# Minerals yearbook: Minerals in the world economy 1989. Year 1989, Volume 3 1989

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# MINERALS IN THE WORLD ECONOMY


**U.S.**
**DEPARTMENT**
**OF THE**
**INTERIOR**


**BUREAU**
**OF**
**MINES**

**1989**

UNITED STATES DEPARTMENT OF THE INTERIOR • Manuel Lujan, Jr., Secretary

BUREAU OF MINES • T S Ary, Director

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# Preface

This edition of the Minerals Yearbook records the performance of the worldwide minerals industry during 1989 and provides background information to assist in interpreting that performance. Content of the individual Yearbook volumes follows:

Volume I, Metals and Minerals, contains chapters on virtually all metallic and industrial mineral commodities important to the U.S. economy. In addition, a chapter on survey methods used in data collection with a statistical summary of nonfuel minerals and a chapter on trends in mining and quarrying in the metals and industrial mineral industries are included.

Volume II, Area Reports: Domestic, contains chapters on the minerals industry of each of the 50 States and Puerto Rico, Northern Marianas, Island Possessions, and Trust Territory. This volume also has a chapter on survey methods used in data collection including a statistical summary of domestic nonfuel minerals.

Volume III, Area Reports: International, contains the latest available mineral data on more than 150 foreign countries and discusses the importance of minerals to the economies of these nations. The 1989 review is presented as five area reports and one world overview: Mineral Industries of Africa, Mineral Industries of Asia and the Pacific, Mineral Industries of Latin America and Canada, Mineral Industries of Europe and U.S.S.R., Mineral Industries of the Middle East, and Minerals in the World Economy. This year's reports incorporate location maps, industry structure tables, and an outlook section previously incorporated in our Minerals Perspectives Series quinquennial regional books, which will be discontinued.

The Bureau of Mines continually strives to improve the value of its publications to users. Constructive comments and suggestions by readers of the Yearbook are welcomed.

T S Ary, Director

# Acknowledgments

The Bureau of Mines, in preparing these Volume III Minerals Yearbook Reports, extensively utilized statistics and data on mineral production, consumption, and trade provided by various foreign government minerals and statistical agencies through various official publications. The cooperation and assistance of these organizations is gratefully acknowledged. Statistical and informational material was also obtained from reports of the U.S. Department of State, from United Nations publications, and from the domestic and foreign technical and trade press. Preparation of this summary volume would not be possible without the contributions of the country specialists and the Branch Chiefs of the Division of International Minerals, the commodity specialists of the Division of Mineral Commodities, and the International Data Section of the Division of Statistics and Information Services, all components of the Information and Analysis Associate Directorate.

George J. Coakley
*Chief, Division of International Minerals*

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# Vitae

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# MINERALS IN THE WORLD ECONOMY

By Charles L. Kimbell and William L. Zajac

## INTRODUCTION

This study is intended to serve three roles. First, it is an extension of the previous works under the same title that have been the overview and summary chapter of the international volume of Minerals Yearbook since the inception of that volume. Following the traditional format of past chapters, the basic statistical presentations herein deal chiefly with 1989, and in some instances with 1988, the latter only because more recent, comprehensive global statistics for 1989 are simply not yet available owing to delayed data collection and processing in some countries and continued governmental suppression of data in others.

The second role of this study is to provide an update to the coverage of events impacting on the world's mineral industry that have occurred between the end of 1989 and the preparation of this study. Inclusion of this update is almost essential because of the potential effect of some of these events on global mineral industry activities.

Finally, this study, in parallel with the regional volumes that it summarizes and complements, includes limited materials on the short-term outlook for the world's mineral industry, at least insofar as the impact of events covered in the update can be examined. For simplification of outline, the update through 1990 and outlook appear as a single section with regional subdivisions, and follow the 1989 review. This format has been adopted because most of the noteworthy events are regional in nature and most seem destined to have their greatest impact on the specific regions rather than on the world as a whole.

## 1989 SUMMARY

In overview, the world's mineral industry in 1989 registered gains over its 1988 performance, but these gains were by no means as pronounced as had been those of 1988. The traditional statistical measures of mineral industry performance, namely production, trade, and consumption levels, reflected significant growth in most industry sectors from crude material extraction through the gamut of downstream processing. Growth in market economy countries generally exceeded growth in the centrally planned economy countries as a result of a variety of causes that will be covered subsequently, but even among the centrally planned countries there were some upturns. In contrast to these measures of the soundness of the industry, the situation for nonfuel mineral and metal prices was less satisfactory than in 1988, and low crude oil prices continued as a problem for the all-important petroleum sector, despite some gains during the year. The oil price situation mitigated against price increases for competitive fuels. Although this was unfavorable for fuel producers, it remained advantageous to consumers, including nonfuel mineral producers, processors, and transporters. Thus it cannot be viewed as a negative factor for the whole of the global mineral industry.

Global crude mineral output value was estimated at nearly $1,420 billion in current dollars, an increase of 9% over the 1988 level, and an increase in current dollar terms for the seventh consecutive year. Measured in terms of constant dollars, however, adjusting for inflation, the increase was only 4.7% compared with the 1988 level. Despite the prolonged growth trend, the 1989 crude mineral output value level was still 3.2% below the record high set in 1980, which was $1,467 billion in terms of 1989 dollars.

Less precisely assessed was the value of mineral commodities moving in international trade in 1989. The value of world mineral commodity export trade in 1988 was estimated at $542 billion in current (1988) dollars, and partial returns suggested that the 1989 level would be in the range of $590 billion to $605 billion in terms of 1989 dollars. This would represent a 9% to 12% growth in terms of current dollars, or a 5% to 7% growth in terms of constant dollars. In any event, although the 1989 level was substantially ahead of that of 1988, it was still far below the 1980 record high of almost $710 billion on a current dollar basis or $1,046 billion in terms of 1989 dollars. This lower level was almost entirely the result of much lower unit values for energy commodities in the later years of the decade; substantially lower oil prices tended to keep all energy material prices down through most of the later 1980's, although there was a pronounced upturn in 1989. Certainly though, regardless of the actual dollar value level of mineral commodity export trade, there was an increase in the quantity of materials being moved between 1988 and 1989.

Consumption of the majority of mineral commodities advanced in 1989, with a number of materials reaching new record-high levels, but the gains were not as impressive on a global basis as had been the increases registered in 1988.

An assessment of 1989 worldwide mineral industry investment is impossible owing to the incomplete nature of available data. Steel industry investment probably topped 1988 levels, at least in market economy countries, where, for a selected group of countries, Bureau of Mines-collected data showed an increase of almost 7.9% between 1987 and 1988. Returns for 1989, however, were insufficiently complete to fix a growth rate. Foreign investment in mining, smelting, and refining by U.S. firms slumped by almost 6% between 1988 and 1989, while the much larger U.S. overseas investment in oil advanced only by 0.3%. These figures, however, cannot be regarded as indicative of investment by

U.S. firms within the United States. Moreover, they should not be considered indicative of trends in investment by firms in other market economy countries in mineral industry operations—major investment areas for which comprehensive data are not available.

The unit prices paid in 1989 for the majority of metallic mineral commodities advanced with respect to their 1988 levels, but for most of those showing increases, the growth rate, while greater than the inflation rate, fell short of gains made between 1987 and 1988. Gold and silver were the most notable exceptions, with their prices falling. Among key fertilizers and other chemical commodities, the price changes in 1989 were generally downward. Mineral fuels, on the other hand, generally logged price upturns in 1989 in contrast to slumps in 1988, although they fell short of the levels attained in the early 1980's.

The patterns of changes that developed in world mineral industry activities in 1989 were the result of a wide spectrum of political, economic, and social situations and changes in these situations. The momentous international political events of 1989 clearly would have great impact in the long run, not only on performance, but on the very structure of the global industry. However, the impact of these events was not nearly so much manifest in the 1989 industry picture as they were harbingers of things to come.

Almost without doubt, the most critical happenings were those that effectively would lead to the dismemberment of the Soviet-sponsored Council for Mutual Economic Assistance (CMEA) as a result of the unprecedented changes in the internal political situations within CMEA's East European member countries. The countries included are Albania, Bulgaria, Czechoslovakia, the German Democratic Republic, Hungary, Poland, and Romania. The rapidity of these changes, which occurred almost entirely in the last half of the year and were concentrated in the final 2 months was such that there was little chance for measurable immediate changes in their mineral industry structures, which had developed during more than 40 years since the end of World War II.

The entire nature of the organization, physical plants, and activities of these countries' mineral industries was structured to perform specific roles in a "grand plan" involving them and the U.S.S.R. in an economic bloc. Alterations in such a structure could only come with the passage of time, and indeed with the timing of the governmental changes, there was hardly time within 1989 for the new leadership to evaluate where they were and how they wanted to proceed with industrial transition, including transitions in mineral industry activities.

Hardly less momentous from the viewpoint of potential readjustments in the global mineral industry picture were shifts in policy and openly expressed attitudes within the U.S.S.R. Here again, however, the impact of these changes on mineral industry activity was more one of providing potentials for alterations than one of actual changes in 1989.

The announced policies of "glasnost" and "perestroika" signaled doctrinal changes that, at least in theory, would ultimately lead to shifts of the Soviet mineral industry toward the style of economic thinking that prevails in market economy countries. The outwardly affable Soviet foreign policy toward the smaller CMEA countries of Eastern Europe as they moved away from their tight linkages with the U.S.S.R. came as a surprise to many. The resulting potential for major shifts in material flow patterns could alter mineral industry traditions in this region that are of 40 years or more duration.

Less settling were the possible impacts of political and social unrest within the U.S.S.R. as some of the individual republics began agitation for wholly or significantly autonomous status. Clearly, a number of components of the Soviet mineral industry were experiencing difficulties; they not only failed to meet planned growth targets, but indeed were unable to avoid downturns with respect to 1988 performance.

In China, the internal problems that led to the events in Beijing's Tiananman Square proved to be a detriment to the country's efforts to increase international involvement in many economic areas, including mineral industry operations. There were abundant indications that China was still striving for increased international linkages, but the Government's suppression of demonstrations led to a reluctance on the part of potential partners to become involved or to increase existing involvement.

As the year drew to a close, a potential threat to world mineral trade flow was seemingly resolved in Panama. Prospects for problems in operation of the vital Panama Canal had been on the increase from May, when forces loyal to the former president, Manuel Noreiga, forcibly set aside the results of an election and retained control of the country. In a situation of rapidly worsening relations between the United States and Panama, the intervention by U.S. Armed Forces enabled the previously elected Government to assume control of the country, a move that seemingly met with the approval of an overwhelming proportion of the population. This, in turn, appeared to insure that there would be no interruption in interocean flow of mineral and other commodities through the important seaway.

On a nonconfrontational note, the 12 countries of the European Communities (EC) moved toward closer ties and a more unified approach to mutual problems. From the viewpoint of mineral industry operations, this, in effect, provided stronger links between member countries. These collectively in 1989 accounted for nearly 18% of the world's steel production, almost 15% of its cement output, 14% of global coal production, 13% of world aluminum output, and just under 12% of world refined copper production, to cite but five major commodities. The EC countries, too, account for a very significant share of global consumption of these and other mineral commodities. The significance of this country group with production and consumption of these magnitudes that could operate almost as a single entity in resource policy should not escape notice of other global producers, producer groups, consumers, and consumer groups.

The overall mineral industry performance in such key raw material source areas as Australia and Canada was not affected unfavorably by general world events. For another such country, the Republic of South Africa, there were the beginnings of changes in governmental internal policies aimed at improving relations with other nations that had imposed economic sanctions because of the Republic's apartheid policies.

Following the 1988 declaration of a cease-fire in the Iran-Iraq war, mineral industry activities in the countries of the Near East began to move back toward more normal operations. Efforts commenced to restore lost operative capacity in the former belligerent states, and to improve the regional environment for investment, at least through yearend 1989.

In Asia, the Republic of Korea continued its emergence as a processor of imported raw materials to produce steel, refined copper, refined lead, and slab zinc,

and additionally produced cement and nitrogen in ammonia from domestic resources with imported energy. Taiwan, too, expanded operations as an important raw material processor for steel production and was a significant source of cement and nitrogen in ammonia from local materials.

In Latin America, notably in Mexico and Brazil, financial problems relating to foreign exchange availability continued to impact on mineral industry operations, although output levels generally edged upward in 1989. Despite these problems, Companhia Vale do Rio Doce S/A (CVRD) of Brazil was the world's leading mineral producing company in terms of profit in 1989.

## PRODUCTION

The estimated value of world crude mineral production in 1989 was nearly $1,420 billion in terms of current dollars or more than $1,168 billion in terms of constant 1983 dollars. This latter figure was almost 4.7% above the 1988 level but did not attain the historic high of $1,207.1 billion 1983 dollars set in 1980. The accompanying tabulation provides the latest available revised time series for the value of world crude mineral production in terms of both constant 1983 dollars and current dollars. It also provides one of the two statistical bases for the estimation, this being the data on the value of production of a group of key commodities that was compiled for and published in the authoritative French language mineral industry periodical Annales des Mines for years up to 1983.[1]

It should be stressed that the values just discussed and those presented in the tabulation are for crude minerals only and by no means reflect adequately the role of the entire mineral industry in the world economy. These figures represent only the value of mineral materials as they are mined or otherwise extracted from the earth. They do not reflect the value added to these materials through downstream processing within the facilities commonly accepted as mineral industry plants. That is, value added through beneficiation of ores, smelting, refining, and similar processing is not included in these figures. Comprehensive world data on the value added by such processing are not available; however, a conservative estimate of the total value of processed output from mineral industry plants derived wholly from primary (newly mined) materials would be on the order of about $2,800 billion constant 1983 dollars or $3,400 billion in terms of 1989 dollars.

To fully evaluate the worth of the total output of mineral industry plants would require the addition of a substantial (although as yet unestimated) increment for the output derived from secondary sources, such as scrap and other reclaimed substances. Such recovery for some mineral materials is virtually nonexistent or inconsequential (as in the cases of sand and gravel and fuels for example), but for others it is very substantial. For example, in 1989, almost 30% of world steel production, 45% of world refined lead output, and 15% of world refined copper production were clearly identified as being derived from scrap. Similarly, for market economy countries (data on centrally planned economy countries are not available), about 25% of total aluminum output was from scrap.

It is also important to note that the overall impact of the mineral industry extends far beyond the worth of all its products, whether of primary or secondary origin. Mineral products constitute the overwhelmingly dominant share of the total raw material supply for all manufacturing operations. These operations encompass 1) the traditional "smokestack" industry facilities that use steel and other metals in the production of industrial equipment and consumer durables, 2) the construction industry that converts mineral products into a host of structural types, and 3) such industries as textile mills whose raw materials are increasingly chemical-based fabrics. In the areas of agricultural and forestry industries, mineral fertilizers and other mineral-based soil treatment products are indispensable for maintaining high production and productivity. Mineral products are essential to

| Year | Value of 53[1] major crude mineral commodities[2] | | Value of all crude mineral commodities[3] | |
|---|---|---|---|---|
| | Billion current dollars | Billion 1983 constant dollars | Billion current dollars | Billion 1983 constant dollars |
| 1950 | 25.9 | 103.5 | 29.5 | 117.9 |
| 1953 | 37.0 | 135.1 | 42.5 | 155.3 |
| 1958 | 50.0 | 173.5 | 60.1 | 208.5 |
| 1963 | 59.0 | 192.0 | 72.3 | 235.3 |
| 1968 | 77.9 | 222.3 | 94.5 | 269.8 |
| 1973 | 159.2 | 357.3 | 191.6 | 430.0 |
| 1978 | 477.0 | 728.5 | 539.6 | 824.1 |
| 1979 | 656.5 | 901.2 | 733.2 | 1,006.5 |
| 1980 | 902.9 | 1,094.6 | 995.7 | 1,207.1 |
| 1981 | 912.0 | 1,008.1 | 993.2 | 1,097.9 |
| 1982 | 902.9 | 938.1 | 971.2 | 1,009.1 |
| 1983 | 930.4 | 930.4 | 988.7 | 988.7 |
| 1984 | 1,000.8 | 965.5 | 1,063.5 | 1,026.0 |
| 1985 | 1,018.8 | 954.5 | 1,082.6 | 1,014.3 |
| 1986 | 1,077.9 | 984.1 | 1,145.5 | 1,045.8 |
| 1987 | 1,125.6 | 996.2 | 1,196.1 | 1,058.6 |
| 1988 | 1,225.7 | 1,049.9 | 1,302.5 | 1,115.7 |
| 1989 | 1,336.2 | 1,099.2 | 1,419.9 | 1,168.1 |

[1]The list of commodities included has been varied slightly by the authors of the basic source article over the years, and the number 53 may be regarded as debatable. Forty-eight commodities were included in every study, 1950-83 inclusive, and are included in a listing in table 3 of the 1985 edition of this chapter; this list of 52 entries also includes columbium-tantalum (as a single entry), kyanite, and uranium (each of which has been included in the study from 1958-83 inclusive, and beryl (which was included in the study from 1950-68 inclusive). Additionally, a generic group (natural abrasives), perlite, and vermiculite were incorporated into the 1950 study but dropped thereafter; lithium was included in 1958 only; and asphaltic limestone was included from 1950-68 inclusive. The alterations in the number of commodities had little, if any, significant effect on the totals, with the possible exception of uranium's omission in 1950 and 1953.

[2]Data for 1950, 1953, 1958, 1963, 1968, 1973, 1978, and 1983 are as reported in Annales des Mines, July-Aug.-Sept. 1985, p. 9. Data in constant dollars for 1979-82 and 1984-89 inclusive are extrapolated from the 1983 Annales des Mines figures on the basis of the United Nations index of extractive mineral industry production in the United Nations Monthly Bulletin of Statistics, Aug. 1989, p. 236. Data in current dollars for 1979-82 and 1984-89 inclusive are derived from the constant dollar estimates using reciprocals of the most recent available U.S. price deflators.

[3]Data extrapolated from values for 53 commodities to compensate for other (additional) mineral commodities. For details on the basis for this extrapolation, see accompanying text under "Value of World Mineral Production."

the transportation industry as the raw materials for roads, railroads, runways, and docking facilities, as well as for the conveyances that use them. In addition, the minerals industry is a major user of the transportation networks. Moreover, the mineral industry provides all but a small share of the total energy required for the mining and processing of other mineral commodities and of agricultural materials from its crude form to the manufactures therefrom derived. Additionally, it provides the overwhelmingly dominant share of the energy required to transport raw materials, products, and the world's population around this planet. Finally, all electrical energy—that derived from hydroelectric and geothermal sites—could not be produced and distributed without equipment and transmission lines fabricated from mineral commodities.

| Year | Index numbers (1980=100) | | | |
|---|---|---|---|---|
| | Coal | Crude petroleum and natural gas | Metals | Extractive industry total |
| Annual averages: | | | | |
| 1978 | 93.8 | 104.4 | 98.2 | 102.0 |
| 1982 | r102.4 | 80.7 | r96.9 | 85.7 |
| 1983r | 101.3 | 79.5 | 97.1 | 84.9 |
| 1984r | 100.7 | 82.6 | 103.8 | 88.1 |
| 1985r | 105.5 | 79.7 | 108.0 | 87.1 |
| 1986r | 107.1 | 82.7 | 108.9 | 89.8 |
| 1987r | 107.0 | 83.3 | 113.0 | 90.9 |
| 1988r | 107.6 | 87.9 | 122.8 | 95.8 |
| 1989 | 107.3 | 92.4 | 133.6 | 100.3 |
| Quarterly results: | | | | |
| 1988: | | | | |
| 1st quarterr | 109.2 | 85.2 | 116.5 | 93.1 |
| 2nd quarterr | 104.6 | 84.7 | 120.5 | 93.2 |
| 3rd quarterr | 104.4 | 87.6 | 125.2 | 95.6 |
| 4th quarterr | 111.8 | 93.8 | 129.2 | 101.1 |
| 1989: | | | | |
| 1st quarter | 111.6 | 88.7 | 128.7 | 97.4 |
| 2nd quarter | 106.6 | 90.3 | 132.8 | 98.8 |
| 3rd quarter | 102.4 | 92.7 | 135.7 | 100.3 |
| 4th quarter | 108.7 | 97.8 | 137.1 | 104.8 |

rRevised.

Source: First quarter of 1988 only—United Nations. Monthly Bulletin of Statistics, v. 44, No. 11, Nov. 1990, p. 236-237; all other data—United Nations. Monthly Bulletin of Statistics, v. 45, No. 2, Feb. 1991, pp. 236-237.

## Production Index Patterns

The accompanying tabulation summarizes the development pattern of the world's extractive mineral industry output over recent years as reflected by these components of the United Nations industrial production indices.

The tabulation demonstrates the general upturn in global extractive mineral industry activity through 1989. Of the three recorded extractive component indices, only coal recorded any downturn across the year, with downturns in each of the first three quarters compared with the previous quarters. The declines in coal, however, were inadequate to do more than reduce the growth rate in the overall index, although the latter suffered a 3.7% slump between the last quarter of 1988 and the first quarter of 1989 as each of the component indices registered declines. Thereafter, however, growth was the rule (with the aforementioned exception for coal), and the extractive index for 1989 reached the highest level since the historic high of 1980.

The tabulation incorporates a number of revisions from the data provided in the previous edition of this chapter, but these revisions generally did not alter the direction of trends but only their magnitude. Detailed region-by-region figures in the source publication showed some regional alterations in trend direction and may be of interest to those engaging in regional comparisons.

Comparison of the index levels and growth trends for the extractive mineral industry with growth trends reported in the same source for certain mineral processing sectors demonstrates the lack of parallelism between raw material production and mineral processing. The annual average index numbers for each of the three sectors reproduced here reached higher levels in 1989 than in 1988. However, the quarterly results show peak levels in the 2nd quarter in the cases of nonmetallic products and base metals, with a downturn in the 3rd quarter and a modest upturn in the 4th quarter. In the case of products of chemicals, petroleum, coal, and rubber, there was a growth through the first half year, a downturn in the 3rd quarter, and a peak in the 4th quarter. These processing sector data appear in a similar accompanying tabulation.

As was the case with extractive industry output, there were revisions in the United Nations data that altered the degree of change in each sector, but that in world aggregate did not alter the direction of the trends.

Both of the foregoing index tabulations reflect weighted aggregates of results from world areas that individually showed quite varied results, both from area to area and from year to year and quarter to quarter. For these regional results that are too extensive and detailed for inclusion here, the reader is referred to the source publication for these tabulations.

## Quantitative Commodity Output

Of the 100 distinct mineral commodities and/or subdivisions of mineral commodities for which world production as measured by the Bureau of Mines is presented in table 1 for 1985-89,[2] 76 registered increases in 1989 relative to their 1988 levels of production and 24 recorded declines. These results were slightly less impressive than results between 1987 and 1988, when 81 logged gains and 19 registered declines, but they were more positive than those registered between 1986 and 1987, when only 64 recorded increases, 35 showed declines, and 1 was unchanged.

Of the 53 metallic mineral commodities recorded separately in table 1, 39 recorded production gains in 1989 and 14 showed

| Year | Index numbers (1980=100) | | |
|---|---|---|---|
| | Non-metallic mineral products | Chemicals, petroleum, coal, rubber products | Base metals |
| Annual averages: | | | |
| 1978 | r96.7 | 95.8 | 100.4 |
| 1982r | 94.3 | 99.1 | 89.3 |
| 1983r | 96.8 | 104.3 | 91.9 |
| 1984r | 100.7 | 110.7 | 99.3 |
| 1985r | 101.6 | 114.3 | 100.5 |
| 1986r | 104.9 | 118.9 | 99.3 |
| 1987 | r108.3 | 125.2 | r103.1 |
| 1988r | 114.2 | 133.3 | 110.5 |
| 1989 | 118.2 | 137.3 | 112.5 |
| Quarterly results: | | | |
| 1988: | | | |
| 1st quarterr | 110.2 | 131.3 | 110.3 |
| 2nd quarterr | 116.3 | 133.3 | 110.6 |
| 3rd quarterr | 115.4 | 132.6 | 108.8 |
| 4th quarterr | 115.1 | 135.8 | 112.2 |
| 1989: | | | |
| 1st quarter | 114.6 | 135.9 | 113.9 |
| 2nd quarter | 121.8 | 138.7 | 115.1 |
| 3rd quarter | 118.0 | 134.6 | 109.8 |
| 4th quarter | 118.6 | 140.2 | 111.2 |

rRevised.

Source: First quarter 1988 only—United Nations. Monthly Bulletin of Statistics, v. 44, No. 11, Nov. 1990, pp. 236-237; all other data—United Nations. Monthly Bulletin of Statistics, v. 45, No. 2, Feb. 1991, pp. 236-237.

declines. Of the 39 showing gains, 22 reached new production highs in 1989. Those that reached new high output levels in 1989 were (in the order they appear in table 1): bauxite, alumina, aluminum, mine copper, primary smelter copper, secondary smelter copper, primary refined copper, secondary refined copper, gold, iron ore, pig iron, crude steel, secondary smelter lead, secondary refined lead, primary magnesium, mine nickel, plant nickel, platinum-group metals, mine silver, titaniferous slag, primary smelter zinc, and zircon concentrates. Others logging gains but not achieving record output levels, together with the year in which they reached historic output highs, were as follows: mine antimony and mine zinc (1987); smelter bismuth and mine cobalt (1986); arsenic oxide, primary refined lead, and monazite concentrate (1985); secondary smelter zinc (both 1982 and 1983); secondary magnesium (1981); manganese ore; molybdenum ore, primary smelter tin, rutile, and tungsten (1980); mine tin and selenium (1979); and ilmenite (1974).

Of the metals for which gains were recorded, gold registered an increase for the ninth consecutive year; mine copper, primary smelter copper, primary refined copper, and platinum-group metals recorded gains for the seventh consecutive year; iron ore, secondary refined lead, and titanium slag output increased for the sixth year in a row; and alumina, aluminum, bauxite, and secondary smelter lead registered gains for the fourth year in a row.

Of the 14 metals showing lower output levels in 1989 than in 1988, mine bismuth recorded a drop for the fourth consecutive year, smelter cobalt registered a drop for the third year, mine lead output declined for a second year, and the remainder logged declines in 1989 after registering increases in 1988. Of those recording output drops, cadmium, chromite, columbium-tantalum concentrates, secondary smelter tin, and vanadium recorded record-high output levels in 1988; smelter cobalt had its record output high in 1986; mine bismuth, primary smelter tin, and tellurium reached record year highs in 1985; beryl concentrate output peaked in 1984; that of uranium in 1980; that of ferroalloys in 1979; that of mine lead in 1973; and that of mercury in 1971.

Examining metallic mineral output from the viewpoint of associated or related commodity groups, there seemed to be a lack of consistent pattern in those commodities associated primarily with steel production. Although production of iron ore and pig iron were in keeping with the growth in steel production, reductions in the output of chromite, ferroalloys (as a class), and ores of alloying metals such as columbium, tantalum, and vanadium went counter to a steel industry growth pattern. In contrast though, output of manganese ore, tungsten concentrate, and molybdenum ore advanced, presumably driven at least in part by demand for these materials by the steel industry. Steel industry expansion seemed related to higher output for nickel (both as an alloying material and as a cladding material) and probably contributed to growth in output of the other important steel-coating materials—tin and zinc.

Among the major nonferrous metals, aluminum in all measured forms (bauxite, alumina, and refined metal) logged growth, with mine output showing the greatest percentage of increase, leading to expectations of further growth in metal output in the near future. Small to modest gains in copper output at all stages seemed to suggest confidence in continued economic growth, with an accompanying increase in demand for the red metal.

Of the 36 individual categories of nonmetallic minerals and their products listed in table 1 under the heading "Industrial Minerals," 26 registered gains in 1989 compared with their 1988 output levels. Of those recording gains, 17 attained new production highs in 1989. These were bentonite, boron, bromine, cement, gem and industrial diamond, feldspar, fluorspar, gypsum, iodine, kaolin, nitrogen, perlite, phosphate rock, salt, soda ash, and strontium minerals.

Other materials logging output growth between 1988 and 1989, but falling short of previous record highs, together with the year in which they recorded record-to-date output, were as follows: fuller's earth and magnesite (1986), barite (1981), guano and lime (1980), sodium sulfate (1979), vermiculite (1978), elemental sulfur (1974), and sulfur from pyrites (1971).

Of the nonmetals registering gains, cement recorded its 14th consecutive year of growth; gypsum, kaolin, and nitrogen at-

tained higher levels of output for the 7th consecutive year; and bentonite, boron, perlite, salt, and soda ash enjoyed their 4th consecutive year of output growth. Production of bromine, feldspar, phosphate rock, strontium minerals, and sulfur from pyrite was increased for the third consecutive year in 1989, and outputs of barite, gem and industrial diamond, fluorspar, iodine, and magnesite were higher for a second year.

Of the 10 commodities in this group registering declines, mica and graphite did so for a second year in a row; all others had registered gains between 1987 and 1988. Of those registering declines, diatomite, potash, and byproduct sulfur had set record production levels in 1988; talc output peaked in 1985; corundum in 1980; Thomas slag in 1979; mica in 1978; asbestos in 1976; pumice in 1973; and natural graphite in 1963.

From the viewpoint of groupings of nonmetallic commodities, potash seemed out of step with other fertilizer raw materials in logging a decline. The drop in Thomas slag output was undoubtedly more the result of decreasing use of phosphatic iron ore in steel production than an intentional cut in output of this minor fertilizer product. The economic strength of the world's chemical industries undoubtedly buoyed output of mineral substances such as common salt, sodium sulfate, soda ash, sulfur, nitrogen in ammonia, as well as lesser commodities such as boron, bromine, and iodine. Global upturns in construction were reflected in the measured continued growth in output of cement and gypsum, and presumably in other construction materials such as sand and gravel and stone. Although comprehensive world data on these simple construction materials are not yet being compiled by the Bureau owing to difficulties in the acquisition of sound data on these materials for many countries, examination of returns for some key countries demonstrates a perceptible upturn in output in 1989.

Of the 11 mineral fuel commodities listed in table 1, all registered output gains between 1988 and 1989. Considering the production of primary energy sources, crude oil output increased for the third consecutive year but still remained short of its 1979 record high. Marketed natural gas output (gross production less that flared, vented, and reinjected into reservoirs for pressure maintenance) increased for the seventh consecutive year. Output reached a new historic high, as increases from gasfields were augmented by increases in gas recovery from fields in which gas occurs as a byproduct of oil. The recovery of natural gas liquids, chiefly butane, propane, and natural gasoline, as a byproduct of natural gas also reached a new high in 1989, a fourth year of such growth. Production of all three listed types of coal increased in 1989. Anthracite did so for the seventh consecutive year, bituminous coal did so for the eighth consecutive year, and lignite output increased to preserve a 22-year streak of growth. Peat is listed among mineral fuels because of its similar origin and nature to low rank coals; however, about 80% of total peat output is used as a soil conditioner and for other nonfuel purposes. Peat output increased for the second consecutive year, and apparently reached a new record, topping the 1986 level. Bureau of Mines figures published in earlier editions of the Minerals Yearbook show even higher levels in the late 1970's and early 1980's, but these figures included estimates for Soviet production that were subsequently revised downward very substantially.

As for the four mineral fuel products listed in the table, refined oil, although increasing for a fourth consecutive year, fell short of its record-to-date high set in 1979. Carbon black output, up for a third consecutive year, reached a new high in 1989. Metallurgical coke, although increasing for a third consecutive year, still fell short of the to-date historic high set in 1980. Output of other coke edged upward again but fell short of the to-date record high of 1979.

