistics

	1975	1976	1977	1978	1979
United States:					
Production:					
Domestic ores, recoverable content metric tons	425,792	439,543	407,889	302,669	267,341
Value thousands	$366,097	$358,541	$309,338	$206,854	$219,841
Slab zinc:					
From domestic ores metric tons	279,376	346,429	322,208	267,350	255,344
From foreign ores do	118,018	106,125	86,156	139,348	217,137
From scrap do	52,513	62,192	45,914	34,774	53,212
Total	449,907	514,746	454,278	441,472	525,693
Secondary zinc[1] do	204,402	276,089	284,065	304,047	316,818
Exports of slab zinc do	6,257	3,187	215	723	279
Imports (general):					
Ores (zinc content) do	131,530	88,101	111,410	188,003	224,952
Slab zinc do	345,127	648,174	523,206	617,840	527,212
Stocks, December 31:					
Producer do	67,745	87,952	r83,760	37,928	59,066
Consumer do	97,319	109,909	r86,477	99,325	93,334
Government stockpile do	349,914	349,440	347,828	345,872	345,684
Reprocessed GSA zinc[2] do	3,123	--	--	--	--
Consumption:					
Slab zinc do	839,445	1,028,876	999,505	1,050,585	1,000,606
All classes do	1,117,484	1,394,244	1,367,704	1,441,810	1,394,314
Price: Prime Western, cents per pound (delivered)	38.96	37.01	34.39	30.97	37.30
World:					
Production:					
Mine thousand metric tons	5,850	5,690	5,906	5,878	5,998
Smelter[3] do	5,013	5,362	5,527	5,614	5,998
Price: Prime Western grade, London cents per pound	33.76	32.38	26.71	26.88	33.59

rRevised.
[1]Excludes redistilled slab zinc.
[2]Included in total amount withdrawn from Government stockpile.
[3]Primary metal production only; includes secondary metal production where inseparably included in country total.

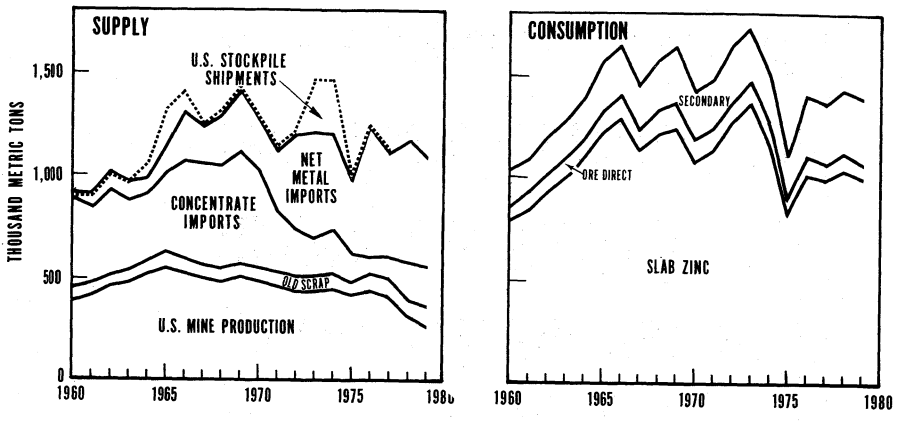

Figure 1.—Trends in supply and consumption in the United States.

slowed in the second half of the year.

Quoted prices for Prime Western Grade zinc increased from 29 cents per pound in February 1978 to 40.5 cents in mid-1979, but by yearend had fallen to 37.5 cents. Producer stocks rose significantly in 1979, while consumer stocks declined somewhat.

Legislation and Government Programs.—The stockpile goal for zinc remained at 1,191,134 tons through 1979.

The Environmental Protection Agency (EPA) issued final regulations limiting the content of pollutants including zinc, in effluents from ore mining and milling operations. The maximum zinc content was set at 1.5 milligrams per liter per day for mine drainage and two-thirds that amount for mill effluent. These regulations, effective July 11, 1978, represent the degree of control achievable by the application of the best practicable control technology available. In its economic analysis, EPA did not expect the regulations to affect significantly prices, production, and capital availability, and expected little impact on the local economies or balance of trade.

In December 1977, the Lead-Zinc Producers Committee filed a petition with the U.S. International Trade Commission seeking temporary relief from excessive imports. On June 20, 1978, the Commission found that increased imports of unalloyed, unwrought zinc were not a substantial cause of serious injury or a threat thereof, to the domestic industry for purposes of the import relief provisions of the Trade Act of 1974.

In accordance with the Trade Act of 1974, the Department of Labor investigated the eligibility of certain workers in the zinc industry to apply for worker adjustment assistance. The Department found that increased imports of zinc materials led to worker layoffs at about 19 mines, 2 smelters, and 2 plants that processed zinc-bearing materials in 1978-79. Benefits to eligible employees provide for such items as training, assistance in finding a new job, and a relocation allowance.

The International Lead and Zinc Study Group held an extraordinary session in July 1978 to evaluate the zinc situation in addition to its regular session in Geneva, Switzerland, in November. The Study Group found that the zinc market improved in 1978 through reduction in producer stocks, and noted the rapid rise in zinc exports to Socialist countries, and the closure of about 20 mines with a total production rate of about 150,000 tons of zinc per year. At its annual session in Geneva in October 1979, the Study Group was concerned about the supply of zinc metal exceeding demand and the resultant increase in stocks in 1979-80.

Table 2.—Zinc statistics, 1900-79

(Metric tons, except as noted)

Year	World		United States									
	Smelter production (thousand metric tons)	Mine production (thousand metric tons)	Slab zinc production		Mine production	General Imports		Exports		Consumption		Price, cents per pound
			Primary	Secondary		Slab zinc	Ore, zinc content	Slab zinc	Ore, zinc content	Slab zinc	Ore, direct	
1900	479	NA	112,388	NA	150,546	802	NA	20,322	38,158	90,173	NA	4.30
1901	511	NA	127,752	NA	167,646	252	NA	3,075	40,058	128,529	NA	4.00
1902	547	NA	142,362	NA	192,922	406	NA	2,937	50,560	138,511	NA	4.76
1903	574	NA	144,441	NA	180,194	183	NA	1,380	35,753	140,052	NA	5.25
1904	629	NA	169,373	NA	201,951	309	NA	9,205	32,578	164,120	NA	5.00
1905	660	NA	184,929	NA	213,003	388	NA	5,004	28,074	181,834	54,708	5.90
1906	704	NA	203,908	NA	201,147	926	22,749	4,237	25,147	200,289	60,098	6.20
1907	738	NA	226,669	6,396	235,824	1,550	23,691	511	18,463	205,903	51,647	5.50
1908	723	NA	190,893	6,495	212,758	799	17,849	1,119	23,685	194,289	43,549	4.20
1909	775	NA	232,022	8,412	277,075	8,577	23,165	303	11,299	245,602	49,114	5.40
1910	810	NA	244,200	11,597	297,295	1,778	15,155	8,386	17,882	223,062	45,896	5.40
1911	894	NA	259,932	12,740	313,215	3,038	13,522	13,023	16,584	254,065	41,841	5.70
1912	963	NA	307,360	23,645	343,656	10,083	13,516	6,808	21,182	308,752	58,089	6.90
1913	1,015	NA	314,499	23,579	368,694	5,534	8,549	12,234	16,069	267,955	64,067	5.60
1914	876	NA	320,281	18,638	377,082	798	8,737	67,594	10,079	272,140	64,064	5.10
1915	837	NA	444,084	27,001	533,057	820	28,471	119,213	755	330,991	72,186	14.20
1916	973	NA	606,311	26,105	638,039	621	94,352	187,211	71	416,685	81,897	13.60
1917	1,095	1,101	607,427	15,272	647,159	233	77,089	199,639	1,197	375,251	88,517	8.90
1918	823	935	469,856	8,997	577,052	32	23,153	96,751	56	384,458	93,239	8.00
1919	659	806	422,515	17,915	497,905	64	12,221	132,718	--	293,895	90,909	7.00
1920	722	855	420,369	19,387	532,993	7,418	12,095	103,661	--	293,060	106,122	7.80
1921	472	511	181,891	15,942	232,820	6,777	2,057	4,495	--	184,703	51,917	4.70
1922	711	804	321,395	29,926	428,220	47	910	31,571	1,538	338,462	86,104	5.70
1923	946	980	463,058	35,774	554,009	19	1,904	29,885	2,544	405,071	106,633	6.70
1924	1,002	1,463	469,322	32,192	578,763	23	1,368	69,165	334	406,652	99,207	6.30
1925	1,128	1,354	519,768	35,544	644,870	22	12,280	69,264	62,551	453,680	100,903	7.66
1926	1,218	1,603	561,023	37,012	702,672	20	13,215	38,936	86,411	505,326	117,744	7.37
1927	1,306	1,604	537,522	38,813	651,850	54	8,630	41,454	42,380	468,446	110,628	6.25
1928	1,401	1,591	546,652	44,149	630,648	2	1,512	22,942	4,099	568,351	112,573	6.03
1929	1,451	1,751	567,396	42,953	657,236	205	13,073	13,073	64	575,427	125,286	6.49

See footnotes at end of table.

Table 2.—Zinc statistics, 1900-79 —Continued

(Metric tons, except as noted)

Year	World		United States									
	Smelter production (thousand metric tons)	Mine production (thousand metric tons)	Slab zinc production		Mine production	General Imports		Exports		Consumption		Price, cents per pound
			Primary	Secondary		Slab zinc	Ore, zinc content	Slab zinc	Ore, zinc content	Slab zinc	Ore, direct	
1930	1,394	1,567	451,819	31,614	540,161	255	23,441	4,203	--	409,050	94,856	4.56
1931	997	1,045	264,894	19,618	372,234	249	708	583	12	335,658	67,614	3.64
1932	781	904	187,922	13,352	258,757	281	1,727	5,870	--	234,961	49,833	2.88
1933	983	1,134	278,671	27,294	348,613	1,715	1,935	1,039	734	317,787	64,974	4.03
1934	1,168	1,353	329,843	17,863	398,906	1,565	12,952	4,631	3,285	326,496	69,246	4.16
1935	1,332	1,451	381,593	25,991	469,834	4,032	9,544	1,467	418	429,099	77,766	4.33
1936	1,464	1,612	446,455	38,291	522,152	10,578	156	34	222	527,982	87,082	4.90
1937	1,623	1,751	505,215	46,769	568,226	33,755	7,994	226	285	553,383	101,262	6.52
1938	1,566	1,755	404,914	28,679	468,745	6,559	16,858	--	122	381,925	62,686	4.61
1939	1,650	1,789	460,157	45,748	529,621	28,030	32,749	4,096	275	567,898	77,016	5.12
1940	1,620	1,927	612,599	44,377	603,340	14,940	163,584	71,750	406	665,018	87,014	6.34
1941	1,749	2,072	745,724	53,980	679,595	31,347	262,370	81,020	--	750,637	122,302	7.48
1942	1,800	2,094	809,093	48,258	696,741	33,016	334,214	121,507	--	660,584	104,328	8.25
1943	1,840	2,018	854,849	43,740	675,123	50,943	489,017	88,395	1	740,968	104,054	8.25
1944	1,622	2,059	788,618	44,486	651,941	57,721	383,462	19,573	--	806,148	129,053	8.25
1945	1,302	1,616	693,598	44,672	557,336	88,102	346,290	7,060	--	773,204	118,834	8.25
1946	1,392	1,583	660,668	40,384	521,480	95,021	246,805	42,841	81	735,039	121,558	8.73
1947	1,599	1,769	728,011	54,016	578,428	65,600	270,304	96,769	1,274	713,374	132,379	10.50
1948	1,706	1,858	714,648	56,536	571,506	84,579	239,681	59,454	3,218	741,837	120,337	13.58
1949	1,825	1,910	739,158	49,932	538,145	115,114	218,794	53,260	2,654	645,771	79,961	12.15
1950	1,969	2,150	765,181	60,754	565,516	141,497	252,717	11,718	1,034	877,369	121,957	13.88
1951	2,141	2,359	799,804	44,141	617,964	79,871	274,675	33,121	2,803	847,284	121,422	17.99
1952	2,232	2,585	820,530	49,996	604,186	104,966	407,903	52,357	3,057	773,632	99,134	16.21
1953	2,359	2,667	831,077	47,967	496,620	212,804	466,043	16,301	2,679	894,418	107,269	10.86
1954	2,449	2,658	727,948	61,700	429,526	142,299	413,157	22,674	--	802,223	90,035	10.69
1955	2,658	2,903	874,076	59,912	466,902	177,532	433,674	16,392	--	1,015,877	107,170	12.30
1956	2,812	3,112	892,316	65,433	492,003	222,240	476,590	7,995	775	915,159	102,864	13.49
1957	2,903	3,148	894,299	65,764	482,382	244,039	477,192	9,784	6	848,780	100,072	11.40
1958	2,731	3,057	708,735	42,279	373,765	177,082	418,720	1,881	--	787,733	86,126	10.31

1959	2,858	3,121	724,538	52,452	385,829	142,394	453,697	10,550	1	867,448	98,039	11.46
1960	3,025	3,338	725,309	62,352	395,013	109,558	414,724	68,170	12	796,403	80,082	12.95
1961	3,248	3,488	768,200	50,110	421,288	115,722	377,117	45,409	1,515	844,782	88,225	11.55
1962	3,406	3,565	797,774	53,415	458,574	128,781	424,016	32,751	123	936,053	92,154	11.63
1963	3,487	3,661	809,739	54,706	480,131	131,321	338,170	30,711	15	1,002,542	94,987	12.01
1964	3,693	4,028	865,531	64,951	521,503	107,356	323,997	24,054	35	1,095,215	96,114	13.57
1965	3,949	4,302	902,107	75,858	554,429	138,790	388,311	5,388	NA	1,228,412	111,486	14.50
1966	4,081	4,483	929,924	75,535	519,416	252,356	472,934	1,276	NA	1,291,528	114,937	14.50
1967	4,126	4,835	851,692	66,683	498,419	201,497	484,520	15,249	NA	1,134,592	103,692	13.85
1968	4,628	4,975	926,137	72,452	480,305	276,307	492,933	29,947	NA	1,225,295	112,590	13.50
1969	4,973	5,342	944,014	64,005	501,786	294,632	546,234	8,435	NA	1,256,796	114,951	14.65
1970	4,827	5,464	796,337	69,995	484,560	245,315	476,961	261	NA	1,076,784	113,199	15.32
1971	4,744	5,515	695,297	73,412	455,899	289,907	310,730	12,107	NA	1,137,664	108,185	[1]16.13
1972	5,131	5,436	574,411	66,876	433,922	474,106	231,212	3,923	NA	1,286,705	118,325	[1]17.75
1973	5,332	5,709	529,323	75,466	434,406	537,095	181,105	13,214	NA	1,364,350	117,617	[1]20.66
1974	5,609	5,781	503,658	71,246	453,476	489,461	217,763	17,293	NA	1,168,178	115,315	[1]35.95
1975	5,013	5,850	397,394	52,513	425,792	345,127	131,530	6,257	NA	839,445	75,053	[1]38.96
1976	5,362	5,690	452,554	62,192	439,543	648,174	88,101	3,187	NA	1,028,876	91,844	[1]37.01
1977	5,527	5,906	408,364	45,914	407,889	523,206	111,410	215	W	999,505	86,490	[1]34.39
1978	5,614	5,878	406,698	34,774	302,669	617,840	188,003	723	10,973	1,050,585	89,959	[1]30.97
1979	5,998	5,998	472,481	53,212	267,341	527,212	224,952	279	20,095	1,000,606	79,710	[1]37.30

NA Not available. W Withheld, Bureau of Mines not at liberty to publish.
[1]Delivered.