The overall performance of the nonfuel mineral industry can only be summarized in terms of the value of production, and for these nonfuel commodities, exactitudes for the role of each commodity in the aggregate are not available for any year subsequent to 1983 (see Value of World Mineral Production). Among fuel commodities, however, the overall pattern of output level changes and their interrelationships can be demonstrated in terms of the common denominator of their energy content. This has been done in this chapter on the basis of standard coal equivalents as presented by the United Nations. An accompanying tabulation summarizes world energy commodity output for 1981-88 as reported by the United Nations and provides Bureau of Mines estimates for 1988.

It is perhaps noteworthy that Bureau of Mines estimates of 1988 fuels output that were published in the previous edition of this chapter were quite close to the results ultimately published by the United Nations for 1988 as the sum of reported data for most countries. The Bureau's estimate of total energy production in terms of standard coal equivalent was only 0.3% above the ultimately reported United Nations figure. Some individual components of the total were further from the actual reported levels than was the total. Estimated natural gas output was 5.7%

| Year | Million metric tons of standard coal equivalent | | | | | |
|---|---|---|---|---|---|---|
| | Coal | Crude petroleum and natural gas liquids | Natural gas | Primary electricity | | Total |
| | | | | Hydro and geothermal | Nuclear | |
| 1981 | 2,635 | 4,250 | 1,859 | 220 | 99 | 9,063 |
| 1982 | 2,712 | 4,027 | 1,844 | 226 | 107 | 8,916 |
| 1983 | 2,719 | 3,982 | 1,856 | 237 | 124 | [1]8,917 |
| 1984 | 2,851 | 4,032 | 2,022 | 245 | 150 | 9,300 |
| 1985 | [r]2,998 | [r]3,990 | 2,098 | 249 | 178 | [r,1]9,514 |
| 1986 | [r]3,076 | [r]4,184 | [r]2,140 | 252 | [r]190 | [1]9,843 |
| 1987 | [r]3,157 | [r]4,208 | [r]2,256 | 255 | [r]209 | [1]10,086 |
| 1988 | 3,256 | 4,395 | 2,335 | 261 | 227 | 10,474 |
| 1989[e] | 3,303 | 4,527 | 2,419 | 265 | 246 | 10,760 |

[e]Estimated. [r]Revised.

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

Source: 1981—United Nations. 1984 Energy Statistics Yearbook, New York, 1986, pp. 2, 691; 1982—United Nations. 1985 Energy Statistics Yearbook, New York, 1987, pp. 2, 380; 1983—United Nations. 1986 Energy Statistic Yearbook, New York, 1988, pp. 2, 378; 1984—United Nations. 1987 Energy Statistics Yearbook, New York, 1989, pp. 2, 392; 1985-88—United Nations. 1988 Energy Statistics Yearbook, New York, 1990, pp. 2, 392; 1989—U.S. Bureau of Mines estimates.

above the ultimately reported level, but this overage was compensated to a significant extent for by lower estimates for coal, crude petroleum and natural gas liquids, hydropower and geothermal power, and nuclear power. These were low by 2.9%, 0.1%, 1.9%, and 0.9%, respectively.

For 1989, an increase of 2.8% in total energy output has been estimated, the result of gains in output from each of the listed energy sources. These increases, however, were by no means uniform when measured in terms of percentage growth. Nuclear electric power output increased by an estimated 8.3% but, because its share of the total was so small, it had far less impact on that figure than did growths of 3.6% for natural gas and 3.0% for liquid fuels. Increases in coal at 1.4% and hydropower at 1.5% were at the low end of the growth scale.

An examination of data on power output and generating capacity continues to show the shift toward nuclear power. This is significant to world mineral economics not only because the mineral industry is the source of raw materials for thermal and nuclear power, but also because the mineral industry is a significant user of electrical energy in the mining, processing, and transport of mineral materials. In the absence of comprehensive world statistics for 1989, the tabulations providing output and capacity data compare figures for 1981 and 1987 with those for 1988.

In just 8 years, output by world nuclear plants increased by 131%, including a growth of 8.6% between 1987 and 1988. In 1988, electricity generated by nuclear plants was about 17% of all power generated and was 46.6% of primary electricity. While the 1981-88 growth in geothermal power production was about 138%, and thus exceeded the growth in nuclear power over the 8-year span, this remained a very minor source of total energy, and its 1987-88 growth was only 2.7%. As in the past years, the conventional sources of electricity—hydroelectric plants and thermal plants—recorded increases in output. However, the growths for these, 2.4% for hydropower and 3.4% for thermal power between 1987 and 1988, were not great enough to maintain their shares of total power production. Thus, their shares fell in both cases, not only across the 8-year period 1981 to 1988 but also between 1987 and 1988.

Similar trends in the growth of generating capacity, although not precisely parallel, can be seen in the tabulation of capacity. There was a 97% increase in nuclear plant capacity between 1981 and 1988 and

| Source plant type | 1981 | | 1987 | | 1988 | |
|---|---|---|---|---|---|---|
| | Production (billion kilowatt hours) | Share of total (percent) | Production (billion kilowatt hours) | Share of total (percent) | Production (billion kilowatt hours) | Share of total (percent) |
| Primary electricity: | | | | | | |
| Hydroelectric | 1,776 | 21.2 | 2,038 | r19.2 | 2,087 | 18.9 |
| Geothermal | 16 | .2 | r37 | .3 | 38 | .3 |
| Nuclear | 801 | 9.6 | r1,705 | r16.1 | 1,852 | 16.8 |
| Subtotal | 1,2592 | 130.9 | r 13,779 | r 135.7 | 3,977 | 136.1 |
| Secondary electricity: | | | | | | |
| Thermal | 5,792 | 69.1 | r6,810 | r64.3 | 7,040 | 63.9 |
| Total | 8,384 | 100.0 | r10,589 | 100.0 | 11,017 | 100.0 |

rRevised.
1Data do not add to total shown because of independent rounding.
Source: 1981—United Nations. 1984 Energy Statistics Yearbook, New York, 1986, p. 384; 1987-88—United Nations. 1988 Energy Statistics Yearbook, New York, 1990, p. 392.

| Plant type | 1981 | | 1987 | | 1988 | |
|---|---|---|---|---|---|---|
| | Capacity (million kilowatts) | Share of total (percent) | Capacity (million kilowatts) | Share of total (percent) | Capacity (million kilowatts) | Share of total (percent) |
| Primary plants: | | | | | | |
| Hydroelectric | 488 | 23.1 | r593 | 22.9 | 603 | 23.0 |
| Geothermal | 3 | .1 | r8 | .3 | 9 | .3 |
| Nuclear | 161 | 7.6 | 306 | r11.8 | 318 | 12.1 |
| Subtotal | 652 | 30.8 | 1906 | 134.9 | 1929 | 135.3 |
| Secondary plants: | | | | | | |
| Thermal | 1,462 | 69.2 | r1,687 | r65.1 | 1,702 | 64.7 |
| Total | 2,114 | 100.0 | 2,593 | 100.0 | 2631 | 100.0 |

rRevised.
1Data do not add to total shown because of independent rounding.
Sources: 1981—United Nations. 1984 Energy Statistics Yearbook, New York, 1986. p. 328; 1987-88—United Nations. 1988 Energy Statistics Yearbook, New York, 1990, p. 392.

a 3.9% increase in this capacity between 1987 and 1988. Total generating capacity increased 24.4% between 1981 and 1988 and only 1.5% between 1987 and 1988. There were increases in the capacities of each of the types of plants listed both over the 8-year period and between 1987 and 1988, but percentage registered for hydroplants were below that for the total for 1981 and 1988 and only slightly above that for the total between 1987 and 1988. Thermal plant capacity increases on a percentage basis were below the total capacity growths both between 1981 and 1988 and between 1987 and 1988. Geothermal plants, although recording percentage growths substantially in excess of those for all plants combined, remained unimportant because their contribution to the total was almost inconsequential. Thus, nuclear powerplants appreciably increased their share of total generating capacity, from a level of 7.6% in 1981 to a level of 12.1% by 1988.

The figures on actual production and capacity can be used to evaluate the utilization of generating capacity. There was a 5.3% increase in utilization of capacity between 1981 and 1988 and a 2.4% increase in this figure between 1987 and 1988. Over the 8-year period, capacity utilization of nuclear plants increased 16.7% and that of thermal plants by 4.2%, while hydro plant and geothermal plant utilization dropped by 5.1% and 21.8%, respectively. The growth in nuclear plant capacity utilization, which included a 4.2% growth between 1987 and 1988 alone, could be considered even more remarkable when the restrictions on nuclear operations for reasons of public safety are considered.

The gradual increase in the proportional role of public utilities in total power generation, as opposed to so-called "self-producers," that is, plants with capacities essentially dedicated to some specific industry or group of industries, continued in 1989. Of total electric power generated in the world, 93.3% was from public utility plants and 6.7% from self-producer's plants in 1988, compared with 93.1% and 6.9%, respectively, in 1987 and 92.9% and 7.1% in 1981, respectively.

Output by both public utilities and self-producers increased for each source plant type (hydro, geothermal, nuclear, and thermal) between 1981 and 1988, but the shares of the totals accounted for by each have shifted across time. Thermal self-producers registered a slight gain from 8.4% of the 1981 total to 8.9% of the 1988 total; hydroelectric self-producers accounted for 5.9% of total 1981 hydroelectric power output, but only 5.0% of the 1988 total. Nuclear power self-producers were responsible for 0.7% of 1981's nuclear power total, but only 0.4% of 1988's total nuclear power output. In contrast, self-producer geothermal plants accounted for only 1.7% of 1981's total geothermal power output, but for 14.6% of 1988's total geothermal power production. The role of electric power self-producers is significant in some major mineral producing countries, where such power generation is primarily dedicated to the industry that produces the power. Mineral industry firms that acquire power from public utilities are forced into a competitive position with other sectors of the economy and may well suffer in times of shortage. Specific data on mineral industry control over power facilities for their own use are not available on a comprehensive global basis. However, for selected major mineral producing and processing countries, the proportion of total electric power produced by self-producers in aggregate varies quite widely. In 1988, such plants generated 4.4% of the U.S.S.R.'s total output, 5.4% of total U.S. output, 7.0% in India, 7.1% in Australia, 11.5% in Japan, 11.8% in Norway, 14.9% of output in the Federal Republic of Germany, 7.7% in Canada, 21.9% in Chile, and 39.3% in Zaire. Contrasting with the relatively high Chilean and Zairian figures is the 2.8% level in Zambia, the other major copper producer, refiner, and exporter.

### Value of World Mineral Production

The value of world crude mineral production in 1989 was estimated at $1,168.1 billion in constant 1983 dollars, or $1,419.9 billion in current (1989) dollars. Details on the basic methodology employed to prepare this estimate are outlined in the 1985 edition of this chapter to which the reader is referred.

### Geographic Distribution of World Mineral Output Value

Available information is inadequate to reliably extrapolate to 1989 the 1983 data on geographic distribution of world crude mineral output value published in the July-September 1985 edition of Annales des Mines and reproduced in summary form in the 1985 edition of the Minerals Yearbook. These data for 1983 appear in the 1985 "Minerals in the World Economy" chapter (table 2), together with corresponding figures for 1950 and 1978, and with some textual comments on this material. The reader is referred to this publication, as well as to its original source, for further information.

### Commodity Distribution of World Mineral Output Value

As is the case with geographic distribution of world mineral output value, the inadequacy of data precludes any reliable extrapolation to 1989 of the various commodities' shares of the totals shown for 1983 in the 1985 edition of this chapter. Clearly, some major shifts in percentage shares, if not in ranking, will have occurred as a result of unit price changes, such as in the cases of crude oil and gold to cite but two of the more notable commodities. For details on the 1983 distribution of the total, the reader is referred to the 1985 edition of this chapter, particularly to table 3, and to the source publication for that table.

## TRADE

In 1988, the aggregate value of total world international export trade in mineral commodities was estimated at nearly $542 billion in current (1988) dollars, which was about 8.6% above the 1987 level, but still 23.7% below the record high set in 1980. Comparable comprehensive data for 1989 were not available in time for inclusion in this chapter, but 1989 returns for developed market economy countries only were 11.8% above those for 1988. These countries accounted for about 50% of the total mineral commodity export trade in 1988. It would be unsound to utilize the overall 11.8% growth rate for mineral commodity export trade for these countries to extrapolate the growth in total world mineral commodity trade because these developed market economy countries account for substantially different shares of the five major mineral commodity groups listed in table 2. Specifically, developed market economy countries in 1988 accounted for 56% of world export of ore, concentrate, and scrap, 74.7% of world exports of iron and steel, 71.7% of world exports of nonferrous metals, and 57.8% of all exports of crude nonmetals,

but only 26.6% of world exports of mineral fuels. Moreover, even within each of these groups, the actual product mix included in developed market economy country aggregates differ from that in developing market economy country aggregates and in centrally planned economy country aggregates. Nonetheless, an increase of 9% to 12% in the value of world mineral commodity export trade seems indicated by available returns.

The accompanying tabulation provides a data series for the estimated value of world export trade in all mineral commodities from 1979 through 1988; also shown is the subdivision of those data between nonfuel and fuel mineral commodities and the total's share of total world merchandise trade.

The addition of 1988 data to that published in last year's edition of this study, as well as revisions of data published previously for 1985 and 1987, does not alter the fact that 1987 proved to be a watershed year for total mineral commodity trade. The downtrend in that value that extended from 1981 through 1986 (with only a minuscule upturn in 1984) was substantially reversed in 1987, and the upturn in that year clearly has continued through 1988 and 1989, even though the 1989 results cannot yet be quantified with any precision. Despite the reversal in quantitative level, however, the growth in value of other merchandise exports has been so substantial that the mineral commodity share of total merchandise trade declined for the eighth consecutive year. The tabulation also demonstrates that the decline in value of total mineral commodity exports between 1980 and 1986 was chiefly the result of precipitous declines in the value of mineral fuel commodities. Moreover, while the increase in the total in 1987 was shared by both fuel and nonfuel commodities, the growth in the total in 1988 was entirely the result of the continued upturn in nonfuel mineral commodities, for 1988 saw another drop in the value of mineral fuel export value. The aggregate estimated value of nonfuel mineral commodity exports has increased regularly, although not steadily, since 1984 and substantially surpassed the 1980 previous record high with its 25.5% gain between 1987 and 1988.

This tabulation, however, shows growth in current dollars only; if it were to be recast in terms of constant dollars, the picture would not be so bright. Adjusted for inflation, using U.S. implicit price deflators for exports, the 1988 value of mineral commodity exports was only $473,633 million in terms of 1980 dollars, or only 67% of the 1980 record high.

The role of individual major mineral commodity groups in world export trade for 1983 and 1988 is evident in table 2, as is the contribution of these groups to total merchandise export trade. This table is the basis for the estimates of total value of all mineral commodity export trade that was presented in the accompanying tabulation. Table 3 demonstrates the relative importance of each of these major groups of mineral commodities in the aggregate of export trade in major mineral commodities, and reflects the constantly lower share of the total accounted for by mineral fuel commodities in each year between 1983 and 1988. Table 4 shows the change in each of the major mineral commodity groups across the same time period in terms of percent change from the level of the previous year.

Information on the geographic pattern of trade by selected major geographic and political country groups for the major mineral commodity groups shown in table 2 is available in the source publication for these data.

## CONSUMPTION

### Nonfuel Mineral Commodities

Available statistics on 1989 worldwide consumption of selected nonfuel minerals shown in table 5 show increases for 11 of 14 listed nonfuel mineral commodities with 1 unchanged from the 1988 level, a departure from the pattern of the past 2 years, in which each of the listed commodities registered gains. The 1989 results, however, were better than those for 1986 when only seven listed nonfuel mineral commodities recorded gains with one unchanged from 1985.

Consumption of the two ferrous metal raw materials listed advanced as functions of increased output of pig iron and crude steel. The increase in iron ore consumption exceeded the increase in iron ore output, suggesting a slight drawdown of world iron ore inventories. The estimated increase in iron and steel scrap consumption was slightly greater than the minuscule increase in world steel production, but it is believed that there was little change in the ratio of iron ore to scrap in steel plant feed on a global basis.

Before summarizing the nonferrous metal use situation, it is essential to comment on the nature of some of the data published. Examination of table 5 shows that separate statistics have been provided for market economy countries and for centrally planned economy countries. This has been done for two reasons. First, the consumption trends from year to year for these two groups of countries often differ because, in market economy countries, use trends are influenced to a significant extent by variations in the broader economies of the countries, whereas in centrally planned economy countries they are regulated by rigid central government economic planning. Second, however, and

| Year | Value of mineral commodity export trade (million current dollars) | | | Change in total from previous year (percent) | Mineral commodities' share of all commodities exported (percent) |
|---|---|---|---|---|---|
| | Mineral fuels | Nonfuel minerals[1] | Total | | |
| 1979 | 333,031 | 188,416 | 521,447 | 41.3 | 31.9 |
| 1980 | 483,033 | 226,848 | 709,881 | 36.1 | 35.4 |
| 1981 | 474,266 | 199,328 | 673,594 | -5.1 | 34.3 |
| 1982 | 430,384 | 180,950 | 611,334 | -9.2 | 33.1 |
| 1983 | 384,188 | 174,724 | 558,912 | -8.6 | 30.8 |
| 1984 | 378,398 | 184,701 | 563,099 | .7 | 29.5 |
| 1985[r] | 361,646 | 188,666 | 550,312 | -2.3 | 28.5 |
| 1986[r] | 262,595 | 195,384 | 457,984 | -16.8 | 21.7 |
| 1987[r] | 279,639 | 219,227 | 498,866 | 8.9 | 20.1 |
| 1988 | 266,845 | 275,050 | 541,895 | 8.6 | 19.2 |

[r]Revised.
[1]In part estimated, based on data presented in table 2 of this chapter.

perhaps more importantly, the consumption figures provided for the centrally planned economy countries are universally apparent consumption figures. That is, they represent the sum of production (often estimated) and imports, minus exports, plus or minus variations in stocks. For these countries, however, both import and export data may be significantly incomplete, and data on stocks are not available. Under the definition of apparent consumption, any change in the level of any of the component figures will result in a change in the calculated apparent consumption. Aside from the lack of stock data and the questionable nature of the completeness of trade reporting, there is the problem of the estimate of the level of production. For several commodities in this group, there are significant differences between production estimates by the Bureau of Mines and those of Metallgesellschaft AG, the source of these consumption figures. Hence, the consumption numbers provided here would differ if Bureau production numbers were substituted in the equations for those of Metallgesellschaft. For instance, substitution of the Bureau's estimates for refined copper output for 1989 would reduce the centrally planned economy countries' consumption by about 253,000 tons. Similar but smaller reductions would result for lead and zinc, but results for aluminum, cadmium, magnesium, nickel, and tin would be only little altered.

Bearing the foregoing in mind, and thus considering the consumption data for the centrally planned economy countries to be more an indicator of trends from year to year rather than a precise quantification of materials consumed, one can examine consumption changes and the relationship to production changes.

Of the eight nonferrous metals reported, five logged consumption increases, but of these, only aluminum registered a greater growth in output than in consumption. Output advanced 2.1%, but consumption advanced only 1.3%, suggesting additions to stocks. Cadmium consumption increased 4.8%, but output fell 4.0%, suggesting a substantial stock drawdown. Copper consumption increased 3.9%, and output rose by 3.3%, indicating a small stock drawdown. The 2.0% increase in lead consumption was only partly compensated by a 0.8% growth in output reflecting a further decline in stocks, and for nickel, the small consumption increase and the small output increase were virtually synchronized at 0.5%. Magnesium consumption fell by 1.4% but output increased 2.3%, apparently producing an inventory buildup. Similarly, for tin, an essentially unchanged consumption level with a 3.0% growth in output suggests a considerable growth in stocks. Finally, a drop of 0.5% in zinc consumption and a 1.0% growth in output presumably reflects an inventory increase.

Examining the differences in performances in nonferrous metal use between the market economy nations and the centrally planned economy countries, it is clear that growth in aluminum and nickel consumption was shared, the increase in cadmium use was only in market economy countries, and upturns in copper and lead consumption in market economy countries more than offset declines in the centrally planned economy countries. The decline in magnesium and zinc use was only in the market economy countries, with the drop of magnesium use there corresponding to a flat demand level in the centrally planned economy countries, and with the drop in the market economy zinc use at least partly offset by an increase in centrally planned countries.

Among the chemical and fertilizer commodities listed, only the world use of sulfur turned downward in 1989, with the consumption of nitrogenous, phosphatic, and potassic fertilizers advancing for a third consecutive year.

### Mineral Fuel Commodities

Mineral fuel and primary electric power consumption are shown in table 5 in terms of standard coal equivalent (SCE) to facilitate interfuel comparisons. The growth in the aggregate reached a new record high of 10,282 million metric tons SCE, exceeding the revised 1988 total by almost 2.7%. This increase, however, was not as large as the 3.7% growth logged between 1987 and 1988. Considering the relative share of total energy provided by each listed energy source, solid fuels lost ground slightly with liquid fuels, natural gas, and nuclear power gaining slightly and hydropower maintaining its share. The revision of data for 1988 published in the previous edition of this chapter makes it important to point out that contrary to the statement in the previous edition, the increase in liquid fuel consumption in that year did not exceed the previous record set in 1979, but that record was topped by the 1989 level.

## INVESTMENT

Comprehensive world mineral industry investment data do not exist, but limited material published on aggregates of investment in some elements of the world mineral industry suggest a continued upturn in the investment level, at least in market economy countries in 1989. Steel industry investments in Organization for Economic Cooperation and Development (OECD) countries are not yet available for 1989 but, as shown in table 6, increased by 22.1% in 1988, after showing a decrease of 5.2% (revised) in 1987. The pattern of investment ups and downs varied during 1988 within country blocs and economic alliances showing no particular trends. Investment in the steel industry by the United States increased by 58.3% between 1987 and 1988 and was 11.9% higher than the previous highest amount invested during the 1984-88 period but was still 41.5% less than the amount invested in 1983. Investment in the steel industries of the European Coal and Steel Community (ECSC) dropped again in 1988 from the revised amount for 1987, which became the first drop after several years of steady growth in what became the expanded ECSC in 1986. This drop in 1988 was the result of lower investments by Denmark, France, the Federal Republic of Germany, Ireland, Italy, Luxembourg, the Netherlands, and Spain; investments grew or remained level in Belgium, Portugal, and the United Kingdom in 1987 and 1988. A decrease in investment in the Canadian (-26.6%) steel industry was offset by increases registered by the members of the European Free Trade Association (EFTA) of 31.7%, by Japan of 19.8%, by Turkey of 22.4%, and a slight increase by the nations of Latin America. If data for the world steel industry as a whole, including those of the centrally planned economy countries, were available, the same pattern presumably would be shown as that reported; that is, it would remain fairly stable, with increases in some countries being offset by decreases in others. However, the lack of comprehensive information on the centrally planned economy countries makes it impossible to determine whether the overall trend was up or down despite recorded increases or decreases in production of the materials involved. Preliminary data show that investment levels in industries dealing with the production and/or processing of mineral commodities for

1989 will probably increase over those of 1988, as has been the case for the past several years.

Market economy petroleum industry investment, as reported by the Global Energy Component of the Chase Manhattan Bank and which has been summarized in past editions of this chapter, was not available in time for inclusion into this chapter, therefore table 7 of this chapter has not been updated from what has already been presented. However, general information for 1989 shows that investment in the petroleum industry around the world was on the increase. Reports by parts of the worldwide petroleum industry indicate that total investments increased about 10% in 1989, with the majority of the financing going to the production arm of the industry. An increase was registered by the petrochemical side of the petroleum industry, but reports indicate that there were decreases in investments in exploration, manufacturing, marketing, and distribution.

Some countries, particularly Venezuela, are making considerable long-range plans for investments in their petroleum industries as a result of continuing unrest in the Near East. Considered as a "safe" source of crude petroleum because of its relatively stable government, Venezuela, which has the world's largest proven oil reserves (59 billion barrels) outside the Near East, started, in 1989, to make long-range plans for investments in its petroleum industry. The state oil company, Petroleos de Venezuela (PDVSA), announced a $24 billion, 6-year capital investment plan coupled with new policies to encourage foreign investments. These plans are being made with an eye to the market in the United States, which imports more than one-half of the crude petroleum it consumes, and Venezuela is well situated for the market in the United States. Tankers leaving Venezuela reach the east coast of the United States in 4 days (30 days from Saudi Arabia) and the PDVSA is a very efficiently run organization. Its cost of oil exploration averages 10 cents per discovered barrel of oil ($5 per barrel in the United States) and oil production costs average $2.50 per barrel, less than 10% of the current international sales price. In late 1989, PDVSA paid $700 million to complete its purchase of Citgo Petroleum, and, as owner, now has priority access to 8,500 affiliated gasoline stations in the United States.

General information indicates that investment by the Soviets in the petroleum industry decreased during 1989 in favor of investments in areas that would put products for consumers on store shelves. The decrease in investments in virtually all aspects of the already troubled and problem-plagued Soviet petroleum industry was evident as production of crude petroleum dropped in 1989 for the first time in many years. The old and inefficient Soviet equipment can no longer handle the ever-growing need for crude petroleum to satisfy internal demand as well as to meet commitments to export contracts. In general, great uncertainty looms in the worldwide petroleum industry. Investors seemingly are reluctant to invest in an industry that is increasingly at the mercy of so many complications, including the effects of the environmental movement, the uncertainties surrounding the economies of the U.S.S.R. and Eastern Europe, governmental policy changes, and continued unrest in the Near East.

Data on U.S. foreign investment in mineral industry activity are updated to 1989 in table 8 of this chapter. These data show that U.S. direct foreign investment in the petroleum industry remained steady in 1989, while U.S. direct foreign investment in the mining, smelting, and refining industries showed the first decrease (-6.0%) in several years. Reinvested earnings of foreign affiliates showed the same pattern of declining in the smelting and metals fabricating sectors (-11.0%) while increasing substantially in the petroleum sector. While the reinvested earnings in the smelting and fabricated metals industries declined after 3 years of steady growth, the petroleum industry again reversed from the dramatic 97.5% decrease in 1988 from 1987 to a dramatic increase in 1989 from 1988 to a level slightly higher than in 1986. Income showed the same reversed, divergent paths. Income from mining, smelting, and refining decreased by 2.5% in 1989, but there was an increase of 7.5% in income from the petroleum industry.

Direct foreign investment in the United States in 1989 totaled $64.6 billion, down from the $72.7 billion of 1988, but still well above that of earlier years. According to the U.S. Department of Commerce, the United Kingdom lead in this investment in 1989 with purchases of $22 billion, followed by Japan ($14.9 billion), Australia ($4.5 billion), Canada ($3.9 billion), the Netherlands ($3.3 billion), France ($3.1 billion), the Federal Republic of Germany ($2.5 billion), and all others ($10.4 billion). Direct foreign investment in other areas of the world is likely to change dramatically in the next few years. The political changes in eastern Europe and the U.S.S.R. may very well cause shifts in investment patterns by the investing countries. Many of the mining and metals processing industries, as well as the petroleum and natural gas industries, of eastern Europe are extremely inefficient and outmoded. If these industries are to be brought up to the standards that will make them environmentally and economically viable and competitive on the world market, then much capital must be invested in their modernization and reorganization.

## TRANSPORTATION

### Marine Transport

Bulk carriers, freighters, and tankers are the three classes of marine vessels engaged in transporting mineral commodities. However, vessels in each of these categories are not devoted wholly to mineral commodity transport. Bulk carriers move agricultural products as well as crude minerals and mineral fertilizers, as ore/bulk/oil carriers also do. Freighters, owing to their great variety, can be devoted wholly to hauling mineral products or wholly to moving nonmineral goods, as well as carrying mixed mineral and nonmineral cargoes. They include general cargo carriers, full containerships, partial containerships, roll-on/roll-off ships, and barge carriers. Tankers, although largely engaged in moving crude oil and refinery products, also transport liquid chemicals, molasses, wine, liquefied natural gas, and other fluids.

Although physical characteristics of vessels, such as size, draft, crew requirements, and type of propulsion system, as well as fuel costs, have an undeniable influence on shipping industry performance, problems of and changes in the quantity and quality and types of material moved also significantly affect the shipping sector of the world economy. Unfortunately, comprehensive data in this regard are not available.

***Bulk Carriers.***—During 1989, the world's bulk carrier fleet increased by 3 vessels compared with decreases of 30 vessels in 1988 and 407 vessels in 1987. Although it was only 3 vessels, this was the

second increase in 5 years; 227 vessels were added to this fleet in 1985. During 1989, the total deadweight tonnage of bulk carriers increased by 2.5% compared with an increase of 1.5% in 1988 and a decrease of 1.3% in 1987. The average deadweight tonnage of bulk carriers increased by 2.3% in 1989 to 43,670 tons from 42,679 tons in 1988. The tabulation shows the distribution of the bulk carrier fleet of the world as of December 31, 1989.

| Country of registry | Number of vessels | Deadweight tonnage (thousand long tons) |
|---|---|---|
| Panama | 854 | 31,817 |
| Liberia | 511 | 27,989 |
| Japan | 287 | 18,468 |
| Greece | 442 | 18,365 |
| Cyprus | 410 | 15,742 |
| Philippines | 285 | 12,479 |
| Norway (NIS) | 177 | 10,299 |
| British Dependencies | 176 | 9,810 |
| Korea, Republic of | 154 | 8,415 |
| China | 240 | 8,098 |
| U.S.S.R. | 244 | 7,060 |
| India | 118 | 5,101 |
| Brazil | 94 | 5,071 |
| Bahamas | 114 | 5,020 |
| Italy | 67 | 4,334 |
| Taiwan | 63 | 4,212 |
| Yugoslavia | 90 | 3,451 |
| Singapore | 70 | 3,391 |
| Romania | 70 | 2,993 |
| Poland | 92 | 2,593 |
| Turkey | 58 | 2,553 |
| Malta | 79 | 2,441 |
| Belgium | 20 | 1,988 |
| Australia | 29 | 1,873 |
| Iran | 50 | 1,771 |
| Spain | 43 | 1,477 |
| Other | 541 | 17,805 |
| Total | 5,335 | 233,139 |

***Freighters.***—The world's freighter fleet decreased in 1989 by 323 vessels compared with a decrease in 1988 of 54 vessels and a decrease in 1987 of 214 vessels. Despite the decrease in the number of vessels during 1989, the total deadweight tonnage of the freighter fleet remained about the same, decreasing by 0.01% compared with decreases in 1988 of 1.0% and in 1987 of 6.1%. Thus, there was virtually no decrease in the average tonnage of freighters despite the loss of 2.6% of the fleet. The tabulation shows the distribution of the world's freighter fleet at the end of 1989.

| Country of registry | Number of vessels | Deadweight tonnage (thousand long tons) |
|---|---|---|
| Panama | 1,707 | 17,164 |
| U.S.S.R. | 1,732 | 11,543 |
| China | 860 | 8,664 |
| United States | 371 | 7,237 |
| Cyprus | 537 | 5,082 |
| Liberia | 311 | 4,843 |
| Japan | 411 | 3,575 |
| Singapore | 216 | 2,997 |
| Germany, Federal Republic of | 244 | 2,918 |
| Taiwan | 147 | 2,804 |
| Greece | 238 | 2,781 |
| British Dependencies | 252 | 2,444 |
| Bahamas | 225 | 2,233 |
| Netherlands | 256 | 2,149 |
| Yugoslavia | 167 | 1,954 |
| Korea, Republic of | 211 | 1,883 |
| Denmark (DIS) | 136 | 1,799 |
| Philippines | 225 | 1,753 |
| India | 112 | 1,705 |
| Romania | 220 | 1,647 |
| United Kingdom | 89 | 1,578 |
| Poland | 143 | 1,408 |
| Italy | 181 | 1,381 |
| Brazil | 114 | 1,127 |
| Turkey | 202 | 1,099 |
| Other | 2,888 | 24,292 |
| Total | 12,195 | 118,060 |

***Tankers.***—The world's tanker fleet decreased by 117 vessels in 1989, the first decrease in 3 years following increases of 160 vessels in 1988 and 91 vessel as in 1987 as opposed to decreases of 457 vessels in 1986 and 26 vessels in 1985. Despite the decrease of total deadweight tonnage in 1989 of 1.1%, the average deadweight tonnage in 1989 increased by the same ratio of 1.1%, continuing the trend of the past several years to the use of medium-size tankers. The tabulation presents the distribution of the tanker fleet of the world at the end of 1989.

Information gleaned from articles and reports concerning the world's merchant fleet indicated that the total deadweight tonnage of combination, bulk carriers, freighters, and tankers increased slightly during 1989 despite a drop of 485 in the total number of vessels to 22,983 from 23,468 during the year. During 1989, 16 vessels were lost and 123 were scrapped, which was a loss of 807,000 and 2,044,000 deadweight tons, respectively. Deliveries of 484 new vessels with a total deadweight tonnage of 19,316,000 and adjustments for remeasurements or temporary or permanent deactivation of minus 830 vessels totaling 13,895,000 deadweight tons resulted in the yearend figures. New deliveries in 1989 of bulk carriers and tankers, the 2 categories of ships most involved in international mineral commodity transport, saw decreases compared with those of 1988 in the number of vessels. The number of bulk carriers decreased by only 1 ship (-0.9%) while the total deadweight tonnage increased by 561,000 tons (+8.9%). The number of deliveries of new

| Country of registry | Number of vessels | Deadweight tonnage (thousand long tons) |
|---|---|---|
| Liberia | 574 | 55,366 |
| Panama | 590 | 21,340 |
| Norway (NIS) | 261 | 17,009 |
| United States | 239 | 15,754 |
| Greece | 203 | 15,285 |
| Japan | 295 | 14,144 |
| British Dependencies | 111 | 12,542 |
| Bahamas | 159 | 12,322 |
| Cyprus | 104 | 8,899 |
| U.S.S.R. | 420 | 7,061 |
| Singapore | 121 | 5,106 |
| Iran | 35 | 5,044 |
| Italy | 222 | 4,737 |
| Denmark (DIS) | 54 | 3,984 |
| France | 51 | 3,715 |
| Brazil | 83 | 3,555 |
| Spain | 80 | 3,321 |
| India | 63 | 3,030 |
| China | 168 | 2,778 |
| Malta | 68 | 2,614 |
| Saudia Arabia | 32 | 2,270 |
| Kuwait | 24 | 2,192 |
| Isle of Man | 42 | 1,944 |
| United Kingdom | 68 | 1,854 |
| Korea, Republic of | 64 | 1,611 |
| Iraq | 20 | 1,508 |
| Other | 982 | 22,938 |
| Total | 5,133 | 251,923 |

tankers decreased by 61 vessels (-27.7%) and the total deadweight tonnage decreased by 3,103,000 tons (-23.8%). The trend in bulk carriers is toward larger ships, with the average size of ships on order being 74,000 deadweight tons while the existing fleet averages 43,000 deadweight tons. The following tabulation shows the deliveries of new oceangoing merchant vessels during 1988 and 1989 by vessel type and deadweight tonnage.

| | 1988 | 1989 |
|---|---|---|
| Number: | | |
| Combination | 27 | 8 |
| Freighter | 330 | 203 |
| Bulk carrier | 115 | 114 |
| Tanker | 220 | 159 |
| Total | 692 | 484 |
| Deadweight tonnage (thousand long tons): | | |
| Combination | 130 | 35 |
| Freighter | 4,178 | 2,502 |
| Bulk carrier | 6,300 | 6,861 |
| Tanker | 13,021 | 9,918 |
| Total | 23,629 | 19,316 |

Known ship scrappings and losses during 1989 were as follows, with thousand deadweight tons in parenthesis following the number of vessels: combinations—5 (35); bulk carriers—16 (593); freighters—86 (822); and tankers—32 (1,402). The total broken up for scrap or lost during 1989 fell to 2.85 million deadweight tons, a 5% drop from the tonnage scrapped or lost during 1988. The resale value of large tankers again remained above scrap metal value in 1989, which helped prevent scrapping, and continued the rise since the early 1980's when a surplus of ships reduced prices. Large tankers, at the end of 1989, were estimated to be worth at least $40 million each, compared with about $100 million each for a comparable new ship, and are also usually immediately available for service.

Information furnished by the Maritime Administration, an agency of the U.S. Department of Transportation, shows that the average deadweight tonnage of new tankers delivered during 1989 was 62,377 long tons, which continued the trend of the past few years to the use of tankers in the small to medium range. This, however, was an increase of only 5% over the average deadweight tonnage of the tankers delivered during 1988 compared with a 15% average increase during the previous year. The following tabulation shows the number and percentage of the total of the major types of oceangoing merchant vessels under construction or on order for the years 1985-89.

| | As of December 31 | | | | |
|---|---|---|---|---|---|
| | 1985 | 1986 | 1987 | 1988 | 1989 |
| Number: | | | | | |
| Combination | 14 | 19 | 19 | 27 | 48 |
| Freighter | 513 | 397 | 401 | 290 | 708 |
| Bulk carrier | 429 | 274 | 190 | 181 | 260 |
| Tanker | 264 | 222 | 302 | 210 | 490 |
| Total | 1,220 | 912 | 926 | 708 | 1,506 |
| Percent: | | | | | |
| Combination | 1.1 | 2.1 | 3.5 | 3.9 | 3.2 |
| Freighter | 42.1 | 43.6 | 43.3 | 41.0 | 47.0 |
| Bulk carrier | 35.2 | 30.0 | 20.5 | 25.5 | 17.3 |
| Tanker | 21.6 | 24.3 | 32.7 | 29.6 | 32.5 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

The following tabulation shows the deadweight tonnage of oceangoing merchant ships on order at the end of 1989 by the country of construction.

| Country | Deadweight tonnage (thousand long tons) |
|---|---|
| Japan | 21,985.7 |
| Korea, Republic of | 16,376.9 |
| Denmark | 2,801.3 |
| Yugoslavia | 2,628.9 |
| Spain | 1,663.5 |
| Brazil | 1,588.9 |
| Germany, Federal Republic of | 1,517.1 |
| China | 1,506.7 |
| Taiwan | 1,418.6 |
| Italy | 1,356.6 |
| Poland | 1,236.2 |
| Romania | 878.1 |
| German Democratic Republic | 629.3 |
| United Kingdom | 617.0 |
| Others | 4,155.8 |
| Total | 60,360.6 |

## Ocean Freight Rates

Data on ocean freight rates that, in the past, had been published by the United Nations are no longer available. Other sources, however, provide information that is indicative of this broad area. Considering ocean shipping rates for iron ore as representative of dry cargo in general, these average rates increased during 1989 from a low of no change for iron ore shipped from Brazil to the Netherlands to a high of 28% for iron ore shipped from Brazil to Japan. This was a smaller range of increases than during 1988 when comparable rates increased from 16% to 51% from Australia to Europe and Brazil to Japan, respectively. The yearly average rate for shipping iron ore from Canada to Europe increased 27% between 1988 and 1989 although there was an increase of only about 18% in the value of the material itself during the same period. In addition to the value of the material being shipped, other factors determine the variance of these rates. These factors include the size of the ship, the availability of different size ships, the cost of marine fuel, and the general economic conditions in the importing countries.

Tanker rates, as usual, generally followed the same trend as for dry cargo and ended 1989 somewhat higher than at the beginning of the year. Increased demand for internationally shipped crude oil coupled with increased investment in tankers by owners are resulting in increased tanker rates. According to industry sources, rates for large tankers in 1985

averaged about $5,000 per day but by late 1988 the rates had reached an average of $16,000 per day and, in 1989, surpassed the $20,000 per day mark. Freight rates for crude petroleum rose in 1989 an average of about 5% over comparable rates for 1988 and continued the trend of the past several years despite the end to the "tanker war" in the Persian Gulf in 1988 and the subsequent oversupply of crude petroleum on the world market.

### Panama and Suez Canals

Revised data on fiscal year 1988 shipments through the Panama Canal showed an increase of 1.0% in mineral commodity movements rather than the decline as previously reported, but a slight decline of 0.3% was reported for fiscal year 1989.

| | Fiscal year[1] | | | | |
|---|---|---|---|---|---|
| | 1985 | 1986 | 1987 | 1988 | 1989 |
| Number of transits: | | | | | |
| Commercial ocean traffic | 11,515 | 11,925 | 12,230 | 12,234 | 11,989 |
| Other traffic | 1,251 | 1,353 | 1,214 | 1,207 | 1,400 |
| Total | 12,766 | 13,278 | 13,444 | 13,441 | 13,389 |
| Cargo moved (thousand metric tons): | | | | | |
| Commercial ocean traffic: | | | | | |
| Mineral commodities | 74,128 | 74,139 | r68,890 | 69,586 | 69,461 |
| Other commodities | 66,740 | 68,052 | r82,187 | 89,408 | 84,609 |
| Subtotal | 140,868 | 142,191 | 151,077 | 158,994 | 154,070 |
| Other traffic | 265 | 184 | 212 | 303 | 236 |
| Total | 141,133 | 142,375 | 151,289 | 159,297 | 154,306 |

rRevised.
[1]Year ending Sept. 30 of that stated.

In fiscal year 1989, mineral commodities accounted for 45.1% of all commercial ocean traffic through the Panama Canal, a larger percentage than the 43.8% in 1988 and a result in the drop of movements of nonmineral commodities through the canal in 1989. Table 10 shows mineral commodity movements through this canal during 1987-89 by major mineral groups.

In terms of major mineral commodity groups, fuels remained dominant in 1989 but dropped again both in terms of quantity and share, registering a 6.0% decline on a tonnage basis to account for only 45.8% of the total mineral commodities transiting the canal compared with 48.6% in 1988 and 49.4% in 1987. Industrial minerals remained in second place in 1989, with a 3.9% increase in tonnage, to account for 27.4% of total mineral commodities compared with 26.3% and 26.4% (revised) in 1988 and 1987, respectively. Total metals remained in third place in 1989 with a 6.9% increase in tonnage, to account for 26.9% of total mineral commodities, up from 25.1% in 1988 and 23.5% (revised) in 1987.

Iron and steel ingots and semimanufactures remained the dominant single metals class, and fertilizer materials were again the overwhelmingly dominant industrial minerals class. Refined petroleum products were for the sixth consecutive year the dominant fuel commodity although they dropped by 9.4% and remained less than one-half of the mineral fuels moved through the canal during 1989. The amount of mineral commodities moved through the Panama Canal continued to decrease despite increases in various materials over the years, such as movements of bauxite and alumina (which increased by 62.8% in 1989) and unspecified ores and concentrates (which increased by 13.6% in 1989) from the Pacific to the Atlantic. The economic sanctions by the United States against Panama and the subsequent military intervention in Panama by U.S. forces near yearend 1989 had little-to-no direct effect on the functioning of the waterway. Actions and harassment against many of the 7,600 employees of the Canal Commission by the Panamanian Government during the year caused severe morale problems but did not disrupt the working of the canal since the Noreiga Panamanian Government was adamant about avoiding any action that could be interpreted as a threat to the canal. The drop of $10 million in revenue for the canal during 1989 was attributed to plummeting grain sales, a slump in imports of Japanese cars by the United States, and generally slow economic conditions in Japan and the United States.

The civilian Government installed after the invasion by the United States has to make long-term decisions about the operation of the canal because they are to take over completely in 1999. One of the decisions that has to be made is if the Panamanians want to try to operate the canal at a profit. As mandated by the U.S. Congress, the Panama Canal Commission has operated the canal on a break-even basis, and, since 1979, has taken in $4 billion and spent $4 billion. In the short term, the Panamanian Government has to decide how to show shippers that they intend to run the canal in a businesslike manner. Some analysts have suggested that the best way to do this is to rehabilitate the canal's two ports, Balboa on the Gulf of Panama and Christobal on the Caribbean, both of which are run by the Panamanian Government. Balboa, where ships enter from the Pacific Ocean, is mainly a refueling and servicing depot for ships using the canal; Christobal, on the Atlantic side, handles a huge volume of goods going through the Colon Free Zone, the world's largest duty-free port after Hong Kong. During the 1980's, however, maintenance and security fell off at these and the country's other ports, resulting in rotting docks and rusting and broken equipment. It will be essential for the new Government to demonstrate that this condition can be reversed and that the canal can operate smoothly and efficiently as a sound business venture.

Information on mineral commodity shipments through the Suez Canal during 1988 and 1989 was not available to the Bureau of Mines in time to be included in this edition of this chapter.

### Overland Transport

The paucity of detailed information available has prevented a comprehensive study of the overland international transport of mineral commodities. Large-scale international rail shipments of mineral commodities were confined chiefly to movements between the United States and Canada and Mexico and to transfers within Europe south of the Baltic Sea. Notable exceptions continued to be the

shipment of large quantities of iron ore from Sweden to Narvik, Norway, for loading onto vessels for export through that port, and to the flow of a variety of minerals from several southern African nations through the Republic of South Africa for export through that country's ports. During 1989, efforts were continued to restore regular service on rail lines in Mozambique and Zaire to lessen the dependence on the railroads and ports of the Republic of South Africa by the nations in that area, but economic conditions and continuing guerrilla activity and civil unrest prevented this from becoming a reality. Although not on an international rail line, the rail tunnel through Canada's western Selkirk Mountains was completed in 1989. This tunnel provides Canada's transcontinental main line the capability to carry raw materials such as coal, potash, and sulfur from the Canadian interior smoothly and without interruption to the west coast for shipment to countries on the Pacific Rim. Inland rail rates often, however, determine whether or not the material being transported can compete on the world market. Although Canada has an extremely flexible and efficient rail system, the long haulage distances can result in a cost disadvantage on the world market. Canadian coal typically travels between 1,000 and 2,000 kilometers from producer to export ports. With the resulting costs of about $20 per metric ton, the Canadian coal gets a great deal of competition from coals from countries such as the Republic of South Africa, which also has very efficient mining and transportation, but shorter internal haulage distances that reduce the haulage costs to about $8 per metric ton. A new rail service was initiated in the Republic of South Africa in 1989 that operates 200-car trains at a maximum speed of 90 kilometers per hour compared with the previous speed of 60 kilometers per hour, making Transvaal coal exported through Richards Bay even more competitive on the world market.

Major international pipeline movements of crude petroleum and natural gas in 1989 were, in general, confined to the same area cited as the centers of rail movements of mineral commodities. Noteworthy here, however, was the continuing operation of the pipelines for both oil and natural gas from the U.S.S.R. to the other centrally planned economy countries and on to some market economy countries of Europe despite growing problems in the Soviet petroleum and natural gas industries.

Information on rail and pipeline transport of mineral commodities within certain individual countries is provided in the appropriate country chapter.

## PRICES

Comprehensive data on market prices for crude minerals and mineral products for the world as a whole do not exist, and even the data that are available are not necessarily compatible between countries, particularly between the market economy countries and the centrally planned economy countries. Further, it should be evident that the actual delivered price for a small quantity of any specific commodity at some point substantially removed from a production facility or a seacoast port will differ appreciably from that for a large volume of the same product at or near its production source or a major import center.

Nevertheless, the regularly published prices of selected major mineral commodities in key market areas can be regarded as indicative of general world price trends.

Tables 11, 12, and 13 summarize prices for selected metals in the United States, the United Kingdom, and Canada, respectively, for 1985-89 inclusive, with monthly data provided for 1989. In broadest overview, of the 20 prices listed in the tables, 11 showed advances in the annual averages between 1988 and 1989, 8 showed declines, and 1989 data were not yet available for 1 (although presumably it would reflect an upturn). These results were considerably less impressive than those recorded between 1987 and 1988 when 16 showed upturns and only 4 showed drops.

Of the 11 prices recording gains, copper was higher in both the U.S. and British market, with the Canadian figure being unreported. For the red metal, the price advances for both markets exceeded the inflationary rates for a third consecutive year, although the 1988-89 gain was much less than that registered for the past 2 years. The Canadian copper price, unreported for 1989, had shown significant advances in both 1987 and 1988, and indeed had registered a slight upturn between 1985 and 1986. This latter price increase, however, which corresponded to declines on the U.S. and British markets, nevertheless had been so small that it was not even sufficient to compensate for inflation. Although the annual average prices in 1989 were appreciably higher than those of 1988, examination of the monthly results demonstrates a generally downward trend across the year, with the December 1989 price in both the United States and the United Kingdom significantly below the 1988 average.

Lead recorded advances in the annual average price on all three markets in 1989, in each case marking a fourth consecutive year in which the average increased. Moreover, except in the case of the United Kingdom increase in 1989 and the Canadian increase in 1988, the rise in the average price exceeded the inflationary rate. For lead, monthly prices seesawed across the year, and although the December 1989 average exceeded the 1988 annual average in each market, there were clear indications of a modest yearend downturn.

Zinc likewise registered upturns far and away above the inflationary rate in 1989 and as with copper, the increases in each market were for a third consecutive year. In each market, all gains in 1987, 1988, and 1989 topped the inflation rate, with those in 1989 being intermediate, on a percentage basis, between the lower increases between 1986 and 1987 and the phenomenally high increases between 1987 and 1988. Monthly 1989 zinc prices peaked in each market in March, and with modest fluctuations thereafter, edged downward, reaching their lowest 1989 levels in November (United Kingdom) and December (United States and Canada). Despite the declines, however, the yearend monthly prices were still substantially above the 1988 annual average.

In marked contrast to the price upturns for copper, lead, and zinc were the substantial declines in the aluminum prices on both the United States and United Kingdom markets. The 20% drop in the United States in terms of the annual average price and the corresponding 25% drop in the United Kingdom would appear even more significant if inflation were taken into account. Although there were some minor upturns across the year in monthly results, the price trend in both markets was down, with January averages being the highest and December averages being the lowest.

In each of the three markets, the annual average 1989 silver price was below that of 1988, repeating the 1987 to 1988 performance. On a monthly basis, there was a general downturn from January until September, followed by a partial recovery.

The 1989 annual average United Kingdom gold price, the only one shown for the yellow metal, was almost 13% below the 1988 average, but despite a general drop to a low point in September edged back up by December to a level higher than any prior 1989 monthly level.

The sole nickel price shown is recorded on table 13 as a Canadian price, although since 1987 it actually has been the New York dealer price. It fell by 1.8% in terms of the annual 1989 average compared with the 1988 average. However, this small drop in the annual average price failed to reflect the pattern across the year. After peaking at US$8.33 per pound in February, it declined to only US$3.94 per pound in December, a level that was only slightly higher than the US$3.89 of February 1988; the last month for which it was below the US$4.00 level.

In contrast, tin, in both the United States and the United Kingdom, price listings logged a 1989 average price that was of the order of 20% above that of 1988. (The prices listed in the United Kingdom table are the Kuala Lumpur, Malaysia prices for 1988 on.) In the United Kingdom price listing, the April monthly average was the high point across the year; in the United States, the price peaked in May. From these points on, the average monthly prices declined, and on both markets reached levels below the 1988 average by yearend.

In contrast to its companion metal, nickel, cobalt enjoyed a generally improved year in 1989 with a 7.8% increase in the average annual price. The October monthly price was the highest attained during the year, but the subsequent modest drop seemed just that.

Finally, the 17% decline in the annual average cadmium price was no doubt disappointing to producers, as was the generally downward trend across the year (August's figure apparently was a statistical aberration). Nevertheless, the low December average price of $5.22 per pound was far above the less than $2.00 per pound prices that prevailed during the years up to and including 1987.

The 1989 prices for iron ore for shipment to Europe varied substantially according to origin and physical nature of the product, as one might well expect. Expressed on a DWT-f.o.b. basis, as reported by the United Nations Conference on Trade and Development's Trust Fund Project on Iron Ore, pellets ranged from a low of 45.90 cents per Fe-unit for those from Bong in Liberia to 53.50 cents per Fe-unit for those from Sweden's Luossavaara Kiirunavaara AB (LKAB). Lump ore prices on the same basis varied from 27.10 cents per Fe-unit for Iscor Ltd.'s South African product to 29.56 cents for Societe Nationale Industrielle et Miniere's product from Mauritania. For fines, again on the same basis, the prices varied from a low of 20.70 cents per Fe-unit for Iscor's South African material to 30.50 cents per Fe-unit for LKAB fines (MAF) from Sweden. Australian ores, quoted on a cost and freight basis at Rotterdam, varied from a low of 16.20 cents per Fe-unit for Robe River fines to 35.30 cents per Fe-unit for the intermediate Hamersly or Mount Newman fines, and on to highs of 43.00 cents per Fe-unit for lump ore from Hamersly or Mount Newman lump ore. Price advances from 1988 levels varied considerably, but most were between 13% and 21%.

Prices for ores to be delivered to the Japanese market were, on an f.o.b. basis, generally similar to those sited for the European market, ranging from a low of 16.69 cents per Fe-unit for Taharoa iron sand from New Zealand to 45.20 cents per Fe-unit for Nibrasco pellets from Brazil. As on the European market, price increases over the levels of 1988 were variable, with an increase for Liberian Lamco fines of only 4.3% being typically low. Most increases were between 13% and 18%.

Among the industrial minerals and their chemical derivatives, contract prices for exported sulfur on an f.o.b. basis were substantially lower in the second half of 1989 for several major marketing areas. U.S. exports, f.o.b. U.S. Gulf of Mexico ports, dropped from a $110 to $115 per ton range in the first half of the year to a $79 to $85 per ton range in the second half. Similarly, Canadian exports, f.o.b. Vancouver, dropped from a first half year range of $105 to $113 per ton to $80 to $95 per ton for the last 6 months. Middle East sulfur, f.o.b. Persian Gulf ports, ranged from $95 to $105 per ton for the first half of 1989 and fell to a $81 to $90 per ton range for the remainder of the year. Only the Polish export market showed a somewhat anomalous behavior; for the first half of 1989, the quoted prices ranged $110 to $118 per ton, f.o.b. Gdansk, and for the second half of the year were reported as $100 to $120 per ton—a lower bottom price on the second half year range, but a higher top price for that period.

As a measure of nitrogen material prices, urea, f.o.b. East European ports in bulk, was at a level of about $120 per ton in January but fell rather sharply between February and July to about $75 per ton. Thereafter urea edged back up to slightly more than $85 per ton by September and then slumped slightly under $80 per ton in October and November. By yearend, however, the urea again increased to a level of $80 per ton. In comparison, the higher price for bagged Middle East product, f.o.b. ports in that area, started the year at a level slightly under $150 per ton, fell significantly beginning in April and plunged to a low of $70 per ton by August, a level notably below that of the bulk East European product. The Middle East bagged product price, however, climbed rapidly again through the waning months of the year to close at about $105 per ton.

In the case of ammonia, another nitrogen product regularly examined, the c&f price in northwest Europe started 1989 slightly more than $160 per ton, edged slightly higher in February, and then fell sharply to about $90 per ton by September and then moved upward again, closing the year between $110 and $120 per ton. The obviously lower f.o.b. Caribbean ports ammonia price began the year at about $130 per ton and advanced to about $135 per ton in February. Thereafter, it fell to barely $60 per ton in July and then moved generally upward gradually to end the year at about $75 per ton.

Ammonium sulfate in the U.S. Gulf of Mexico area began the year at about $58 per ton, f.o.b. on a bulk basis, and advanced in steps to about $64 per ton in August, and thereafter declined to $55 per ton at yearend. The West European bulk f.o.b. price was at about $63 per ton at the outset of 1989, moved up to $64 per ton in February and held that level through May. This price then declined to $59 to $60 per ton through September and then plunged to $44 per ton at yearend.

Among phosphatic materials, there was a divergence in detailed price patterns through 1989, but they ended the year universally lower than they were at the start of the year. Phosphoric acid, on the basis of f.o.b. U.S. Gulf of Mexico ports, stood at about $380 per ton of contained $P_2O_5$ from January through May and fell sharply to about $340 per ton of contained $P_2O_5$ in June and edged slightly down thereafter, ending the year at about $335 per ton of contained $P_2O_5$. Diammonium phosphate, f.o.b. U.S. Gulf of Mexico on

a bulk basis, began 1989 at $195 per ton, generally moved down to a low of a little better than $165 per ton in June, recovered to about $187 per ton in August, thereafter falling to about $148 per ton at yearend.

The triple super phosphate price, f.o.b. U.S. Gulf bulk rate, was at about $162 per year in January 1989, a rate that held through March, at which point in time it started to fall and recorded an almost even decline to just over $125 per ton at yearend.

Potash prices, at least as measured for standard potassium chloride, f.o.b. Vancouver were generally flat, starting 1989 just under $100 per ton and holding that level through July, at which point they slumped slightly over the next 3 months to the just-over $96 level that prevailed through yearend.

World cement prices vary substantially from area to area, and an overall analysis would be far too extensive, even in summary form, to present here. In the United States, the price, expressed in terms of the average value at mills, advanced only 0.7% in 1989 over the 1988 level, to the equivalent of $54.23 per metric ton. Taking into account inflation, however, the price could be viewed as dropping by 3.3%. In fact, on a constant dollar basis, the price of cement in the United States has declined almost constantly from 1985 to the present.

The topic of energy material prices on a global basis is very complex, both from the viewpoint of monetary equivalency and that of the exceedingly variable nature of the material involved. For this reason, the following summary can only touch on broadest generalities. Moreover, the energy material picture is deficient because of the lack of information on much of the material produced, traded, and consumed within the centrally planned economy nations that is truly comparable with that available for market economy countries. The U.S. Department of Energy's compilation of average world crude oil prices shows an increase of 39% between January 1, 1989 and January 1, 1990, from $13.58 to $18.91 per barrel, but this average covers only the f.o.b. prices of internationally traded oil. Moreover, these global year-start-to-yearend results are a tremendous oversimplification of actual changes across the year and from one area to the next. For details, either by area or in terms of a time series within the year, the reader is referred to the Energy Information Administration's publication "Weekly Petroleum Status Report." In broadest terms, the global average began the year on an upturn, and with two minor periods of dropoff, reached almost $19 per barrel in early April. At that time, it began to move generally downward with occasional minor upturns, to a low of about $15.30 per barrel in mid-August. Thereafter, it moved erratically upward, with occasional minor downturns, to the yearend level of $18.91 per barrel.

Summarizing only yearend figures for major country groups, crude oil from the Organization of Petroleum Exportiing Countries (OPEC) member states registered a 40% increase from $13.36 per barrel on January 1, 1989, to $18.72 on January 1, 1990. Corresponding figures for non-OPEC countries were $14.06 per barrel on January 1, 1989, to $19.29 per barrel on January 1, 1990. The latter figures include the United States, which showed an increase from $13.41 to $18.87 per barrel across the year.

Prices on refinery products are entirely too complex to be discussed here in detail; however, it can be noted that the general upturn in crude oil prices was generally reflected in available series on product prices.

Price data for coal were less comprehensive than for oil and its products, but there were figures available to suggest trend patterns. For the countries of the Organization for Economic Cooperation and Development (OECD) as a group, the average import price for coking coal in 1989 was $58.04 per ton or 5.1% above the 1988 level. Within the OECD, the countries of the European Communities (EC) recorded an average import price of $57.23, which was 2.9% above the 1988 level, and Japan reported an average import price of $58.39 per ton, 6.1% above the 1988 level. For steam coal, the OECD country average import price was $48.32 per ton, 9.8% above the 1988 level, and this figure included an EC country average price of $48.32 per ton and a Japanese price of $48.76 per ton, these figures being 8.4% and 14.4%, respectively, above 1988 levels. In the United States, the price of steam coal for industry averaged $36.41 per ton, down 1.2% from that of 1988, and the price of steam coal for electric power generation was $33.20 per ton, down 1.7% from that of 1988. The U.S. coking coal price also declined, falling 0.4% to $52.36 per ton. In Australia, the price for steam coal for industry advanced 12.4% to $32.67 per ton while that for steam coal for electric power generation moved upward 5.3% to $25.19 per ton, and the coking coal price fell from $22.88 to $22.08 per ton. It should be noted here that all the foregoing figures on coal do not correspond to those provided in the previous edition of this report, and thus should not be directly compared.

Reporting on natural gas prices is also far from comprehensive, but available information on most OECD countries suggests a drop in unit prices for almost every country listed, whether the gas is used by general industry, power generators, or households. Countries for which results were counter to this decline were Australia, Canada, Finland, Japan, and the United States. Readers desiring details are encouraged to examine the International Energy Agency's "Energy Prices and Taxes," a quarterly volume for the fourth quarter 1990.

## STATISTICAL SUMMARY OF WORLD PRODUCTION AND TRADE OF MAJOR MINERAL COMMODITIES FOR 1989

The final 26 tables of this chapter, tables 14-39, extend and expand the statistical series on production that was started in the 1963 edition of the "Area Reports: International" volume of the "Minerals Yearbook" and that was subsequently updated and expanded in the 1965 and 1967-88 editions. In this year's edition, for the first time, a column has been added to each of these tables providing a 5 year average for 1985-89, inclusive. This should provide a clearer picture more rapidly of the role of each major producer over the 5-year period. The listing order of major producers, however, continues to be, as in past years, in descending order of rank in the year of review, 1989.

With the inclusion of silver and uranium oxide in the 1988 edition of this chapter, this group of tables now includes each of the crude minerals that ranked from 1st to 19th in 1983 in terms of value of their output (as well as four others of lesser rank). These 23 crude mineral commodities accounted for 93% of the estimated value of world crude mineral of world crude mineral production in 1983. In addition, world output of five key downstream products—aluminum, steel, cement, nitrogen in ammonia, and refined

oil are included because of their significance as products.

These 26 tables are primarily a supplement to other statistical data within this chapter but also serve as a summary of international production data for major mineral commodities covered in greater detail on a commodity basis in Volume I of the 1988 "Minerals Yearbook" and on a country basis in Volume III.

In this edition, the data presented in these tables, in most instances, correspond with the data in the individual commodity world production tables appearing in Volume I and may differ somewhat from a total that might be obtained by adding figures presented for any single commodity in each of the country chapters of Volume III. This apparent disparity results from the problems of scheduling the compilation of tables in the numerous commodity and country reports in the separate volumes. In an effort to provide the user with the most up-to-date information possible, data received after completion of worldwide commodity production tables (Volume I) have been included in many of the individual country production tables (Volume III). Limitations of time, however, often prevent the incorporation of these revisions in the abbreviated versions of the world commodity tables included here. Thus, a more precise figure for total world production of any commodity could possibly be obtained by adding figures presented in the individual country chapters. For summary purposes, however, the tables of this chapter are sufficiently correct without the inclusion of all of these revisions.

The series of data on world trade in major mineral commodities that appeared in earlier editions of this chapter (tables 57-69 in the 1967 edition) could not be included because of scheduling problems.

## UPDATE AND OUTLOOK

### General Summary

World political events that occurred subsequent to yearend 1989 but that bear heavily on the global mineral industry have been of such significance that they cannot be disregarded, and certainly they contribute to any type of "outlook." However, to write of them simply as "forecasts" in an "outlook" section of this study would be to unjustly pretend to status as prophets. Thus, this section covers events that have occurred not as predictions but rather as history. The section also includes an element with some broad statistical information, but this is included last rather than first for two reasons: the information is subject to considerable revision as additional data become available and as preliminary returns are corrected; and the authors view it as less important than the events that govern the statistics.