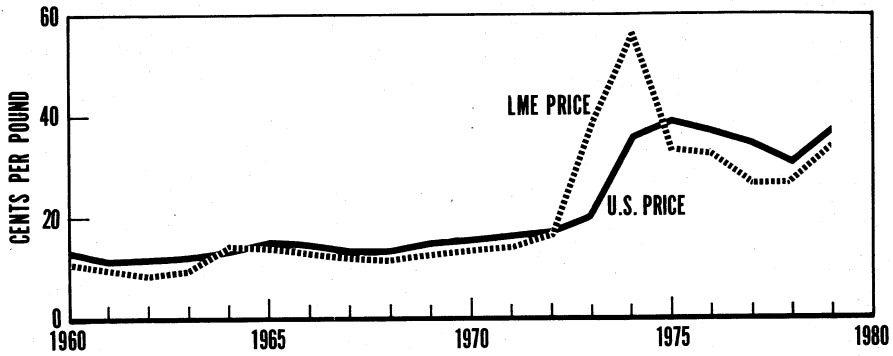

Figure 2.—Trends in average London Metal Exchange (LME) and domestic zinc prices.

DOMESTIC PRODUCTION

MINE PRODUCTION

U.S. mine production of recoverable zinc from 19 States was 302,669 tons in 1978, significantly below that of 1977, and dropped further to 267,341 tons in 1979 from 16 States. Most of the decline in production took place in Colorado, New Mexico, New York, and Utah as the result of strikes and mine closures.

The 25 leading U.S. zinc mines accounted for 95% of the recoverable domestic zinc mined in 1978 and 98% in 1979. The 10 leading mines accounted for 69% of total mine production in 1978 and 68% in 1979. Tennessee was the foremost producer of zinc during 1978-79. Eight underground mines produced zinc from zinc ores, and three underground mines and one open pit mine at the Copperhill deposit produced zinc from copper-zinc ore in 1978-79. Jersey Miniere Zinc Co., a 60-40 joint venture of The New Jersey Zinc Co. and Union Miniere, S.A. of Belgium, continued development of the Gordonsville mine and completed construction of a new 8,200-ton-per-day mill at the site. Further development of the Stonewall mine was deferred. The area along the Cincinnati Arch from central Tennessee to southern Kentucky in which the Elmwood and Gordonsville mines are being developed, continued to be the focal point for zinc exploration by a large number of foreign and domestic companies during 1978-79.

In east Tennessee, New Jersey Zinc continued construction and development at its Beaver Creek property and began production from the Lost Creek orebody which is adjacent to the Jefferson City mine. ASARCO Incorporated maintained production at the Young and Immel mines in 1978-79. The New Market and Coy mines, which had been shut down in 1977 due to poor demand for zinc concentrates, reopened in January and June 1979, respectively. Strikes in 1979 curtailed production at all four mines. The zinc concentrate produced from the Young and Immel mines is used mainly for the production of zinc oxide at ASARCO's own plants in Ohio and Illinois.

St. Joe Minerals Corp., in a joint venture with a subsidiary of Freeport Minerals Co., completed an exploration shaft and started drifting for further exploration of the ore zone at its Carthage project near Nashville, Tenn. Ore reserves were estimated at 45 to 70 million tons grading 3.5% to 5.2% zinc. Detailed drilling to further evaluate the potential of a large low-grade zinc prospect at Fountain Run, Ky. was continued by St. Joe during 1978. Drilling to 2,000 feet has indicated ore grading 2% to 4% zinc which was considered uneconomical due to the depth of the deposit and the current price of zinc. Cominco American Inc., in a joint venture with ASARCO and NL Industries, Inc., completed two exploration and ventilation shafts at the Prewitt Hollow zinc project near Burkesville, Ky.

Zinc production as a coproduct came from eight lead mines in Missouri in 1978-79. Ozark Lead Co. began expansion in 1979 of the Milliken mine, formerly the Ozark mine, which could provide an additional 2,000 tons of zinc per year when completed in 1981. Production at the Buick mine near Boss, Mo., owned 50% each by Homestake Mining Co. and AMAX Inc., declined 11% in 1978 as a result of a 10-week labor strike.

As a result of a program of planned increases begun in 1978, about 1.8 million tons of ore were milled in 1979, the highest tonnage since the mine began production. Ore reserves were given as 44 million tons grading 6.5% lead and 1.6% zinc.

In New York, at St. Joe Zinc's Balmat and Edwards mines, production in both years declined sharply as a result of a strike which began on June 1, 1978, and ended in July 1979. St. Joe had made arrangements to assure a supply of raw material to its smelter at Monaca, Pa., through 1979, as production at the mine was scheduled for half its normal rate following settlement of the differences between labor and management. The company estimated that known ore deposits at the Edwards mine will be depleted within 3 years of normal production.

In Colorado, zinc production was from eight mines in 1978 and seven mines in 1979. Idarado Mining Co., owned 80.1% by Newmont Mining Corp., placed the Idarado mine on care and maintenance status in July 1978 as a result of low zinc prices and high smelting and refining charges. In August 1978 the Camp Bird mine was closed indefinitely due to high costs and mining problems. Resurrection Mining Co., wholly owned by Newmont Mining Corp. and managed by ASARCO, mined 8% less ore in 1979 than in 1978 at the Leadville mine. Ore reserves were 1.5 million tons grading 10.1% zinc and 5% lead at yearend 1979. Homestake Mining Co. produced some byproduct zinc from its Bulldog silver mine near Creede. In June 1978 the Sunnyside gold mine of Standard Metals Corp., which produces byproduct zinc, was flooded out when the bed of an overlying lake collapsed into the present workings and those of an old stope. The mine was reopened in 1979.

Production of zinc in Idaho was reported from about 20 mines in 1978-79, but about half of them produced less than 1 ton each as a byproduct from other metal mining operations. At The Bunker Hill mine of The Bunker Hill Co., a wholly owned subsidiary of Gulf Resources & Chemical Corp., production in 1978 increased over that of 1977. Production from the Star-Morning Unit Area, owned 30% by Hecla Mining Co., decreased slightly in 1979 to 257,700 tons grading 6.4% zinc, 4.9% lead, and 96 grams of silver per ton. Ore reserves at the mine were increased to 1.4 million tons through the development of new ore and increased metal prices which lowered the cutoff grade for mining. Hecla's wholly owned Lucky Friday mine produced 159,600 tons of ore in 1979 compared with 143,900 tons mined during 1978. Ore grade was 1.5% zinc and 11.5% lead, with 562 grams of silver per ton. Calculated ore reserves at the end of 1979 were 530,000 tons. Operating costs increased about 23% in 1978 compared with about a 13% increase during 1977. Development continued on the west end of the Lucky Friday vein in 1979, and the sinking of a new shaft was expected to increase production by 35%. Intermountain Mining Engineers, with equal participation by U.S. Antimony Corp., produced zinc together with lead, silver, and gold from its recently rehabilitated Nabob mine located in the Pine Creek area of the Coeur d'Alene mining district.

In Utah, Park City Ventures, a joint venture owned 60% by The Anaconda Company and 40% by ASARCO, closed the Ontario mine in February 1978 when it became unprofitable. In 1979, Noranda Exploration Inc., a subsidiary of Noranda Mines Ltd., acquired the assets of Park City Ventures. In mid-1978, the Kennecott Copper Corp. ceased mining operations at the Burgin mine.

In Virginia, Piedmont Mineral Associates, a joint venture of Callahan Mining Corp. (49%) and New Jersey Zinc (51%), conducted cost studies on one zinc property to determine the feasibility of producing zinc chemicals, sulfuric acid, and other sulfur or metal products.

No mines produced zinc in Washington in 1979, compared with one mine in 1978, two in 1977, and four in 1976. Bunker Hill's Pend Oreille mine remained on a care and maintenance basis pending improvement in the zinc market.

In northern Maine, Superior Oil Co. and Louisiana Land and Exploration Co. continued exploration and drilling on their large zinc-copper discovery at Bald Mountain. Sulfide mineralization in two major ore types consisted of 9.1 million tons of zinc ore assaying 2.5% zinc, and 3.6 million tons of copper-zinc ore assaying 1.1% copper and 1.8% zinc. Both ore types contain some values in gold and silver. Pilot plant studies were planned for 1979-80. The Bald Mountain deposit is on land leased from the Great Northern Nekoosa Paper Co.

In Wisconsin, the Exxon Minerals Co., U.S.A., a division of Exxon Corp., continued evaluation and feasibility studies on its large zinc-copper discovery near Crandon in northern Wisconsin. Permits were sought in 1979 for underground development work. Because of depressed zinc prices, Eagle-Picher Industries, Inc., closed the Bear Hole

mine at the end of February 1978 and reduced its mining activities at the Shullsburg mine until October 1, 1978, when it was closed because of unfavorable economic conditions and high costs of environmental regulations. In October 1978, Noranda Exploration Inc., closed its Rhinelander district exploration office due to low zinc prices and a new State mining tax law.

Following the 1977 closure of the Bruce mine by Cyprus Mines Corp., no zinc mines were in operation in Arizona during 1978-79. Some byproduct zinc was recovered, however, by mines engaged in producing principally silver or copper.

Bunker Hill cited poor conditions in the zinc market and in 1978 closed its Pan American zinc mine and 1,360-ton-per-day Caselton concentrator located in Lincoln County, Nev.

Near Pinos Altos, Grant County, N. Mex., close-spaced drilling by Exxon Minerals at a new base metal discovery confirmed probable reserves of about 7 million tons of ore containing 3% zinc, 2% copper, and a lesser amount of silver. Operations at the Ground Hog mine of ASARCO were shut down completely in August 1978 for economic reasons.

Houston Oil and Minerals Corp., in a joint venture with General Crude Oil Co., continued its drilling program to make a preliminary economic evaluation of lead-zinc mineralization discovered during 1977 in the Western Brooks Mountain Range of Alaska, 80 miles north of Kotzebue. Elsewhere in Alaska, Pan Sound, a joint venture of Noranda Mines Ltd., Texas Gas Transmission Corp., Mitsubishi Corp., and Marietta Resources International, announced the discovery in 1978 of silver, lead, zinc, and copper mineralization near Hawk Inlet on Admiralty Island. In the Southwestern Brooks Range, the Ambler-Mining Co., a limited partnership of The Anaconda Company and Sunshine Mining Co., continued drilling and evaluation in 1978 of their silver, lead, zinc, and copper property which was discovered in 1975.

SMELTER AND REFINERY PRODUCTION

U.S. slab zinc production at seven primary plants and eight secondary plants decreased slightly in 1978 from that of the previous year, but increased substantially in 1979. During 1978-79, ASARCO's Corpus Christi, Tex. electrolytic zinc plant processed domestic and foreign zinc concentrates as well as zinc fume. A modernization program was underway in 1979 at the plant to allow treatment of a wider variety of concentrates, reduce costs, and expand capacity by 25%. Completion was expected by yearend 1981. Plans for the construction of a new zinc plant in Kentucky were terminated in 1978 due to the depressed condition of the zinc market.

Amax Zinc Co., Inc., produced more zinc in 1979 than in 1978 at its Sauget, Ill., electrolytic zinc plant. About one-third of the feed for the facility came from Amax's share of production from subsidiary companies in Missouri and one-quarter from the company's share in the Newfoundland mine in Canada. Production was suspended for 7 weeks in 1978 as a result of a coal industry strike that interrupted the supply of electrical power. Bunker Hill in Idaho produced more slab zinc in 1978 than in 1977 when production was intentionally held back because of the poor zinc market. During 1978, approximately 67% of Bunker Hill's finished zinc production was Special High Grade zinc and the remaining 33% was galvanizing grades and zinc alloys. Sales of zinc metals were handled by The Bunker Hill Sales Co. in Kellogg, Idaho.

For the fiscal year ended July 31, 1978, New Jersey Zinc showed a 16% increase in slab zinc production; capacity utilization was 85% for metal production. Company mines produced 80% of the concentrate requirements for the Palmerton Pa. plant.

Metal production began in late November 1978 at Jersey Miniere's new zinc refinery at Clarksville, Tenn. The $97 million, 82,000-ton-per-year facility is the first completely new zinc refinery to be built in the United States since 1941. Concentrate from the Tennessee mines being developed by the partnership was transported to the plant by rail or truck; however, the company eventually plans to use river barges to transport the concentrate from the mills to the smelter.

During 1978, St. Joe Zinc completed a study on the feasibility of constructing a new electrolytic plant in place of its electrothermic plant at Monaca, Pa. The company closed the plant in December 1979 because of high energy and work force requirements and the substantial capital required to meet new environmental regulations.

Secondary slab zinc was produced at four primary plants in 1979, with St. Joe Zinc being the largest producer. Of the nine companies producing slab zinc solely from secondary materials, Pacific Smelting Co. and W. J. Bullock, Inc., were the largest

producers. The grade of zinc from secondary plants was all Prime Western.

Slag-Fuming Plants.—Slag-fuming plants processed lead blast furnace slags and residues to produce zinc oxide fume. The oxide was either sold and used as oxide or sent to smelters and refineries for processing into metallic zinc. Three plants operated in 1978-79; ASARCO at El Paso, Tex., and East Helena, Mont., and Bunker Hill at Kellogg, Idaho.

Byproduct Sulfuric Acid.—Production of byproduct sulfuric acid from zinc plants was 686,276 tons in 1978, and 773,836 tons in 1979. In 1978, seven plants roasted zinc sulfide concentrates and produced sulfuric acid, with one plant operating solely to produce calcine for processing to zinc oxide or slab zinc. In 1979, byproduct sulfuric acid was also produced from the new zinc plant in Tennessee.

Zinc Dust.—St. Joe Zinc constructed a zinc dust plant at Monaca, Pa., in 1978 with a capacity of 3,600 tons per year, but production ended in December 1979 with the plant's closure.

CONSUMPTION AND USES

More companies participated in the slab zinc consumption survey in 1978 and reported slab zinc consumption increased over that of 1977. A large increase in shipments of galvanized steel to the automotive industry, as reported by the American Iron and Steel Institute, contributed to higher zinc consumption. In 1979, reported slab zinc consumption for the first half of the year was 7% greater than that of the comparable 1978 period. In the second half of 1979 consumption fell compared with that of the second half of 1978 as the result of cutbacks in automobile production and the downturn in the construction industry. For 1979, most of the decline was in diecasting alloys as automobile production fell from 9.17 million units in 1978 to 8.42 million units in 1979.

Production of rolled zinc products decreased to 23,585 tons in 1978 and 21,100 tons in 1979. Strip and foil accounted for 79% of the total in 1978 and 78% in 1979. Production of rolled zinc from scrap was 19,788 tons in 1978, and 18,556 tons in 1979.

The Zinc Institute Inc., conducted a survey of over 400 diecasters in 1978-79 to determine the market distribution of zinc die castings shipped by these companies. The results showed that automotive components continued to decline and accounted for 43.3% of the total in 1979. Builders' hardware fell slightly to 22.1% and domestic appliances remained unchanged at 7.1%. Industrial, agricultural, and commercial machinery; electrical components; scientific and professional equipment; and miscellaneous uses have shown increased use of zinc die castings in recent years.

ZINC PIGMENTS AND SALTS

Production.—Production and shipments of zinc oxide in 1978-79 decreased from those of 1977. The source of domestic zinc oxide production was slightly more than half from ore and concentrate (American process), about one-quarter from slab zinc (French process), and about one-fifth from secondary material. Total French process zinc oxide, including that from remelt and scrap, was 38% of the total in 1978 and 36% in 1979. Lead-free zinc oxide was produced at 13 plants in 1978-79 and leaded zinc oxide was produced at 1 plant.

Zinc sulfate production from about a dozen companies showed a significant increase in 1978 over that of 1977, mainly because of additional reporting companies. Zinc sulfate production came from secondary material and from ore. Zinc chloride production from five companies was derived entirely from secondary material.

In its 10-K report, St. Joe Zinc showed production of 48,654 tons of zinc oxide in 1978. ASARCO, with plants at Columbus, Ohio, and Hillsboro, Ill., produced about 31,800 tons in 1978 and 30,900 tons in 1979, according to its annual report. ASARCO produced zinc oxide from concentrates produced by company mines in Tennessee and from zinc metal. New Jersey Zinc produced both American and French process zinc oxide. Other major zinc oxide producers such as the Eagle-Picher, Hillsboro, Ill., plant and the Sherwin-Williams Co., Coffeyville, Kans., plant, used calcines, fume, and secondary materials as raw materials. New Jersey Zinc and St. Joe Zinc were the two largest of the half-dozen producers of French process zinc oxide. With the closure of its Monaca plant, St. Joe Zinc ceased production of zinc oxide.

Consumption and Uses.—The apparent consumption of zinc oxide increased to about 205,000 tons in 1978 and 206,000 tons in 1979. Of the major uses of zinc oxide, only chemicals showed an increase. The use in

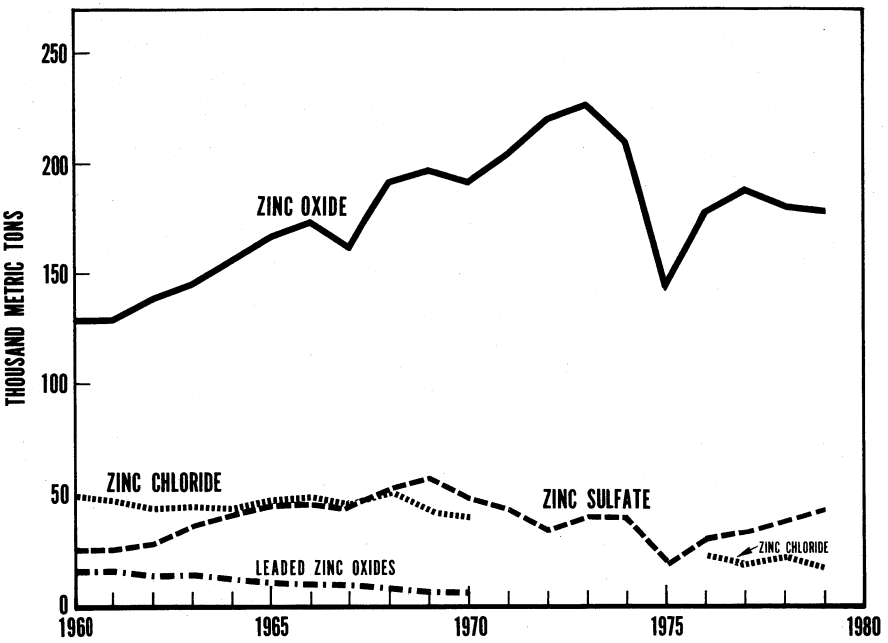

Figure 3.— Trends in shipment of zinc pigments.

photocopying continued the downward trend of recent years. Among miscellaneous uses, zinc oxide was used in floor coverings, fabrics, lubricants, plastics, and rayon manufacturing. The use of zinc sulfate in agriculture was up significantly in 1979 with lesser amounts assigned to rayon, flotation reagents, and chemicals. The use in rayon and flotation reagents declined in 1979 compared with that in 1978. Leaded zinc oxide was used in rubber, and lithopone was used mainly in paints. Shipments of zinc chloride were lower in 1979 compared with those in 1978, with most of the zinc chloride used in wood preserving, soldering, fluxes, and batteries.

Prices.—List prices for zinc oxide at the beginning of 1978 were 36.5 cents per pound for American process, lead-free pigment grade; 38 cents for French process, regular; 39.5 to 40.5 for electrophotographic grade, and 34.25 cents for 12% leaded zinc oxide. With the reduction in the price of zinc metal in February, U.S. producers lowered zinc oxide prices by 1.25 cents per pound. In June, St. Joe Zinc raised its prices 2 cents per pound for American and French process and 0.75 cent per pound for electrophotographic grade. The price of leaded zinc oxide increased from 32.9 cents to 34 cents per pound. Prices remained steady through August except for leaded zinc oxide which fell 1.5 cents to 32.5 cents per pound. Prices were raised in September through November by all producers so that by yearend prices were 40.75 cents per pound for American process zinc oxide, 42.25 cents for French process, 43.75 to 44.75 cents for electrophotographic grade, and 37 cents for 12% leaded zinc oxide.

In 1979, prices were increased by 2.25 cents in February and another 2 cents in April, but in August the price was adjusted downward by 1.5 cents and again in September by 1 cent, generally in line with movements in the price of zinc metal. In November the price was increased by 2 cents, leading to yearend prices of 44.5 cents per pound for American process, lead-free pigment grade; 46 cents for French process, regular; 47.25 to 48.25 cents for electrophotographic grade; and 39.25 cents for 12% leaded zinc oxide in 50-short-ton rail car quantities.

The price of zinc sulfate, granular monohydrate industrial, 36% zinc, bags in carload lots, advanced in mid-1978 from $24 to $26.50 in January to a quoted price of $26.50

to $29 where it remained through 1979. The price of technical-grade zinc chloride, 50% solution, in tank-car quantities, was quoted at $10 to $17.55 per 100 pounds in early January 1978 and thereafter at $10 to $15.25 through yearend 1979.

Foreign Trade.—Exports of zinc oxide decreased to 1,121 tons valued at $1.178 million in 1978, with Australia, Belgium, and Canada receiving 66% of the total. In 1979, 1,057 tons valued at $1,139 was exported with Australia, Belgium, and Venezuela receiving 70% of the total. Imports of all classes of zinc compounds increased significantly in 1978-79. Zinc oxide was a major component of imports of zinc compounds and accounted for most of the increase. Mexico and Canada supplied over 90% of the zinc oxide; other European Economic Community countries contributed most of the remainder. Venezuela and India supplied 2% of the total in 1979.

STOCKS

Producer stocks at yearend 1978 were at their lowest yearend level since 1974 when they were 36,033 tons. By December 1979 the level had increased to 55,831 tons as demand slackened. The monthly data as reported by American Bureau of Metal Statistics (ABMS) showed that producer stocks at plants and elsewhere declined continuously through October 1978 to almost half that at the end of January, but increased for the next few months. In early 1979 stocks declined as demand remained strong, but in the last half of the year producer stocks increased as demand slackened.

Inventories of slab zinc at consumer plants generally trended upward during 1978 to close at 99,325 tons. In 1979, stocks were high in the first half but as economic activity waned in the second half and inventory costs increased, stocks fell from about 94,000 tons in July to just below 80,000 tons in the final months of the year.

PRICES

ASARCO initiated a price decrease of 1.5 cents per pound of zinc, effective February 21, 1978, to 29 cents for Prime Western Grade zinc, and 29.5 cents for Special High Grade. ASARCO cited high producer stocks, poor demand, and high import levels as the reasons for the price cut. At monthend other producers were quoting the same price. In June, St. Joe Zinc raised the price for Prime Western zinc by 2 cents to 31 cents per pound. All other producers quickly followed, but National Zinc and ASARCO rescinded the increase, and at monthend prices ranged from 29 to 31 cents per pound for Prime Western and High Grade; 29.25 to 31.25 cents for Controlled Lead Grade; and 29.5 to 31.5 cents for Continuous Galvanizing and Special High Grades. In mid-July, ASARCO and National Zinc raised the price of zinc by 1.5 cents per pound for all grades. At monthend prices ranged from 30.5 to 31 cents per pound for Prime Western and High Grade; 30.75 to 31.25 cents for Controlled Lead Grade; and 31 to 31.5 cents for Continuous Galvanizing and Special High Grades. On August 15, ASARCO raised its prices of Prime Western zinc to 32.5 cents, Continuous Galvanizing Grade to 32.75 cents, and Special High Grade to 33 cents. Several producers tried to list all grades at 33 cents, thereby eliminating the premium pricing system, but by monthend all producers except Bunker Hill were on the same price schedule as ASARCO. Zinc prices increased 2 cents in October when the price of Prime Western and High Grade zinc was increased to 34.5 cents by all U.S. producers except Bunker Hill which quoted all grades at 35 cents per pound. These prices remained in effect for the rest of the year.

In January 1979, producers raised their prices by 1 cent per pound, except Bunker Hill, which raised prices 0.5 cent to 35.5 cents for all grades. Prices again increased in February and March to 39.5 cents for Prime Western and High Grade zinc, with Bunker Hill quoting 39.5 cents for all grades. In June, New Jersey Zinc raised all its grades by 2 cents per pound but a month later rescinded the increase. By yearend several price adjustments had taken place, with all producers quoting 37.5 cents for Prime Western and High Grade, 37.75 cents for Controlled Lead Grade, and 38 cents for Continuous Galvanizing and Special High Grades.

In February 1978, major European custom smelters lowered their list prices by $50, to $550 per ton (24.9 cents per pound). Producers cited weak demand and wide-

spread discounting as the reason for the price cut. Prices were increased in April by some producers and by August the price ranged from $575 to $625. Prices were increased again in September and October by major European producers to $720 per ton. Most producers considered the price increases during 1978 a reflection of a weakened dollar rather than of increased production costs. Two increases at $40 each in early 1979 and another of $45 in May brought the price to $845. By June there were reports of discounting, as many producers felt they were losing sales to customers buying lower priced zinc on the London Metal Exchange (LME). The price was lowered to $780 in July where it remained through December.

On the LME prices fell to the 1978 low of 21 cents per pound at the end of February. In March, prices began to rise, ending the year at 32 cents per pound. Production cutbacks contributed to the price increase. By early April 1979, prices were 36 to 37 cents per pound, but then gradually declined to about 28 cents in August. By yearend prices had recovered to 34 to 36 cents.

U.S. dealer prices for Special High Grade zinc steadily increased during 1978, beginning at 28.5 to 28.8 cents per pound and ending the year at 35 cents per pound. By April 1979, the price was 39.5 to 40 cents but declined to 34 to 37 cents in December.

On February 8, 1978, the New York Commodity Exchange (Comex) began trading on its Special High Grade zinc contract. Trading was very light throughout 1979. Prices fluctuated upward in 1978 and ended at 34.5 cents per pound. Prices varied widely in 1979, from a high of 39.3 cents in April to a low of 28.6 cents in November.

In December 1978, the Council on Wage and Price Stability (COWPS) issued guidelines covering the nonferrous metals industry, and zinc producers were informally advised that their metals were excluded from price regulations. However, in February 1979, COWPS announced that zinc was not exempt from the guidelines because the producer prices did not follow closely enough those on organized exchanges.

FOREIGN TRADE

Exports of zinc ores and concentrate (zinc content) in 1979 were about double those of 1978. Prior to 1978, exports of zinc ores and concentrate were combined with those of lead and reported as gross weight.

General imports of zinc in ore and concentrates increased substantially in 1978-79 to double those of 1977.

In June 1978, the U.S. Department of the Treasury reversed an earlier decision on the Spanish zinc case by reducing the ad valorem penalty duty on imports of Spanish zinc from 4% to 1.29%. Because of intense criticism, Treasury again reversed its position in November and notified the Spanish Government that the penalty duty would be raised to 3.19%, a decision opposed by the Spanish Government. In late December, Treasury finally amended the duty to 2.64%.

New rates of duty on zinc materials were announced as a result of the Tokyo round of multilateral trade negotiations completed in 1979. Progressively lower rates will be phased in over an 8-year period beginning January 1, 1980. The new rates are as follows:

Tariff: Item	Number	Most Favored Nation (MFN)		Non-MFN
		Jan. 1, 1980	Jan. 1, 1987	Jan. 1, 1980
Ore and concentrate	602.20	0.62 cent per pound on zinc content	0.3 cent per pound on zinc content	1.67 cents per pound on zinc content.
Fume	603.50	0.62 cent per pound on zinc content	0.3 cent per pound on zinc content	1.67 cents per pound on zinc content.
Unwrought, other than alloys	626.02	1.9% ad valorem	1.5% ad valorem	1.75 cents per pound.
Alloys	626.04	19% ad valorem	19% ad valorem	45% ad valorem.
Waste and scrap	626.10	4.8% ad valorem	2.1% ad valorem	11% ad valorem.

The duty on waste and scrap remained suspended until June 30, 1981 according to P.L. 95-508. The suspension of duty on zinc ore, concentrates and other zinc bearing materials expired on June 30, 1978.

WORLD REVIEW

The World Bureau of Metal Statistics[3] indicated that world consumption of slab zinc was 6.2 million tons in 1978-79 compared with 5.9 million tons in 1977. Consumption was higher in Asia in 1979 compared with that in 1978, but consumption dropped in Europe and in Centrally Planned Economy Countries. According to the Bureau of Mines, world mine production declined in 1978 but increased in 1979 as new mines opened and became fully operational. Many mines with small production rates closed in 1978. Significant increases in primary smelter production in 1978-79 occurred in Canada, the Netherlands, India, the Republic of Korea, the United States, and Australia.

Smelter production of secondary zinc, as shown in table 42, has been separated from primary zinc production where information is available. Substantial quantities of secondary slab zinc were produced in France, the Federal Republic of Germany, Japan, the United States, and the U.S.S.R. Producer stocks worldwide decreased 52% to about 400,000 tons during 1978 but by yearend 1979 had climbed to about 480,000 tons. Consumer stocks were about 185,000 tons at yearend 1979 compared with 166,000 tons 2 years earlier.[4] LME stocks increased about 5,000 tons, ending 1978 at 69,550 tons, and in 1979 they generally declined further to 46,000 tons at yearend.

World mine capacity was estimated to be 7.92 million tons of zinc in 1978, with a small increase to about 8 million tons in 1979. Most of the expansion took place in Australia, Canada, and Spain. A new mine opened in mainland China in the Hochih area of Guangxi Province in 1979. In the first phase of operation 18,000 tons of zinc will be extracted annually in addition to tin, lead, antimony, and precious metals. It was reported that construction began on a lead-zinc mine in Uzbekistan in the U.S.S.R. in 1979. The Wheal Jane mine in the United Kingdom, which closed in early 1978, and produced a small amount of byproduct zinc, was being refurbished by Carnon Consolidated Tin Mines.

World primary zinc smelter capacity increased to about 7.24 million tons per year in 1978, and to 7.26 million tons by yearend 1979. In Italy, the Monteponi electrolytic plant with a capacity of 15,000 tons per year was closed in October 1979 as part of a reorganization of the Government controlled lead and zinc operations. This closure was more than offset by increased electrolytic capacity in Austria, India, and the Republic of Korea.

Australia.—The zinc content of the ore at the Mount Isa mine in Queensland, increased from 6% in 1977 to 6.3% in 1978. Reserves declined to 56 million tons of ore assaying 6.5% zinc. Drilling results added 1 million tons to reserves but extraction and material reappraisal resulted in a net reduction of 1 million tons from that of 1977. The company deferred development of the McArthur River lead-zinc-silver deposit in the Northern Territory due to the lack of an efficient beneficiation process for the fine-grained ore. Mount Isa and Western Selcast (Pty.) Ltd., announced plans to develop the Teutonic Bore copper-zinc deposit. Production is expected in 1981 from the deposit containing 2.3 million tons of ore grading 3.5% copper, 9.5% zinc, and 165 grams of silver per ton.

At the West Coast mines in Tasmania, EZ Industries Ltd., increased production over that of 1977 to 656,013 tons of ore grading 12.7% zinc in 1978, and maintained that rate into 1979. Reserves were increased to 8.1 million tons of ore in 1979. The company commissioned a small plant to treat the silicate ores from the Beltana mine. Aberfoyle Ltd., owned 47% by Cominco Ltd., began development of the Que River zinc-lead-silver deposit in Tasmania, with production scheduled for 1981. The ore will be milled at the Rosebery concentrator at EZ Industries, after a modernization and expansion program is completed in 1981, at a rate of about 230,000 tons per year. Ore reserves were 6.3 million tons grading 9.6% zinc and 5.2% lead. Australian Mining & Smelting Ltd., produced 11% less zinc concentrate in 1978 than in 1977 because of lower zinc demand, the need for plant repairs, and lower grade of ore mined. Production recovered in 1979 to a record high as new equipment allowed the treatment of larger quantities of lower grade ore. Cobar Mines Pty. Ltd., 100% owned by BH South Ltd., treated 518,650 tons of ore in 1978, down 7% from that of 1977, but the ore grade increased to 3%. The concentrate was smelted at Cockle Creek.

EZ Industries produced 203,650 tons of zinc from the Risdon smelter in the fiscal year ending June 30, 1979, which was the highest level recorded by the company. Increased sales to Asian countries allowed the high production rate. Combined produc-

tion at the Cockle Creek smelter of Sulfide Corp. Pty. Ltd., and the Port Pirie plant of The Broken Hill Associated Smelters Pty. Ltd., increased in both 1978 and 1979 over that of 1977, with operations near capacity in 1979. Pollution control projects were completed at both plants, including a 205-meter stack at Port Pirie to control ground levels of sulfur dioxide.