***The Near East and the Crisis There.***—Of all 1990 political events influencing the world's mineral industry, the Iraqi invasion of Kuwait and the remarkable events that followed this aggression must head the list. The almost immediate imposition of economic sanctions, involving embargoes on shipment of virtually all goods into and out of Iraq, caused severe dislocations in the production and trade of mineral commodities, not only within the region itself, but with a ripple effect, into other world areas as well.

Most notably, production of crude oil and sulfur for the export market was almost immediately interrupted in both Iraq and Kuwait, there being no viable means of export deliveries of either product, except for oil into the tiny Jordanian market. Together, Iraq and Kuwait had produced about 7.5% of the world's oil and 3.1% of the world's sulfur in 1989, and the imposition of embargoes under the United Nations Security Council Resolution No. 661 of 6 August 1990 effectively terminated output, except that for internal use, as of that date.

The Iraqi invasion of Kuwait not only led to the virtual end of oil and sulfur production for world markets in these two countries, but it further provided a threat to the even more substantial production of oil in Saudi Arabia on Iraq's southern border. That country accounted for 8.6% of the world's 1989 output as well as 2.5% of the 1989 world total sulfur production, the latter as a byproduct of petroleum. Because Saudi Arabia's production, processing, and loading facilities are sited within the range of Iraqi aircraft and missiles, that country was one of the key members of the coalition organized to confront Iraq. Indeed, the prospects of a multicountry Near East war could have had a disastrous direct effect on economic activity of many countries: Turkey on Iraq's northern border, Iran on its eastern border, Syria and Jordan on Iraq's west, as well as nearby Israel and Lebanon, and the Arabian Peninsula states of Bahrain, Oman, Qatar, and the United Arab Emirates to the southeast. Just as significant was the threat to the economies of the veritable host of countries dependent on oil from the entire Persian Gulf area.

The initial threat of war in August led to upturning oil prices, but these subsided to a degree as it appeared that open warfare was not in the immediate offing. From a total mineral industry perspective, not only were oil and sulfur operations threatened, but so to were the other growing mineral industry producing and processing facilities in the Gulf area, including but not limited to natural gas, aluminum and copper smelting and refining, and steel and nitrogen (ammonia) plants.

Following Iraq's invasion, that country engaged in a program of systematically plundering petroleum and chemical equipment from Kuwaiti facilities. This policy insured that should the Iraqis withdraw, it would be impossible for Kuwait to restart operations immediately. Further, the Iraqis prepared demolition charges to destroy much of that which they could not remove, including the oil and gas wells themselves.

In the actual event, when Operation Desert Storm swept the Iraqis out of Kuwait, destruction, particularly of oil facilities, was very extensive. Much of this was the result of intentional Iraqi destruction, but additional havoc was wrought by coalition air strikes and missile attacks against such targets as oil loading terminals from which the Iraqis were releasing oil that spread down the Persian Gulf. At this point it might be noted that the spreading intentional oil spills threatened not only the wildlife of the Persian Gulf, but also posed a critical problem relating to another absolutely vital resource of the region—its water supply. Obviously essential to sustaining human, animal, and plant life in the area, the supply of desalinized water from Persian Gulf intake plants is also critical to the region's industry.

Fortunately, the desalination facilities were adequately protected, and the greatest economic casualty of the war was the oilfields in Kuwait and oil and other industrial facilities in Iraq. The nature of the permanent damage to the petroleum reservoirs tapped by the hundreds of wells set on fire had not been fully assessed at this writing, but some authorities speculated that it could be very large. It was estimated that the fires and oil spills de-

pleted Kuwaiti oil reserves by about 3%. Other obvious economic dislocations in the area that were the result of the confrontation included the loss of revenues to Jordan, Syria, and Turkey from the restriction of oil and other material transiting these countries from Iraq destined for foreign markets, as well as for materials being imported through these countries. Further, because Syria and Turkey were linked with the coalition, any cross-border trade in mineral commodities as well as other merchandise was restricted after mid-August.

The total impact on the global mineral industry of Iraq's invasion of Kuwait and the subsequent events cannot yet be fully assessed. Obviously, some production and processing facilities will be out of service for an extended time. If indeed they all ever will be restored completely remains in doubt. Construction activity to restore damaged structures of all types—buildings, roads, bridges, airfields, and the like—will stimulate output of mineral construction materials. Likewise the replacement of damaged and destroyed mineral industry production and processing equipment will stimulate output by manufacturers of these products. Replacement of older equipment, such as in some oil refineries, will alter the relative economics of the plants in this area with respect to facilities elsewhere performing the same role. Most significantly, if the international political linkages forged in establishing the coalition against Iraq remain in place, there is at least a glimmer of hope for improved relationships throughout the region, including the several Moslem states as well as Israel. Such improved relations, should they come about, could provide a more fertile environment for investment in this region's mineral resources than has existed for the past half century.

***Eastern Europe.***—Beyond the impact of Iraq's ill-starred invasion of Kuwait and the subsequent embargo and war in that area, the beginnings of changes in mineral industry operations in Eastern Europe were probably the next most significant post-1989 events and the area in which longer ranged changes would most certainly alter global industry structure. The basic long-range goals of each of the countries involved in the transition from centrally planned economies to market economies deal with economic rationalization. Each country presumably filled a specified set of niches in the economic linkage with the U.S.S.R. in prior times, but there is no assurance that these roles will remain economically viable under a market economy system. For the past 40 years or more, these countries have been viewed by many as a rather homogenous single entity, linked inexorably to the U.S.S.R. This, however, is far from the truth. Each has its own distinct individual characteristics and thus differences from others that must be considered, although they do have certain problems, particularly broad-spectrum environmental problems, that they share. The following sections treat the countries individually.

For the German Democratic Republic, where promises of massive economic assistance from the Federal Republic of Germany provided some degree of protection from the vicissitudes of economic transition, mineral industry activities, particularly in key commodities, were expected to drop sharply. A 1990 decline of about 15% was expected in output of lignite, the country's dominant energy source, and a 25% shortfall in cement output was anticipated. Production of potash, highly significant for foreign exchange earnings, was expected to be maintained in 1990, but environmental considerations in a unified Germany did not bode well for the longer term outlook for this industry. Steel production, based on economically questionable domestic energy sources and imported iron and ferroalloying materials, was expected to log a drop of 15% or more in 1990. Much of the high-cost import-based nonferrous metals industry was expected to reduce operations, if not to close entirely, within a few years.

The one fact that sets the German Democratic Republic apart from the other former CMEA members is that through its reunion with the Federal Republic of Germany, it will enjoy an immediate direct link with the EC. All other former CMEA members will have to apply for membership and presumably meet certain standards for membership, but this was not the case for the German Democratic Republic. To be sure, as a part of reunified Germany, the area will have massive adjustments to make, but its initial membership will not be predicated upon conformity to standards before joining.

Romania, the site of the most violent overthrow of a centrally planned government in all of Eastern Europe, had managed, in effect, to liquidate its international debt prior to the governmental change. This, however, seemingly was only accomplished at the expense of goading the population to replace the Government. The lack of major international debt boded well for foreign investment; however, the domestic economy seemed none too sound, and the degree of change in the overall Government was questioned by some. Moreover, mineral industry ventures that would offer a reasonable return rate for investment were not evident. The Romanian imported-raw-material-based steel industry had been expanded out of proportion with respect to realistic, sound market economy country principles, and in fact, its growth had even been questioned within the context of its former role in CMEA. A reduction of 25% in steel output in 1990 alone seemed likely, as did a halving of bituminous coal output, a 30% reduction in lignite production, and a 25% drop in cement output.

It is notable that these levels, however, represented recoveries in output levels from the last months of 1989 and the early months of 1990, when cement output, for example, fell to only one-third of the previous average monthly rates. The plunge in production here in these months seemed to reflect the degree of civil strife that prevailed at that time.

In Czechoslovakia, early on, there were announced plans to substantially reduce production of steel over coming years, recognizing the economic inefficiency and poor environmental characteristics of the industry's facilities. However, also to be taken into account was the longstanding tradition of the country as one of the area's most technically competent producers of steel, through which the country was able to provide a greater quantity of quality products than some of its competitors.

The transitional reduction of the steel industry here, however, because of its important role in the economy, had to take into account the need to maintain indigenous industrial employment until retraining of workers and overall industrial realignment could take place. Thus, idealistic goals for transition had to be modified, at least for the near term. Declines of 5% in output of steel and cement and of 10% in aluminum were indicated for 1990, these in part related to anticipated 7% to 10% reductions in output of bituminous coal and lignite. Available information is not sufficiently detailed to assess whether the modest drop in steel output was accomplished through simply reducing out-

put of common steel, while maintaining production of higher quality products, or if it represented an across-the-board cutback.

In Poland, it appeared that idealistic goals of adjustment to the market economy system will have to be tempered with the realities of maintaining internal economic viability and employment levels and with providing vital foreign exchange earnings. Anticipated declines of 10% to 15% in bituminous coal production and 7% to 10% in lignite output for 1990 were expected to have a significant effect on domestic production of cement and steel, with reductions in output of the order of 25% and 10%, respectively, indicated. On the other hand, outputs of copper and sulfur were expected to be maintained at or near 1989 levels because of their foreign exchange earning potentials. Similarly, efforts would be made to maintain output of higher quality coal for export.

The effect of economic transition in Bulgaria was evidenced in an anticipated 1990 drop of 25% in steel output. The relatively small role of the steel industry in this country's economy apparently made the drop in planned output less fraught with indigenous economic problems than in other former CMEA countries. The impact of transition on copper, lead, and zinc operations, traditionally strong points in the country's minerals economy, could not yet be assessed.

Hungary, where the mineral industry regularly makes a more modest contribution to the economy then in other East European countries, was by no means insulated from the effects of transition. Here, bituminous coal production was expected to decline by 20% in 1990, lignite output by about 10%, and steel output was expected to fall by 15%. In contrast, cement output was expected to remain stable, if not to advance marginally. The country's bauxite industry was not immediately affected by transitional operations in 1990, and an output of only a few percentage points below the 1989 level seemed assured. In the near future, however, substantial cutbacks may occur, occasioned by mine water and other problems relating to the very nature of the deposits, problems that place Hungary in a distinctly disadvantageous position with respect to traditional market economy country bauxite producers. Moreover, because of energy costs and environmental considerations, the future existence of the country's small aluminum industry was questionable.

Albania, least industrialized of the centrally planned economy countries of Eastern Europe but nevertheless a key resource area for chromite and nickeliferous iron ore, was among the last of the countries in the region to begin the transition to a market economy. Assessment of progress in this direction, if any, was almost impossible. Markets for chromite and potentially for ferrochrome seemed relatively ensured, but the future of the nickeliferous iron ore mining operations seemed somewhat less secure. Large numbers of Albanian workers, including miners, tried to leave the country, some successfully.

***U.S.S.R.***—Not too many years ago, the world's greatest concern regarding the Soviet Union from the minerals viewpoint was its place in a so-called "resource war"—its possible quest for resources outside of the territorial limits of the country. By 1990, it appeared that a more timely concern might be whether or not the U.S.S.R. would remain as a monolithic player on the world mineral industry scene or dissolve into a host of autonomous or nearly autonomous republics, vying with each other, as well as with other countries for resources as well as for markets for their products. Although the central Soviet Government clearly was making all possible efforts to keep the constituent republics united, there was pressure from many of them for severance of at least some of the controlling ties. The Baltic republics, Latvia, Lithuania, and Estonia, each made efforts toward separation as did the Moldavian, Armenian, and Georgian republics. Intense civil strife swept the Armenian and Azerbaijan republics, and to one degree or another, there were open disorders in the Turkmen, Uzbek, Tadzhik, Kirghiz, and Kazakh republics of the south-central area. Even the Russian republic itself was not without potent political forces, that if not advocating "disunion," clamored for a greater share of management over their own activities, with a corresponding loss of control by the central Government. The latter kept up efforts to maintain some forms of central control through the revamped ministries concerned with mineral and industry activities.

Limited statistical information pointed to substantial shortfalls in targeted output levels for 1990; crude oil output apparently dropped by 6% or more, a decline for the third consecutive year and to a level below that attained in any year subsequent to 1977. The shortfall in anthracite and bituminous coal, at least in part due to strikes, was even more startling—more than 18%—and a drop in lignite output of the order of 5% was also indicated. Only in the case of natural gas among the crude mineral fuel commodities was there a suggestion of an upturn, about 4% on the basis of 10 months' data. The picture was no less dismal among the major nonfuel mineral commodities. A 2% drop in iron ore output, a 3.6% downturn in steel production and a nearly 3.3% decline in cement output were reflective of the country's plight.

Soviet governmental officials were openly suggesting that without some kind of a turnaround in the economy, the Government could fall, but they did not suggest whether the resulting alternative would be a less market-oriented centralist structure or a host of smaller states with variant approaches to achieving economic viability.

***The Common Market.***—The 12 nations of the European Communities (EC), often dubbed "The Common Market," continued to edge toward the "magic year" of 1992 with relatively little ado, perhaps chiefly because events elsewhere in the world edged them out as a noteworthy news item. Unquestionably, the major event in the EC in the post-1989 time has been the linkage of the former German Democratic Republic through its reunification with the Federal Republic of Germany. Although industrial restructuring as a result of the reunification will unquestionably lead to the closure of some former German Democratic Republic mines and mineral processing facilities, the addition of the German Democratic Republic added considerable potentilally productive capacity. Measured in terms of 1989 output, the merger would add 5.6% to the EC's steel output, 2% to its aluminum output, just under 7% to its refined copper output, almost 8% to cement output, 11% to nitrogen in ammonia output, almost 75% to its potash production, and nearly 180% to its lignite coal production. Such additions are far from inconsequential.

Preliminary figures suggest that EC steel production in 1990 declined by about 2.6% as rationalization of the industry continued. In contrast, cement output turned upward about 4% on the basis of 9 months results for most countries. Among the fuel commodities, EC output of oil moved up by about 1.5%, chiefly on the strength of producers in the United King-

dom's offshore fields, but production of anthracite and bituminous coal was expected to register a 3.5% decline, chiefly because of rationalization in the United Kingdom. Trends in these major commodities were hardly bellwethers for the nonferrous metals, where EC production of aluminum and refined lead were expected to show modest declines, in contrast to marginal upturns for refined copper and zinc.

***Yugoslavia.***—As in the U.S.S.R., disputes between the various member republics of Yugoslavia became so intense as to threaten the continuation of the union between them. The result, although more severe in 1991 than in 1990, was lower output levels for a number of mineral products, headed by steel, bauxite, aluminum, refined lead, slab zinc, cement, lignite, crude oil, and natural gas, to cite only those of greatest economic significance.

***Other Europe.***—Among the non-EC Scandinavian countries, Sweden easily maintained its preeminence as Europe's largest iron ore producer after the U.S.S.R., but output fell by about 8% to a little under 20 million tons. The country's steel industry reduced output by 5%, but remained a prominent producer of high quality-special and alloy steels. The country's well-known nonferrous industry recorded upturns in copper production, both at the mine and refined metal stage, although the latter output was in part based on imported materials. There was also an upturn in mine lead production, but a decline in the domestic lead refining activity, resulting in increased concentrate exports. Mine zinc production, historically all included for the export market, was reduced marginally. The country's modest aluminum industry also reduced output marginally.

Neighboring Norway, unquestionably market economy Europe's largest aluminum producer, increased output about 1.4% to more than 870,000 tons, using indigenous hydropower and imported aluminum raw materials. Nickel processing here, primarily based on imported raw material but including a small indigenous mine production, was increased about 5%, a shift generally counter to the world's 1990 trend. The country's zinc smelting operations, utilizing more than 85% imported raw materials, logged a 3.7% upturn in output. The country's small ferrous industry reduced iron ore output by almost 12% and cut its already-small steel production by almost 40%. Cement production too fell, in this case by just under 9%, but the country's big mineral foreign exchange earner, the petroleum industry, registered a gain of more than 9%, in part to provide supplies to markets served through August from Iraq and Kuwait.

Across the Baltic from Sweden and Norway, Finland reduced domestic mine production of both copper and zinc by about 12%, but at the same time increased the larger refined productions of both metals, copper by more than 16%, zinc by more than 8%, using imported raw materials augmented by the modest home mine productions. The country's small nickel output was increased at both the mine and plant stage, and cement output advanced marginally, but there was a 2% decline in steel production.

In Austria, the country's most significant metal product, steel, recorded a 9% decline in production to a 1990 level of about 4.3 million tons. The country's iron miners also cut output, but their production was not the principal source of supply for the domestic steel industry. Cement production was increased 8%, reflecting building industry growth. Austrian nonferrous metals producers increased mine zinc output, but the domestic supply remained inadequate to provide the feedstock for Austrian refiners. The country's already-inconsequential mine lead output declined further, but the modest import-based refined lead industry advanced output by almost 7%. There was a nearly 4% decrease in primary aluminum output in Austria, but in neighboring Switzerland, aluminum production advanced slightly, and Swiss steel output turned upward by 6%.

***Canada.***—Available preliminary statistics on Canada's mineral commodity output strongly suggest an overall downturn in activity following 1989. In fact, considering a variety of significant products, only mine copper and silver production apparently logged substantial gains, rising between 7% and 9% each.

Canadian gold output advanced by an estimated 3%, the production gain in primary aluminum was very modest, and an upturn in refined copper output was statistically insignificant. Other commodities of note logged downturns, with some of the most precipitous declines being a 9.6% drop in iron ore and an even more startling 22% decline in steel production. Output of bituminous coal, crude oil, and natural gas declined in a 1% to 2% range, and lignite output fell by more than 5%. There were precipitous drops in production of mine and refined lead (almost 16% and 23%, respectively) and slab zinc (almost 12%), and mine zinc output diminished too, but for it, at least, the drop was only about 3%. Canada's nickel industry, the largest in the market economy world, logged a nearly 6% drop in the case of mine production and almost 3% in the case of plant output. There were indications that sulfur and potash production diminished among the major crude industrial minerals and cement output fell by slightly less than 13%. Based on the just-mentioned group of production declines, a downturn of 5% to 10% in current dollars in the worth of total Canadian mineral industry output could be expected for 1990.

***Australia.***—The extremely variable performance of the world's mineral industry in the months since the end of 1989 can perhaps best be demonstrated by comparison of the performance of the mineral industry of Australia with that of Canada. Both countries fall within that small group of countries that are geographically large, economically advanced, industrially and technologically highly developed, and provided with diversified resource bases far beyond levels simply adequate to meet the needs of their populations. Thus, they both enjoy the benefits of relative self-sufficiency in mineral materials, availability of a supply of a variety of substances that can be exported without depriving the indigenous population of adequate supplies for their needs, and the ability to maximize income from this exportable material by performing downstream processing to increase its unit value to an optimum level.

As has just been shown in the foregoing coverage of Canada, there were clear indications of an almost universal downturn in mineral production in 1990. In contrast, the Australian experience has been much more positive. Preliminary indications are that output of all major mineral fuel commodities—bituminous coal, lignite, crude oil, and natural gas—registered gains of 10% or more over 1989 levels in Australia. Iron ore production, very predominantly for the export market, was up by more than 10%, and although domestic steel output fell, the decline was less than 2%, compared with the nearly 22% shortfall in Canada. Among the nonferrous

metals, both countries logged production gains in copper at both the mine and refinery stages, but in Canada, mine output growth far outstripped that of refined copper, whereas in Australia, they were much nearer balanced. In the case of aluminum of course, the two countries are radically different; Australia's production is based on its resources of both bauxite and the energy to process it, while Canada traditionally has used low cost indigenously derived energy to process imported bauxite and alumina. Nonetheless, it is still rather anomalous that Australia apparently achieved an increase of almost 9% in aluminum production (with a 5.5% growth in bauxite output), in contrast to Canada's meager 0.8% growth in aluminum.

In the case of the oft-associated nonferrous metals, lead, zinc, and silver, Australian output at the mine and metal stages grew significantly, whereas in Canada, only silver output showed an upturn, presumably because of growth in its byproduct output with copper. Australian gold production grew by almost 20% in contrast to a 3% growth in Canada, and Australia mine nickel advanced 3% in comparison to the near 6% drop in Canada, but Australia did log a substantial downturn in nickel plant production, a shortfall more substantial than that in Canada.

For the so-called "industrial" or nonmetallic mineral commodities, there are not too many products for which comparisons can be made. Both countries showed significant downturns in cement output, whereas in the case of salt, which both countries produce in world class amounts, preliminary Canadian data show an increase in output and Australia output was estimated at an increased level. For other key materials in this group, Canada's resource strengths in such items as sulfur and potash do not match with Australia's preeminence in diamond.

***China.***—The legacy of the 1988 events in Tiananmen Square remained through 1990 and into 1991 as a deterrent to closer linkages between China and other countries. Nonetheless, China's mineral industry seemed to be making steady if slow progress in its production efforts in 1990. Gains of 8% and 0.6% in pig iron and crude steel output, respectively, were evidenced at midyear 1990; and cement production was over 7% ahead of 1989 levels. Gains of 1.2% in coal output and 0.6% in natural gas production that were estimated on the basis of results through the early fall months apparently would be adequate to maintain overall energy output levels, even in the face of a 0.3% drop expected in crude oil output. To what extent the slowing in growth could be attributed to less than satisfactory international relations stemming from the suppression of dissent was a question without an answer. For the near future, it was evident that major efforts were being made to restore losses in confidence on the part of market economy countries and that the development rate would be increased if international linkages were increased. It seemed noteworthy that published statistical reporting of mineral industry activity in China has substantially increased in recent years, obviating the necessity of elaborately contriving estimates from technical tidbits and propagandistic statements. This has been interpreted as a move to encourage market economy interest.

***Japan.***—Available statistics on Japan, long noted for its promptness and precision in reporting, suggest that mineral industry activities were generally following a pattern of modest gains in the time since the end of 1989. The all-important output of steel advanced about 2.2% in 1990. The island nation's inconsequential primary aluminum output again declined marginally, but secondary production advanced 6% to more than 1.4 million tons. Refined copper output advanced almost 2%, refined lead output edged down about 1%, nickel plant output was lower by 4%, but slab zinc output increased about 3.4%. This latter growth was increasingly dependent on imported raw materials. Zinc is the single traditional nonferrous base metal for which Japan's indigenous mining industry has regularly supplied a significant share of the raw material base. Japanese mine zinc output, however, dropped again in 1990, this time by 3.4%, to a level of only 127,000 tons, only 18.5% of the supply required for slab zinc output.

Continued rationalization of the coal industry led to a 19% drop in output; 1990 was the first year in recent times in which output was less than 10 million tons. A slight gain in natural gas production and a slight drop in crude oil output were registered against such trivial output levels as to have virtually no effect on the huge demand for imported energy. This latter demand level was a source for considerable global criticism of Japan's neutralist policy regarding the Iraqi seizure of Kuwait. Widely expressed were views that Japanese policy was not so much a moral stand against war as it was a fear of supply loss.

Japan's cement industry reflected a continuing building boom, with output in 1990 advancing 5%.

***Other Asia and Pacific Islands.***—Among the Asian countries, a number seemed to be enjoying more salubrious economic conditions for mineral industry operations in 1990 than were those in other areas of the world.

The rising processing centers of the Republic of Korea and Taiwan registered impressive gains in steel and cement. The former also recorded increases in its refined copper output and its nickel plant, opened in 1989, increased output.

Indonesia, long noted for crude oil and tin production, raised oil output substantially from August onward in response to restrictions on deliveries toward markets from Iraq and Kuwait. It also edged tin refinery output upward in contrast to a modest decline in mine output. As a result, the country was smelting virtually its entire mine output, thereby maximizing foreign exchange earnings for this commodity. Moreover, Indonesia turned its mine copper output upward by more than 10%, but its mine nickel output declined by about 10%. The country's small steel industry logged an impressive production increase of more than 40% in 1990.

The region's premier tin producer, Malaysia, advanced refined tin output by almost 4%, while reducing mine output almost 11%, requiring increased imports of tin in concentrates. Nearby Thailand also raised smelter tin output slightly while reducing mine output in 1990, placing the country in a position of being a net importer of tin in concentrate. Thailand, with relative economic stability and an optimistic outlook, was gradually gaining significance as a processing center, and the country's very modest steel industry was approaching an annual output capacity of 1 million tons.

In the Philippines, there were continuing problems of civil unrest that may have been reflected in declines in copper industry performance—somewhat less than 6% for mine production and 4% for refined output, although the island republic's nickel mine output scored a modest increase.

The region's remaining resource giant, India, increased iron ore output by 17% if

output levels of the first 5 months were maintained through yearend, but even if they were not, which is more likely, some gain was probably achieved. A 3% growth in Indian steel output seemed likely, as was a 2% gain in aluminum output in spite of a small reduction in bauxite production. Never very strong in its nonferrous metal resource base except for aluminum, India suffered a slight setback in copper output at all levels, but registered gains in both lead and zinc in terms of both mine yield and refinery output in 1990.

The most newsworthy happenings in the Pacific Islands probably were the 17% decline of Papua New Guinea's mine copper output occasioned by civil strife and a 7% shortfall in New Caledonia's mine nickel output. On the other side of the coin, tiny Christmas Island south of Indonesia returned to the roster of phosphate rock producers, if only in a small way, reviving the island's one industrial activity.

***Brazil.***—In recent years, Brazil has attained a very significant role as a supplier of mined tin to the world and has played a growing role as a steel producer, these adding notably to the country's long-term prominence as a source of iron ore. Regrettably, Brazil's post-1989 performance registers negatively for each of these key commodities. At least in the case of iron ore, the evident 1990 production shortfall of about 0.8% was less on a percentage basis than the estimated 2% shortfall for the world in total. For steel, however, where world output also apparently dropped about 2%, Brazil registered a downturn of almost 18%, a phenomenal decline for a producer of more than 25 million tons (1989 level). In the case of tin, Brazil, the world's leading producer in 1989, accounting for 23% of the total, registered a 21% drop in output for 1990 while the world total declined by only about 7%. The Brazilian output reduction accounted for most of the shortfall in the market economy world, but the country nonetheless remained the world's leading producer.

On a more positive note, preliminary reports suggest an increase in output of bauxite and only a modest decline in aluminum production in 1990, enabling the country to retain its rank among the top five producers of these commodities.

As for the outlook for Brazil, despite its vast resource potential, the country's economic plight impedes further foreign investment, if for no reason other than the overall economic insecurity in a country burdened with so large a foreign debt. Global reaction against continued removal of rainforest, essential for charcoal ironmaking, was another negative factor linked to mineral industry activity that attracted worldwide attention.

***Mexico.***—Despite large foreign debts, Mexico, in direct contrast to Brazil, registered a successful year for its ferrous metal industry with iron ore output advancing by almost 7%, and steel output up by more than 10%. The country, more noted for nonferrous metal operations than for its iron and steel, showed substantial gains in mine output of copper, lead, silver, and zinc. At the same time, output of refined copper and lead and slab zinc output fell marginally. Of some significance was the modest 1% upturn in crude oil output and a presumably equal or near-equal growth in natural gas production after stagnation in the former and a downturn in the latter in 1989.

In a mineral activity not often considered by many as a significant Mexican export product, the country's cement industry continued to market a substantial amount of cement in the United States—a quantity on the order of 4.5 million tons or about 20% of Mexican output. The country's cement output was expected to advance by almost 5% in 1990.

***Other Latin America.***—Latin America's premier copper producer, Chile, registered a small drop in mine copper output in 1990, but possible revenue losses from this decline were likely more than compensated by a significant increase in refined copper output, thereby permitting the country to increase revenues per ton of copper exported by shipping a higher proportion of total output in the form of a higher unit value product. An increase in mine silver output was also recorded and may have reached 25% growth, thereby further adding to export earnings. Among lesser commodities, there apparently was a substantial slump in the byproduct recovery of molybdenum by the copper industry.

Peru's mineral industry evidenced across-the-board reductions in output of the traditional foreign exchange earners—copper, lead, silver, and zinc—adding to this Andean country's economic woes.

Venezuela seemed to enjoy an upturn in 1990. A modest slump in domestic steel output was at least partly offset by an upturn in aluminum production, this based to an increasing degree on imported raw material. A 20% growth in oil output, which began the year above the 1989 level and increased appreciably in September following the cutoff of Iraqi and Kuwaiti oil, was also a bright spot for the Venezuelan economy.

Colombia, too, probably benefitted from the situation in the Near East; a 6% growth in crude oil output was indicated by returns through midyear, and further increases seemed likely.

Oil, also the chief mineral commodity export exchange earner for Ecuador, apparently did not register as pronounced a set of gains as it did in Venezuela and Colombia, or it was regulated in large part by pipeline capacity from the inland fields to the coast and by loading capacities there. Nevertheless, production seemingly was raised close to delivery capacity, exceeding 1989 levels and closely approaching the record high of 1988.

Despite the peaceful shift in government in Nicaragua through the election process, civil unrest in Central America continued, at least north of Panama. Data on mineral industry operations subsequent to yearend 1989 were, at best, sketchy, but little short-term improvement seemed likely. In the Caribbean, development efforts in Cuba that had led to an upturn in nickel operations in 1989 apparently encounter new problems, and a slump in 1990 seemed likely.

***South Africa, The Republic of.***—The outlook seemed to be brightening for mineral producing firms in the Republic of South Africa, as governmental efforts to eliminate apartheid led the EC countries to eliminate economic sanctions against the Republic. As the Government's restraints on the population were lessened, however, civil strife increased, and such strife obviously had some impact on overall economic activity, including that at the mineral industry. Available information suggests that production results in major commodities were mixed—some increasing, others falling short of 1989 levels, with no distinct patterns developing.

***Developing Africa.***—For most of the African continent, mineral industry development has been generally less than bright since the end of 1989, and the outlook is at best clouded. The key copperbelt

producers, Zaire and Zambia, registered downturns in mine copper output, and the former logged a drop in refined copper production as well. Zaire's refined output shortfall was not as great as that in its mine output, thus the loss in marketing was greater in lower unit value product forms.

The large but as yet mineralogically underdeveloped Sudan and iron-rich Liberia suffered severely from civil wars; mining in the latter was virtually shut down in 1990 as a result. On a somewhat brighter note, competing factions in Angola seemed to be edging toward a settlement that could bode well for the development of the country's mineral resources; mineral exploitation has been restricted here for years by internal strife.

Namibia's emergence as an independent country has been less than auspicious from a mineral production viewpoint, coinciding with several major mine accidents and changes in company ownership. Output of traditional nonferrous foreign currency earners copper, lead, silver, and zinc slumped in 1990.

In both Botswana and Zimbabwe, production of key mineral foreign exchange earners—copper and nickel—apparently turned downward in 1990, with future prospects uncertain at this writing.

Across the continent's northern tier are five nations whose most notable contributions to the world's mineral supply are their production of crude oil and phosphate rock, and one of them additionally is a world class marketed natural gas producer. Collectively, in 1989, Algeria, Morocco, Tunisia, Libya, and Egypt (from west to east) accounted for 5.4% of world crude oil output and 16.7% of phosphate rock production, and in 1990 their aggregate output shares increased to 5.8% and 19.2%, respectively, based on preliminary figures. In the case of crude oil, these north African producers logged gains as a result of the Persian Gulf situation. Libya ranked first with just under 493 million barrels in 1990, followed by Algeria with almost 429 million barrels, and Egypt with 316 million barrels; output in Morocco and Tunisia was minor. In the case of phosphate rock, Morocco's output was dominant at almost 6.8 million tons in 1990, followed by Tunisia at slightly under 2 million tons, with Algeria and Egypt far lower, each in the 300,000 to 400,000 ton range, and Libya having no production.

Algeria was the solitary world class source of marketed natural gas in this area, accounting for about 2% of the world supply, far less than the ranking leaders, the U.S.S.R., the United States, Canada, and the Netherlands, but quite close to the United Kingdom and substantially ahead of all other producers.