The mill at the Woodlawn zinc-lead-silver-copper deposit in New South Wales, in which St. Joe Minerals, Phelps Dodge Corp., and Australian Mining & Smelting Ltd. each hold a one-third interest, was completed in December 1978 and contributed substantially to production in 1979. The mill has a capacity of 2,700 tons per day. Proven reserves at Woodlawn were estimated at 6.3 million tons assaying 14.4% zinc, 5.5% lead, 1.7% copper, and 89 grams of silver per ton at yearend 1978. The mining method is open pit and about 260 workers are employed.

Canada.—Mine output in 1979 from 29 mines was up over that of 1978. Mill capacity utilization was estimated at 83%, and the average recovery rate of zinc at the mills was 84%. Mill capacity at producing mines increased to 97,000 tons of ore per day, mainly through new mine openings and expansion.[5]

In New Brunswick, Brunswick Mining & Smelting Corp. Ltd., reinstated the planned expansion of the No. 12 mine. In 1978, the company experienced a total operating cost per ton milled of $19.36[6] at its No. 12 underground mine, and $17.84 at the No. 6 mine where mining was mostly underground. Ore mined in 1979, at 2.97 million tons, was about the same as that in 1978. Proven and probable reserves were 9.3 million tons of contained zinc at yearend 1979.

In Ontario, Mattabi Mines Ltd., increased production by 8% over that of 1978 to 945,000 tons of ore grading 6.9% zinc. Ore reserves at yearend 1979 were 3.4 million tons grading 7% zinc, including 400,000 tons from a newly discovered ore lens. The Geco Div. of Noranda treated 1.5 million tons of copper-zinc ore grading 3.2% zinc. Yearend 1979 reserves were 20.4 million tons grading 3.8% zinc. Noranda began rehabilitating the Lyon Lake mine for planned commencement of mining in July 1980. Texasgulf Inc., completed the expansion at the concentrator at Kidd Creek in 1978 with the addition of a fourth circuit which increased capacity by 1.1 million tons of ore per year. Ore milled in 1979 was 3.7 million tons compared with 3 million tons in 1978. Development work continued with completion scheduled for 1981, although some ore was produced from the No. 2 mine in 1979. In October 1979, Noranda acquired all the shares of Heath Steele Mines Ltd., which had a 75% interest in the Little River Joint Venture, a 3,600-ton-per-day lead-zinc-copper mine and mill near Newcastle. Reserves at yearend 1979 were 28.1 million tons of ore grading 1.5% lead, 4.5% zinc, and 1.1% copper.

Cominco Ltd., operated the Sullivan mine in British Columbia and the Pine Point mine in the Northwest Territories in 1978-79, but closed the HB mine in August 1978. Production of zinc concentrate from the two mines was about the same in 1979 as in 1978. Ore grade increased from 3.3% zinc in 1978 to 3.7% in 1979 at the Sullivan mine, but decreased from 5.9% to 5.5% zinc at the Pine Point mine. The modernization program continued at the Sullivan mine, including the completion of a waste water treatment plant for removing metallics from mine and mill water before discharge into the local river. A project to modernize the concentrator to improve efficiency and reduce energy costs was begun in 1979 at the Pine Point mine. The company added ore reserves in excess of production in 1979 to maintain its 10-year reserves status. Cominco acquired the remaining 25% of the outstanding shares of Arvik Mines Ltd., owner of the Polaris deposit on Little Cornwallis Island. In November 1979, Cominco announced its intention to bring the Polaris zinc-lead mine into production by 1982 at a rate of 2,000 tons of ore per day. Ore reserves were given as 23 million tons grading 14.1% zinc and 4.3% lead. Cyprus Anvil Mining Corp. announced the discovery of the Cirque deposit in British Columbia in 1979 with 18 million tons of material grading 7.9% zinc, 2.3% lead, and 49 grams of silver per ton.

In Quebec, the Matagami Div. of Noranda, which includes the Mattagami Lake, Orchan, Norita, and Radiore No. 2 mines, treated 1.3 million tons of ore grading 5.4% zinc. Ore reserves at yearend 1979 were estimated at 9.5 million tons assaying 5.7% zinc. Louvem Mining Co. Inc., ceased operations at its zinc-gold-silver mining operations in 1978. At the Manitou Div., ore was exhausted.

In Manitoba, ore production in 1979 by Hudson Bay Mining and Smelting Co., Ltd., was 2% more than that of 1978, at 1.7 million tons grading 2.9% zinc compared with 3.2% zinc in 1978. The Westarm mine was brought into production in January

1978 and the White Lake mine resumed operations. The new 3,500-ton-per-day mill adjacent to the Stall Lake mine was opened in June 1979. At the Ruttan mine, Sherritt Gordon Mines Ltd. began underground mining in early 1979 and planned to phase out open pit mining in 1980.

Noranda Mines Ltd. and MacDonald Mines Ltd. announced the reopening of the former West MacDonald mine in mid-1981 under a joint venture company, Les Mines Gallen Limited. Zinc output from the open pit mine was expected to be about 19,000 tons per year.

Zinc production in the Yukon Territory from the Faro mine of Cyprus Anvil Mining Corp. was about the same in 1978 and 1979. The concentrates were sold principally to customers in Japan and the Federal Republic of Germany. Under a 2-year contract, about 14,000 tons of zinc concentrate will be shipped to the U.S.S.R. In November 1978, the company reached an agreement to acquire the Kerr Addison and Canadian Natural Resources Ltd. properties in the Anvil district. These properties include the Grum, Vangorda, and Swim deposits with reserves of about 40 million tons containing 8% to 10% lead and zinc. Kerr Addison suspended evaluation of the Grum zinc-lead-silver deposit in 1978 because the company felt the property was uneconomical. United Keno Hill Mines Ltd. produced less zinc in 1978 than in 1977 because of high treatment and transportation charges.

Production at ASARCO's Buchans mine in Newfoundland, originally scheduled to close in 1978, continued into 1979 due to higher lead and zinc prices.

In Nova Scotia, Imperial Oil Ltd. began production at Gays River in late 1979. Capacity of the mill is 1,350 tons per day. Reserves were given as 11 million tons containing 4.2% zinc and 2.8% lead.

In British Columbia, Western Mines Ltd. milled 266,877 tons of ore in 1979, about the same as that in 1978, from the Lynx and Myra mines. About 150,000 tons of new ore reserves were found, bringing the total to 1.15 million tons grading 8% zinc. The company continued exploration of the Great Slave Reef and West Reef properties in the Northwest Territories but found the deposit uneconomical at current metal prices.

Texasgulf Canada Ltd. produced 106,700 tons of zinc metal at its smelter in Ontario, up from 72,850 tons in 1978. Cominco Ltd. produced about 208,000 tons of metal, up 6% over that of 1978, at Trail, British Columbia. The company began construction for modernization and expansion of its electrolytic plant, including the first commercial-scale zinc concentrate leach plant using the pressure leaching system developed with Sherritt Gordon. Canadian Electrolytic Zinc operated its Valleyfield, Quebec smelter at 92% of capacity in 1979 compared with 73% in 1978. Canadian zinc metal capacity was 644,000 tons, which incorporated a revised figure of 218,000 tons for Valleyfield.

Canadian zinc reserves on January 1, 1979, were given as 26.5 million tons at the producing mines and deposits under development, with the Provinces of New Brunswick and Ontario containing about three-fifths of the total.

Fers et Metaux Recycles Ltd. began operations of Canada's first heavy media separation metal recycling plant in 1978. The company recovers about 5,500 tons per year of zinc die cast, mainly from shredded automobiles, and sells it for the manufacture of zinc dust, zinc oxides, and copper alloys.

Honduras.—Reserves in all ore bodies of the El Mochito mine of Rosario Resources Corp. were 7.2 million tons averaging 9.5% zinc and 4.5% lead. Ore reserves increased as a result of development work in the San Juan orebody. The mill was being expanded from 1,100 tons to 2,200 tons of ore per day.

Ireland.—Tara Mines Ltd. treated a total of 1.6 million tons of ore grading 11.4% zinc and 2.5% lead from the Navan mine in 1979, 19% above that of 1978. In 1978 a 5-week strike and modifications in mining plans cut production. Production has not reached design capacity of 2.2 million tons because of mechanical and labor problems. New Jersey Zinc withdrew from the zinc smelter project in 1978, but there were reports of Soviet and Japanese interest in building a plant at the Balylongford site.

Irish Base Metals, a subsidiary of Northgate Exploration Ltd., treated 231,404 tons of ore from the Tynagh mine, County Galway, in 1978. Production was down from that of 1977 because of a labor strike from June through December. The ore grade was 3.4% zinc and 4.1% lead, with some silver and copper. Metallurgical recovery of zinc was 79% compared with 81% in 1977. Ore reserves were given as 820,000 tons assaying 5% lead, 3.4% zinc, 0.2% copper, and 37.7 grams of silver per ton. About 295,000 tons of material was excluded from reserve estimates given in 1977 following redesign of the mining blocks. Arrangements were

made for the sale of concentrates through 1980. An intensive diamond drilling program in the Tynagh area continued through 1979.

Mogul of Ireland Ltd. mined 610,856 tons of ore grading 5.6% zinc and 3.2% lead, 7% less than in 1978. Metal recovery of zinc was 83% and operating costs increased 20% over those of 1978. Ore reserves after dilution were 3.1 million tons grading 5.2% zinc and 2.6% lead.

Japan.—The stockpile program, initiated in 1976 by the Metallic Minerals Stockpile Association, held a total of 160,270 tons by yearend 1978, made up of 21,000 tons in the Government stockpile and 139,720 tons in the private stockpile.

Dowa Mining Co. Ltd. began operations at the Ezuri mine in 1979. Production was expected to be 14,000 tons of zinc and 4,000 tons of lead annually by 1980. Reserves were given as 3 million tons of ore grading 14% zinc and 8% lead, with lesser quantities of copper, gold, and silver.

Several mines with an annual production of about 4,000 tons of zinc closed during 1978 because of high production costs and low zinc prices. Mitsui Mining & Smelting Co., Ltd., curtailed production at its Kamioka mine several times in 1978 to reduce its stock of zinc concentrate. Mine capacity is 6,500 tons of ore per day. Mitsui also closed its Hikoshima zinc plant, with an annual capacity of 84,000 tons, during August 1978.

Mexico.—Industrial Minera Mexico, S.A. (IMM), was restructured to comply with Mexican law resulting in ASARCO's 34% ownership now in Mexico Desarrollo Industrial Minero, S.A., a new holding company for IMM. IMM opened the new Tecolote copper-zinc-tungsten mine in 1978 with a capacity of 9,000 tons of zinc per year. Expansion projects were underway at Taxco, Santa Barbara, and San Martin, increasing capacity from 6,100 tons of ore per day to 12,200 tons. IMM began construction of the Rosario silver-lead-zinc mine with a capacity of 730 tons of ore per day, and the Velardena silver-lead-zinc mine is expected to start up in early 1980 at a rate of 800 tons per day.

Nicaragua.—Neptune Mining Co., owned 52.5% by ASARCO, placed the Vesubio mine on standby in August 1978 for economic reasons. In November 1979, the Government issued a decree nationalizing the mining industry in that country, including the mines owned by Neptune.

Peru.—Zinc mine production in 1978 was below that of 1977 because of labor strikes in midyear. Centromin, the State mining company, accounted for 42% of the country's production in 1978-79. Cia. Minera Milpo S.A., one of the most important lead-zinc producers in the medium sector, completed a new 1,800-ton-per-day concentrator in 1979. The mill, which replaces an older unit, will increase capacity by 13,000 tons of zinc per year. San Ignacio de Morococha S.A., Peru's second largest producer with 32,960 tons in 1979, continued with its mine expansion of 33% to 2,000 tons of ore per day. Cia. Minera Atachocha, S.A., which produced 17,100 tons of zinc in 1979, increased its plant capacity 20% in 1979 to 1,800 tons of ore per day. In 1978, the Government exempted mining companies producing zinc as their principal product from the 17.5% export tax, a step which aided zinc producers in a market of low international prices.

Basic engineering work continued and construction began on the 100,000-ton-per-year zinc refinery to be built at Cajamarquilla.

Cia. Minera del Madrigal, a division of Homestake Mining, continued to mine copper-lead-zinc ore. ASARCO, through Northern Peru Mining Corp., produced 7,300 tons of zinc from the Quiruvilca mine in 1978 and 8,250 tons in 1979. New orebodies were discovered with high silver content, and a 30% expansion was planned. Cia Minerales Santander, Inc., a subsidiary of St. Joe Minerals, produced about 73,000 tons of zinc concentrates in 1978-79, a substantial increase over that of 1977. Work began on a new tunnel to gain access to new mineralization at lower levels.

South Africa, Republic of.—Black Mountain Mineral Development Co. Ltd., of which Phelps Dodge Corp. owns 49%, began trial milling in late 1979 at the Broken Hill mine at Aggeneys. Beginning in 1980, the annual production from the mine was expected to be about 90,000 tons of lead, 18,000 tons of zinc, and a byproduct copper and silver. Proven reserves amount to 38 million tons grading 6.4% lead, 2.9% zinc, and lesser quantities of copper and silver.

Spain.—The Rubiales zinc-lead mine of Exploracion Minera International Espana, S.A., in which Cominco Europe NV is the major shareholder with 47.48%, began commercial operation on July 1, 1978. Ore production in 1979 was 680,000 tons grading 8.9% zinc and 2% lead. Reserves at yearend 1979 were 12.5 million tons of ore grading 7.6% zinc and 1.4% lead. The entire output has been contracted for sale to smelters in

Spain under long-term sales agreements. Andaluza de Piritas began production at its open pit mine and mill at Aznalcollar in 1979 at the rate of 57,000 tons of contained zinc per year.

Thailand.—In August 1978, Gulf & Western Industries sold its 55% holding of Thai Zinc Ltd., which held a concession for the Mae Sot zinc deposit, to Whashin Industrial Co., a South Korean firm. It was reported that Whashin arranged financing for the mine and smelter project in late 1979.

Yugoslavia.—Work was under way at the Trepca mine to expand production by 14,000 tons of contained zinc by 1980, and at the Srebrenica mine by 7,000 tons. Expansion started at the Kopaonik lead and zinc mill at Leposanic, Serbia, and should be completed in 1980.