These northern tier African countries also made modest contributions to world supplies of lead, zinc, and silver. Moreover, Algeria, Egypt, Morocco, and Tunisia each had steel industries—four of only eight countries on the whole continent to do so—but again the aggregate contribution to world supplies was very modest.

**Statistical Update**

Few comprehensive statistical measures of world mineral industry activity are available for time intervals subsequent to 1989. The United Nations indices of world industrial production for the first quarter of 1990 suggests a slump for global extractive industry output with respect to the final quarter of 1989, with a slight upturn in the second quarter. These preliminary results, historically subject to considerable change as additional data become available and as preliminary figures are corrected, indicate a 1.6% decline between 1989's fourth quarter and 1990's first quarter and a 0.6% upturn for the second quarter. Of the three most significant components of this index, metals extraction showed an upturn of just less than 6.8% in the first quarter of 1990 and a further, but much smaller growth of 0.4% in the second quarter. These gains, however, were not sufficient to compensate for declines registered by fuels. There was a nearly 3.3% drop in petroleum and natural gas industry operations between the last quarter of 1989 and the first quarter of 1990 and a further 0.6% decline in that index in the second quarter of 1990. Further, there was a nearly 1.4% drop in coal extraction between the last quarter of 1989 and the first quarter of 1990, and it was followed by an almost insignificant 0.2% upturn in that index in the second quarter of 1990.

Geographically, the performance of the extractive sector varied considerably. The centrally planned economies of Eastern Europe, including the U.S.S.R., collectively showed declines in each component index and in the aggregate, not only between the last quarter of 1989 and the first quarter of 1990 and between the first and the second quarters of 1990, but also registered a drop in the third quarter of 1990 as well. Developed market economy countries fared much better, at least on the basis of these early returns, with marked upturns in the metals extraction component in each quarter of 1990, up to and including the third quarter. These countries indeed showed declines in the petroleum and natural gas extraction sectorial index in each of the first three quarters of 1990, but the declines were appreciably less than those logged for the centrally planned economy countries of Eastern Europe, including the U.S.S.R. In the case of coal extraction, the developed market economy countries recorded a downturn between the last quarter of 1989 and the first quarter of 1990 and between the second and third quarters of 1990, but these were seasonal downturns that are experienced in most years. Indeed, there was a notable increase in the coal extractive index for these countries between the first and second quarters of 1990 that was distinctly counter to the pattern established in most prior years.

In the third major group of reporting countries, the developing market economy states, there was the usual lag in data acquisition, and results for the third quarter of 1990 were not yet available. (This is the reason why the global indices are not available for the third quarter). The preliminary returns for the first two quarters of 1990 for these countries suggest a sharp upturn in metallic extraction in the first quarter with respect to the last quarter of 1989 but a slump in the second quarter of that year. In the case of crude oil and gas extraction, there was a drop in the first quarter and a modest increase in the second quarter, and in the case of coal extraction, there was an increase in the first quarter of 1990 with respect to the fourth quarter 1989 level, but it was followed by a greater-than-normal seasonal slump in the second quarter of 1990. The absence of data on this group of countries for the third quarter is unfortunate and important, for it would be in third quarter results that the events in the Near East would be mirrored.

Considering the manufacturing indices that reflect mineral industry activity, the global picture for both of the first two quarters of 1990 was that of increase in the indices for (1) basic metals, (2) nonmetallic mineral products, and (3) chemicals, petroleum, coal, and rubber products. As in the case of the extractive indices, however, these growths were not universal through the major country groups. The centrally planned economy states of Eastern Eu-

rope fared better in manufacturing than they did in crude minerals extraction, with gains in the first quarter of 1990, but these gains were offset or at least partly offset by declines in the second and/or third quarters.

Developed market economy countries in aggregate logged increases between 1989's fourth quarter and 1990's first quarter for each of the aforementioned manufacturing indices, but their index for chemicals, petroleum, coal, and rubber products turned downward in both the second and third quarters, while their indices for basic metals products and nonmetallic mineral products advanced between the first and second quarters and then edged downward in the third quarter.

All three manufacturing indices cited increased in developing market economy countries in both the first and second quarters, but data were not available for the all-important third quarter, when the impact of the Iraqi takeover of Kuwait would have its effect on these indices.

## AVAILABILITY OF DATA

Some comment on data availability must be an integral part of a study such as this. For many years, the centrally planned economy nations of the world regarded as state secrets much of their mineral commodity production information, as well as a considerable body of the foreign trade information on these commodities, and virtually all reporting on their consumption. Within the past 5 years, this pattern has undergone some evolution, and although these countries still fall short of market economy countries in their willingness to publish, there has been measurable improvement. First, China, and then subsequently the former CMEA member countries of Eastern Europe have released in print an increasing amount of information in organized, coherent formats, although in a number of cases it is not clear that the information provided is in perfect definitional accord with market economy country practices. Thus, these recently available statistics must be carefully studied to ensure that they are provided in terms of conventional market economy definitions.

At the same time that heretofore unpublished information is becoming available for the centrally planned (or formally centrally planned) economy countries, there has been a slow but steady disquieting erosion of availability of production, trade, and consumption data for market economy countries. There are evident reasons for some of these losses in information. The foremost of these relates to corporate mergers. As the number of producing or consuming firms of a given commodity in a given political jurisdiction declines, it is increasingly difficult for government agencies to protect proprietary company data. In past years, this protection was afforded by aggregating data for the several companies operating in the area, but as the number of operators diminishes this is no longer always possible. Hopefully, given this situation, companies will at least authorize release of data after a period of time, when its publication will not provide competitors with unfair access, but will make possible longer term studies.

Other reasons for restricting data publication are less obvious, some relating to international politics, but it is hoped that governments will show restraint in suppression of data and will work actively with companies to encourage release of data. Past experience has shown that too much secrecy by firms leads to erroneous estimations to fill data cells, and that in turn to faulty analysis for planning purposes.

## SOURCES

This study summarizes and amalgamates much information collected, compiled, and utilized by the Bureau of Mines numerous country specialists and branch chiefs for inclusion in their country and regional reports that comprise the five other volumes of the international studies of the Minerals Yearbook. Because of the plethora of sources used in preparing these regional studies, it is impossible to cite all sources of information used in preparing this summary, but some recognition seems due.

Generally speaking, the preparation of this study, and its related detailed studies on countries and areas, would be impossible without the efforts of the personnel of our counterpart agencies throughout the world. Information that they collect, compile, and then publish, either in their own volumes or in publications of central statistical agencies in their countries, are the foundations upon which this work rests. Thus, we must begin by expressing our appreciation to the multitude of persons employed by these agencies for their contributions.

It is also appropriate to recognize some of the employees of the Department of State, Regional Resource Officers and others, who have channeled publications and other informational materials from the countries for which they are responsible into the Bureau of Mines.

Next, acknowledgement must be given Bureau country-and commodity-specialist colleagues in the Division of International Minerals and the Division of Mineral Commodities, who regularly process vast volumes of material to gain from it the information that we aggregate herein. Special recognition must also be given to the personnel of the International Data Section of the Division of Statistics and Information Services for painstakingly compiling foreign trade information and coordinating the assembly of world production data on the various commodities provided by the country specialists and approved by the appropriate commodity specialists.

Beyond the realm of our own government, we must acknowledge the work of the highly professional staffs of the Statistical Office of the United Nations as well as similar offices in the OECD and the EC. These organizations provide certain statistical aggregates that cannot be prepared within the Bureau of Mines because of limitations of financial and personnel resources.

Particular appreciation is due to the mineral statistics personnel of the American Bureau of Metal Statistics; the International Lead and Zinc Study Group; the German-based firm, Metallgesellschaft, A.G.; the French-based firm, Metalleurop; the Italian-based firm, Nuova Samim; and the World Bureau of Metal Statistics of the United Kingdom. Bureau of Mines employees are in regular contact with these individuals because of their special competence in international data on nonferrous metals.

Similarly, for their cooperative consultations relating to many mineral commodities not only in their own countries but in other world areas as well, special individual acknowledgement must be given to the personnel of the British Geological Survey, and to Canada's mineral agency, Energy, Mines, and Resources Canada.

Two individuals must be cited for un-

compensated contributions to this study, above and beyond the plethora of material coming from all others.

Mr. Francois Callot, now retired from his post with the French mining periodical "Annales des Mines" for more than 20 years furthered and fine-tuned global mineral production value studies originated in the early 1950's by Mssrs. Blondel and Venturi. Mr. Callot's work is the basis for the Bureau's global mineral production value studies that have been incorporated in "Minerals In the World Economy" almost from its inception.

Finally, in this, the year of his unexpected and untimely death, special recognition must be accorded to Mr. Willy Bauer, editor of Metallgesellshaft, A.G.'s statistical annual, "Metallstatistik". Mr. Bauer, known throughout the community of those engaged in the collection and study of information on production, trade, and consumption of nonferrous metals, contributed not only in a significant way to the collection of information but more importantly played a key role in its sound definition, evaluation, and interpretation. For nearly a score of years he met with a succession of Bureau of Mines employees on matters of mutual interest and made particularly significant contributions to clarifying the picture of activities in the poorly reported centrally planned economy countries of Europe and Asia.

[1]Callot, F. Production et consummation mondiales de minerals en 1983. Annales des Mines. Nos. 7, 8, 9, July-Aug.-Sept. 1985, pp. 3-123.

[2]Table 1 contains 103 data lines, but 3 of these are totals of others; these total lines are not included in the total of 100 distinct commodities or forms of commodities counted here.

TABLE 1

## WORLD PRODUCTION OF MAJOR MINERAL COMMODITIES[1]

| Commodity | | 1985 | 1986 | 1987 | 1988[p] | 1989[e] |
|---|---|---|---|---|---|---|
| METALS | | | | | | |
| Aluminum: | | | | | | |
| Bauxite, gross weight[2] | thousand metric tons | 85,286 | 88,863 | 92,850 | 99,061 | 106,113 |
| Alumina, gross weight | do. | 32,220 | 32,921 | 34,818 | 36,559 | 38,700 |
| Unalloyed ingot metal | do. | 15,398 | 15,413 | 16,385 | 17,608 | 17,980 |
| Antimony, mine output, Sb content | metric tons | 55,824 | 60,015 | 69,857 | 67,992 | 68,362 |
| Arsenic, trioxide[3] | do. | 53,235 | 53,173 | 52,351 | 52,047 | 52,390 |
| Beryl concentrate, gross weight[3] | do. | 8,141 | 8,259 | 7,932 | 8,302 | 7,586 |
| Bismuth:[4] | | | | | | |
| Mine output, Bi content | do. | 4,407 | 3,457 | 2,886 | 2,767 | 2,762 |
| Smelter | do. | 4,325 | 4,367 | 4,290 | 3,567 | 3,595 |
| Cadmium, smelter | do. | 18,924 | 19,070 | 19,066 | 21,899 | 21,002 |
| Chromite, gross weight[3] | thousand metric tons | 10,935 | 11,547 | 11,355 | 12,167 | 11,901 |
| Cobalt: | | | | | | |
| Mine output, Co content | metric tons | 51,139 | 52,986 | 44,735 | 47,205 | 47,360 |
| Metal, refined | do. | 27,552 | 31,475 | 28,066 | 27,166 | 26,319 |
| Columbium-tantalum concentrate, gross weight[3 5] | do. | 35,579 | 34,835 | 22,560 | 40,208 | 33,251 |
| Copper: | | | | | | |
| Mine output, Cu content | thousand metric tons | 7,988 | 7,993 | 8,306 | 8,537 | 8,887 |
| Metal: | | | | | | |
| Smelter: | | | | | | |
| Primary[6] | do. | 7,657 | 7,896 | 8,013 | 8,293 | 8,547 |
| Secondary[7] | do. | 967 | 962 | 925 | 1,037 | 1,044 |
| Refined: | | | | | | |
| Primary[6] | do. | 7,885 | 8,154 | 8,260 | 8,655 | 9,004 |
| Secondary[7] | do. | 1,523 | 1,448 | 1,573 | 1,676 | 1,722 |
| Gold, mine output, Au content | kilograms | 1,531,858 | 1,602,215 | 1,658,142 | 1,847,840 | 1,971,104 |
| Iron and steel: | | | | | | |
| Iron ore, iron ore concentrates, iron ore agglomerates, gross weight | thousand metric tons | 860,556 | 865,977 | 889,162 | 906,293 | 923,632 |
| Metal: | | | | | | |
| Pig iron | do. | 509,764 | 508,335 | 522,047 | 549,619 | 559,962 |
| Ferroalloys | do. | 15,171 | 15,304 | 15,496 | 16,990 | 16,940 |
| Steel, crude | do. | 718,075 | 711,355 | 733,308 | 778,403 | 784,223 |

See footnotes at end of table.

TABLE 1—Continued

## WORLD PRODUCTION OF MAJOR MINERAL COMMODITIES[1]

| Commodity | | 1985 | 1986 | 1987 | 1988[p] | 1989[e] |
|---|---|---|---|---|---|---|
| METALS—Continued | | | | | | |
| Lead: | | | | | | |
| Mine output, Pb content | thousand metric tons | 3,431 | 3,335 | 3,429 | 3,414 | 3,395 |
| Metal: | | | | | | |
| Smelter: | | | | | | |
| Primary | do. | 3,403 | 3,147 | 3,291 | 3,298 | 3,290 |
| Secondary | do. | 2,174 | 2,271 | 2,400 | 2,512 | 2,576 |
| Refined: | | | | | | |
| Primary | do. | 3,357 | 3,193 | 3,204 | 3,240 | 3,254 |
| Secondary | do. | 2,284 | 2,359 | 2,518 | 2,616 | 2,649 |
| Magnesium metal, smelter: | | | | | | |
| Primary | metric tons | 325,183 | 322,408 | 323,930 | 334,372 | 343,548 |
| Secondary | do. | 73,098 | 66,989 | 65,825 | 70,727 | 73,700 |
| Manganese ore, gross weight | thousand metric tons | 25,384 | 24,946 | 23,702 | 23,906 | 24,029 |
| Mercury, mine output, Hg content | metric tons | 6,136 | 7,247 | 5,810 | 5,890 | 5,840 |
| Molybdenum, mine output, Mo content | do. | 98,424 | 92,819 | 89,171 | 94,472 | 116,464 |
| Monazite concentrate (source of rare-earth metals and thorium)[4] | do. | 34,363 | 31,218 | 26,008 | 25,450 | 27,325 |
| Nickel: | | | | | | |
| Mine output, Ni content | do. | 812,370 | 788,469 | 825,524 | 872,061 | 931,987 |
| Metal, plant output | do. | 762,559 | 742,821 | 780,165 | 860,204 | 864,319 |
| Platinum-group metals, mine output, metals content | kilograms | 246,988 | 260,192 | 273,582 | 281,854 | 283,643 |
| Selenium, smelter[3 5] | metric tons | [4]1,318 | [4]1,215 | [4]1,236 | 1,541 | 1,553 |
| Silver, mine output, Ag content | do. | 13,051 | 12,970 | 13,757 | 14,167 | 14,452 |
| Tellurium, smelter[3 4 5] | do. | 100 | 85 | 74 | 78 | 65 |
| Tin: | | | | | | |
| Mine output, Sn content | do. | 180,725 | 172,471 | 178,131 | 200,150 | 216,457 |
| Metal, smelter: | | | | | | |
| Primary | do. | 192,990 | 184,239 | 189,276 | 215,133 | 222,418 |
| Secondary | do. | 17,545 | 15,591 | 16,238 | 19,491 | 19,409 |
| Titanium concentrate, gross weight: | | | | | | |
| Ilmenite[4 8] | thousand metric tons | 3,457 | 3,420 | 3,879 | 4,003 | 4,213 |
| Rutile[3 4] | do. | 373 | 394 | 439 | 434 | 476 |
| Titaniferous slag | do. | 1,280 | 1,285 | 1,575 | 1,725 | 1,765 |
| Tungsten, mine output, W content | metric tons | 46,579 | 43,344 | 42,177 | [4]42,604 | [4]43,280 |
| Uranium, mine output, $U_3O_8$ content[3 5] | do. | 41,467 | 43,921 | 43,455 | 44,775 | 40,171 |
| Vanadium, mine output, V content | do. | 33,352 | 32,418 | 31,471 | 34,270 | 33,829 |
| Zinc: | | | | | | |
| Mine output, Zn content | thousand metric tons | 6,758 | 6,936 | 7,232 | 7,015 | 7,062 |
| Metal, smelter: | | | | | | |
| Primary[6] | do. | 6,462 | 6,400 | 6,695 | 6,776 | 6,842 |
| Secondary[7] | do. | 323 | 291 | 314 | 339 | 345 |
| Zirconium concentrate | do. | [4]815 | [4]741 | [4]753 | 921 | 993 |
| INDUSTRIAL MINERALS | | | | | | |
| Asbestos | do. | 4,249 | 4,032 | 4,228 | 4,361 | 4,325 |
| Barite | do. | 6,067 | 4,708 | 4,704 | 5,481 | 5,712 |
| Boron materials | do. | 2,505 | 2,511 | 2,704 | 2,880 | 2,989 |
| Bromine[3] | do. | 382 | 375 | 391 | 409 | 423 |
| Cement, hydraulic | do. | 959,615 | 1,004,491 | 1,048,247 | 1,104,565 | 1,123,153 |
| Clays:[3] | | | | | | |
| Bentonite | do. | 9,188 | 9,222 | 9,234 | 9,586 | 9,794 |

See footnotes at end of table.

TABLE 1—Continued

## WORLD PRODUCTION OF MAJOR MINERAL COMMODITIES[1]

| Commodity | | 1985 | 1986 | 1987 | 1988[p] | 1989[e] |
|---|---|---|---|---|---|---|
| INDUSTRIAL MINERALS—Continued | | | | | | |
| Clays—Continued | | | | | | |
| Fuller's earth[5] | thousand metric tons | 3,090 | 2,961 | 3,084 | 2,997 | 3,079 |
| Kaolin | do. | 21,004 | 22,259 | 23,008 | 24,818 | 25,669 |
| Corundum, natural | metric tons | 9,301 | 9,694 | 9,241 | 9,411 | 8,994 |
| Diamond, natural: | | | | | | |
| Gem[e] | thousand carats | 26,237 | 39,037 | 38,004 | 42,616 | 43,016 |
| Industrial[e] | do. | 39,781 | 52,726 | 49,599 | 50,730 | 51,821 |
| Total | do. | 66,018 | 91,763 | 87,603 | 93,346 | 94,837 |
| Diatomite[3] | thousand metric tons | 1,841 | 1,848 | 1,822 | 1,872 | 1,838 |
| Feldspar[3] | do. | 4,024 | 4,024 | 4,333 | 4,678 | 4,686 |
| Fluorspar | do. | 4,979 | 4,854 | 4,843 | 5,292 | 5,731 |
| Graphite[4] | metric tons | 583,779 | 624,718 | 648,156 | 643,938 | 631,213 |
| Gypsum | thousand metric tons | 86,986 | 88,999 | 92,455 | 95,988 | 98,583 |
| Iodine | metric tons | [4]12,784 | [4]12,971 | [4]12,637 | 14,994 | 15,622 |
| Lime[3] | thousand metric tons | 122,906 | 122,949 | 126,463 | 132,735 | 135,331 |
| Magnesite[4] | do. | 12,168 | 12,299 | 11,753 | 11,936 | 12,003 |
| Mica[3] | do. | 255 | 290 | 290 | 275 | 265 |
| Nitrogen: N content of ammonia | do. | 91,056 | 91,558 | 94,115 | 98,514 | 99,584 |
| Perlite[3] | do. | 1,629 | 1,701 | 1,781 | 1,873 | 1,916 |
| Phosphate, gross weight: | | | | | | |
| Phosphate rock | do. | 148,849 | 138,869 | 144,231 | 160,375 | 162,268 |
| Thomas slag | do. | 2,515 | 2,037 | 1,650 | 1,673 | 1,623 |
| Guano | do. | 9 | 16 | 12 | 10 | 11 |
| Potash, marketable, $K_2O$ equivalent | do. | 29,151 | 28,788 | 30,526 | 32,108 | 29,789 |
| Pumice[3 5] | do. | 10,930 | 10,893 | 11,907 | 12,636 | 12,312 |
| Salt | do. | 172,912 | 174,829 | 178,609 | 183,694 | 190,587 |
| Sodium compounds, n.e.s.:[3] | | | | | | |
| Soda ash | do. | 29,126 | 29,359 | 30,236 | 31,053 | 31,668 |
| Sulfate | do. | 4,532 | 4,583 | 4,682 | 4,700 | 4,738 |
| Strontium materials[3 5] | metric tons | 162,572 | 149,843 | 181,703 | 231,013 | 244,300 |
| Sulfur, elemental basis: | | | | | | |
| Elemental[9] | thousand metric tons | 15,322 | 14,709 | 14,296 | 13,873 | 14,574 |
| From pyrites | do. | 8,895 | 8,881 | 9,800 | 10,163 | 10,214 |
| Byproduct[10] | do. | 29,554 | 30,011 | 31,972 | 34,060 | 33,560 |
| Total | do. | 53,771 | 53,601 | 56,068 | 58,096 | 58,348 |
| Talc, soapstone, pyrophyllite | do. | 7,828 | 7,697 | 7,804 | 7,991 | 7,980 |
| Vermiculite[3 5] | metric tons | 504,406 | 525,532 | 561,630 | 543,409 | 546,936 |
| MINERAL FUELS AND RELATED MATERIALS | | | | | | |
| Carbon black[3 5] | thousand metric tons | 4,487 | 4,434 | 4,548 | 4,760 | 4,832 |
| Coal: | | | | | | |
| Anthracite | million metric tons | 328 | 340 | 356 | 364 | 359 |
| Bituminous | do. | 2,966 | 3,063 | 3,136 | 3,233 | 3,299 |
| Lignite | do. | 1,150 | 1,176 | 1,199 | 1,216 | 1,225 |
| Total | do. | 4,444 | 4,579 | 4,691 | 4,814 | 4,883 |
| Coke:[11] | | | | | | |
| Metallurgical | thousand metric tons | 345,569 | 339,341 | 342,329 | 352,823 | 359,599 |
| Other | do. | 12,551 | 13,523 | 13,773 | 13,822 | 13,987 |
| Gas, natural, marketed | billion cubic meters | 1,742 | 1,792 | 1,866 | 1,948 | 2,019 |
| Natural gas liquids[3] | million 42-gallon barrels | 1,532 | 1,628 | 1,650 | 1,663 | 1,695 |
| Peat | thousand metric tons | 181,809 | 190,039 | 186,388 | 191,704 | 197,884 |

See footnotes at end of table.

TABLE 1—Continued

## WORLD PRODUCTION OF MAJOR MINERAL COMMODITIES[1]

| Commodity | | 1985 | 1986 | 1987 | 1988[p] | 1989[e] |
|---|---|---|---|---|---|---|
| MINERAL FUELS AND RELATED MATERIALS—Continued | | | | | | |
| Petroleum: | | | | | | |
| Crude | million 42-gallon barrels | 19,664 | 20,631 | 20,652 | 21,260 | 21,915 |
| Refined | do. | 21,114 | 21,972 | 22,148 | 22,626 | 22,812 |

[e]Estimated. [p]Preliminary.

[1]Incorporates numerous revisions from the corresponding table in previous editions of this chapter. Figures generally conform to those published in appropriate commodity chapters of volume I of the "Minerals Yearbook," 1989 edition.

[2]Includes bauxite equivalent of nepheline syenite concentrate and alunite ore produced in the U.S.S.R., the only producer on record of such materials as a source of aluminum metal.

[3]Excludes data for China (no adequate basis for estimation available).

[4]Excludes data for the United States (withheld to avoid disclosing company proprietary data).

[5]Excludes data for the U.S.S.R. (no adequate basis for estimation available).

[6]Includes all metal clearly identified as primary as well as all metal that cannot be subdivided clearly between primary and secondary (see footnote 7).

[7]Includes only that metal that is clearly identified as secondary. Some countries do not distinguish between primary and secondary, and for some of these, no basis is available for estimating the breakdown of total production. For such countries, the total has been included under Primary" (see footnote 6).

[8]Includes leucoxene.

[9]Comprises sulfur produced by the Frasch process plus sulfur mined in the elemental state from ores.

[10]Comprises sulfur recovered from coal gasification, metallurgical operations (except pyrite processing), natural gas, petroleum, tar sands, spent oxides, and gypsum, whether recovered in the elemental state or as a sulfur compound.

[11]Production of coke other than metallurgical by China and the U.S.S.R. is included with "Coke: Metallurgical."

TABLE 2

## VALUE OF EXPORT TRADE IN MAJOR MINERAL COMMODITY GROUPS[1]

(Million U.S. dollars)

| Commodity group | 1983 | 1984 | 1985[r] | 1986[r] | 1987[r] | 1988 |
|---|---|---|---|---|---|---|
| Metals: | | | | | | |
| All ores, concentrates, scrap | 23,247 | 25,753 | 24,943 | 24,143 | 26,620 | 32,921 |
| Iron and steel | 61,322 | 66,126 | 70,318 | 74,592 | 81,414 | 98,468 |
| Nonferrous metals | 36,575 | 36,185 | 35,656 | 36,693 | 44,578 | 61,085 |
| Total | 121,144 | 128,064 | 130,917 | 135,428 | 152,612 | 192,474 |
| Nonmetals, crude only | 9,325 | 9,855 | 9,963 | 10,472 | 11,088 | 12,910 |
| Mineral fuels | 384,188 | 378,398 | 361,646 | 262,595 | 279,639 | 266,845 |
| Grand total | 514,657 | 516,317 | 502,526 | 408,495 | 443,339 | 472,229 |
| All commodities | 1,812,944 | 1,909,303 | 1,933,434 | 2,112,984 | 2,487,137 | 2,829,094 |

[r]Revised.

[1]Data presented are for selected major commodity groups of the Standard International Trade Classification, Revision 2 (SITC-R2) and as such exclude some mineral commodities classified in that data array together with other (nonmineral) commodities. SITC-R2 categories included are as follows: All ores, concentrates, scrap-Div. 28; iron and steel-Div. 67; nonferrous metals-Div. 68; nonmetals (crude only)-Div. 27; and mineral fuels-Div. 3. Major items not included are the metals, metalloids, and metal oxides of Group 513; mineral tar and other coal-, petroleum-, and gas-derived crude chemicals of Div. 52; manufactured fertilizers of Div. 56; and nonmetallic mineral manufactures of Groups 661, 662, 663, and 667. Data include special category exports, ship stores and bunkers, and other exports of minor importance, and exclude the trade between the Federal Republic of Germany and the German Democratic Republic. Data for centrally planned economy countries of Asia are based on imports of China.

Sources: 1985-88 data: United Nations. Monthly Bulletin of Statistics, v. 44, May 1990, pp. 260-303; 1984 data: United Nations. Monthly Bulletin of Statistics, v. 43, May 1989, pp. 250-293; 1983 data: United Nations. Monthly Bulletin of Statistics, v. 42, May 1988, pp. 274-301.

TABLE 3

## DISTRIBUTION OF VALUE OF WORLD EXPORTTRADE IN MAJOR MINERAL COMMODITY GROUPS[1]

(Percent)

| Commodity group | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 |
|---|---|---|---|---|---|---|
| Metals: | | | | | | |
| All ores, concentrates, scrap | 4.5 | 5.0 | 5.0 | 5.9 | r6.0 | 7.0 |
| Iron and steel | 11.9 | 12.8 | r14.0 | 18.2 | r18.4 | 20.9 |
| Nonferrous metals | 7.1 | 7.0 | r7.0 | 8.9 | 10.1 | 12.9 |
| Total | 23.5 | 24.8 | r26.0 | 33.0 | r34.4 | 40.8 |
| Nonmetals, crude only | 1.8 | 1.9 | 2.0 | 2.6 | 2.5 | 2.7 |
| Mineral fuels | 74.6 | 73.3 | r72.0 | r64.3 | r63.1 | 56.5 |

rRevised.
[1]For detailed definition of groups, see footnote 1, table 2.

TABLE 4

## GROWTH OF VALUE OF WORLD EXPORT TRADE IN MAJOR MINERAL COMMODITY GROUPS[1]

(Percent change from that of previous year)

| Commodity group | 1983 | 1984 | 1985r | 1986r | 1987r | 1988 |
|---|---|---|---|---|---|---|
| Metals: | | | | | | |
| All ores, concentrates, scrap | -5.0 | +10.8 | -3.2 | -3.2 | +10.3 | +23.7 |
| Iron and steel | -10.8 | +7.8 | +6.3 | +6.1 | +9.1 | +20.9 |
| Nonferrous metals | +14. | -1.1 | -1.5 | +2.9 | +21.5 | +37.0 |
| All metals | -3.2 | +5.7 | +2.2 | +3.4 | +12.7 | +26.1 |
| Nonmetals, crude only | -6.2 | +5.7 | +1.1 | +5.1 | +5.9 | +16.4 |
| Mineral fuels | -10.7 | -1.5 | -4.4 | -27.4 | +6.5 | -4.6 |
| All major mineral commodity groups | -9.1 | +0.3 | -2.7 | -18.7 | +8.5 | +6.5 |
| All commodities | -1.9 | +5.3 | +1.3 | +9.3 | +17.7 | +13.7 |

rRevised.
[1]For detailed definition of groups, see footnote 1, table 2.

TABLE 5

## WORLD CONSUMPTION OF SELECTED MINERAL COMMODITIES

(Thousand metric tons unless otherwise specified)

| Commodity | | 1985[r] | 1986[r] | 1987[r] | 1988 | 1989[p] |
|---|---|---|---|---|---|---|
| Ferrous metals: World: | | | | | | |
| Iron ore, gross weight[e] | million metric tons | 857 | 864 | 884 | [r]897 | 923 |
| Iron and steel scrap, gross weight | do. | 319 | 318 | 324 | 344 | 335 |
| Nonferrous metals: | | | | | | |
| Market economy countries: | | | | | | |
| Aluminum, refined | | 12,540 | 12,788 | 13,667 | 14,423 | 14,681 |
| Cadmium | | 13 | 15 | 16 | 17 | 18 |
| Copper, refined | | 7,329 | 7,674 | 8,012 | 8,213 | 8,655 |
| Lead, refined | | 3,976 | 4,070 | 4,158 | 4,230 | 4,375 |
| Magnesium, primary | | 157 | 152 | 161 | 166 | 162 |
| Nickel[1] | | 575 | 574 | 635 | 662 | 664 |
| Tin, refined | | 157 | 164 | 171 | 178 | 178 |
| Zinc, slab | | 4,698 | 4,851 | 4,985 | 5,243 | 5,182 |
| Centrally planned economy countries: | | | | | | |
| Aluminum, refined | | 3,315 | 3,286 | 3,412 | 3,420 | 3,386 |
| Cadmium | | 4 | 4 | 4 | 4 | 4 |
| Copper, refined | | 2,363 | 2,400 | 2,410 | 2,358 | 2,326 |
| Lead, refined | | 1,451 | 1,430 | 1,462 | 1,443 | 1,409 |
| Magnesium, primary | | 102 | 105 | 109 | 112 | 112 |
| Nickel[1] | | 205 | 205 | 202 | 204 | 206 |
| Tin, refined | | 58 | 60 | 60 | 59 | 59 |
| Zinc, slab | | 1,806 | 1,878 | 1,922 | 1,949 | 1,974 |
| World total: | | | | | | |
| Aluminum, refined | | 15,855 | 16,074 | 17,079 | 17,843 | 18,067 |
| Cadmium | | 17 | 19 | 20 | 21 | 22 |
| Copper, refined | | 9,692 | 10,074 | 10,422 | 10,571 | 10,981 |
| Lead, refined | | 5,427 | 5,500 | 5,620 | 5,673 | 5,784 |
| Magnesium, primary | | 259 | 257 | 270 | 278 | 274 |
| Nickel[1] | | 780 | 779 | 837 | 866 | 870 |
| Tin, refined | | 215 | 224 | 231 | 237 | 237 |
| Zinc, slab | | 6,504 | 6,729 | 6,907 | 7,192 | 7,156 |
| Industrial minerals: World: | | | | | | |
| Fertilizers:[2] | | | | | | |
| Nitrogenous, contained N | | 88,162 | 87,667 | 93,965 | 97,462 | 99,222 |
| Phosphatic, contained $P_2O_5$ | | 34,158 | 32,961 | 34,758 | 36,441 | 37,753 |
| Potassic, $K_2O$ equivalent | | 25,947 | 25,543 | 26,024 | 27,127 | 27,780 |
| Sulfur, elemental S equivalent | | 57,916 | 56,938 | 58,945 | 63,064 | 60,919 |
| Mineral fuels: World: | | | | | | |
| Solid fuels | million metric tons of standard coal equivalent | 3,039 | 3,080 | 3,168 | 3,299 | 3,346 |
| Liquid fuels | do. | 3,626 | 3,710 | 3,771 | 3,922 | 4,040 |
| Natural gas | do. | 2,103 | 2,123 | 2,249 | 2,302 | 2,385 |
| Primary electricity: | | | | | | |
| Hydro and geothermal | do. | 249 | 253 | 256 | 262 | 265 |
| Nuclear | do. | 178 | 190 | 210 | 228 | 246 |
| Total[3] | do. | 9,195 | 9,357 | 9,655 | 10,013 | 10,282 |

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

[1]Nickel content of refined nickel, ferronickel, and nickel oxide.