TECHNOLOGY

At the Rolla (Mo.) Research Center of the Bureau of Mines researchers evaluated solvent extraction and precipitation techniques to remove and recover cobalt and nickel from zinc sulfate solution prior to electrolysis. Several reagents lowered the cobalt and nickel levels to less than 0.1 part per million.[7] In another investigation a technique was developed to produce zinc sulfate and elemental sulfur from sphalerite concentrates by reaction with sulfuric acid at 175° to 200°C and ambient pressure.[8] More than 98% of the zinc was recovered. Advantages cited for the method over conventional pyrometallurgical processes were elimination of sulfur dioxide gas, production of a solid sulfur product, and higher zinc recoveries due to elimination of zinc ferrite losses. Laboratory procedures were developed for converting galvanizing wastes to zinc oxide containing less than 0.25% lead. The product is suitable for metallurgical and chemical uses.[9] An inexpensive method was developed that allows the use of zinc cathodes in place of aluminum cathodes in the electrolytic process and makes possible the use of electrolyte containing high amounts of soluble fluoride.[10]

At the Bureau's Salt Lake City (Utah) Research Center an improved method was developed for removing selenium from zinc smelter gas scrubber effluent. Zinc powder was used and treatment costs appeared to be low.[11] At the Albany (Oreg.) Research Center the standard Gibbs energy, enthalpy, and entropy of formation of sphalerite were determined.[12]

At the Bureau's Reno (Nev.) Research Center a detailed investigation was conducted on the fused salt electrolysis of zinc chloride to produce zinc metal.[13]

Work was conducted at the Intermountain Field Operations Center to determine the derivation of minor metal byproducts from lead and zinc production plants.[14]

Under a Bureau of Mines contract, Arthur D. Little, Inc., conducted a study on the recycling of mineral material, including zinc. An energy analysis was presented for scrap preparation, zinc dust production, slab zinc production, pot melting of clean die-cast scrap and off-specification die-cast scrap.[15] A coal mine slump refuse deposit in west-central Illinois was found to contain about 900,000 metric tons of coal and 1,000 metric tons of zinc. Batch tests demonstrated the feasibility of producing both coal and zinc-rich concentrates using a spiral concentrator.[16]

Treatment of a wide range of zinc concentrate grades was demonstrated in a zinc pressure leach process using sulfuric acid with extractions of zinc as high as 99%. The process offers economic advantages in addition to the formation of elemental sulfur rather than sulfur dioxide.[17]

A study on the economic impact of environmental regulations was sponsored by 10 companies involved in the production of copper, lead, and zinc. The results showed that compliance with the regulations would increase the cost of zinc production by about 10%.[18]

A new separator for the electrodes in nickel-zinc batteries was developed which could lead to economical electric cars in 3 to 5 years. The energy density of the nickel-zinc battery is almost twice that of existing lead-acid batteries so that the car could travel about 100 miles on a single charge.[19]

An analysis was carried out of the energy consumption of the zinc-lead blast furnace process which is currently in use in 11 countries. It was found that the process is more economical in the use of primary fossil-fuel energy to make Special High Grade zinc than is the electrolytic zinc process, and for less-refined zinc grades, the advantages are greater.[20]

A method was developed for recovering metals from dilute solutions using a fluidized bed of glass beads in combination with screenlike expanded-mesh electrodes. Possible applications include recovery of metals such as zinc from electroplating effluents and from dilute streams such as mine

discharges.[21]

The New Jersey Zinc Co. patented a complex zinc oxide product which could find application as a scrubber of sulfur dioxide from weak flue gases. The saturated material would be returned to a zinc smelter for recovery of both the zinc and sulfur.[22]

A solvent extraction process was commercialized which has potential applications in recovering zinc from oxide ores and low-grade secondary sources.[23]

A comprehensive coverage of zinc-related investigations and an extensive review of current world literature on the uses of zinc and its products are contained in quarterly issues of Zinc Abstracts published by the Zinc Development Association, London, W1X 6AJ England.

Progress reports of the projects supported by the International Lead and Zinc Research Organization, Inc. (ILZRO), are released annually in the ILZRO Research Digest.

[1]Physical scientist, Section of Nonferrous Metals.

[2]Statistical specialist, Section of Nonferrous Metals.

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[4]International Lead and Zinc Study Group. Lead and Zinc Statistics. Monthly Bull., v. 20, No. 6, June 1980, p. 37.

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Table 3.—Mine production of recoverable zinc in the United States, by State

(Metric tons)

State	1975	1976	1977	1978	1979
Arizona	7,852	8,619	3,973	W	W
California	187	154	2	W	W
Colorado	43,962	45,923	36,530	22,208	9,910
Idaho	37,127	42,262	28,121	32,353	29,660
Illinois	W	W	W	W	W
Kentucky	37	54	--	52	--
Maine	7,546	7,085	6,594	--	--
Missouri	67,918	75,777	74,107	59,038	61,682
Montana	100	58	72	79	104
Nevada	4,986	1,305	1,517	1,371	W
New Jersey	28,218	30,633	30,358	28,915	31,118
New Mexico	9,993	W	W	W	W
New York	69,501	66,833	64,264	26,463	12,133
Pennsylvania	19,133	20,212	20,706	19,099	21,447
Tennessee	75,562	74,854	82,044	87,906	85,119
Utah	17,817	20,394	16,111	3,509	W
Virginia	13,745	10,198	12,040	10,974	11,406
Washington	W	W	5,055	W	--
Wisconsin	W	W	W	W	W
Other States	22,108	35,182	26,395	10,703	4,762
Total	425,792	439,543	407,889	[1]302,669	267,341

W Withheld to avoid disclosing company proprietary data, included with "Other States."

[1]Data do not add to total shown because of independent rounding.

Table 4.—Mine production of recoverable zinc in the United States, by month

(Metric tons)

Month	1978	1979
January	30,357	23,259
February	29,813	21,655
March	31,629	23,793
April	31,538	21,120
May	29,692	22,991
June	20,339	21,921
July	17,857	20,853
August	23,003	25,397
September	22,065	18,715
October	23,668	23,793
November	21,248	22,189
December	21,460	21,655
Total	302,669	267,341

Table 5.—Production of zinc and lead in the United States in 1978, by State and class of ore, from old tailings, etc., in terms of recoverable metals

(Metric tons)

State	Zinc ore			Lead ore			Zinc-lead ore		
	Gross weight (dry basis)	Zinc content	Lead content	Gross weight (dry basis)	Zinc content	Lead content	Gross weight (dry basis)	Zinc content	Lead content
Arizona	--	--	--	(1)	--	(1)	--	--	--
Colorado	--	--	--	(1)	--	(1)	283,338	14,266	8,388
Idaho	(1)	(1)	(1)	(1)	(1)	(1)	789,278	30,228	29,081
Missouri	--	--	--	7,962,153	59,038	461,762	--	--	--
Montana	--	--	--	--	--	--	(1)	(1)	(1)
Nevada	--	--	--	--	--	--	(1)	(1)	(1)
New Jersey	167,074	28,915	--	--	--	--	--	--	--
New York	392,959	26,463	990	--	--	--	--	--	--
Pennsylvania	448,736	19,099	--	--	--	--	--	--	--
Tennessee	3,291,988	83,968	--	--	--	--	--	--	--
Utah	--	--	--	(1)	(1)	(1)	93,370	3,496	2,435
Virginia	455,414	10,974	1,803	--	--	--	--	--	--
Other States[2]	155,102	3,228	223	42,747	4,893	805	--	--	--
Total	4,911,273	172,647	3,016	8,004,900	63,931	462,567	1,165,986	47,990	39,904
Percent of total zinc-lead	--	57	1	--	21	87	--	16	7

State	Copper-zinc, copper-lead, and copper-zinc-lead ores			All other sources[3]			Total		
	Gross weight (dry basis)	Zinc content	Lead content	Gross weight (dry basis)	Zinc content	Lead content	Gross weight (dry basis)	Zinc content	Lead content
Arizona	--	--	--	[1] 44,583,434	W	[1] 416	44,583,434	W	416
Colorado	180,212	7,125	4,270	[1] 202,437	817	[1] 2,493	665,987	22,208	15,151
Idaho	--	--	--	[1] 723,690	[1] 2,125	[1] 15,680	1,512,968	32,353	44,761
Missouri	--	--	--	--	--	--	7,962,153	59,038	461,762
Montana	--	--	--	[1] 8,409	[1] 79	[1] 132	8,409	79	132
Nevada	--	--	--	[1] 787,727	[1] 1,371	[1] 653	787,727	1,371	653
New Jersey	--	--	--	--	--	--	167,074	28,915	--
New York	--	--	--	--	--	--	392,959	26,463	990
Pennsylvania	--	--	--	--	--	--	448,736	19,099	--
Tennessee	1,837,426	3,938	--	--	--	--	5,129,414	87,906	--
Utah	--	--	--	[1] 4,990	[1] 13	[1] 106	98,360	3,509	2,541
Virginia	--	--	--	--	--	--	455,414	10,974	1,803
Other States[2]	--	--	--	600,132	2,634	424	797,981	10,755	1,452
Total[4]	2,017,638	11,063	4,270	46,910,819	7,039	19,904	63,010,616	[4]302,669	529,661
Percent of total zinc-lead	--	4	1	--	2	4	--	100	100

W Withheld to avoid disclosing company proprietary data; included in "Other States."

[1]Zinc ore, lead ore, zinc-lead ore and ore from "all other sources" combined to avoid disclosing company proprietary data.

[2]Other States include Alaska, California, Illinois, Kentucky, New Mexico, Texas, Washington, and Wisconsin.

[3]Zinc and lead recovered from copper, gold, silver, and fluorspar ores, and from mill tailings and miscellaneous cleanups.

[4]Data may not add to totals shown because of independent rounding.

Table 6.—Production of zinc and lead in the United States in 1979, by State and class of ore, from old tailings, etc., in terms of recoverable metals

(Metric tons)

State	Zinc ore			Lead ore			Zinc-lead ore		
	Gross weight (dry basis)	Zinc content	Lead content	Gross weight (dry basis)	Zinc content	Lead content	Gross weight (dry basis)	Zinc content	Lead content
Arizona	--	--	--	510	(1)	28	--	--	--
Colorado	(1)	(1)	--	(1)	--	--	163,507	8,870	5,707
Idaho	--	--	--	660	19	121	750,999	27,500	24,607
Missouri	--	--	--	8,262,993	61,682	472,054	--	--	--
Montana	--	--	--	11,688	50	173	(1)	(1)	(1)
Nevada	--	--	--	--	--	--	--	--	--
New Jersey	175,694	31,118	--	--	--	--	--	--	--
New York	144,232	12,133	458	--	--	--	--	--	--
Pennsylvania	477,726	21,447	--	--	--	--	--	--	--
Tennessee	3,256,310	81,358	--	--	--	--	--	--	--
Virginia	445,096	11,406	1,596	--	--	--	--	--	--
Other States[2]	--	--	--	(1)	(1)	(1)	--	--	--
Total	4,499,058	157,462	2,054	8,275,851	61,751	472,376	914,506	36,370	30,314
Percent of total zinc-lead	--	59	--	--	23	90	--	14	6

State	Copper-zinc, copper-lead, and copper-zinc-lead ores			All other sources[3]			Total		
	Gross weight (dry basis)	Zinc content	Lead content	Gross weight (dry basis)	Zinc content	Lead content	Gross weight (dry basis)	Zinc content	Lead content
Arizona	--	--	--	[1] 47,433,240	W	[1] 326	47,433,750	W	354
Colorado	--	--	--	[1] 192,336	[1] 1,040	1,847	355,843	9,910	7,554
Idaho	--	--	--	703,675	2,141	17,908	1,455,334	29,660	42,636
Missouri	--	--	--	--	--	--	8,262,993	61,682	472,054
Montana	--	--	--	[1] 6,402	[1] 54	[1] 85	18,090	104	258
Nevada	--	--	--	41,188	--	24	41,188	--	24
New Jersey	--	--	--	--	--	--	175,694	31,118	--
New York	--	--	--	--	--	--	144,232	12,133	458
Pennsylvania	--	--	--	--	--	--	477,726	21,447	--
Tennessee	1,900,925	3,761	--	--	--	--	5,157,235	85,119	--
Virginia	--	--	--	--	--	--	445,096	11,406	1,596
Other States[2]	--	--	--	[1] 2,060,238	[1] 4,762	[1]635	2,060,238	4,762	635
Total	1,900,925	3,761	--	50,437,079	7,997	20,825	66,027,419	267,341	525,569
Percent of total zinc-lead	--	1	--	--	3	4	--	100	100

W Withheld to avoid disclosing company proprietary data; included in "Other States."

[1]Zinc ore, lead ore, zinc-lead ore and ore from "all other sources" combined to avoid disclosing company proprietary data.

[2]Other States include California, Illinois, New Mexico, Oregon, Utah, Washington, and Wisconsin.

[3]Zinc and lead recovered from copper, gold, silver, and fluorspar ores, and from mill tailings and miscellaneous cleanups.

Table 7.—Twenty-five leading zinc-producing mines in the United States in 1978 in order of output

Rank	Mine	County and State	Operator	Source of zinc
1	Buick	Iron, Mo	Amax Lead Co. of Missouri	Lead ore.
2	Sterling	Sussex, N.J	The New Jersey Zinc Co	Zinc Ore.
3	Balmat	St. Lawrence, N.Y	St. Joe Zinc Co	Do.
4	Friedensville	Lehigh, Pa	The New Jersey Zinc Co	Do.
5	Young	Jefferson, Tenn	ASARCO Incorporated	Do.
6	Elmwood	Smith, Tenn	The New Jersey Zinc Co	Do.
7	Zinc Mine Works	Jefferson, Tenn	United States Steel Corp	Do.
8	Star Unit	Shoshone, Idaho	The Bunker Hill Co. and Hecla Mining Co.	Lead, lead-zinc ore.
9	Bunker Hill	do	The Bunker Hill Co	Lead-zinc ore.
10	Immel	Knox, Tenn	ASARCO Incorporated	Zinc Ore.
11	Magmont	Iron, Mo	Cominco American Inc	Lead ore.
12	Leadville	Lake, Colo	ASARCO Incorporated	Lead-zinc ore.
13	Austinville and Ivanhoe.	Wythe, Va	The New Jersey Zinc Co	Zinc Ore.
14	Idol	Grainger, Tenn	do	Do.
15	Jefferson City	Jefferson, Tenn	do	Do.
16	Idarado	Ouray and San Miguel, Colo	Idarado Mining Co	Copper-lead-zinc ore.
17	Ozark	Reynolds, Mo	Ozark Lead Co	Lead ore.
18	Ground Hog	Grant, N. Mex	ASARCO Incorporated	Zinc ore.
19	Brushy Creek	Reynolds, Mo	St. Joe Lead Co	Lead ore.
20	Copperhill Plant	Polk, Tenn	Cities Service Co.	Copper-zinc ore.
21	Sunnyside	San Juan, Colo	Standard Metals Corp.	Lead-zinc ore.
22	Edwards	St. Lawrence, N.Y	St. Joe Zinc Co	Zinc ore.
23	Shullsburg	La Fayette, Wis	Eagle-Picher Industries Inc.	Do.
24	Viburnum No. 29	Washington, Mo	St. Joe Lead Co	Lead ore.
25	Burgin	Utah, Utah	Kennecott Copper Corp	Lead-zinc ore.

Table 8.—Twenty-five leading zinc-producing mines in the United States in 1979 in order of output

Rank	Mine	County and State	Operator	Source of Zinc
1	Buick	Iron, Mo	AMAX Lead Co. of Missouri	Lead ore.
2	Sterling	Sussex, N.J	The New Jersey Zinc Co	Zinc ore.
3	Freidensville	Lehigh, Penn	do	Do.
4	Elmwood	Smith, Tenn	do	Do.
5	Star Unit Area	Shoshone, Idaho	The Bunker Hill Co. and Hecla Mining Co	Lead-zinc ore.
6	Zinc Mine Works	Jefferson, Tenn	United States Steel Corp	Zinc ore.
7	Bunker Hill	Shoshone, Idaho	The Bunker Hill Co	Lead-zinc ore.
8	Austinville and Ivanhoe.	Wythe, Va	The New Jersey Zinc Co	Zinc ore.
9	Young	Jefferson, Tenn	ASARCO Inc	Do.
10	Magmont	Iron, Mo	Cominco American Inc	Lead ore.
11	Balmat	St. Lawrence, N.Y	St. Joe Zinc Co	Zinc ore.
12	New Market	Jefferson, Tenn	ASARCO Inc	Do.
13	Immel	Knox, Tenn	do	Do.
14	Jefferson City	Jefferson, Tenn	The New Jersey Zinc Co	Do.
15	Leadville	Lake, Colo	ASARCO Inc	Lead-zinc ore.
16	Idol	Grainger, Tenn	The New Jersey Zinc Co	Zinc ore.
17	Brushy Creek	Reynolds, Mo	St. Joe Lead Co	Lead ore.
18	Copperhill Plant	Polk, Tenn	Cities Services Co	Copper-zinc ore.
19	Milliken (formerly Ozark)	Reynolds, Mo	Ozark Lead Co	Lead ore.
20	Viburnum No. 29	Washington, Mo	St. Joe Lead Co	Do.
21	Viburnum No. 28	Iron, Mo	do	Do.
22	Fletcher	Reynolds, Mo	do	Do.
23	Shullsburg	La Fayette, Wis	Eagle-Picher Industries Inc	Zinc ore.
24	Lucky Friday	Shoshone, Idaho	Hecla Mining Co	Silver ore.
25	Edwards	St. Lawrence, N.Y	St. Joe Zinc Co	Zinc ore.

Table 9.—Primary and redistilled secondary slab zinc produced in the United States[1]

(Metric tons)

	1975	1976	1977	1978	1979
Primary:					
From domestic ores	279,376	346,429	322,208	267,350	255,344
From foreign ores	118,018	106,125	86,156	139,348	217,137
Total	397,394	452,554	408,364	406,698	472,481
Redistilled secondary	52,513	62,192	45,914	34,774	53,212
Total (excludes zinc recovered by remelting)	449,907	514,746	454,278	441,472	525,693

[1]Excludes processed zinc from the General Services Administration (GSA).