[2]Data are for years ending June 30 of that stated.

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

Sources: Based on data provided by the World Bureau of Metal Statistics (market economy countries, nonferrous metals except magnesium); Metallgesellschaft AG (centrally planned economy countries, nonferrous metals and all magnesium consumption); British Sulphur Corp. Ltd. (nonmetals); and 1988 United Nations Energy Statistics Yearbook (all mineral fuels for 1985-88). Data on iron ore and iron and steel scrap for all years and on mineral fuels for 1988 compiled from a variety of sources by the U.S. Bureau of Mines.

TABLE 6

## ANNUAL INVESTMENT IN THE STEEL INDUSTRY FOR SELECTED COUNTRIES

(Million dollars)

| Country or country group | 1984 | 1985 | 1986 | 1987 | 1988 |
|---|---|---|---|---|---|
| Organization for Economic Cooperation and Development (OECD): | | | | | |
| European Communities: | | | | | |
| Belgium | 179 | 229 | 308 | 321 | 372 |
| France | 544 | 504 | 420 | r489 | 429 |
| Germany, Federal Republic of | 733 | 1,268 | 914 | 851 | 786 |
| Ireland and Denmark | 7 | 8 | 6 | r8 | 7 |
| Italy | 368 | 583 | 978 | r855 | 575 |
| Luxembourg | 34 | 50 | 71 | 85 | 81 |
| Netherlands | 131 | 239 | 348 | 278 | 206 |
| Portugal | (1) | (1) | 1 | 8 | 12 |
| Spain | (2) | (2) | 650 | r701 | 476 |
| United Kingdom | 297 | 263 | 365 | 479 | 546 |
| Subtotal[3] | 2,345 | 3,159 | 4,081 | r4,075 | 3,490 |
| EFTA[4] | 274 | 372 | 457 | r612 | 806 |
| Other:[5] | | | | | |
| Australia | 96 | 134 | 485 | e550 | e650 |
| Canada | 207 | 432 | 766 | 651 | 478 |
| Japan | 2,669 | 2,892 | 4,011 | 3,488 | 4,177 |
| Spain[6] | 290 | 395 | XX | XX | XX |
| Turkey | 217 | 210 | 146 | 98 | 120 |
| United States | 1,203 | 1,641 | 862 | 1,160 | 1,836 |
| Subtotal | r4,682 | r5,704 | r6,270 | r5,947 | 7,261 |
| Total OECD[7] | 7,301 | 9,235 | 10,808 | 10,634 | 11,557 |
| Latin America:[8] | | | | | |
| Argentina | 147 | 184 | 191 | 262 | 202 |
| Brazil | 809 | 472 | 413 | 540 | 394 |
| Chile | 11 | 1 | 4 | 1 | 22 |
| Colombia | 8 | 13 | 10 | 11 | 25 |
| Ecuador | NA | 2 | NA | NA | NA |
| Mexico | 526 | 491 | 119 | 171 | 324 |
| Peru | 1 | 4 | 2 | 1 | 2 |
| Uruguay | 1 | 1 | 1 | — | (9) |
| Venezuela | 25 | 25 | 121 | 111 | 123 |
| Central America | (9) | NA | NA | 1 | 9 |
| Total | 1,528 | 1,193 | 861 | [10]1,099 | 1,101 |
| Grand total | r8,829 | r10,428 | r11,669 | r11,733 | 12,658 |

eEstimated. rRevised. NA Not available. XX Not applicable; included with EC figures.

[1]1984-85 figures included with EFTA total; joined EC in 1986.

[2]1984-85 figures listed separately; joined EC in 1986.

[3]Source: EUROSTAT Iron and Steel Statistical Yearbook 1989. Luxembourg 1990. Source reports in million European Currency Units (ECU). For this tabulation the units in the source have been converted to U.S. dollars using the following factors supplied by the International Monetary Fund: U.S. dollars per ECU, average for the period: 1984—0.78899; 1985—0.76219; 1986—0.98119; 1987—1.15432; and 1988—1.18388.

[4]European Free Trade Association (EFTA) figures exclude data for Switzerland.

[5]Data for New Zealand have not been available since 1979. Estimates for Australia for 1987-88 by the U.S. Bureau of Mines.

[6]Portugal and Spain became members of the EC effective Jan. 1, 1986.

[7]Sources for OECD other than EC and Canada: The Iron and Steel Industry in 1985. Paris, 1987, p. 32; The Iron and Steel Industry in 1986. Paris, 1987, p. 32; The Iron and Steel Industry in 1987. Paris, 1988, p. 32; The Iron and Steel Industry in 1988. Paris, 1989, p. 34. Source for Canada: Canadian Minerals Yearbook 1986-89.

[9]Less than 1/2 unit.

[8]Source for Latin America: Instituto Latinamericano del Fierro y el Acero. Statistical Yearbook of Steelmaking and Iron Ore Mining in Latin America 1988. Santiago, p. 189.

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

TABLE 7

## MARKET ECONOMY COUNTRY PETROLEUM INDUSTRY CAPITAL AND EXPLORATION EXPENDITURES, BY GEOGRAPHIC AREA

(Million dollars)

| Area and type of expenditure | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|
| United States: | | | | | |
| Capital | 4,400 | 3,710 | 3,710 | 2,800 | 2,960 |
| Exploration | 46,260 | 48,060 | 43,640 | 24,830 | 19,760 |
| Total | 50,660 | 51,770 | 47,350 | 27,630 | 22,720 |
| Other North America: | | | | | |
| Capital | 1,720 | 2,760 | 3,330 | 2,100 | 1,610 |
| Exploration | 6,810 | 9,490 | 8,790 | 6,380 | 5,930 |
| Total | 8,530 | 12,250 | 12,120 | 8,480 | 7,540 |
| Central and South America: | | | | | |
| Capital | 1,220 | 980 | 850 | 820 | 800 |
| Exploration | 6,920 | 4,750 | 4,910 | 4,870 | 4,430 |
| Total | 8,140 | 5,730 | 5,760 | 5,690 | 5,230 |
| Western Europe: | | | | | |
| Capital | 2,050 | 1,720 | 1,650 | 1,480 | 2,730 |
| Exploration | 11,960 | 12,100 | 11,620 | 11,550 | 12,030 |
| Total | 14,010 | 13,820 | 13,270 | 13,030 | 14,760 |
| Africa and Middle East: | | | | | |
| Capital | 1,880 | 1,750 | 990 | 940 | 1,020 |
| Exploration | 5,970 | 4,530 | 4,010 | 3,160 | 2,770 |
| Total | 7,850 | 6,280 | 5,000 | 4,100 | 3,790 |
| Far East and Oceania: | | | | | |
| Capital | 2,130 | 1,630 | 2,110 | 3,090 | 3,420 |
| Exploration | 5,240 | 4,970 | 4,400 | 3,680 | 2,100 |
| Total | 7,370 | 6,600 | 6,510 | 6,770 | 5,520 |
| Tankers | 4,300 | 2,050 | 990 | 1,580 | 1,510 |
| World: | | | | | |
| Capital (including tankers) | 17,700 | 14,600 | 13,630 | 12,810 | 14,050 |
| Exploration | 83,160 | 83,900 | 77,370 | 54,470 | 47,020 |
| Grand total | 100,860 | 98,500 | 91,000 | 67,280 | 61,070 |

Source: Chase Manhattan Bank, Global Energy Component. Capital Investments of the World Petroleum Industry 1987. New York.

TABLE 8

## SALIENT STATISTICS ON U.S. FOREIGN INVESTMENT IN MINERAL INDUSTRY ACTIVITIES

(Million dollars; inflows [-])

| | r1985 | r1986 | r1987 | r1988 | 1989 |
|---|---|---|---|---|---|
| Direct foreign investment: Total: | 230,250 | 259,800 | 314,307 | 333,501 | 373,436 |
| Of which: | | | | | |
| Mining, smelting, refining | 7,345 | 7,923 | 8,004 | 9,228 | 8,678 |
| Petroleum | 57,695 | 58,497 | 59,774 | 57,745 | 57,945 |
| Reinvested earnings of foreign affiliates: Total: | 14,102 | 10,021 | 19,714 | 12,614 | 22,416 |
| Of which: | | | | | |
| Smelting and fabricated metals | 95 | 235 | 572 | 1,144 | 1,018 |
| Petroleum | 2,690 | -1,180 | 189 | -1,158 | 213 |
| Equity and intercompany account flows: Total: | -941 | 8,657 | 11,331 | 3,329 | 9,306 |
| Of which: | | | | | |
| Smelting and fabricated metals | -136 | 243 | -275 | 343 | -723 |
| Petroleum | -4,026 | 3,331 | 2,009 | -1,882 | -4,215 |
| Income: Total: | 28,295 | 30,900 | 40,588 | 49,819 | 53,617 |
| Of which: | | | | | |
| Mining, smelting, refining | 335 | 471 | 706 | 1,196 | 1,161 |
| Petroleum | 9,043 | 7,271 | 7,159 | 7,874 | 8,463 |

rRevised.

Source: U.S. Department of Commerce. Survey of Current Business, v. 70, No. 8, Aug. 1990.

TABLE 9

## WORLD MERCHANT FLEET DISTRIBUTION, BY TYPE[1]

| | | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|
| Number of vessels: | | | | | | |
| Bulk carriers | | 5,787 | 5,481 | 5,302 | 5,332 | 5,335 |
| Freighters[2] | | 13,937 | 12,786 | 12,572 | 12,518 | 12,195 |
| Tankers | | 5,456 | 4,999 | 5,090 | 5,250 | 5,133 |
| Other[3] | | 375 | 352 | 343 | 368 | 320 |
| Total | | 25,555 | 23,618 | 23,307 | 23,468 | 22,983 |
| Gross tonnage: | | | | | | |
| Bulk carriers | thousand long tons | 135,366 | 130,654 | 128,468 | 130,225 | 131,135 |
| Freighters[2] | do. | 97,284 | 93,157 | 93,966 | 95,932 | 94,780 |
| Tankers | do. | 158,508 | 134,660 | 135,010 | 140,833 | 137,129 |
| Other[3] | do. | 3,898 | 3,798 | 3,688 | 4,367 | 3,720 |
| Total | do. | 395,056 | 362,179 | 361,132 | 371,357 | 366,764 |
| Deadweight tonnage: | | | | | | |
| Bulk carriers | do. | 235,833 | 227,325 | 224,309 | 227,515 | 233,139 |
| Freighters[2] | do. | 126,542 | 118,845 | 116,937 | 118,077 | 118,060 |
| Tankers | do. | 292,345 | 245,584 | 245,906 | 254,796 | 251,923 |
| Other[3] | do. | 1,604 | 1,476 | 1,405 | 1,531 | 1,367 |
| Total | do. | [4]656,323 | [4]593,229 | 588,557 | 601,919 | 604,489 |

[1]Maritime Administration classification. Tankers include whaling tankers. Vessels shown here as "Other" include combination passenger and cargo and combination passenger and refrigerated cargo. Data are as of Dec. 31 of the year indicated.

[2]Includes refrigerated freighters.

[3]Excludes refrigerated freighters.

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

Source: U.S. Department of Transportation, Maritime Administration. Merchant Fleets of the World. Annual issues for 1985-88 and unpublished information for 1989.

TABLE 10

## MOVEMENT OF MINERAL COMMODITIES THROUGH THE PANAMA CANAL

(Thousand metric tons)

| | 1987 | | | 1988 | | | 1989 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Atlantic to Pacific | Pacific to Atlantic | Total | Atlantic to Pacific | Pacific to Atlantic | Total | Atlantic to Pacific | Pacific to Atlantic | Total |
| METALS | | | | | | | | | |
| Ore and concentrate: | | | | | | | | | |
| Bauxite and alumina | 116 | 744 | 860 | 181 | 1,404 | 1,585 | 137 | 2,286 | 2,423 |
| Chromite | 7 | 23 | 30 | 7 | 25 | 32 | 31 | 67 | 98 |
| Copper | 36 | 737 | 773 | 40 | 871 | 911 | 49 | 579 | 628 |
| Iron | 62 | 534 | 596 | 135 | 776 | 911 | 119 | 287 | 406 |
| Lead | — | 192 | 192 | 2 | 212 | 214 | — | 225 | 225 |
| Manganese | 36 | 193 | 229 | 72 | 198 | 270 | 99 | 286 | 385 |
| Tin | — | 15 | 15 | — | 9 | 9 | — | 31 | 31 |
| Zinc | 106 | r668 | r774 | 43 | 670 | 713 | 38 | 549 | 587 |
| Other and unspecified | 367 | 1,157 | 1,524 | 268 | 1,660 | 1,928 | 275 | 1,885 | 2,160 |
| Subtotal | 730 | r4,263 | r4,993 | 748 | 5,825 | 6,573 | 748 | 6,195 | 6,943 |
| Ingots and semimanufactures: | | | | | | | | | |
| Aluminum | 371 | 52 | 423 | 422 | 39 | 461 | 288 | 14 | 302 |
| Copper | 15 | 840 | 855 | 14 | 785 | 799 | 2 | 886 | 888 |
| Iron and steel[1 2] | 5,859 | 3,733 | 9,592 | 5,042 | 4,187 | 9,229 | 6,439 | 3,686 | 10,125 |
| Lead | 3 | 51 | 54 | 7 | 62 | 69 | — | 68 | 68 |
| Tin[1] | 14 | 11 | 25 | 13 | 10 | 23 | 22 | 7 | 29 |
| Zinc | 14 | 152 | 166 | 15 | 171 | 186 | 25 | 166 | 191 |
| Other | 19 | 80 | 99 | 37 | 73 | 110 | 53 | 59 | 112 |
| Subtotal | 6,295 | 4,919 | 11,214 | 5,550 | 5,327 | 10,877 | 6,829 | 4,886 | 11,715 |
| Total | 7,025 | r9,182 | r16,207 | 6,298 | 11,152 | 17,450 | 7,577 | 11,081 | 18,658 |
| INDUSTRIAL MINERALS | | | | | | | | | |
| Borax | 3 | 385 | 388 | 1 | 438 | 439 | 1 | 399 | 400 |
| Cement | 253 | 3 | 256 | 152 | 1 | 153 | 238 | 4 | 242 |
| Clays, fire and china | 447 | 27 | 474 | 480 | 25 | 505 | 562 | 40 | 602 |
| Fertilizer materials | 10,047 | 2,148 | 12,195 | 10,454 | 1,878 | 12,332 | 11,890 | 2,542 | 14,432 |
| Salt | 120 | 1,128 | 1,248 | 42 | 813 | 855 | 21 | 718 | 739 |
| Sulfur | 8 | 3,278 | 3,286 | 9 | 3,641 | 3,650 | 7 | 2,189 | 2,196 |
| Other[3] | 185 | r148 | r333 | 187 | 191 | 378 | 283 | 130 | 413 |
| Total | 11,063 | r7,117 | r18,180 | 11,325 | 6,987 | 18,312 | 13,002 | 6,022 | 19,024 |
| MINERAL FUELS | | | | | | | | | |
| Carbon black | 6 | 85 | 91 | 40 | 1 | 41 | 78 | 2 | 80 |
| Coal and coke | 5,997 | 2,052 | 8,049 | 5,477 | 3,237 | 8,714 | 5,386 | 3,692 | 9,078 |
| Petroleum: | | | | | | | | | |
| Crude | 3,447 | 5,655 | 9,102 | 2,865 | 6,063 | 8,928 | 2,123 | 5,877 | 8,000 |
| Refined | 9,863 | 7,398 | 17,261 | 9,183 | 6,958 | 16,141 | 7,891 | 6,730 | 14,621 |
| Subtotal | 13,310 | 13,053 | 26,363 | 12,048 | 13,021 | 25,069 | 10,014 | 12,607 | 22,621 |
| Total | 19,313 | 15,190 | 34,503 | 17,565 | 16,259 | 33,824 | 15,478 | 16,301 | 31,779 |
| Grand total | 37,401 | r31,489 | r68,890 | 35,188 | 34,398 | 69,586 | 36,057 | 33,404 | 69,461 |

rRevised.

[1]Tinplate is included under "Tin" as in the source publication rather than under "Iron and steel."

[2]Includes a category identified simply as "Scrap" in source publication, which may include scrap other than iron and steel scrap.

[3]Comprises asbestos, bricks and tile, clinkers, diatomite, dross, marble and other stone, slag, and soda and other sodium compounds.

Source: Panama Canal Commission Annual Report 1989.

TABLE 11

## NONFERROUS METAL PRICES IN THE UNITED STATES

(Average cents per pound unless otherwise specified)

| Year and month | Aluminum[1] | Cadmium[2] | Cobalt[3] | Copper[4] | Lead[5] | Silver[6] | Tin[7] | Zinc[8] |
|---|---|---|---|---|---|---|---|---|
| 1985 | 81.000 | 1.208 | 11.43 | 65.566 | 19.067 | 6.142 | 5.259 | 40.366 |
| 1986 | 55.869 | 1.248 | 7.49 | 64.652 | 22.047 | 5.470 | 2.941 | 37.995 |
| 1987 | 72.295 | 1.988 | 6.56 | 81.096 | 35.943 | 7.009 | 3.156 | 41.923 |
| 1988 | 110.087 | 7.598 | 7.09 | 119.107 | 37.140 | 6.535 | 3.310 | 60.197 |
| 1989: | | | | | | | | |
| January | 107.725 | 8.415 | 7.53 | 156.237 | 40.171 | 5.972 | 3.456 | 79.269 |
| February | 99.579 | 8.000 | 7.68 | 138.811 | 37.011 | 5.891 | 3.626 | 87.699 |
| March | 95.783 | 7.457 | 7.58 | 147.092 | 35.065 | 5.930 | 4.078 | 93.710 |
| April | 96.375 | 7.025 | 7.59 | 142.086 | 35.018 | 5.791 | 4.711 | 88.052 |
| May | 97.795 | 7.005 | 7.63 | 125.746 | 36.338 | 5.447 | 4.733 | 84.644 |
| June | 87.659 | 6.527 | 7.71 | 114.501 | 39.152 | 5.280 | 4.671 | 80.590 |
| July | 80.400 | 5.300 | 7.63 | 112.087 | 40.288 | 5.237 | 4.485 | 79.667 |
| August | 81.370 | 3.817 | 7.62 | 126.030 | 41.752 | 5.179 | 4.010 | 81.320 |
| September | 78.300 | 5.488 | 7.69 | 137.039 | 43.625 | 5.133 | 3.833 | 81.076 |
| October | 79.762 | 5.810 | 7.75 | 130.259 | 43.625 | 5.133 | 3.716 | 79.948 |
| November | 75.810 | 5.267 | 7.62 | 116.709 | 41.256 | 5.465 | 3.191 | 75.922 |
| December | 73.563 | 5.220 | 7.64 | 107.816 | 38.894 | 5.533 | 3.165 | 72.330 |
| Average | 87.843 | 6.278 | 7.64 | 129.534 | 39.350 | 5.499 | 3.973 | 82.019 |

[1]For 1984-85 inclusive: U.S. list price, North American producer; for 1986-88: Metals Week U.S. market price.
[2]U.S. dollars per pound: 1985-88—producer; 1989—New York dealer market price.
[3]U.S. dollars per pound, average annual spot for cathodes.
[4]Electrolytic, f.o.b. refinery, producer.
[5]Refined lead, 1985—U.S. producer price; 1986-89—North America producer price.
[6]U.S. dollars per troy ounce, 0.99 fine, New York.
[7]U.S. dollars per pound, New York dealer.
[8]United States high-grade.

Source: American Bureau of Metal Statistics Inc. except cobalt, which is compiled by the Bureau of Mines.

TABLE 12

## NONFERROUS METAL PRICES IN THE UNITED KINGDOM[1]

(Average U.S. cents per pound unless otherwise specified)

| Year and month | Aluminum[2] | Copper[3] | Gold[4] | Lead[5] | Silver[6] | Tin[7] | Zinc[8] |
|---|---|---|---|---|---|---|---|
| 1985 | 47.850 | 64.904 | 317.265 | 17.842 | 6.132 | 5.567 | 36.233 |
| 1986 | 52.179 | 62.314 | 367.512 | 18.429 | 5.465 | 2.723 | 34.194 |
| 1987 | 71.004 | 80.847 | 446.470 | 27.041 | 7.024 | 3.035 | 36.197 |
| 1988 | 117.334 | 118.010 | 437.047 | 29.727 | 6.531 | 3.199 | 56.262 |
| 1989: | | | | | | | |
| January | 108.751 | 153.952 | 404.014 | 30.622 | 5.991 | 3.361 | 78.573 |
| February | 99.022 | 140.474 | 387.508 | 28.168 | 5.878 | 3.571 | 87.541 |
| March | 94.062 | 148.059 | 390.150 | 26.693 | 5.949 | 3.974 | 88.893 |
| April | 96.423 | 141.426 | 384.400 | 27.554 | 5.793 | 4.625 | 75.044 |
| May | 102.481 | 124.238 | 371.045 | 29.148 | 5.445 | 4.601 | 73.778 |
| June | 86.825 | 115.485 | 367.598 | 30.161 | 5.282 | 4.507 | 69.717 |
| July | 79.648 | 113.625 | 375.038 | 31.322 | 5.230 | 4.357 | 73.220 |
| August | 81.570 | 125.293 | 365.143 | 31.814 | 5.185 | 3.953 | 78.279 |

See footnotes at end of table.

TABLE 12—Continued

## NONFERROUS METAL PRICES IN THE UNITED KINGDOM[1]

(Average U.S. cents per pound unless otherwise specified)

| Year and month | Aluminum[2] | Copper[3] | Gold[4] | Lead[5] | Silver[6] | Tin[7] | Zinc[8] |
|---|---|---|---|---|---|---|---|
| 1989—Conrinued | | | | | | | |
| September | 77.924 | 130.836 | 361.745 | 32.995 | 5.134 | 3.751 | 73.766 |
| October | 82.555 | 129.790 | 366.884 | 34.072 | 5.145 | 3.594 | 71.789 |
| November | 78.748 | 117.538 | 394.261 | 31.385 | 5.483 | 3.101 | 65.103 |
| December | 74.084 | 109.704 | 409.385 | 32.220 | 5.566 | 3.059 | 65.785 |
| Average | 88.508 | 129.201 | 381.431 | 30.513 | 5.507 | 3.871 | 75.124 |

[1]London Metal Exchange.
[2]Unalloyed ingot, 99.5%.
[3]For 1985, electrolytic wirebars, monthly average settlement price; for 1986-89, Grade A settlement price.
[4]U.S. dollars per troy ounce, final price.
[5]Refined lead, monthly average cash price.
[6]U.S. dollars per troy ounce, 0.999 fine, spot price.
[7]U.S. dollars per pound, for 1985-87 Straits tin; beginning 1988 Kuala Lumpur tin market price. (1986 and 1987 average prices were the same on both markets.)
[8]Monthly average cash price, high-grade.

Source: American Bureau of Metal Statistics Inc.

TABLE 13

## NONFERROUS METAL PRICES IN CANADA

(Average U.S. cents per pound unless otherwise specified)

| Year and month | Copper[1] | Lead[2] | Nickel[3] | Silver[4] | Zinc[5] |
|---|---|---|---|---|---|
| 1985 | 64.071 | 19.205 | 3.200 | 6.145 | 41.731 |
| 1986 | 64.222 | 22.245 | 3.200 | 5.474 | 40.403 |
| 1987 | 73.150 | 35.948 | 2.277 | 6.988 | 43.910 |
| 1988 | 121.516 | 37.033 | 6.091 | 6.550 | 61.039 |
| 1989: | | | | | |
| January | NA | 40.364 | 7.923 | 5.992 | 81.341 |
| February | NA | 37.000 | 8.332 | 5.911 | 89.250 |
| March | NA | 35.000 | 7.715 | 5.950 | 94.773 |
| April | NA | 35.000 | 6.833 | 5.810 | 87.500 |
| May | NA | 36.391 | 6.102 | 5.479 | 85.000 |
| June | NA | 39.318 | 5.423 | 5.300 | 80.455 |
| July | NA | 40.381 | 5.485 | 5.257 | 80.000 |
| August | NA | 42.087 | 5.824 | 5.199 | 82.870 |
| September | NA | 44.000 | 5.063 | 5.152 | 81.429 |
| October | NA | 44.000 | 4.701 | 5.155 | 79.864 |
| November | NA | 40.864 | 4.445 | 5.494 | 75.182 |
| December | NA | 38.000 | 3.940 | 5.615 | 73.000 |
| Average | NA | 39.367 | 5.982 | 5.526 | 82.555 |

NA Not available.
[1]Hudson Bay Mining & Smelting Co. Ltd. delivered price for cathode.
[2]Producers' price, carload quantities, pig lead, Cominco Ltd.
[3]U.S. dollars per pound 1985-86 inclusive: Canadian producer price. Beginning Jan. 1987: New York dealers, cathode.
[4]U.S. dollars per troy ounce.
[5]Producers' price, carload quantities, regular high-grade, Cominco, Ltd.

Source: American Bureau of Metal Statistics Inc.

TABLE 14

## LEADING WORLD PRODUCERS OF BAUXITE[1]

(Thousand metric tons, gross weight)

| Country | 1985 | 1986 | 1987 | 1988[p] | 1989[e] | Average 1985-89 |
|---|---|---|---|---|---|---|
| Australia | 31,839 | 32,384 | 34,102 | 36,192 | [2]38,583 | 34,620 |
| Guinea[e] | 11,790 | 13,300 | 13,500 | 15,600 | [2]16,523 | 14,143 |
| Jamaica | 6,239 | 6,944 | 7,660 | 7,408 | [2]9,395 | 7,529 |
| Brazil | 5,846 | 6,544 | 6,567 | 7,728 | 8,500 | 7,037 |
| U.S.S.R.[e 3] | 5,695 | 5,710 | [r]5,725 | [r]5,715 | 5,685 | 5,706 |
| India | 2,281 | 2,322 | 2,736 | 3,691 | [2]4,768 | 3,160 |
| China[e] | [r]1,650 | 1,650 | 2,400 | [r]3,500 | 4,000 | 2,640 |
| Suriname | 3,738 | 3,731 | 2,522 | 3,434 | [2]3,530 | 3,391 |
| Yugoslavia | 3,538 | 3,459 | 3,394 | 3,034 | [2]3,252 | 3,335 |
| Hungary | 2,815 | 3,022 | 3,101 | 2,593 | 2,700 | 2,846 |
| Greece | 2,453 | 2,230 | 2,472 | [e]2,400 | 2,400 | 2,391 |
| Sierra Leone | 1,185 | 1,246 | 1,390 | 1,379 | [2]1,500 | 1,340 |
| Guyana | [e]1,675 | 2,074 | 2,785 | 1,774 | 1,281 | 1,918 |
| Total | [r]80,744 | 84,616 | 88,354 | 94,448 | 102,117 | 90,056 |
| Other | [r]4,542 | [r]4,245 | 4,495 | 4,613 | 3,997 | 4,378 |
| Grand total | 85,286 | [r]88,861 | 92,849 | 99,061 | 106,114 | 94,434 |

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

[1]Table includes data available through June 13, 1990.

[2]Reported figure.

[3]Includes bauxite equivalent of nepheline syenite concentrate and alunite ore, which are produced in the U.S.S.R. only.

TABLE 15

## LEADING WORLD PRODUCERS OF ALUMINUM[1]

(Thousand metric tons)

| Country | 1985 | 1986 | 1987 | 1988[p] | 1989[e] | Average 1985-89 |
|---|---|---|---|---|---|---|
| United States | 3,500 | 3,037 | 3,343 | 3,944 | [2]4,030 | 3,571 |
| U.S.S.R.[e] | 2,200 | 2,300 | 2,400 | 2,400 | 2,400 | 2,340 |
| Canada | 1,282 | 1,355 | 1,540 | 1,535 | [2]1,555 | 1,453 |
| Australia | 851 | 882 | 1,004 | 1,150 | [2]1,244 | 1,026 |
| Brazil | 549 | 757 | 843 | 874 | [2]935 | 792 |
| Norway | 743 | 726 | 806 | 864 | [2]859 | 800 |
| China[e] | 410 | 410 | 615 | 800 | 825 | 612 |
| Germany, Federal Republic of | 745 | 765 | 738 | 744 | [2]742 | 747 |
| Venezuela | 396 | [r]424 | 440 | 455 | 500 | 443 |
| India | 260 | 257 | 265 | 375 | 375 | 306 |
| Spain | 370 | 350 | 341 | 323 | [2]352 | 347 |
| France | 293 | 322 | 323 | 328 | [2]335 | 320 |
| United Kingdom | 275 | 276 | 294 | 300 | [2]297 | 288 |
| Netherlands | 251 | 266 | 276 | 278 | [2]274 | 269 |
| New Zealand | 241 | [r]236 | 252 | 264 | [2]260 | 251 |
| Yugoslavia[e] | 280 | 282 | 244 | [r]260 | 260 | 265 |
| Romania | 247 | 269 | 260 | [e]260 | 250 | 257 |
| Indonesia | 217 | 219 | 202 | 185 | 222 | 209 |
| Italy | 224 | 243 | 233 | 222 | 220 | 228 |
| Total | 13,334 | [r]13,376 | 14,419 | 15,561 | 15,935 | 14,525 |
| Other | 2,064 | [r]2,037 | 1,966 | 2,047 | 2,045 | 2,032 |
| Grand total | 15,398 | [r]15,413 | 16,385 | 17,608 | 17,980 | 16,557 |

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

[1]Table includes data available through May 23, 1990.

[2]Reported figure.

TABLE 16

## LEADING WORLD PRODUCERS OF CHROMITE[1]

(Thousand metric tons, gross weight)

| Country | 1985 | 1986 | 1987 | 1988[p] | 1989[e] | Average 1985-89 |
|---|---|---|---|---|---|---|
| South Africa, Republic of | 3,699 | 3,907 | 3,847 | 4,245 | 3,800 | 3,900 |
| U.S.S.R. | 3,360 | 3,640 | 3,570 | [r e]3,700 | 3,800 | 3,614 |
| India | [r]569 | [r]638 | 624 | 759 | 800 | 678 |
| Finland | 506 | 678 | 543 | [e]700 | 750 | 635 |
| Albania[e] | 825 | 850 | 830 | 750 | 700 | 791 |
| Turkey | 589 | 543 | [e]600 | [e]625 | 650 | 601 |
| Zimbabwe | 536 | 533 | 570 | 561 | 570 | 554 |
| Brazil | 190 | 223 | 191 | [e]240 | 225 | 214 |
| Philippines | 272 | 174 | 188 | [e]190 | 190 | 203 |
| Total | [r]10,546 | [r]11,186 | 10,963 | 11,770 | 11,485 | 11,190 |
| Other | 399 | [r]369 | 392 | 397 | 416 | 395 |
| Grand total | [r]10,945 | [r]11,555 | 11,355 | 12,167 | 11,901 | 11,585 |

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through Apr. 3, 1990.

TABLE 17

## LEADING WORLD PRODUCERS OF MINE COPPER[1]

(Thousand metric tons, Cu content of ore)

| Country | 1985 | 1986 | 1987 | 1988[p] | 1989[e] | Average 1985-89 |
|---|---|---|---|---|---|---|
| Chile[2] | 1,360 | 1,399 | 1,413 | 1,472 | [3]1,645 | 1,458 |
| United States[2] | 1,103 | 1,144 | 1,244 | 1,420 | [3]1,498 | 1,282 |
| Canada[2] | 739 | [r]699 | 794 | 756 | 714 | 740 |
| U.S.S.R.[e 2] | 600 | 620 | 630 | 640 | 640 | 626 |
| Zaire | 558 | 532 | [e]525 | [e]530 | 475 | 418 |
| Zambia | 459 | 462 | 463 | 432 | 445 | 452 |
| Poland | 431 | 434 | 438 | 437 | 436 | 435 |
| China[e] | 185 | 185 | 250 | [r]375 | 375 | 199 |
| Peru[2] | [r]420 | [r]400 | 418 | 323 | [3]373 | 387 |
| Australia | 260 | 248 | 233 | 238 | [3]289 | 254 |
| Mexico | 177 | 189 | 254 | 280 | 260 | 232 |
| Papua New Guinea | 175 | 178 | 218 | 219 | [3]204 | 199 |
| South Africa, Republic of | 195 | 184 | 188 | 168 | [3]197 | 186 |
| Philippines | 222 | 223 | 216 | 218 | [3]190 | 214 |
| Total | [r]6,884 | [r]6,897 | 7,284 | 6,603 | 7,741 | 7,082 |
| Other | [r]1,104 | [r]1,096 | 1,022 | 1,934 | 1,146 | 1,260 |
| Grand total | [r]7,988 | [r]7,993 | 8,306 | 8,537 | 8,887 | 8,342 |

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through June 27, 1990.
[2]Recoverable.
[3]Reported figure.

TABLE 18

## LEADING WORLD PRODUCERS OF GOLD[1]

(Kilograms)

| Country | 1985 | 1986 | 1987 | 1988[p] | 1989[e] | Average 1985-89 |
|---|---|---|---|---|---|---|
| South Africa, Republic of | 670,754 | 638,047 | 596,456 | 618,369 | 603,000 | 625,325 |
| U.S.S.R.[e] | 270,000 | 275,000 | 275,000 | 280,000 | 280,000 | 276,000 |
| United States | 75,495 | 116,296 | 153,870 | 200,914 | [2]265,541 | 162,423 |
| Australia | 58,521 | 75,079 | 110,696 | 156,950 | 192,000 | 118,649 |
| Canada | 87,561 | 102,899 | 115,818 | 134,813 | 158,440 | 119,906 |
| Brazil[e] | 73,160 | 67,500 | 83,700 | 100,200 | 110,000 | 86,912 |
| China[e] | 61,000 | 66,000 | 72,000 | 78,000 | 85,000 | 72,400 |
| Papua New Guinea | 36,908 | 35,075 | 33,250 | 38,129 | 35,000 | 35,672 |
| Philippines | 33,063 | 40,322 | 32,599 | 35,300 | 30,000 | 34,257 |
| Colombia | 35,532 | 39,995 | 26,550 | 29,020 | [2]27,000 | 31,619 |
| Chile | 17,240 | 17,938 | 17,035 | 20,614 | 20,000 | 18,565 |
| Zimbabwe | 14,691 | 14,853 | 14,710 | 14,191 | 14,500 | 14,589 |
| Total | 1,433,925 | 1,489,004 | 1,531,684 | 1,706,500 | 1,820,481 | 1,596,319 |
| Other | 97,933 | 113,211 | 126,458 | 172,340 | 150,523 | 132,093 |
| Grand total | 1,531,858 | 1,602,215 | 1,658,142 | 1,878,840 | 1,971,004 | 1,728,412 |

[e]Estimated. [p]Preliminary.
[1]Table includes data available through May 30, 1990.
[2]Reported figure.

TABLE 19

## LEADING WORLD PRODUCERS OF IRON ORE, IRON ORE CONCENTRATES, AND IRON ORE AGGLOMERATES[1]

(Thousand metric tons, gross weight)

| Country | 1985 | 1986 | 1987 | 1988[p] | 1989[e] | Average 1985-89 |
|---|---|---|---|---|---|---|
| U.S.S.R. | 247,639 | 249,959 | 250,874 | 249,737 | 241,000 | 247,842 |
| Brazil | 128,251 | 132,288 | 134,105 | 145,040 | [2]153,700 | 138,677 |
| Australia | 97,447 | 94,015 | 101,748 | 96,084 | [2]105,810 | 99,021 |
| China[e] | 80,000 | 90,000 | 100,000 | [r]99,000 | 100,000 | 93,800 |
| United States | 49,533 | 39,486 | 47,648 | 57,515 | [2]59,032 | 50,643 |
| India | 42,545 | 47,800 | 51,018 | 49,961 | [2]49,487 | 48,162 |
| Canada | 39,502 | 36,167 | 37,702 | 38,742 | [2]40,900 | 38,603 |
| South Africa, Republic of | 24,414 | 24,483 | 22,008 | 25,248 | [2]29,958 | 25,222 |
| Sweden | 20,454 | 20,489 | 19,627 | 20,440 | [2]21,578 | 20,518 |
| Venezuela | [r]14,710 | [r]16,207 | 17,196 | 18,218 | [2]18,053 | 16,877 |
| Liberia | 15,318 | 15,295 | 13,742 | 12,767 | 11,700 | 13,764 |
| Mauritania | 9,333 | 8,929 | 9,002 | 10,004 | [2]11,138 | 9,681 |
| France | 14,447 | [r]12,437 | 10,931 | 10,903 | 10,500 | 11,844 |
| Korea, North[e] | 8,000 | [r]8,500 | [r]8,500 | 9,000 | 9,500 | 8,700 |
| Chile | 6,534 | 6,981 | 6,637 | 7,710 | [2]8,474 | 7,267 |
| Mexico | 7,820 | 7,298 | 7,523 | 8,431 | [2]8,141 | 7,843 |
| Yugoslavia | 5,478 | 6,618 | 5,983 | 5,545 | [2]5,080 | 5,741 |
| Spain | 6,463 | 6,089 | 4,492 | 4,212 | [2]4,610 | 5,173 |
| Turkey | 3,994 | 5,249 | 5,366 | 5,693 | [2]3,602 | 4,781 |
| Total | [r]817,888 | [r]823,041 | 848,736 | 868,557 | 888,661 | 849,377 |
| Other | [r]42,668 | [r]42,936 | 40,426 | 37,736 | 34,971 | 39,747 |
| Grand total | [r]860,556 | [r]865,977 | 889,162 | 906,293 | 923,632 | 889,124 |

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through June 27, 1990.
[2]Reported figure.

TABLE 20

## LEADING WORLD PRODUCERS OF CRUDE STEEL[1]

(Thousand metric tons)

| Country | 1985 | 1986 | 1987 | 1988[P] | 1989[e] | Average 1985-89 |
|---|---|---|---|---|---|---|
| U.S.S.R. | 154,668 | 160,550 | 161,887 | 163,037 | 160,000 | 160,028 |
| Japan | 105,279 | 98,275 | 98,513 | 105,681 | [2]107,909 | 103,131 |
| United States | 80,067 | 74,032 | 80,877 | 90,650 | [2]88,852 | 82,896 |
| China[e] | 46,700 | 52,100 | 56,000 | 59,000 | 61,200 | 55,000 |
| Germany, Federal Republic of | 40,497 | 37,134 | 36,248 | 41,023 | [2]41,002 | 39,181 |
| Italy | [r]23,898 | [r]22,883 | 22,859 | 23,760 | [2]25,171 | 23,714 |
| Brazil | 20,456 | 21,234 | 22,231 | 24,536 | [2]25,018 | 22,695 |
| Korea, Republic of | 13,539 | 14,554 | 16,782 | 19,117 | 21,800 | 17,158 |
| France | 18,832 | 17,624 | 17,726 | 19,003 | [2]19,286 | 18,494 |
| United Kingdom | 15,722 | 14,811 | 17,425 | 19,013 | [2]18,813 | 17,157 |
| Poland | 16,126 | 17,144 | 17,148 | 16,873 | 17,000 | 16,858 |
| Czechoslovakia | 15,036 | 15,112 | 15,356 | 15,319 | [2]15,465 | 15,258 |
| Canada | 14,600 | 14,100 | 14,700 | 14,866 | [2]15,458 | 14,745 |
| India | 11,054 | 11,427 | 12,883 | 14,309 | [2]14,429 | 12,820 |
| Romania | 13,795 | 14,276 | 13,885 | [e]14,000 | [2]14,415 | 14,074 |
| Spain | 14,235 | 11,976 | 11,691 | 11,685 | [2]12,684 | 12,454 |
| Belgium | 10,683 | [r]9,770 | 9,787 | 11,222 | [2]10,948 | 10,482 |
| South Africa, Republic of | 8,582 | [e]8,800 | 8,400 | 8,800 | 8,900 | 8,696 |
| Korea, North[e] | 6,500 | 6,500 | 6,500 | 8,000 | 8,000 | 7,100 |
| Mexico | [r]7,399 | [r]7,225 | 7,642 | 7,779 | [2]7,920 | 7,593 |
| German Democratic Republic | 7,853 | 7,967 | 8,243 | 8,131 | 7,800 | 7,999 |
| Total | [r]645,521 | [r]637,494 | 656,783 | 695,804 | 702,070 | 667,534 |
| Other | [r]72,554 | [r]73,861 | 76,525 | 82,599 | 82,153 | 77,538 |
| Grand total | [r]718,075 | [r]711,355 | 733,308 | 778,403 | 784,223 | 745,073 |

[e]Estimated. [P]Preliminary. [r]Revised.
[1]Steel ingots and castings. Table includes data available through June 20, 1990.
[2]Reported figure.

TABLE 21

## LEADING WORLD PRODUCERS OF MINE LEAD[1]

(Thousand metric tons, Pb content of ore)

| Country | 1985 | 1986 | 1987 | 1988[P] | 1989[e] | Average 1985-89 |
|---|---|---|---|---|---|---|
| Australia | 498 | 448 | 489 | 466 | [2]495 | 479 |
| U.S.S.R.[e] | 440 | 440 | 440 | 440 | 440 | 440 |
| United States[3] | 424 | 353 | 319 | 394 | [2]419 | 382 |
| China[e] | [e]200 | 227 | 252 | 312 | 330 | 264 |
| Canada | 268 | 349 | 414 | 368 | [2]275 | 335 |
| Peru | 202 | 194 | 204 | 149 | [2]192 | 188 |
| Mexico | [r]207 | [r]183 | 177 | 171 | [2]163 | 180 |
| Korea, North[e] | 110 | 110 | 110 | 110 | 110 | 110 |
| Yugoslavia | 115 | 115 | 107 | 103 | 100 | 108 |
| Total | [r]2,464 | [r]2,431 | 2,512 | 2,513 | 2,524 | 2,486 |
| Other | [r]967 | [r]904 | 917 | 901 | 871 | 914 |
| Grand total | [r]3,431 | [r]3,335 | 3,429 | 3,414 | 3,395 | 3,401 |

[e]Estimated. [P]Preliminary. [r]Revised.
[1]Table includes data available through June 13, 1990
[2]Reported figure.
[3]Recoverable.

TABLE 22

## LEADING WORLD PRODUCERS OF MANGANESE ORE[1]

(Thousand metric tons, gross weight)

| Country | 1985 | 1986 | 1987 | 1988[p] | 1989[e] | Average 1985-89 |
|---|---|---|---|---|---|---|
| U.S.S.R. | 9,900 | 9,300 | 9,400 | [r e]9,100 | 8,800 | 9,300 |
| South Africa, Republic of | 3,601 | 3,719 | 2,892 | 3,454 | [2]3,623 | 3,458 |
| China | 2,611 | 2,723 | [e]2,750 | [e]2,750 | 2,750 | 2,717 |
| Gabon | 2,340 | 2,510 | 2,403 | 2,254 | 2,600 | 2,421 |
| Australia | 2,003 | 1,649 | 1,853 | 1,985 | [2]2,124 | 1,923 |
| Brazil | 2,523 | 2,697 | 2,067 | 1,945 | 1,602 | 2,167 |
| India | 1,240 | 1,213 | 1,302 | 1,324 | 1,400 | 1,296 |
| Mexico[e] | 396 | 459 | 385 | [2]444 | 428 | 422 |
| Ghana | [r]319 | [r]304 | 274 | 260 | 315 | 294 |
| Hungary | 63 | 63 | 78 | 75 | 75 | 71 |
| Romania | 68 | 67 | [e]65 | [e]65 | 65 | 66 |
| Total | [r]25,064 | [r]24,704 | 23,469 | 23,656 | 23,782 | 24,135 |
| Other | [r]284 | [r]242 | 233 | 250 | 247 | 251 |
| Grand total | [r]25,348 | [r]24,946 | 23,702 | 23,906 | 24,029 | 24,386 |

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through May 16, 1990.
[2]Reported figure.

TABLE 23

## LEADING WORLD PRODUCERS OF MINE NICKEL[1]

(Thousand metric tons, Ni content)

| Country | 1985 | 1986 | 1987 | 1988[p] | 1989[e] | Average 1985-89 |
|---|---|---|---|---|---|---|
| Canada | 170 | 164 | 189 | 219 | [2]204 | 189 |
| U.S.S.R.[e] | [r]185 | [r]195 | [r]205 | [r]215 | 215 | 203 |
| New Caledonia[e] | 72 | 62 | 57 | 68 | 125 | 77 |
| Australia | 86 | 77 | 75 | 62 | [2]67 | 73 |
| Indonesia | 40 | 54 | 58 | 58 | 64 | 55 |
| Cuba | 32 | 32 | 34 | 42 | 43 | 37 |
| South Africa, Republic of[e] | 25 | [r]31 | 34 | 35 | 36 | 32 |
| Dominican Republic | 25 | 22 | 33 | [e]29 | 32 | 28 |
| Total | [r]635 | [r]637 | 685 | 728 | 786 | 694 |
| Other | [r]177 | [r]151 | 141 | 144 | 146 | 152 |
| Grand total | [r]812 | [r]788 | 826 | 872 | 932 | 846 |

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through May 4, 1990.
[2]Reported figure.

TABLE 24

## LEADING WORLD PRODUCERS OF MINE SILVER[1]

(Metric tons, Ag content)

| Country | 1985 | 1986 | 1987 | 1988[p] | 1989[e] | Average 1985-89 |
|---|---|---|---|---|---|---|
| Mexico | [r]2,153 | [r]2,303 | 2,415 | 2,359 | [2]2,306 | 2,307 |
| United States | 1,227 | 1,074 | 1,241 | 1,661 | [2]2,007 | 1,442 |
| Peru | 1,811 | 1,926 | 2,054 | 1,552 | 1,840 | 1,837 |
| U.S.S.R.[e] (refinery) | 1,490 | 1,500 | 1,500 | 1,490 | 1,490 | 1,494 |
| Canada | 1,197 | 1,088 | 1,375 | 1,371 | [2]1,285 | 1,263 |
| Poland | 831 | 829 | 831 | 1,063 | 1,060 | 923 |
| Australia | 1,086 | 1,023 | 1,119 | 1,118 | 1,000 | 1,069 |
| Chile | 517 | 500 | 500 | 507 | 507 | 506 |
| Spain | 367 | 327 | 350 | 353 | 350 | 349 |
| Morocco | 85 | 49 | [e]44 | 226 | 225 | 126 |
| Sweden | 231 | 235 | 215 | 193 | 195 | 214 |
| South Africa, Republic of | 208 | 222 | 208 | 200 | [2]178 | 203 |
| Japan (refinery) | 339 | 351 | 281 | 252 | [2]156 | 276 |
| Yugoslavia (refinery) | 156 | 177 | 165 | 139 | 140 | 155 |
| Namibia | 106 | 108 | 75 | 117 | 100 | 101 |
| Papua New Guinea | 46 | 56 | 61 | 70 | 70 | 61 |
| Total | [r]11,804 | [r]11,712 | 12,373 | 12,601 | 12,839 | 12,266 |
| Other | [r]1,247 | [r]1,258 | 1,384 | 1,566 | 1,613 | 1,414 |
| Grand total | [r]13,051 | [r]12,970 | 13,757 | 14,167 | 14,452 | 13,679 |

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through June 20, 1990.
[2]Reported figure.

TABLE 25

## LEADING WORLD PRODUCERS OF MINE TIN[1]

(Metric tons, Sn content of ore)

| Country | 1985 | 1986 | 1987 | 1988[p] | 1989[e] | Average 1985-89 |
|---|---|---|---|---|---|---|
| Brazil | 26,514 | 26,246 | 27,364 | 44,102 | [2]50,161 | 34,877 |
| Indonesia | [r]21,722 | [r]24,497 | 26,093 | 29,590 | [2]31,263 | 26,633 |
| Malaysia | 36,884 | 29,135 | 30,388 | 28,866 | 31,000 | 31,255 |
| China[e] | 15,000 | 15,000 | 20,000 | 25,000 | 25,000 | 20,000 |
| U.S.S.R.[e] | 13,500 | 14,500 | 16,000 | 16,000 | 16,000 | 15,200 |
| Thailand | 16,864 | 17,066 | 15,006 | 14,225 | 14,500 | 15,532 |
| Bolivia | 16,136 | [r]10,462 | 8,128 | 10,573 | [2]15,858 | 12,231 |
| Australia | 6,363 | 8,508 | 7,691 | 7,009 | [2]7,776 | 7,469 |
| Peru | 3,807 | 4,817 | 5,263 | 4,378 | [2]5,053 | 4,664 |
| Canada | 120 | 2,485 | 3,397 | [e]3,300 | 3,300 | 2,520 |
| United Kingdom | 5,204 | 4,276 | 4,003 | 3,454 | 3,200 | 4,027 |
| Zaire | 3,100 | 2,650 | 2,378 | 2,688 | 2,700 | 2,703 |
| South Africa, Republic of | 2,153 | 2,054 | 1,438 | 1,377 | [2]1,306 | 1,666 |
| Total | [r]167,367 | [r]161,696 | 167,149 | 190,562 | 207,117 | 178,778 |
| Other | [r]13,358 | [r]10,775 | 10,982 | 9,588 | 9,340 | 10,809 |
| Grand total | [r]180,725 | [r]172,471 | 178,131 | 200,150 | 216,457 | 189,587 |

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through June 6, 1990.
[2]Reported figure.

TABLE 26

## LEADING WORLD PRODUCERS OF MINE URANIUM[1 2]

(Metric tons, $U_3O_8$ content)

| Country | 1985 | 1986 | 1987 | 1988[p] | 1989[e] | Average 1985-89 |
|---|---|---|---|---|---|---|
| Canada | 12,814 | 13,824 | 14,666 | 14,695 | 13,269 | 13,854 |
| United States | [r]5,132 | [r]6,126 | 5,893 | 5,956 | 6,276 | 5,877 |
| Australia | 3,781 | 4,899 | 4,422 | 4,165 | 4,311 | 4,316 |
| France | 3,752 | 3,804 | 3,981 | 4,033 | 3,781 | 3,870 |
| Namibia | [e]4,400 | [e]3,990 | 4,175 | 4,139 | 3,629 | 4,067 |
| Niger | 3,751 | 3,671 | 3,501 | 3,496 | 3,514 | 3,587 |
| South Africa, Republic of | 5,751 | 5,460 | 4,735 | 4,583 | 3,456 | 4,797 |
| Gabon | 1,105 | 1,059 | 934 | 1,094 | [e]1,050 | 1,048 |
| Total | 40,486 | 42,833 | 42,307 | 42,161 | 39,286 | 41,415 |
| Others | [r]981 | [r]1,089 | 1,130 | 967 | 908 | 1,015 |
| Grand total | [r]41,467 | [r]43,922 | 43,437 | 43,128 | 40,194 | 42,430 |

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

[1]Table includes data available through Oct. 31, 1990.

[2]Known market economy producing countries; centrally planned economy countries excluded.

TABLE 27

## LEADING WORLD PRODUCERS OF MINE ZINC[1]

(Thousand metric tons, Zn content of ore)

| Country | 1985 | 1986 | 1987 | 1988[p] | 1989[e] | Average 1985-89 |
|---|---|---|---|---|---|---|
| Canada | 1,172 | 1,291 | 1,482 | 1,352 | [2]1,215 | 1,302 |
| U.S.S.R.[e] | 810 | 810 | 810 | 810 | 810 | 810 |
| Australia | 759 | 712 | 778 | [e]766 | [2]803 | 764 |
| Peru | 523 | 598 | 613 | 485 | [2]597 | 563 |
| China | [e]300 | 396 | 458 | 527 | 550 | 446 |
| United States | 252 | 221 | 233 | 256 | [2]288 | 250 |
| Mexico | [r]275 | [r]271 | 271 | 262 | [2]284 | 273 |
| Spain | 235 | [r]227 | 273 | 278 | 265 | 256 |
| Korea, North[e] | 180 | 225 | 220 | 225 | 225 | 215 |
| Poland | 188 | 185 | 184 | [e]184 | 184 | 185 |
| Ireland | 192 | 182 | 177 | 173 | 169 | 179 |
| Sweden | 216 | [r]219 | 219 | 187 | 164 | 201 |
| Brazil | 124 | 124 | 133 | 156 | 157 | 139 |
| Japan | 253 | 222 | 166 | 147 | [2]132 | 184 |
| Yugoslavia | 89 | [r]99 | 87 | 91 | 90 | 91 |
| South Africa, Republic of | 97 | 102 | 113 | 90 | [2]77 | 96 |
| Zaire | 78 | 81 | 75 | 74 | 75 | 77 |
| Germany, Federal Republic of | 118 | 104 | 99 | 76 | [2]73 | 94 |
| Greenland | 70 | 62 | 69 | 78 | [2]72 | 70 |
| Thailand | 78 | 97 | 89 | 78 | [2]63 | 81 |
| Total | [r]5,743 | [r]5,965 | 6,292 | 6,063 | 6,085 | 6,030 |
| Other | [r]1,015 | [r]971 | 940 | 952 | 977 | 971 |
| Grand total | [r]6,758 | 6,936 | 7,232 | 7,015 | 7,062 | 7,001 |

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

[1]Table includes data available through June 29, 1990.

[2]Reported figure.

TABLE 28

## LEADING WORLD PRODUCERS OF HYDRAULIC CEMENT[1]

(Thousand metric tons)

| Country | 1985 | 1986 | 1987 | 1988[p] | 1989[e] | Average 1985-89 |
|---|---|---|---|---|---|---|
| China[e] | 142,500 | 161,500 | 180,000 | 203,000 | 207,000 | 178,800 |
| U.S.S.R. | 130,722 | 135,119 | 137,404 | 139,499 | 140,000 | 136,549 |
| Japan | 72,847 | 71,264 | 71,551 | 77,554 | 81,300 | 74,903 |
| United States (including Puerto Rico) | 71,540 | 72,499 | 72,122 | 70,989 | [2]71,268 | 71,684 |
| India | 33,030 | 36,400 | 36,980 | 40,700 | [2]42,100 | 37,842 |
| Italy | 36,677 | [r]35,938 | 37,257 | [e]37,000 | 36,500 | 36,674 |
| Korea, Republic of | 20,424 | 23,403 | 25,662 | 28,995 | [2]30,474 | 25,792 |
| Germany, Federal Republic of | 25,758 | 26,580 | 25,268 | 26,215 | 26,500 | 26,064 |
| Brazil | 20,612 | 25,297 | 25,470 | 25,328 | 25,000 | 24,341 |
| Spain (including Canary Islands)[e] | [2]24,197 | 24,000 | 23,400 | 24,000 | 24,500 | 24,019 |
| France | 23,546 | [e]23,500 | 23,560 | [e]24,000 | 24,000 | 23,721 |
| Turkey | 17,581 | 20,004 | 21,980 | 22,675 | [2]23,800 | 21,208 |
| Mexico | 20,680 | 19,751 | 22,749 | 22,513 | 23,500 | 21,839 |
| Taiwan | 14,418 | 14,806 | 15,663 | 17,281 | [2]18,043 | 16,042 |
| United Kingdom | 13,339 | 13,413 | 14,311 | 16,506 | 16,000 | 14,714 |
| Poland | 15,000 | 15,800 | 16,100 | 17,000 | 15,000 | 15,780 |
| Indonesia | 10,081 | 10,941 | 11,844 | 12,472 | [2]14,099 | 11,887 |
| Romania | 12,238 | 14,216 | [e]14,300 | [e]14,000 | 14,000 | 13,751 |
| Greece | 13,669 | 13,341 | 13,168 | 13,053 | 13,100 | 13,266 |
| Iran | 12,646 | 12,273 | 12,729 | 12,202 | 12,500 | 12,470 |
| German Democratic Republic | 11,608 | 11,988 | 12,430 | 12,510 | 12,500 | 12,207 |
| Canada | 10,192 | 10,602 | 12,603 | 12,036 | [2]11,832 | 11,453 |
| Total | 692,952 | [r]730,215 | 761,321 | 805,727 | 819,084 | 761,860 |
| Other | [r]266,663 | [r]274,276 | 286,926 | 298,838 | 304,069 | 286,154 |
| Grand total | [r]959,615 | [r]1,004,491 | 1,048,247 | 1,104,565 | 1,123,153 | 1,048,014 |

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through June 27, 1990.
[2]Reported figure.

TABLE 29

## LEADING WORLD PRODUCERS OF NATURAL DIAMOND[1]

(Thousand carats)

| Country | 1985 | 1986 | 1987 | 1988[p] | 1989[e] | Average 1985-89 |
|---|---|---|---|---|---|---|
| Australia | 7,070 | 29,211 | 30,333 | 35,034 | 35,080 | 27,346 |
| Zaire | 20,159 | 23,304 | 19,425 | 18,227 | 19,000 | 20,023 |
| Botswana | 12,635 | [r]13,090 | 13,208 | 15,229 | [2]15,252 | 13,883 |
| U.S.S.R.[e] | 10,800 | 10,800 | 10,800 | 11,000 | 11,000 | 10,880 |
| South Africa, Republic of | [r]10,202 | 10,228 | 9,053 | [r e]8,504 | 9,116 | 9,421 |
| China[e] | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |
| Angola[e] | [2]714 | 250 | 190 | 1,000 | 1,000 | 631 |
| Namibia | 910 | 1,010 | 1,037 | 938 | 1,000 | 979 |
| Brazil | 450 | 625 | 645 | 533 | 550 | 561 |
| Total | [r]63,940 | [r]89,518 | 85,691 | 91,465 | 92,998 | 84,722 |
| Other | [r]2,078 | [r]2,245 | 1,912 | 1,881 | 1,839 | 1,991 |
| Grand total | 66,018 | [r]91,763 | 87,603 | 93,346 | 94,837 | 86,713 |

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Gem and industrial grades undifferentiated. Table includes data available through May 16, 1990.
[2]Reported figure.

TABLE 30

## LEADING WORLD PRODUCERS OF NITROGEN IN AMMONIA[1]

(Thousand metric tons, N content)

| Country | 1985 | 1986 | 1987 | 1988[p] | 1989[e] | Average 1985-89 |
|---|---|---|---|---|---|---|
| U.S.S.R. | 18,300 | 19,600 | 20,000 | [r e]20,100 | 20,100 | 19,620 |
| China[e] | 15,000 | 15,500 | 14,500 | 16,200 | 17,000 | 15,640 |
| United States | 12,915 | 10,804 | 12,004 | 12,544 | [2]12,546 | 12,163 |
| India[3] | 4,270 | [r]4,933 | 5,300 | [e]6,205 | 6,700 | 5,482 |
| Canada | 2,976 | 2,910 | 2,887 | 3,298 | [2]3,332 | 3,081 |
| Netherlands | 2,516 | 2,692 | 2,828 | 2,956 | [2]3,001 | 2,799 |
| Romania | 2,880 | 3,040 | 2,788 | [e]2,800 | 2,600 | 2,822 |
| Indonesia | 2,057 | 2,299 | 2,364 | 2,367 | [2]2,526 | 2,323 |
| Poland | 1,812 | 2,124 | 2,177 | [e]2,200 | 2,200 | 2,103 |
| Mexico | 1,859 | 1,602 | 1,744 | 2,067 | 2,100 | 1,874 |
| Japan | 1,646 | 1,508 | 1,556 | 1,524 | 1,550 | 1,557 |
| Trinidad and Tobago | [r]1,080 | 1,141 | 1,128 | 1,386 | 1,514 | 1,250 |
| Germany, Federal Republic of | 1,908 | 1,570 | 1,932 | 1,750 | 1,500 | 1,732 |
| France | 2,012 | 2,022 | 2,029 | [e]1,832 | 1,476 | 1,874 |
| Italy | [r]1,215 | [r]1,553 | 1,435 | 1,560 | [2]1,446 | 1,442 |
| Pakistan | 1,107 | 1,154 | 1,179 | 1,202 | 1,200 | 1,168 |
| German Democratic Republic | 1,206 | 1,193 | 1,176 | 1,156 | 1,150 | 1,176 |
| Bulgaria | 1,138 | 1,091 | 1,070 | [e]1,050 | 1,050 | 1,080 |
| United Kingdom | 1,767 | 1,388 | 1,415 | 1,105 | [2]1,037 | 1,342 |
| Total | [r]75,897 | [r]76,736 | 78,097 | 82,197 | 82,991 | 79,184 |
| Other | [r]15,159 | [r]14,822 | 16,018 | 16,317 | 16,593 | 15,782 |
| Grand total | [r]91,056 | [r]91,558 | 94,115 | 98,514 | 99,584 | 94,965 |

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through May 30, 1990.
[2]Reported figure.
[3]Data are for years beginning Apr. 1 of that stated.