Table 10.—Distilled and electrolytic zinc, primary and secondary, produced in the United States, by method of reduction

(Metric tons)

Method of reduction	1975	1976	1977	1978	1979
Electrolytic primary	210,521	233,713	213,769	231,225	296,320
Distilled	186,873	218,841	194,596	175,473	176,162
Redistilled secondary:					
At primary smelters	31,689	34,132	26,448	24,085	40,343
At secondary smelters	20,824	28,060	19,465	10,689	12,868
Total	449,907	514,746	454,278	441,472	525,693

Table 11.—Distilled and electrolytic zinc, primary and secondary, produced in the United States, by grade

(Metric tons)

Grade	1975	1976	1977	1978	1979
Special High	219,655	212,437	151,214	179,812	173,082
High	17,158	28,466	38,494	32,830	39,247
Intermediate	7,793	9,515	8,332	--	--
Prime Western	205,301	264,328	256,238	[1]228,830	[1]313,364
Total	449,907	514,746	454,278	441,472	525,693

[1]Includes Controlled Lead Grade and Continuous Galvanizing Grade. Bureau of Mines not at liberty to publish separately.

Table 12.—Production of primary slab zinc in the United States, by State

(Metric tons)

State	1975	1976	1977	1978	1979
Idaho	83,733	91,348	54,954	76,175	73,848
Illinois	50,201	61,876	58,399	55,277	58,315
Oklahoma	31,816	20,323	40,096	42,414	43,599
Pennsylvania	138,146	198,518	194,596	175,473	176,161
Tennessee	--	--	--	1,661	69,449
Texas	93,497	80,489	60,319	55,698	51,109
Total	397,393	452,554	408,364	406,698	472,481

Table 13.—Annual slab zinc capacity of primary zinc plants in the United States

Type of plant	Plant location	Slab zinc capacity (metric tons)	
		1978	1979
Electrolytic plants:			
Amax Zinc Co., Inc	Sauget, Ill	76,000	76,000
ASARCO Incorporated	Corpus Christi, Tex	98,000	98,000
The Bunker Hill Co	Kellogg, Idaho	99,000	103,000
Jersey Miniere Zinc Co	Clarksville, Tenn	82,000	82,000
National Zinc Cc	Bartlesville, Okla	51,000	51,000
Vertical-retort plants:			
The New Jersey Zinc Co	Palmerton, Pa	109,000	109,000
St. Joe Zinc Co	Monaca, Pa	201,000	201,000

Table 14.—Secondary slab zinc plants, by group capacity, in the United States

(Metric tons)

Company	Plant location	Capacity[1]	
		1978	1979
Arco Alloys Corp	Detroit, Mich	52,000	51,000
Belmont Smelting & Refining Works	Brooklyn, N.Y		
W. J. Bullock, Inc	Fairfield, Ala		
T. L. Diamond & Co., Inc	Spelter, W. Va		
Illinois Smelting & Refining Co	Chicago, Ill		
New England Smelting Works, Inc	West Springfield, Mass		
Pacific Smelting Co	Torrance, Calif		
S-G Metals Industries Inc	Kansas City, Kans		

[1]Includes capacity at Hugo Neu-Proler Co., Terminal Island, Calif., Proler International Corp., Houston, Tex., and Prolerized Schiabo Neu Co., Jersey City, N.J., which did not produce slab zinc in 1978-79.

Table 15.—Stocks and consumption of new and old zinc scrap in the United States in 1978

(Metric tons, zinc content)

Class of consumer and type of scrap	Stocks Jan. 1[1]	Receipts	Consumption			Stocks Dec. 31
			New scrap	Old scrap	Total	
Smelters and distillers:						
New clippings	228	1,298	1,414	--	1,414	112
Old zinc	924	10,646	--	10,603	10,603	967
Remelt zinc	363	2,466	--	2645	2,645	184
Engravers' plates	133	907	--	972	972	68
Rod and die scrap	399	2,303	--	2,504	2,504	198
Diecastings	1,141	10,930	--	10,818	10,818	1,253
Fragmentized diecastings	271	18,706	--	16,500	16,500	2,477
Remelt die-cast slab	391	11,686	--	9,628	9,628	2,449
Skimmings and ashes	11,253	35,563	35,172	--	35,172	11,644
Sal skimmings	42	560	568	--	568	34
Die-cast skimmings	2,441	5,336	5,135	--	5,135	2,642
Galvanizers' dross	23,378	49,668	41,752	--	41,752	31,294
Flue dust	521	11,213	10,926	--	10,926	808
Chemical residues	--	2,609	2,609	--	2,609	--
Other	--	843	843	--	843	--
Total	41,485	164,734	98,419	53,670	152,089	54,130
Chemical plant, foundries, and other manufacturers:						
Old zinc	10	23	--	23	23	10
Rod and die scrap	18	102	--	112	112	8
Diecastings	24	107	--	114	114	17
Skimmings and ashes	3,239	5,144	5,063	--	5,063	3,320
Sal skimmings	1,686	3,842	3,790	--	3,790	1,738
Die-cast skimmings	425	363	363	--	363	425
Galvanizers dross	--	715	690	--	690	25
Flue dust	375	5,316	5,307	--	5,307	384
Chemical residues	5,187	6,716	8,031	--	8,031	3,872
Other	453	5,597	5,596	--	5,596	454
Total	11,417	27,925	28,840	249	29,089	10,253
All classes of consumers:						
New clippings	228	1,298	1,414	--	1,414	112
Old zinc	934	10,669	--	10,626	10,626	977
Remelt zinc	363	2,466	--	2,645	2,645	184
Engravers' plates	133	907	--	972	972	68
Rod and die scrap	417	2,405	--	2,616	2,616	206
Diecastings	1,165	11,037	--	10,932	10,932	1,270
Fragmentized diecastings	271	18,706	--	16,500	16,500	2,477
Remelt die-cast slab	391	11,686	--	9,628	9,628	2,449
Skimmings and ashes	14,492	40,707	40,235	--	40,235	14,964
Sal skimmings	1,728	4,402	4,358	--	4,358	1,772
Die-cast skimmings	2,866	5,699	5,498	--	5,498	3,067
Galvanizers' dross	23,378	50,383	42,442	--	42,442	31,319
Flue dust	896	16,529	16,233	--	16,233	1,192
Chemical residues	5,187	9,325	10,640	--	10,640	3,872
Other	453	6,440	6,439	--	6,439	454
Total	52,902	192,659	127,259	53,919	181,178	64,383

[1]Figures partly revised.

Table 16.—Stocks and consumption of new and old zinc scrap in the United States in 1979

(Metric tons, zinc content)

Class of consumer and type of scrap	Stocks Jan. 1[1]	Receipts	Consumption			Stocks Dec. 31
			New scrap	Old scrap	Total	
Smelters and distillers:						
New clippings	112	693	770		770	35
Old zinc	1,043	10,051	--	10,571	10,571	523
Remelt zinc	184	2,553	1,977	--	1,977	760
Engravers' plates	69	722	--	735	735	56
Rod and die scrap	198	2,823	--	2,214	2,214	807
Diecastings	1,159	8,485	--	8,339	8,339	1,305
Fragmentized diecastings	2,517	21,834	--	21,932	21,932	2,419
Remelt die-cast slab	2,449	8,339	--	9,433	9,433	1,355
Skimmings and ashes	8,686	36,448	36,255	--	36,255	8,879
Sal skimmings	27	740	636	--	636	131
Die-cast skimmings	1,853	4,502	5,015	--	5,015	1,340
Galvanizers' dross	31,254	46,418	57,224	--	57,224	20,448
Flue dust	3,878	9,526	9,280	--	9,280	4,124
Chemical residues	295	2,976	2,976	--	2,976	295
Other	--	1,168	1,112	--	1,112	56
Total	53,724	157,278	115,245	53,224	168,469	42,533
Chemical plant, foundries, and other manufacturers:						
Old zinc	10	24	--	24	24	10
Rod and die scrap	7	121	--	104	104	24
Diecastings	17	91	--	90	90	18
Skimmings and ashes	3,114	6,094	5,906	--	5,906	3,302
Sal skimmings	1,499	3,668	3,661	--	3,661	1,506
Die-cast skimmings	182	694	726	--	726	150
Galvanizers dross	25	750	773	--	773	2
Flue dust	565	7,294	6,205	--	6,205	1,654
Chemical residues	3,872	7,891	7,998	--	7,998	3,765
Other	273	9,569	9,751	--	9,751	91
Total	9,564	36,196	35,020	218	35,238	10,522
All classes of consumers:						
New clippings	112	693	770	--	770	35
Old zinc	1,053	10,075	--	10,595	10,595	533
Remelt zinc	184	2,553	1,977	--	1,977	760
Engravers' plates	69	722	--	735	735	56
Rod and die scrap	205	2,944	--	2,318	2,318	831
Diecastings	1,176	8,576	--	8,429	8,429	1,323
Fragmentized diecastings	2,517	21,834	--	21,932	21,932	2,419
Remelt die-cast slab	2,449	8,339	--	9,433	9,433	1,355
Skimmings and ashes	11,800	42,542	42,161	--	42,161	12,181
Sal skimmings	1,526	4,408	4,297	--	4,297	1,637
Die-cast skimmings	2,035	5,196	5,741	--	5,741	1,490
Galvanizers' dross	31,279	47,168	57,997	--	57,997	20,450
Flue dust	4,443	16,820	15,485	--	15,485	5,778
Chemical residues	4,167	10,867	10,974	--	10,974	4,060
Other	273	10,737	10,863	--	10,863	147
Total	63,288	193,474	150,265	53,442	203,707	53,055

[1]Figures partly revised.

Table 17.—Production of zinc products from zinc-base scrap in the United States

(Metric tons)

Products	1975	1976	1977	1978	1979
Redistilled slab zinc	52,513	62,192	45,913	34,774	53,212
Zinc dust	32,186	36,715	35,992	33,346	34,141
Remelt zinc	115	310	268	94	89
Remelt die-cast slab	4,381	4,208	3,535	3,775	3,911
Zinc-die and diecasting alloys	4,300	6,395	7,560	6,024	6,328
Galvanizing stocks	1,302	2,255	2,088	2,686	2,731
Secondary zinc in chemical products	29,906	44,435	55,312	58,649	62,494

Table 18.—Zinc recovered from scrap processed in the United States, by kind of scrap and form of recovery

(Metric tons)

	1978	1979
KIND OF SCRAP		
New scrap:		
Zinc-base	129,657	150,008
Copper-base	132,165	138,565
Magnesium-base	211	222
Total	262,033	288,795
Old scrap:		
Zinc-base	50,545	52,691
Copper-base	25,458	27,824
Aluminum-base	557	524
Magnesium-base	228	196
Total	76,788	81,235
Grand total	338,821	370,030
FORM OF RECOVERY		
As metal:		
By distillation:		
Slab zinc[1]	34,774	53,212
Zinc dust	33,346	34,141
By remelting	2,780	2,820
Total	70,900	90,173
In zinc-base alloys	9,799	10,239
In brass and bronze	198,477	206,181
In aluminum-base alloys	557	524
In magnesium-base alloys	438	418
In chemical products:		
Zinc oxide (lead free)	29,516	31,316
Zinc sulfate	10,914	13,318
Zinc chloride	13,597	12,259
Miscellaneous	4,623	5,602
Total	267,921	279,857
Grand total	338,821	370,030

[1]Includes zinc content of redistilled slab made from remelt die-cast slab.

Table 19.—Zinc dust produced in the United States

Year	Quantity (metric tons)	Value	
		Total (thousands)	Average per pound
1975	38,237	$40,294	$0.478
1976	42,055	45,282	.488
1977	43,177	45,414	.477
1978	38,487	37,427	.441
1979	33,011	32,909	.452

Table 20.—Consumption of zinc in the United States

(Metric tons)

	1975	1976	1977	1978	1979
Slab zinc	839,445	1,028,876	999,505	1,050,585	1,000,606
Ores (zinc content)[1]	75,053	91,844	86,490	89,959	79,710
Secondary (zinc content)[2]	202,986	273,524	281,709	301,266	313,998
Total	1,117,484	1,394,244	1,367,704	1,441,810	1,394,314

[1]Includes ore used directly in galvanizing.
[2]Excludes redistilled slab and remelt zinc.

Table 21.—Slab zinc consumption in the United States, by industry use

(Metric tons)

Industry and product	1975	1976	1977	1978	1979
Galvanizing:					
Sheet and strip	168,550	221,998	236,025	268,687	267,825
Wire and wire rope	22,630	24,314	21,459	22,801	23,557
Tubes and pipe	42,801	44,423	42,657	47,379	45,643
Fittings (for tube and pipe)	5,769	5,851	5,820	6,926	8,231
Tanks and containers	1,739	3,017	3,057	2,896	4,081
Structural shapes	37,408	33,204	26,623	33,264	33,875
Fasteners	4,015	3,654	3,891	4,839	4,993
Pole-line hardware	4,476	4,289	4,475	4,869	4,839
Fencing, wire cloth, and netting	18,190	19,964	20,371	24,997	21,920
Other and unspecified uses	36,328	32,172	32,060	37,356	37,839
Total[1]	341,906	392,886	396,438	454,014	452,803
Brass products:					
Sheet, strip, plate	58,929	82,696	70,168	70,181	64,222
Rod and wire	30,314	49,489	39,525	46,284	51,130
Tube	5,852	6,702	5,542	6,779	6,690
Castings and billets	2,793	3,847	4,076	4,427	3,634
Copper-base ingots	6,008	6,968	7,544	6,581	6,800
Other copper-base products	726	1,112	1,455	7,236	8,928
Total	104,622	150,814	128,310	141,488	141,404
Zinc-base alloy:					
Diecasting alloy	299,543	380,753	359,744	345,968	308,722
Dies and rod alloy	135	932	557	544	68
Slush and sand casting alloy	3,495	5,711	6,829	7,622	5,266
Total	303,173	387,396	367,130	354,134	314,056
Rolled zinc	24,773	27,088	27,406	24,869	22,044
Zinc oxide	35,398	35,405	38,514	37,202	35,513
Other uses:					
Light-metal alloys	5,291	5,232	5,585	11,030	12,850
Other[1]	24,282	30,055	36,122	27,848	21,936
Total	29,573	35,287	41,707	38,878	34,786
Grand total	839,445	1,028,876	999,505	1,050,585	1,000,606

[1]Includes zinc used in making zinc dust, wet batteries, desilverizing lead, powder, alloys, chemicals, castings, and miscellaneous uses not elsewhere mentioned.

Table 22.—Slab zinc consumption in the United States in 1978 by grade and industry use

(Metric tons)

Industry	Special High Grade	High Grade	Intermediate	Brass Special	Prime Western	Remelt	Total
Galvanizing	27,886	35,420	9,716	95,811	284,190	991	454,014
Brass and bronze	55,170	68,319	35	2,545	15,366	53	141,488
Zinc-base alloys	352,197	1,169	--	--	160	608	354,134
Rolled zinc	12,790	--	12,079	--	--	--	24,869
Zinc oxide	18,273	--	--	--	18,929	--	37,202
Other	25,007	4,835	--	--	9,036	--	38,878
Total	491,323	109,743	21,830	98,356	327,681	1,652	1,050,585

Table 23.—Slab zinc consumption in the United States in 1979, by grade and industry use

(Metric tons)

Industry	Special High Grade	High Grade	Intermediate	Brass Special	Prime Western	Remelt	Total
Galvanizing	26,566	31,478	10,630	85,403	297,628	1,098	452,803
Brass and bronze	50,671	70,762	30	1,415	18,302	224	141,404
Zinc-base alloys	311,593	871	--	--	133	1,459	314,056
Rolled zinc	10,185	--	11,859	--	--	--	22,044
Zinc oxide	18,883	144	--	--	16,486	--	35,513
Other	25,207	5,330	--	1	4,248	--	34,786
Total	443,105	108,585	22,519	86,819	336,797	2,781	1,000,606

Table 24.—Rolled zinc produced and quantity available for consumption in the United States

	1978			1979		
		Value			Value	
	Metric tons	Total (thousands)	Average per pound	Metric tons	Total (thousands)	Average per pound
Production:[1]						
Photoengraving plate	W	W	W	W	W	W
Strip and foil	18,617	$18,467	$0.534	16,374	$19,598	$0.616
Total rolled zinc[2]	23,586	24,709	.475	21,100	26,944	.579
Exports	2,262	3,414	.685	1,824	3,385	.842
Imports	337	305	.411	244	267	.496
Available for consumption	21,803	XX	XX	19,545	XX	XX

XX Not applicable. W Withheld to avoid disclosing company proprietary data, included in "Total rolled zinc."