TABLE 31

## LEADING WORLD PRODUCERS OF PHOSPHATE ROCK[1]

(Thousand metric tons, gross weight)

| Country | 1985 | 1986 | 1987 | 1988[p] | 1989[e] | Average 1985-89 |
|---|---|---|---|---|---|---|
| United States | 50,835 | 38,710 | 40,954 | 45,389 | [2]48,866 | 44,951 |
| U.S.S.R.[e] | 33,750 | 33,900 | 34,100 | [r]34,400 | 34,400 | 34,110 |
| Morocco[3] | 20,737 | 21,178 | [e]20,000 | 25,015 | 24,400 | 22,266 |
| China[e] | 6,970 | 6,700 | 9,000 | 15,000 | 15,500 | 10,634 |
| Tunisia | 4,530 | 5,951 | [e]6,390 | 6,103 | 6,100 | 5,815 |
| Jordan | 6,067 | 6,249 | 6,800 | 6,611 | 6,000 | 6,345 |
| Israel | 4,076 | 3,673 | 3,798 | 3,479 | 3,922 | 3,790 |
| Brazil | 4,214 | 4,509 | 4,777 | 4,672 | 3,580 | 4,350 |
| Togo | 2,452 | 2,314 | 2,644 | 3,464 | [2]3,355 | 2,846 |
| South Africa, Republic of | 2,433 | 2,920 | 2,623 | [e]2,850 | 2,900 | 2,745 |
| Total | 136,064 | 126,104 | 131,086 | 146,983 | 149,023 | 137,852 |
| Other | [r]12,785 | [r]12,765 | 13,145 | 13,392 | 13,245 | 13,066 |
| Grand total | [r]148,849 | [r]138,869 | 144,231 | 160,375 | 162,268 | 150,918 |

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Includes only phosphate rock; Thomas slag and guano are excluded. Table includes data available through May 30, 1990.
[2]Reported figure.
[3]Includes output from Western Sahara.

TABLE 32

## LEADING WORLD PRODUCERS OF MARKETABLE POTASH[1]

(Thousand metric tons, $K_2O$ equivalent)

| Country | 1985 | 1986 | 1987 | 1988[p] | 1989[e] | Average 1985-89 |
|---|---|---|---|---|---|---|
| U.S.S.R. | 10,367 | 10,228 | 10,888 | 11,301 | 10,500 | 10,657 |
| Canada | 6,661 | [r]6,753 | 7,668 | 8,311 | [2]7,458 | 7,370 |
| German Democratic Republic | 3,465 | 3,485 | 3,510 | 3,510 | 3,200 | 3,434 |
| Germany, Federal Republic of | 2,583 | 2,161 | 2,199 | 2,390 | 2,240 | 2,315 |
| United States | 1,296 | 1,202 | 1,262 | 1,521 | [2]1,595 | 1,375 |
| Israel | 1,200 | 1,255 | 1,253 | 1,244 | [2]1,271 | 1,245 |
| France | 1,750 | 1,617 | 1,539 | 1,502 | 1,200 | 1,522 |
| Total | 25,572 | [r]25,084 | 26,780 | 28,277 | 26,264 | 26,395 |
| Other | 3,579 | [r]3,704 | 3,746 | 3,831 | 3,525 | 3,677 |
| Grand total | 29,151 | [r]28,788 | 30,526 | 32,108 | 29,789 | 30,072 |

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through Apr. 18, 1990.
[2]Reported figure.

TABLE 33

## LEADING WORLD PRODUCERS OF SALT[1]

(Thousand metric tons)

| Country | 1985 | 1986 | 1987 | 1988[p] | 1989[e] | Average 1985-89 |
|---|---|---|---|---|---|---|
| United States (including Puerto Rico)[e] | 35,441 | 33,296 | 33,142 | 34,506 | 35,291 | 34,335 |
| China[e] | 14,446 | 17,300 | 18,000 | 22,000 | 28,000 | 19,949 |
| U.S.S.R. | 16,100 | 15,300 | 15,400 | 14,800 | 14,800 | 15,280 |
| Germany, Federal Republic of | 13,080 | 13,102 | 13,466 | [e]13,605 | 13,100 | 13,271 |
| Canada | 10,085 | 10,332 | 10,129 | 10,687 | [2]11,140 | 10,475 |
| India[e] | 9,879 | 10,118 | 9,902 | [r e]9,204 | 9,004 | 9,621 |
| France | 7,113 | 7,084 | [e]7,840 | [e]7,925 | 8,050 | 7,602 |
| Mexico | 6,467 | 6,205 | 6,393 | 7,189 | 7,652 | 6,781 |
| Australia | 5,835 | 6,130 | 6,486 | 6,976 | 7,345 | 6,554 |
| United Kingdom | 7,145 | 6,855 | 7,081 | 6,130 | 5,800 | 6,602 |
| Poland | 4,865 | 5,421 | 6,168 | [e]5,700 | 5,700 | 5,571 |
| Romania | 5,019 | 5,355 | 5,395 | [e]5,400 | 5,000 | 5,234 |
| Brazil | 2,689 | 2,200 | 4,550 | 4,356 | 4,391 | 3,637 |
| Italy[e] | [2]3,746 | [r e]4,007 | [r e]4,265 | [r e]4,371 | 4,385 | 4,155 |
| Netherlands | 4,154 | 3,763 | 3,979 | 3,693 | 3,700 | 3,858 |
| Spain | 3,240 | 3,101 | 3,195 | [e]3,100 | 3,100 | 3,147 |
| German Democratic Republic[e] | 3,138 | 3,134 | 3,134 | [r]3,060 | 3,058 | 3,105 |
| Japan | [e]1,200 | 1,370 | 1,397 | 1,363 | 1,350 | 1,336 |
| Turkey | 1,189 | 1,172 | 1,218 | [e]1,350 | 1,350 | 1,256 |
| Total | 154,831 | [r]155,245 | 161,140 | 165,415 | 172,216 | 161,769 |
| Other | [r]18,081 | [r]19,584 | 17,469 | 18,279 | 18,371 | 18,357 |
| Grand total | [r]172,912 | [r]174,829 | 178,609 | 183,694 | 190,587 | 180,126 |

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through June 13, 1990.
[2]Reported figure.

TABLE 34

## LEADING WORLD PRODUCERS OF ELEMENTAL SULFUR[1]

(Thousand metric tons)

| Country | 1985 | | | | 1986 | | | |
|---|---|---|---|---|---|---|---|---|
| | Native | From pyrites | Byproduct | Total | Native | From pyrites | Byproduct | Total |
| United States | [2]5,011 | W | 6,598 | 11,609 | [2]4,043 | W | 7,044 | 11,087 |
| U.S.S.R.[e] | [3]2,760 | 2,421 | [r]3,349 | [r]8,530 | [3]3,000 | 2,090 | [r]3,075 | [r]8,165 |
| Canada[e] | — | — | [r]6,645 | [r]6,645 | — | — | [r]6,587 | [r]6,587 |
| Poland[e] | [3]4,983 | — | 220 | 5,203 | [3]4,987 | — | 220 | 5,207 |
| China[e] | 300 | 2,200 | 400 | 2,900 | 300 | 2,500 | 300 | 3,100 |
| Japan | — | 253 | 2,245 | 2,498 | — | 158 | 2,213 | 2,371 |
| Mexico | [2]1,551 | — | [r e]579 | [r e]2,140 | [2]1,588 | — | [r e]596 | [r e]2,184 |
| Germany, Federal Republic of[e] | — | — | 1,769 | 1,769 | — | — | 1,773 | 1,773 |
| Saudi Arabia | — | — | 1,100 | 1,100 | — | — | 1,446 | 1,446 |
| Iraq[e] | [2]500 | — | 70 | 570 | [2]600 | — | 200 | 800 |
| Spain | — | 1,231 | [e]224 | [e]1,455 | — | 1,195 | [e]220 | [e]1,415 |
| France | — | — | 1,723 | 1,723 | — | — | 1,306 | 1,306 |
| Italy | 1 | 280 | [r e]240 | [r e]521 | — | 309 | [r e]370 | [r e]679 |
| South Africa, Republic of | — | 562 | [e]185 | [e]747 | — | 499 | [e]218 | [e]717 |
| Finland | — | 248 | 302 | 550 | — | 275 | 302 | 577 |
| Kuwait[e] | — | — | [4]238 | [4]238 | — | — | 260 | 260 |
| Yugoslavia | — | [r]218 | [e]173 | [r e]391 | — | [r]320 | [e]178 | [r e]498 |
| Sweden | — | 210 | 146 | 356 | — | 227 | 174 | 401 |
| Philippines | — | 108 | [e]100 | [e]208 | — | 113 | [e]120 | [e]233 |
| Brazil | [2]4 | 91 | 134 | 229 | [2]6 | 92 | 174 | 272 |
| Iran[e] | 30 | — | 150 | 180 | 30 | — | 250 | 280 |
| Belgium[e] | — | — | 260 | 260 | — | — | 300 | 300 |
| German Democratic Republic[e] | — | — | 330 | 330 | — | — | 315 | 315 |
| Total | [r]15,106 | [r]7,731 | [r]26,306 | [r]49,153 | 14,518 | [r]7,686 | [r]26,602 | [r]48,806 |
| Other | [r]216 | [r]1,254 | [r]3,158 | [r]4,618 | 191 | [r]1,195 | [r]3,409 | [r]4,795 |
| Grand total | 15,322 | [r]8,985 | [r]29,464 | [r]53,771 | 14,709 | [r]8,881 | [r]30,011 | [r]53,601 |

| | 1987 | | | | 1988[p] | | | |
|---|---|---|---|---|---|---|---|---|
| | Native | From pyrites | Byproduct | Total | Native | From pyrites | Byproduct | Total |
| United States | [2]3,202 | W | 7,336 | 10,538 | [2]3,174 | W | 7,572 | 10,746 |
| U.S.S.R.[e] | [3]3,000 | 2,150 | [r]4,100 | [r]9,250 | [3]3,000 | 2,150 | [r]5,115 | [r]10,265 |
| Canada[e] | — | — | [r]6,619 | [r]6,619 | — | — | [r]6,930 | [r]6,930 |
| Poland[e] | [3]5,104 | — | 220 | 5,324 | [3]4,900 | — | 190 | 5,090 |
| China[e] | 300 | 3,700 | 500 | 4,500 | 300 | 3,900 | 550 | 4,750 |
| Japan | — | 79 | 2,237 | 2,316 | — | 70 | [e]2,377 | [e]2,447 |
| Mexico | [2]1,806 | — | [r e]652 | [r e]2,458 | [2]1,628 | — | [r e]750 | [r e]2,378 |
| Germany, Federal Republic of[e] | — | — | 1,825 | 1,825 | — | — | 1,795 | 1,795 |
| Saudi Arabia | — | — | 1,432 | 1,432 | — | — | 1,450 | 1,450 |
| Iraq[e] | [2]707 | — | 250 | [4]957 | [2]700 | — | 350 | 1,050 |
| Spain | — | 960 | [e]235 | [e]1,195 | — | [e]1,100 | [e]240 | [e]1,340 |
| France | — | — | [e]1,252 | [e]1,252 | — | — | 1,168 | 1,168 |
| Italy | — | 330 | [r e]410 | [r e]740 | — | [r e]330 | [r]500 | [r e]830 |
| South Africa, Republic of | — | 468 | [e]215 | [e]683 | — | [e]470 | [e]230 | [e]700 |
| Finland | — | 311 | [e]260 | [e]571 | — | [e]300 | [r e]287 | [r e]587 |
| Kuwait[e] | — | — | 310 | 310 | — | — | 360 | 360 |
| Yugoslavia | — | 258 | [e]178 | [r e]436 | — | 252 | [e]173 | [r e]425 |
| Sweden | — | [e]220 | [e]175 | [e]395 | — | 200 | 170 | 370 |

See footnotes at end of table.

TABLE 34—Continued

## LEADING WORLD PRODUCERS OF ELEMENTAL SULFUR[1]

(Thousand metric tons)

| Country | 1987 | | | | 1988[p] | | | |
|---|---|---|---|---|---|---|---|---|
| | Native | From pyrites | Byproduct | Total | Native | From pyrites | Byproduct | Total |
| Philippines | — | 158 | [e]140 | [e]298 | — | [e]160 | [e]150 | [e]310 |
| Brazil | [2]6 | 77 | 230 | 313 | [2]6 | 103 | 213 | 322 |
| Iran[e] | 30 | — | 300 | 330 | 30 | — | 300 | 330 |
| Belgium[e] | — | — | 300 | 300 | — | — | 310 | 310 |
| German Democratic Republic[e] | — | — | 315 | 315 | — | — | 315 | 315 |
| Total | 14,119 | 8,634 | 28,346 | 51,099 | 13,702 | 8,932 | 30,357 | 52,991 |
| Other | 177 | 1,166 | 3,626 | 4,969 | 171 | 1,231 | 3,703 | 5,105 |
| Grand total | 14,296 | 9,800 | 31,972 | 56,068 | 13,873 | 10,163 | 34,060 | 58,096 |

| | 1989[e] | | | | Average 1985-89 | | | |
|---|---|---|---|---|---|---|---|---|
| | Native | From pyrites | Byproduct | Total | Native | From pyrites | Byproduct | Total |
| United States | [2 3]3,888 | W | [4]7,704 | [4]11,592 | [2]3,864 | W | 7,251 | 11,114 |
| U.S.S.R.[e] | [3]2,900 | 2,150 | 4,300 | 9,350 | [3]2,932 | 2,192 | 3,988 | 9,112 |
| Canada[e] | — | — | 6,625 | 6,625 | — | — | 6,681 | 6,681 |
| Poland[e] | [3]4,900 | — | 190 | 5,090 | [3]4,975 | — | 208 | 5,183 |
| China[e] | 300 | 4,000 | 600 | 4,900 | 300 | 3,260 | 470 | 4,030 |
| Japan | — | 63 | 2,460 | 2,523 | — | 125 | 2,306 | 2,431 |
| Mexico | [2 3]1,531 | — | 836 | 2,367 | [2]1,621 | — | 683 | 2,305 |
| Germany, Federal Republic of[e] | — | — | 1,885 | 1,885 | — | — | 1,809 | 1,809 |
| Saudi Arabia | — | — | 1,450 | 1,450 | — | — | 1,376 | 1,376 |
| Iraq[e] | [2]900 | — | 370 | 1,270 | [2]681 | — | 248 | 929 |
| Spain | — | 1,000 | 235 | 1,235 | — | 1,097 | 231 | 1,328 |
| France | — | — | 1,051 | 1,051 | — | — | 1,300 | 1,300 |
| Italy | — | 330 | 500 | 830 | — | 316 | 404 | 720 |
| South Africa, Republic of | — | 470 | 230 | 700 | — | 494 | 216 | 709 |
| Finland | — | 300 | 285 | 585 | — | 287 | 287 | 574 |
| Kuwait[e] | — | — | 575 | 575 | — | — | 349 | 349 |
| Yugoslavia | — | 255 | 173 | 428 | — | 261 | 175 | 436 |
| Sweden | — | 225 | 175 | 400 | — | 216 | 168 | 384 |
| Philippines | — | 195 | 185 | 380 | — | 147 | 139 | 286 |
| Brazil | [2]6 | 100 | 225 | 331 | [2]6 | 93 | 195 | 293 |
| Iran[e] | 30 | — | 300 | 330 | 30 | — | 260 | 290 |
| Belgium[e] | — | — | 320 | 320 | — | — | 298 | 298 |
| German Democratic Republic[e] | — | — | 290 | 290 | — | — | 313 | 313 |
| Total | 14,419 | 8,988 | 29,829 | 53,236 | 14,373 | 8,394 | 28,288 | 51,057 |
| Other | 155 | 1,226 | 3,731 | 5,112 | 182 | 1,214 | 3,525 | 4,920 |
| Grand total | 14,574 | 10,214 | 33,560 | 58,348 | 14,555 | 9,609 | 31,813 | 55,977 |

[e]Estimated. [p]Preliminary. [r]Revised. W Withheld to avoid disclosing company proprietary data; included with "Byproduct."

[1]Includes all recorded production of sulfur, regardless of the form in which it is recovered. Thus, it includes elemental sulfur, whether mined by conventional methods or by the Frasch process, as well as (1) elemental sulfur and the S content of compounds such as $H_2S$, $SO_2$, and $H_2SO_4$ recovered as a principal product of pyrite mining and as a byproduct of the recovery of crude oil and natural gas and as a byproduct of petroleum refining, coal treatment, and metal smelting and/or refining, and (2) sulfur recovered from tar sands, spent oxides, and other miscellaneous sources. Table includes data available through May 16, 1990.

[2]Entirely Frasch process sulfur.

[3]Includes Frasch process sulfur as follows, in thousand metric tons: Poland: 1985—4,326, 1986—4,437, 1987—4,410, 1988—4,400 (estimated), and 1989—4,400 (estimated); the U.S.S.R. (estimated): 1985—960, 1986—1,100, 1987—1,100, 1988—1,100, and 1989—1,100; and total of individually listed countries and grade total: 1985—12,352, 1986—11,774, 1987—11,231, 1988—11,009 (revised), and 1989—11,825.

[4]Reported figure.

TABLE 35

## LEADING WORLD PRODUCERS OF COAL (ALL GRADES)[1]

(Million metric tons)

| Country | 1985 | | | 1986 | | | 1987 | | | 1988[p] | | | 1989[e] | | | Average 1985-89 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Lignite | Bituminous and anthracite | Total | Lignite | Bituminous and anthracite | Total | Lignite | Bituminous and anthracite | Total | Lignite | Bituminous and anthracite | Total | Lignite | Bituminous and anthracite | Total | Lignite | Bituminous and anthracite | Total |
| China[e] | (2) | 850 | 850 | (2) | r894 | r894 | (2) | r928 | r928 | (2) | r985 | r985 | (2) | 1,040 | 1,040 | — | 939 | 939 |
| United States | 66 | 736 | 802 | 69 | 738 | 808 | 71 | 762 | 833 | 77 | 785 | 862 | 3 78 | 3 811 | 3 890 | 72 | 766 | 839 |
| U.S.S.R. | 157 | 569 | 726 | 163 | 588 | 751 | 165 | 595 | 760 | 172 | 599 | 771 | 163 | 575 | 738 | 164 | 585 | 749 |
| German Democratic Republic | 312 | — | 312 | 311 | — | 311 | 309 | — | 309 | 310 | — | 310 | 3 301 | — | 3 301 | 309 | — | 309 |
| Poland | 58 | 192 | 250 | 67 | 192 | 259 | 73 | 193 | 266 | 74 | 193 | 267 | 3 72 | 3 178 | 3 250 | 69 | 190 | 258 |
| Australia | 37 | 158 | 195 | 38 | 170 | 208 | 45 | 178 | 223 | 43 | 177 | 220 | 3 48 | 3 190 | 3 238 | 42 | 175 | 217 |
| India | 8 | 149 | 157 | 8 | 163 | 171 | 8 | 177 | 186 | 13 | 189 | 202 | 3 13 | 3 199 | 3 212 | 10 | 175 | 186 |
| Germany, Federal Republic of | 121 | 82 | 203 | 114 | 81 | 195 | 109 | 76 | 185 | 109 | 73 | 182 | 3 110 | 3 71 | 3 182 | 113 | 77 | 189 |
| South Africa, Republic of | — | 174 | 174 | — | 177 | 177 | — | 177 | 177 | — | 181 | 181 | — | 176 | 176 | — | 177 | 177 |
| Czechoslovakia | 102 | 26 | 129 | 103 | 26 | 129 | 102 | 26 | 128 | 100 | 26 | 126 | 94 | 25 | 119 | 100 | 26 | 126 |
| United Kingdom | (4) | 94 | 94 | (4) | 108 | 108 | (4) | 105 | 105 | (4) | 104 | 104 | (3 4) | 3 101 | 3 101 | — | 102 | 102 |
| Korea, North | 13 | 44 | 57 | 14 | 48 | 62 | 15 | 55 | 70 | 18 | 62 | 80 | 20 | 65 | 85 | 16 | 55 | 71 |
| Yugoslavia | 69 | (4) | 70 | 70 | (4) | 70 | 71 | (4) | 72 | 72 | (4) | 73 | 74 | (4) | 75 | 71 | — | 72 |
| Canada | 10 | r51 | r61 | 8 | r50 | r58 | 10 | 51 | 61 | 12 | 58 | 71 | 3 11 | 3 60 | 3 71 | 10 | 54 | 64 |
| Romania | 39 | 10 | 49 | 40 | 11 | 51 | 44 | 12 | 56 | 45 | 12 | 57 | 53 | 8 | 61 | 44 | 11 | 55 |
| Turkey | 36 | 9 | 45 | r45 | 9 | r54 | 46 | 8 | 54 | 39 | 7 | 46 | 52 | 6 | 58 | 44 | 8 | 51 |
| Greece | 36 | — | 36 | r39 | — | r39 | 45 | — | 45 | 48 | — | 48 | 52 | — | 52 | 44 | — | 44 |
| Spain | r17 | r22 | 40 | r17 | r22 | 38 | 16 | 19 | 35 | 17 | 19 | 36 | 18 | 19 | 37 | 17 | 20 | 37 |
| Bulgaria | 32 | (4) | 32 | 35 | (4) | 35 | 35 | (4) | 35 | 35 | (4) | 35 | 34 | (4) | 34 | 34 | — | 34 |
| Korea, Republic of | — | 25 | 25 | — | 24 | 24 | — | 24 | 24 | — | 23 | 23 | — | 3 21 | 3 21 | — | 23 | 23 |
| Hungary | 21 | 3 | 24 | 21 | 2 | 23 | 21 | 2 | 23 | 19 | 2 | 21 | 3 18 | 3 2 | 3 20 | 20 | 2 | 22 |
| Total | r1,134 | r3,194 | r4,331 | r1,162 | r3,303 | r4,465 | 1,185 | 3,388 | 4,575 | 1,203 | 3,495 | 4,700 | 1,211 | 3,547 | 4,761 | 1,179 | 3,385 | 4,566 |
| Other | r16 | r100 | r113 | r14 | r100 | r114 | 14 | 104 | 116 | 13 | 103 | 114 | 14 | 111 | 122 | 14 | 104 | 116 |
| Grand total | r1,150 | r3,294 | r4,444 | r1,176 | r3,403 | r4,579 | 1,199 | 3,492 | 4,691 | 1,216 | 3,598 | 4,814 | 1,225 | 3,658 | 4,883 | 1,193 | 3,489 | 4,682 |

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

[1]Table includes data available through Oct. 31, 1990. Data may not add to totals shown because of independent rounding.

[2]Output small; included under "Bituminous and anthracite."

[3]Reported figure.

[4]Less than 1/2 unit.

TABLE 36

## LEADING WORLD PRODUCERS OF MARKETED NATURAL GAS[1]

(Million cubic meters)

| Country | 1985 | 1986 | 1987 | 1988[p] | 1989[e] | Average 1985-89 |
|---|---|---|---|---|---|---|
| U.S.S.R. | 643,000 | 686,000 | 727,000 | 770,000 | 796,000 | 724,400 |
| United States | 463,878 | 452,824 | 468,256 | 482,114 | [2]488,751 | 471,165 |
| Canada | 80,171 | 76,334 | 80,553 | 89,031 | [2]97,597 | 84,737 |
| Netherlands (gross) | 80,721 | 74,037 | 74,247 | 65,610 | [2]74,570 | 73,837 |
| Algeria | 34,300 | 39,400 | 39,400 | 44,900 | 48,400 | 41,280 |
| United Kingdom | 39,396 | 41,454 | 43,690 | 41,761 | [2]41,228 | 41,506 |
| Indonesia | 32,526 | 31,525 | 33,651 | 37,154 | 40,000 | 34,971 |
| Mexico | 33,899 | 33,278 | 33,817 | 34,512 | 35,000 | 34,101 |
| Romania | 38,904 | 39,371 | 37,418 | 33,000 | 32,000 | 36,139 |
| Norway | 26,699 | 28,102 | 29,868 | 29,754 | [2]31,964 | 29,277 |
| Saudi Arabia | 20,275 | 24,000 | 19,500 | 22,650 | 23,000 | 21,885 |
| Iran | 14,600 | 15,200 | 16,000 | 20,000 | 22,200 | 17,600 |
| United Arab Emirates | 13,030 | 15,020 | 19,310 | 19,640 | [2]21,980 | 17,796 |
| Argentina | 14,868 | 14,333 | 14,769 | 17,831 | 18,546 | 16,069 |
| Australia | 13,466 | 14,710 | 15,025 | 15,386 | 17,806 | 15,279 |
| Malaysia (Sarawak) | 12,380 | 14,950 | 15,500 | 16,450 | 17,160 | 15,288 |
| Italy | 14,158 | 15,893 | 16,324 | 16,634 | [2]16,978 | 15,997 |
| China[e] | 12,930 | 13,690 | 13,800 | 14,285 | 16,000 | 14,141 |
| Germany, Federal Republic of (gross) | 14,459 | 13,865 | 15,871 | 14,783 | [2]14,650 | 14,726 |
| Venezuela | 14,106 | 16,322 | [e]13,200 | [e]12,700 | 14,000 | 14,066 |
| German Democratic Republic[e] | 11,430 | 11,430 | 13,000 | 12,000 | 10,780 | 11,728 |
| Total | 1,629,196 | 1,671,738 | 1,740,199 | 1,810,195 | 1,878,610 | 1,745,988 |
| Other | 112,665 | 119,962 | 125,592 | 138,121 | 140,038 | 127,276 |
| Grand total | 1,741,861 | 1,791,700 | 1,865,791 | 1,948,316 | 2,018,648 | 1,873,263 |

[e]Estimated. [p]Preliminary.

[1]Comprises all gas collected and utilized as a fuel of a chemical industry raw material as well as that used for gas lift in fields, including gas used in oilfields and/or gasfields as a fuel by producers even though it is not actually sold. Excludes gas produced and subsequently vented to the atmosphere, flared, and/or reinjected to reservoirs. Table includes data available through Oct. 31, 1990.

[2]Reported figure.

TABLE 37

## LEADING WORLD PRODUCERS OF NATUAL GAS PLANT LIQUIDS[1 2]

(Million 42-gallon barrels)

| Country | 1985 | 1986 | 1987 | 1988[p] | 1989[e] | Average 1985-89 |
|---|---|---|---|---|---|---|
| United States | [r]584 | [r]571 | 588 | 594 | [3]570 | 581 |
| U.S.S.R.[e] | 250 | 290 | [r]288 | [r]249 | 263 | 268 |
| Saudi Arabia | [r]123 | [r]150 | 126 | 152 | [3]154 | 141 |
| Canada | 125 | 120 | 134 | 139 | [3]150 | 134 |
| Mexico | 99 | 128 | 123 | 135 | 137 | 124 |
| United Arab Emirates[e] | [r]47 | [r]52 | 53 | 55 | 58 | 53 |
| United Kingdom | 60 | 67 | 66 | 58 | 56 | 61 |
| Algeria | [r]44 | [r]44 | 51 | 44 | 47 | 46 |
| Total | [r]1,332 | [r]1,422 | 1,429 | 1,426 | 1,435 | 1,409 |
| Other | [r]200 | [r]206 | 221 | 237 | 260 | 225 |
| Grand total | [r]1,532 | [r]1,628 | 1,650 | 1,663 | 1,695 | 1,634 |

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

[1]Every effort has been made to include only those natural gas liquids produced by natural gas processing plants and to exclude natural gas liquids obtained from field treatment facilities, including wellhead separators, because the latter are normally blended with crude oil and thus are included in crude oil output statistics. In some cases, however, sources do not clearly specify whether data presented represent only output of natural gas processing plants or if they include field output. Thus, some of the figures may include field output. Table includes data available through Oct. 31, 1990.

[2]In addition to the countries listed, China, Czechoslovakia, and the German Democratic Republic may also produce natural gas plant liquids in substantial quantities, but available information is inadequate to make reliable estimates of output levels.

[3]Reported figure.

TABLE 38

## LEADING WORLD PRODUCERS OF CRUDE OIL[1]

(Million 42-gallon barrels)

| Country | 1985 | 1986 | 1987 | 1988[p] | 1989[e] | Average 1985-89 |
|---|---|---|---|---|---|---|
| U.S.S.R. | 4,373 | 4,520 | 4,589 | 4,586 | 4,462 | 4,506 |
| United States | 3,274 | 3,168 | 3,047 | 2,979 | [2]2,779 | 3,049 |
| Saudi Arabia[3] | 1,237 | 1,841 | 1,536 | 1,850 | [2]1,879 | 1,669 |
| Iran | 811 | 696 | 845 | 834 | 1,064 | 850 |
| China[e] | 874 | 954 | 978 | 999 | 1,000 | 961 |
| Iraq | 521 | 617 | 792 | 981 | 978 | 778 |
| Mexico | 960 | [r]889 | 930 | 919 | [2]920 | 924 |
| United Arab Emirates | [r]453 | [r]511 | 536 | 562 | 708 | 554 |
| Kuwait[3] | 374 | 519 | 497 | 546 | 658 | 519 |
| United Kingdom | 914 | 905 | 878 | 821 | [2]653 | 834 |
| Venezuela | 614 | [r]654 | 664 | 576 | [2]638 | 629 |
| Nigeria | 540 | 535 | 472 | 511 | [2]618 | 535 |
| Canada | [r]572 | 538 | 561 | 504 | [2]612 | 557 |
| Norway | 285 | 316 | 369 | 418 | [2]557 | 389 |
| Indonesia | 484 | 507 | 479 | 492 | [2]514 | 495 |
| Libya | [r]401 | [r]380 | 356 | 375 | 409 | 384 |
| Total | [r]16,687 | [r]17,550 | 17,529 | 17,953 | 18,449 | 17,634 |
| Other | [r]2,977 | [r]3,081 | 3,123 | 3,307 | 3,466 | 3,191 |
| Grand total | [r]19,664 | [r]20,631 | 20,652 | 21,260 | 21,915 | 20,824 |

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through Oct. 31, 1990.
[2]Reported figure.
[3]Includes the country's share of production from the Kuwait-Saudi Arabia Divided Zone.

TABLE 39

## LEADING WORLD PRODUCERS OF REFINED OIL[1]

(Million 42-gallon barrels)

| Country | 1985 | 1986 | 1987 | 1988[p] | 1989[e] | Average 1985-89 |
|---|---|---|---|---|---|---|
| United States (including Puerto Rico and Virgin Islands) | [r]5,250 | [r]5,430 | 5,532 | 5,708 | [2]5,654 | 5,515 |
| U.S.S.R.[e] | 3,136 | 3,229 | 3,255 | 3,160 | 3,000 | 3,156 |
| Japan | 1,304 | 1,272 | 1,237 | 1,153 | 1,340 | 1,261 |
| China[e] | 655 | 700 | 710 | 725 | 725 | 703 |
| Italy | 595 | 660 | 656 | 670 | 683 | 653 |
| United Kingdom | 611 | 624 | 625 | 658 | [2]670 | 638 |
| Canada | 569 | 594 | 641 | 645 | [2]639 | 618 |
| Germany, Federal Republic of | 665 | 649 | 622 | 671 | 633 | 648 |
| France | 603 | 584 | 539 | 593 | 587 | 581 |
| Mexico | 519 | 505 | 520 | 522 | [2]540 | 521 |
| Saudi Arabia[e 3] | 363 | 495 | 503 | 520 | 525 | 481 |
| Netherlands | 364 | 430 | 436 | 476 | 473 | 436 |
| Brazil | 449 | 476 | 453 | 476 | 470 | 465 |
| Spain (including Canary Islands) | 369 | 416 | 398 | 405 | [2]429 | 403 |
| Venezuela | 379 | 391 | 364 | 367 | 380 | 376 |
| India | [r]293 | [r]323 | 345 | 347 | 350 | 332 |
| Singapore[e] | [r]294 | 287 | 282 | 285 | 291 | 288 |
| Total | [r]16,418 | [r]17,065 | 17,118 | 17,381 | 17,389 | 17,074 |
| Other | [r]4,696 | [r]4,907 | 5,030 | 5,245 | 5,423 | 5,060 |
| Grand total | [r]21,114 | [r]21,972 | 22,148 | 22,626 | 22,812 | 22,134 |

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through Oct. 31, 1990.
[2]Reported figure.
[3]Includes country's share of production from the Kuwait-Saudi Arabia Divided Zone.



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