[1]Figures represent net production. In addition, 19,788 tons in 1978 and 18,556 tons in 1979 were rerolled from scrap originating in fabricating plants operating in connection with zinc-rolling mills.

[2]Includes other plate over 0.375 inch thick, sheet zinc less than 0.375 inch thick, and rod and wire. Bureau of Mines not at liberty to publish separately.

Table 25.—Slab zinc consumption in the United States in 1978, by industry and State

(Metric tons)

State	Galvanizers	Brass mills[1]	Die casters[2]	Other[3]	Total
Alabama	27,849	W	--	W	29,854
Arizona	W	--	--	W	W
Arkansas	W	--	--	W	W
California	29,365	2,439	19,758	1,211	52,773
Colorado	W	--	W	W	W
Connecticut	2,241	27,284	W	W	35,840
Delaware	W	W	--	W	W
Florida	3,763	--	--	--	3,763
Georgia	W	--	W	--	W
Hawaii	W	--	--	--	W
Idaho	--	--	W	W	W
Illinois	58,316	28,871	60,468	6,658	154,313
Indiana	65,531	W	9,682	W	95,469
Iowa	186	--	W	W	2,056
Kansas	W	W	W	W	W
Kentucky	W	W	--	--	16,312
Louisiana	2,868	--	W	W	4,701
Maine	W	--	--	--	W
Maryland	W	--	--	W	18,836
Massachusetts	W	W	--	W	4,893
Michigan	1,778	18,130	63,193	975	84,076
Minnesota	779	--	--	--	779
Mississippi	1,608	--	--	--	1,608
Missouri	6,354	W	W	W	10,338
Nebraska	4,314	W	--	W	4,870
New Jersey	1,757	5,055	W	W	13,772
New York	16,147	W	80,573	W	114,857
North Carolina	W	--	W	W	W
Ohio	65,491	W	48,031	W	123,081
Oklahoma	W	--	--	W	4,539
Oregon	1,139	W	W	W	1,735
Pennsylvania	60,657	8,284	W	W	133,774
Rhode Island	W	W	--	W	W
South Carolina	W	--	--	--	W
Tennessee	W	--	W	W	W
Texas	18,340	W	W	W	38,771
Utah	W	W	--	--	W
Virginia	W	W	W	W	652
Washington	W	--	--	W	2,466
West Virginia	W	--	--	W	26,169
Wisconsin	808	W	5,748	W	9,792
Undistributed	83,732	51,732	66,073	92,105	58,844
Total[4]	453,023	141,435	353,526	100,949	1,048,933

W Withheld to avoid disclosing company proprietary data; included with "Undistributed."

[1]Includes brass mills, brass ingot makers, and brass foundries.

[2]Includes producers of zinc-base alloy for diecastings, stamping dies, and rods.

[3]Includes slab zinc used in rolled zinc products and in zinc oxide.

[4]Excludes remelt zinc.

Table 26.—Slab zinc consumption in the United States in 1979, by industry and State

(Metric tons)

State	Galvanizers	Brass mills[1]	Die casters[2]	Other[3]
Alabama	26,964	W	--	W
Arizona	W	--	--	W
Arkansas	W	--	W	W
California	34,591	2,773	16,952	1,105
Colorado	W	--	W	W
Connecticut	2,782	37,538	W	W
Delaware	W	W	--	W
Florida	3,726	--	--	--
Georgia	W	--	W	--
Hawaii	W	--	--	--
Idaho	--	--	W	W
Illinois	61,587	23,724	46,735	6,896
Indiana	59,510	W	6,907	W
Iowa	239	--	W	W
Kansas	W	W	W	W
Kentucky	W	W	--	--
Louisiana	2,436	--	W	W
Maine	W	--	--	--
Maryland	W	--	--	W
Massachusetts	W	W	--	W
Michigan	1,413	15,958	56,881	564
Minnesota	700	--	--	--
Mississippi	1,481	--	--	--
Missouri	6,880	W	W	W
Nebraska	6,642	W	W	W
New Jersey	1,725	4,832	W	W
New York	15,838	W	74,591	W
North Carolina	W	--	W	W
Ohio	66,392	W	39,422	W
Oklahoma	W	--	--	W
Oregon	1,119	W	W	W
Pennsylvania	57,059	7,924	W	W
Rhode Island	W	W	--	W
South Carolina	W	--	--	--
Tennessee	W	--	W	W
Texas	16,445	W	W	W
Utah	W	W	--	--
Virginia	W	W	W	W
Washington	W	--	--	W
West Virginia	W	--	--	W
Wisconsin	843	W	5,783	W
Undistributed	83,333	48,431	65,327	83,777
Total[4]	451,705	141,180	312,598	92,342

W Withheld to avoid disclosing company proprietary data; included with "Undistributed."
[1]Includes brass mills, brass ingot makers, and brass foundries.
[2]Includes producers of zinc-base alloy for diecastings, stamping dies, and rods.
[3]Includes slab zinc used in rolled zinc products and in zinc oxide.
[4]Excludes remelt zinc.

Table 27.—Production and shipments of zinc pigments and compounds[1] in the United States

Pigment or compound	1978				1979			
	Production (metric tons)	Shipments			Production (metric tons)	Shipments		
		Quantity (metric tons)	Value[2]			Quantity (metric tons)	Value[2]	
			Total (thousands)	Average per ton			Total (thousands)	Average per ton
Zinc oxide[3]	186,797	181,452	$133,703	$668	172,729	179,769	$156,297	$782
Zinc sulfate	39,122	36,958	11,505	282	46,765	45,770	12,332	244
Zinc chloride, 50°Baumé[4]	31,937	24,767	W	W	26,601	20,003	W	W

W Withheld to avoid dislosing company proprietary data.
[1]Excludes leaded zinc oxide and lithopone.
[2]Value at plant, exclusive of container.
[3]Zinc oxide containing 5% or more lead is classed as leaded zinc oxide.
[4]Includes zinc content of zinc ammonium chloride and chromated zinc chloride.

Table 28.—Zinc content of zinc pigments[1] and compounds produced by domestic manufacturers, by source

(Metric tons)

Pigment or compound	1978				1979			
	Zinc in pigments and compounds produced from—			Total zinc in pigments and compounds	Zinc in pigments and compounds produced from—			Total zinc in pigments and compounds
	Ore	Slab zinc	Secondary material		Ore	Slab zinc	Secondary material	
Zinc oxide	84,615	35,370	29,516	149,501	74,324	32,567	31,316	138,207
Zinc sulfate	1,560	--	10,915	12,475	887	--	13,318	14,205
Zinc chloride[2]	--	--	10,628	10,628	--	--	8,931	8,931

[1]Excludes leaded zinc oxide, zinc sulfide, and lithopone.
[2]Includes zinc content of zinc ammonium chloride and chromated zinc chloride.

Table 29.—Distribution of zinc oxide shipments, by industry

(Metric tons)

Industry	1975	1976	1977	1978	1979
Rubber	87,279	94,954	101,729	97,989	93,075
Paints	9,994	14,242	12,519	13,237	12,503
Ceramics	5,715	7,650	7,354	9,245	9,236
Chemicals	15,916	30,106	26,327	27,057	27,710
Agriculture	1,676	3,158	5,499	4,847	4,397
Photocopying	22,359	21,907	21,352	19,096	16,148
Other	10,815	7,676	15,322	9,981	16,700
Total	153,754	179,693	190,102	181,452	179,769

Table 30.—Distribution of zinc sulfate shipments, by industry

(Metric tons)

Year	Agriculture		Other[1]		Total	
	Gross weight	Dry basis	Gross weight	Dry basis	Gross weight	Dry basis
1975	7,684	3,247	13,628	5,309	21,312	8,556
1976	11,609	4,832	19,547	9,328	31,156	14,160
1977	14,085	5,553	19,962	8,840	34,047	14,393
1978	19,261	7,268	17,697	6,741	36,958	14,009
1979	31,318	11,122	14,452	5,659	45,770	16,791

[1]Includes rayon; Bureau of Mines not at liberty to publish separately.

Table 31.— Producer stocks of slab zinc in the United States, December 31

(Metric tons)

	1975	1976	1977	1978	1979
Primary producers	66,616	83,963	76,637	34,570	56,971
Secondary producers	1,129	3,989	r7,123	3,358	2,095
Total	67,745	87,952	r83,760	37,928	59,066

rRevised.

Table 32.—Consumer stocks of slab zinc at plants, December 31, by grade

(Metric tons)

Year	Special High Grade	High Grade	Intermediate	Brass Special	Prime Western	Remelt	Total
1977[r]	30,165	7,606	3,159	9,102	36,404	41	86,477
1978	36,599	9,754	2,871	6,063	43,855	183	99,325
1979	34,913	9,714	2,806	3,886	41,946	69	93,334

[r]Revised.

Table 33.—Average monthly U.S., LME,[1] and European Producers' prices for Prime Western zinc and equivalent

(Metallic zinc, cents per pound)

Month	1978			1979		
	United States	LME cash	European producer	United States	LME cash	European producer
January	30.50	23.47	27.22	34.57	32.64	33.32
February	30.06	21.62	25.33	35.62	35.92	35.58
March	29.00	23.01	24.95	37.24	36.00	36.29
April	29.00	25.12	24.95	38.99	35.74	36.29
May	29.00	25.43	24.95	39.39	35.28	36.57
June	29.01	26.17	24.95	39.39	34.13	38.33
July	29.80	26.45	24.95	39.40	32.69	37.35
August	31.16	28.01	26.77	36.90	30.12	35.38
September	32.37	28.73	28.92	35.80	32.79	35.38
October	32.83	32.31	31.30	36.21	32.00	35.38
November	34.43	31.15	32.66	36.82	31.76	35.38
December	34.50	31.14	32.66	37.23	33.98	35.38
Average for year	30.97	26.88	27.47	37.30	33.59	35.89

[1]London Metal Exchange.

Source: Metals Week.

Table 34.—U.S. exports of zinc and zinc alloys, by country

Destination	1977		1978		1979	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Unwrought zinc and zinc alloys:						
Argentina	18	$34	8	$34	42	$77
Australia	--	--	18	81	5	25
Bahrain	40	82	--	--	--	--
Belgium-Luxembourg	--	--	5	11	3	16
Canada	415	458	333	409	98	277
Chile	13	18	39	27	29	47
Colombia	1	1	5	10	2	4
Dominican Republic	4	13	1	2	90	76
Ecuador	--	--	64	61	1	5
Egypt	104	99	--	--	27	56
France	(1)	1	(1)	4	--	--
Germany, Federal Republic of	4	12	9	6	14	23
Guatemala	125	121	(1)	2	1	3
Honduras	--	--	1	8	--	--
India	--	--	350	255	--	--
Indonesia	--	--	--	--	--	--
Iran	--	--	59	59	--	--
Israel	8	17	1	2	20	36
Italy	4	3	1	9	2	2
Japan	24	20	35	84	9	22
Korea, Republic of	--	--	(1)	1	(1)	5
Liberia	--	--	2	4	2	5
Mexico	93	50	215	127	98	242
Netherlands	2	6	2	1	19	25
Netherlands Antilles	--	--	1	4	--	2
New Zealand	--	--	1	5	(1)	2
Nicaragua	1	2	2	2	--	--
Nigeria	--	--	5	12	2	3
Philippines	11	11	7	14	7	9
Saudi Arabia	1	2	26	31	60	100
Singapore	--	--	--	--	--	--

See footnotes at end of table.

Table 34.—U.S. exports of zinc and zinc alloys, by country —Continued

Destination	1977		1978		1979	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Unwrought zinc and zinc alloys: —Continued						
South Africa, Republic of	--	--	18	$95	31	$47
Switzerland	--	--	9	21	3	7
Taiwan	48	$52	8	10	11	41
United Arab Emirates	(1)	1	--	--	3	4
United Kingdom	4	8	5	18	9	115
Venezuela	29	40	24	104	31	43
Other	165	228	23	50	26	66
Total	1,114	1,279	1,277	1,563	645	1,385
Wrought zinc and zinc alloys:						
Afghanistan	19	28	10	14	--	--
Algeria	--	--	13	26	--	--
Argentina	16	27	65	106	86	142
Australia	85	170	12	33	9	12
Austria	--	--	10	24	19	46
Belgium-Luxembourg	2,057	1,191	7	15	110	64
Bermuda	1	1	12	11	--	--
Canada	3,338	2,780	1,453	1,641	897	1,601
Chile	34	56	60	113	13	18
Colombia	47	70	48	69	33	55
Denmark	24	83	2	2	3	6
Dominican Republic	1	1	4	5	70	106
Ecuador	53	105	61	157	552	522
Egypt	42	61	15	22	22	33
El Salvador	33	26	8	14	--	--
France	5	13	4	5	9	19
Germany, Federal Republic of	--	--	12	31	--	--
Greece	16	23	14	22	8	12
Guatemala	13	17	15	30	5	9
Guyana	6	15	12	34	4	9
Hong Kong	34	50	135	194	33	49
India	9	12	24	37	28	45
Israel	57	77	69	108	54	90
Italy	34	56	82	201	90	173
Japan	17	72	3	8	18	38
Kuwait	--	--	5	33	1	2
Lebanon	24	38	30	48	15	25
Malaysia	--	--	15	19	50	84
Mexico	102	134	104	195	164	376
Netherlands	4	23	7	4	--	--
New Zealand	63	84	31	41	18	28
Pakistan	21	32	15	23	14	24
Panama	22	47	2	3	3	7
Peru	32	54	16	27	62	136
Philippines	43	89	69	105	61	105
Portugal	5	9	35	65	38	67
Saudi Arabia	7	12	48	62	33	59
Singapore	7	17	9	18	38	31
South Africa, Republic of	96	154	76	125	100	170
Spain	2	4	25	42	69	115
Sri Lanka	21	33	15	22	38	65
Sweden	25	33	1	3	4	9
Switzerland	26	41	--	--	--	--
Syria	37	61	16	26	10	18
Taiwan	53	76	69	111	241	336
Thailand	--	--	25	36	12	17
Turkey	32	30	21	30	7	12
United Arab Emirates	5	8	--	--	--	--
United Kingdom	299	311	156	277	79	187
Uruguay	6	7	6	17	27	49
Venezuela	157	235	100	136	49	80
Other	80	227	76	115	89	173
Total	7,110	6,693	3,122	4,505	3,285	5,224

[1]Less than 1/2 unit.

Table 35.—U.S. exports of zinc, by class

Year	Zinc ore and concentrates		Blocks, pigs, anodes, etc.				Wrought zinc and zinc alloys				Waste and scrap (zinc content)		Dust (blue powder)	
			Unwrought		Unwrought alloys		Sheets, plates, and strip		Angels, bars, pipes, rods, etc.					
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
1977	NA	NA	215	$210	899	$1,069	2,432	$3,144	4,677	$3,549	7,445	$2,972	928	$726
1978	10,973	$4,356	723	865	r554	r698	2,262	3,414	860	1,091	14,986	6,738	1,803	2,018
1979	20,095	7,317	279	553	366	832	1,824	3,385	1,461	1,839	28,149	14,142	966	1,450

rRevised.
NA Not available.

Table 36.—U.S. exports of zinc ore and concentrates, by country

(Zinc content)

Destination	1978		1979	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Belgium-Luxembourg	7,579	$2,986	10,935	$3,595
Brazil	13	5	--	--
Canada	254	111	1,574	1,275
Chile	20	17	755	367
Germany, Federal Republic of	6	1	--	--
Nigeria	--	--	3	6
Philippines	1	1	--	--
Saudi Arabia	1	1	33	22
Sweden	2	5	--	--
Taiwan	77	86	75	33
Trinidad and Tobago	4	3	--	--
United Kingdom	3,016	1,230	6,716	2,011
Venezuela	--	--	4	8

Table 37.—U.S. general imports of zinc, by country

Country	1977		1978		1979	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
ORES AND CONCENTRATES (zinc content)						
Argentina	--	--	--	--	3	$3
Australia	3,940	$968	1,851	$617	708	94
Bolivia	4,528	673	397	72	11,935	5,157
Canada	53,141	21,064	143,318	50,408	143,957	57,988
Chile	10,690	3,750	5,933	3,347	1,240	683
Colombia	16	2	10	1	16	2
Costa Rica	772	553	--	--	--	--
Germany, Federal Republic of	737	302	6,535	2,564	7,802	4,101
Greenland	--	--	--	--	--	--
Honduras	15,757	8,275	13,141	4,888	13,383	5,112
Japan	--	--	101	39	--	--
Mexico	3,891	615	2,613	813	16,207	5,007
Nicaragua	2,768	1,907	4,046	1,681	4	3
Peru	938	141	10,058	2,885	29,697	14,419
Thailand	14,232	1,303	--	--	--	--
Total	111,410	39,553	188,003	67,315	224,952	92,519
BLOCKS, PIGS, OR SLABS						
Algeria	1,159	557	2,547	1,518	5,317	4,250
Australia	26,546	19,612	34,785	21,992	33,721	25,634
Belgium-Luxembourg	38,983	24,686	19,215	10,595	11,228	8,153
Canada	217,321	160,224	261,842	172,412	259,543	197,270
China:						
Mainland	1,006	615	801	384	208	90
Taiwan	--	--	--	--	104	16
Finland	29,637	21,245	32,964	21,535	26,410	21,361
France	15,810	11,021	22,824	13,875	13,445	10,608
Germany, Federal Republic of	37,695	25,886	36,955	22,058	19,110	14,813
Greece	--	--	244	144	--	--
Italy	19,597	13,844	11,149	6,303	5,492	3,880
Japan	13,021	9,769	8,605	6,290	10,118	7,971
Korea, Republic of	--	--	4,000	2,402	2,300	1,721
Mexico	27,198	18,826	51,471	30,433	39,332	28,873
Morocco	--	--	2,080	1,002	--	--
Netherlands	5,828	3,737	10,097	5,673	3,180	2,314
Norway	--	--	--	--	--	--
Peru	17,132	11,740	10,245	6,002	7,394	5,488
Poland	3,575	1,991	5,670	2,828	100	75
South Africa, Republic of	5,339	3,811	8,112	4,872	--	--
Spain	25,709	16,821	60,225	33,931	66,738	43,703
Switzerland	--	--	--	--	--	--
Tanzania	--	--	1,001	595	1,200	848
Hong Kong	--	--	--	--	105	79
United Kingdom	1,490	981	997	565	2,383	1,315
Yugoslavia	3,242	2,101	3,777	2,082	--	--
Zaire	32,393	23,910	25,630	14,682	14,880	11,812
Zambia	525	359	2,604	1,261	4,904	2,277
Total	523,206	371,736	617,840	383,434	527,212	392,551

Table 38.—U.S. imports for consumption of zinc, by country

Country	1977		1978		1979	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
ORES AND CONCENTRATES (zinc content)						
Argentina	--	--	--	--	3	$3
Australia	3,318	$896	1,346	$489	50	7
Bolivia	4,528	673	397	72	11,935	5,157
Canada	54,804	21,621	66,551	21,744	9,912	3,277
Chile	10,690	3,751	5,933	3,347	1,240	683
Colombia	16	2	10	1	16	2
Germany, Federal Republic of	737	302	6,535	2,564	7,802	4,101
Greenland	--	--	--	--	--	--
Honduras	15,757	8,275	13,141	4,888	13,383	5,112
Japan	--	--	101	39	--	--
Mexico	3,400	526	959	535	13,457	4,340
Nicaragua	857	407	2,727	1,066	4	3
Peru	938	141	8,615	2,425	29,697	14,419
Thailand	14,232	1,303	--	--	--	--
Total	109,277	37,897	106,315	37,170	87,499	37,104
BLOCKS, PIGS, OR SLABS						
Algeria	881	407	2,547	1,518	4,276	3,415
Angola	--	--	--	--	989	793
Australia	26,546	19,612	34,785	21,992	33,721	25,634
Belgium-Luxembourg	37,482	23,986	19,165	10,565	12,327	9,061
Canada	217,321	160,224	261,841	172,411	259,543	197,270
China:						
Mainland	829	536	801	384	236	93
Taiwan	--	--	--	--	104	16
Finland	29,537	21,115	32,964	21,535	25,160	20,298
France	16,981	11,999	22,477	8,238	13,792	10,873
Germany, Federal Republic of	37,695	25,886	36,955	22,058	19,110	14,813
Ghana	--	--	--	--	1,003	589
Greece	--	--	244	144	--	--
Italy	16,597	11,909	14,148	13,610	5,492	3,880
Japan	--	--	4,990	3,547	10,118	7,971
Korea, Republic of	--	--	4,000	2,402	2,300	1,721
Mexico	29,022	20,418	48,712	28,865	36,833	27,385
Morocco	--	--	2,080	1,002	--	--
Netherlands	4,451	2,808	11,098	6,357	3,180	2,314
Norway	--	--	--	--	--	--
Peru	18,931	13,020	10,245	6,002	7,394	5,488
Poland	3,575	1,991	5,670	2,828	100	75
Romania	--	--	--	--	--	--
South Africa, Republic of	5,339	3,811	8,112	4,872	--	--
Spain	21,309	14,416	64,626	36,336	66,738	43,703
Switzerland	--	--	--	--	1	1
Tanzania	--	--	1,001	595	1,200	848
United Kingdom	1,490	981	997	565	2,383	1,315
Yugoslavia	2,918	1,923	3,777	2,082	--	--
Zaire	32,192	23,733	28,630	16,913	14,829	11,767
Zambia	525	359	2,605	1,261	3,301	1,276
Total	503,621	359,134	622,470	386,082	524,130	390,599

Table 39.—U.S. imports for consumption of zinc, by class

	Ore (zinc content)		Blocks, pigs, slabs[1]		Sheets, plates, strips other forms		Waste and scrap	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
1977	109,277	$37,897	503,621	$359,134	186	$211	9,188	$2,175
1978	106,315	37,170	622,470	386,082	337	305	3,310	1,250
1979	87,499	37,104	524,130	390,599	244	267	3,259	1,530

	Dross and skimmings (zinc content)		Zinc fume (zinc content)		Dust, powder, flakes		Total value[2] (thousands)
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	
1977	11,739	$5,204	233	$516	6,702	$6,277	$411,414
1978	7,436	2,104	60	10	8,978	7,455	434,376
1979	4,454	1,735	28	2	3,586	3,440	434,677

[1]Unwrought alloys of zinc were imported as follows: 1977, 321 metric tons ($211,624); 1978, 23 metric tons ($13,319); and 1979, 78 metric tons ($72,725).

[2]In addition, manufactures of zinc were imported as follows: 1977, $261,554; 1978, $461,880; 1979, $213,699.

Table 40.—U.S. imports for consumption of zinc pigments and compounds

Kind	1978		1979	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Zinc oxide	24,392	$16,956	26,912	$21,415
Zinc sulfide	846	723	741	680
Lithopone	129	67	168	91
Zinc chloride	1,440	891	1,201	788
Zinc sulfate	5,716	1,992	6,849	26,370
Zinc cyanide	39	625	41	68
Zinc hydrosulfite	300	209	336	266
Zinc compounds, n.s.p.f	707	785	823	939
Total	33,569	22,248	37,071	50,617

Table 41.—Zinc: World mine production (content of ore), by country

(Thousand metric tons)

Continent and country	1976	1977	1978[p]	1979[e]
North America:				
Canada[1]	[r]982.1	1,070.5	1,066.9	[2]1,148.5
Guatemala	[r].5	1.0	1.0	[1]1.0
Honduras	24.8	26.5	24.3	22.0
Mexico[1]	259.2	265.5	244.9	240
Nicaragua	14.3	10.1	3.6	--
United States[1]	439.5	407.9	302.7	[2]267.3
South America:				
Argentina	[r]40.6	39.2	36.9	38.0
Bolivia	48.5	61.4	53.9	[2]51.6
Brazil	[r]69.6	81.2	81.6	80.0
Chile[1]	5.0	3.9	1.8	1.9
Colombia	.1	--	--	--
Ecuador	.1	2.0	1.2	2.0
Peru[1]	421.3	405.4	457.5	490.0
Europe:				
Austria	17.6	19.7	22.5	20.0
Bulgaria[e]	85.5	87.0	88.0	89.0
Czechoslovakia	9.3	9.4	8.8	9.1
Finland	61.1	62.9	52.9	[2]54.6
France	34.7	41.8	39.9	[2]35.9
Germany, Federal Republic of[4]	111.2	111.4	97.4	[2]96.9
Greece	26.5	18.0	25.6	[2]25.7
Greenland	81.0	76.6	82.4	[2]87.3
Hungary	2.2	2.8	2.6	2.5
Ireland	62.8	116.3	176.0	[2]212.3
Italy	[r]86.4	79.3	73.8	[2]65.5
Norway	[r]29.1	31.3	28.9	29.0
Poland	[r]180.0	188.0	194.0	190.0
Romania	[r e]67.0	[r e]62.0	60.0	60.0
Spain	[r]83.7	98.3	143.5	[2]136.3
Sweden	128.3	140.2	162.8	[2]164.4
U.S.S.R.[1] [e]	720.0	735.0	770.0	770.0
United Kingdom	4.8	7.7	2.7	--
Yugoslavia	106.6	112.4	97.4	[2]112.4
Africa:				
Algeria	[r]6.9	2.7	4.8	6.0
Congo (Brazzaville)	[r]5.3	5.3	4.8	5.0
Morocco	[r]17.7	7.8	4.3	12.0
Nigeria	.4	--	--	--
South Africa, Republic of	82.6	76.8	71.8	55.0
South West Africa[e]	45.5	42.2	40.3	56.8
Tunisia	7.3	7.1	7.4	7.4
Zaire	67.8	73.0	73.7	68.0
Zambia[1]	48.8	45.0	45.0	45.0
Asia:				
Burma	2.2	1.8	2.6	3.0
China, Mainland[1] [e]	100.0	100.0	120.0	120.0
Cyprus	.9	.2	--	--
India	27.4	32.5	39.8	39.0
Iran	72.0	61.5	[e]45.0	40.0
Japan[1]	260.0	275.7	275.1	[2]243.3
Korea, North[1] [e]	150.0	150.0	140.0	140.0
Korea, Republic of	59.1	68.4	66.4	[2]62.4
Philippines	[r]11.6	12.4	9.3	[2]9.7
Thailand[3]	([4])	.3	--	--
Turkey[e]	42.8	67.1	40.7	46.0
Vietnam[e]	10.0	10.0	8.0	6.0
Oceania:				
Australia	[r]468.6	491.6	473.3	530.0
Total	[r]5,690.3	5,906.1	5,877.8	5,977.8

[e]Estimate. [p]Preliminary. [r]Revised.

[1]Recoverable content of concentrates.

[2]Reported figure.

[3]Content of zinc concentrates; additional quantities of zinc may be contained in lead concentrates produced, but information is inadequate to make reliable estimates of such production.

[4]Less than 1/2 unit.

Table 42.—Zinc: World smelter production by country[1]

(Thousand metric tons)

Country	1976	1977	1978[p]	1979[e]
North America:				
Canada, primary	472.3	494.9	495.4	[2]580.4
Mexico, primary	[r]175.2	174.4	173.1	160.0
United States:				
Primary	452.5	408.4	406.7	[2]472.5
Secondary	62.2	45.9	34.8	[2]53.2
Total	514.7	454.3	441.5	[2]525.7
South America:				
Argentina, primary	35.2	29.0	23.9	37.0
Brazil:				
Primary	43.2	47.5	57.0	65.0
Secondary	7.0	9.5	12.0	14.0
Total	50.2	57.0	69.0	79.0
Peru, primary	[r]54.7	66.9	68.4	69.0
Europe:				
Austria, primary and secondary	16.5	16.7	21.7	23.0
Belgium:				
Primary	[r]234.7	247.6	233.9	255.4
Secondary	[r]6.5	10.6	6.6	5.0
Total	241.2	258.2	240.5	[2]260.4
Bulgaria, primary and secondary	92.5	90.0	91.0	92.0
Finland, primary	110.6	138.0	132.9	[2]147.1
France:				
Primary[e]	218.3	223.3	216.2	229.0
Secondary[e]	15.0	15.0	15.0	20.0
Total	233.3	238.3	231.2	[2]249.0
German Democratic Republic, primary and secondary	15.0	15.5	16.0	16.0
Germany, Federal Republic of:				
Primary	283.4	335.1	288.7	[2]333.6
Secondary	21.4	19.7	18.1	[2]21.9
Total	304.8	354.8	306.8	[2]355.5
Greece, secondary	(3)	(3)	--	--
Hungary, secondary	.7	.6	[e].6	.6
Italy, primary and secondary	191.2	169.4	177.6	[2]202.8
Netherlands, primary and secondary	140.8	109.4	135.3	[2]154.0
Norway, primary	64.4	69.8	71.6	[2]77.5
Poland, primary and secondary	237.0	228.0	222.0	217.0
Romania, primary and secondary	[r]53.4	51.9	49.8	48.5
Spain, primary	[r]161.1	156.6	163.3	[2]179.7
U.S.S.R.:				
Primary	720.0	735.0	770.0	770.0
Secondary	80.0	80.0	80.0	80.0
Total	800.0	815.0	850.0	850.0
United Kingdom, primary and secondary	41.6	81.5	73.6	[2]76.7
Yugoslavia:				
Primary	86.5	89.2	[e]82.2	87.9
Secondary	9.0	9.6	[e]10.0	11.0
Total	95.5	98.8	92.2	[2]98.9
Africa:				
Algeria, primary	[r]20.0	20.0	25.7	17.0
South Africa, Republic of, primary[4]	[r]66.2	76.0	79.1	80.0
Zaire, primary	61.7	51.0	43.5	[2]43.7
Zambia, primary	[r]36.3	40.1	41.6	40.0
Asia:				
China, Mainland, primary and secondary	[r]100.0	[r]100.0	120.0	120.0
India, primary	26.8	36.0	59.4	[2]65.9
Japan:				
Primary	742.0	778.4	767.9	[2]789.4
Secondary	34.0	26.6	24.8	25.0
Total	776.0	805.0	792.7	814.4
Korea, North, primary[4]	135.0	135.0	130.0	130.0
Korea, Republic of, primary	27.5	32.8	59.0	83.0
Thailand, primary	(3)	(3)	(3)	--

See footnotes at end of table.

Table 42.—Zinc: World smelter production by country[1] —Continued

(Thousand metric tons)

Country	1976	1977	1978[p]	1979[e]
Asia: —Continued				
Turkey, primary	2.3	20.9	20.0	24.0
Vietnam, primary[e]	[r]9.0	9.0	7.2	5.4
Oceania: Australia:				
Primary	242.6	249.7	290.1	[2]305.4
Secondary[e]	[r]6.6	[r]6.7	4.7	4.7
Total	249.2	256.4	294.8	310.1
Grand total	5,611.9	5,751.2	5,820.4	6,233.3
Of which:				
Primary	4,481.5	4,664.6	4,706.8	5,047.9
Secondary	242.4	224.2	206.6	235.4
Undifferentiated	888.0	862.4	907.0	950.0

[e]Estimate. [p]Preliminary. [r]Revised.

[1]Table combines data provided in table 39 and 40 of the 1977 edition of this chapter. Wherever possible, detailed information on raw material source of output (primary — directly from ores, and secondary — from scrap) has been provided. In cases where raw material source is unreported and insufficient data are available to estimate the distribution of the total, that total has been left undistributed (primary and secondary). To the extent possible, this table reflects metal production at the first measurable stage of metal output.

[2]Reported figure.

[3]Less than 50 metric tons.

[4]May include small quantities of secondary.