

Approved For Release 2002/02/19 : CIA-RDP86T00608R000600040041-8

CIA/OER/S-07572-75

██████████ WORLD MINERALS STUDY

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CIA/OER/S-07572-75

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MEMORANDUM FOR:

[REDACTED]

ASSIGNMENT :

SUBJECT :

World Minerals Study

REFERENCE :

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1. Attached is the additional information on 21 non-fuel minerals in the USSR and Eastern Europe that can be passed

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2. This information, including the paper on the PRC that was forwarded last month, completes our contributions [REDACTED] mineral study. Again, I hope these contributions will be helpful in your effort to receive a copy of the final report.

[REDACTED]

MAURICE C. ERNST
Director

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Economic Research

Attachment:
as stated

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Contribution  World Minerals Study

S-07572

16 July 1975

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Contribution [REDACTED] World Minerals Study

USSR

Soviet mineral resources are unparalleled in the world. The USSR occupies a leading position with respect to reserves of coking coal, iron and manganese ores, the principal alloying metals, and many nonferrous metals, including copper, lead, and zinc.

Soviet production of many minerals and metals is adequate to meet steadily growing domestic needs and to support a high level of exports. The USSR has long been a leading world exporter of iron, manganese, and chrome ores and, in recent years has been able to export substantial quantities of nickel, vanadium, and titanium. Aluminum and copper have been exported in steadily increasing amounts in the past decade. The USSR is an active trader of both lead and zinc. Exports of these metals exceed imports, although not by large amounts.

The USSR is not as well-off with respect to supplies of some other minerals and metals -- fluorspar, tungsten, molybdenum, cobalt, antimony, mercury, and tin. Current production levels rival those of world leaders but barely cover or fall short of domestic needs, making some reliance on imports necessary. Reserves of these minerals and

metals are large, but access to them is hampered by location and difficulties of terrain and climate.

In the case of minor metals, reserves of zirconium are ample and zirconium oxides have been offered for sale to non-Communist countries. Reserves of columbium and tantalum are found in complex ores bearing both metals but the low content of tantalum makes it scarce relative to columbium. The USSR has imported tantalite ores to compensate for this deficiency.

In the years ahead the USSR plans to increase production of virtually all minerals and metals. Capability to export metals already established as export commodities probably will increase, but few new categories will be added to the export list. A possible exception is cobalt, which may become available for export if byproduct yields keep pace with increases in the production of nickel. Prospects are less favorable for exports of other metals. Promising deposits of tungsten, molybdenum, mercury, and antimony are in various stages of exploration or development, but programs for their exploitation are aimed primarily at satisfaction of domestic needs. There are no firm indications yet that the new deposits are sufficiently rich to generate exportable surpluses.

Regardless of the mineral or metal concerned, however,

the USSR is faced with the fact that long lead times and heavy investment are required to develop even the most promising deposits -- most of which are located in remote and inhospitable areas. Concern about costs and time tables for development projects helps explain the strong Soviet interest in having other countries -- non-Communist as well as Communist -- join in ventures to develop its resources in return for products from the venture. To the extent that mutually satisfactory terms can be worked out, such ventures would promote greater availability of Soviet minerals and metals on world markets.

Succeeding sections describe Soviet supply positions with respect to individual minerals and metals. Information on production and trade is assembled in the accompanying tables.

Table 1
USSR: Production of Minerals and Metals
Selected Years^{a/}

	1950	1955	1960	1965	1970	1973	1974
Iron ore ^{b/}	39.7	71.9	105.9	153.4	195.5	216.1	225.0
Coking coal ^{b/}	46.0	70.0	96.8	117.8	136.7	141.4	N.A.
Manganese ore ^{b/}	3.4	4.7	5.9	7.6	6.8	8.2	N.A.
Chrome ore ^{b/}	0.6	1.0	1.5	2.5	3.0	3.3	3.4
Molybdenum ^{c/}	2.0	3.0	5.0	7.3	9.5	10.0	10.5
Tungsten ^{d/}	9.0	9.5	11.5	14.0	14.5	16.0	16.5
Nickel ^{e/}	30	45	70	100	137	164	170
Cobalt ^{e/}	0.5	1.0	1.6	2.3	3.7	4.5	4.8
Aluminum ^{e/}	150	400	650	1,000	1,700	2,000	2,150
Titanium sponge ^{f/}	-	1	3	12	24	30	32
Copper ^{f/}	250	375	475	700	1,000	1,200	1,250
Lead ^{e/}	100	240	300	380	480	520	540
Zinc ^{e/}	110	260	350	475	690	780	790
Tin ^{e/}	8	9	12	14	21	23	24
Antimony ^{c/}	3.0	5.0	6.0	6.5	7.0	7.3	7.5
Mercury ^{g/}	15	20	25	40	48	52	54
Fluorspar	100	150	250	350	500	525	525

^{a/} All data are estimated except for iron and manganese ores and coking coal. Data for the two ferrous ores are from the statistical yearbook for 1973, Narodnoye Khozyaistvo SSSR v 1973, Moscow, 1974, p. 267 and the short statistical handbook for 1974, SSSR v Tsifrakh v 1974 godu, Moscow, 1974, p. 85. In the case of coking coal, data for 1950 and 1955 were estimated, but data for 1960-73 were obtained from the statistical yearbook for 1974 published in Moscow by the secretariat of the CEMA organization, Statisticheskii Yezhegodnik Stran-Chlenov Soveta Ekonomicheskoy Vzaïmopromoschi, Moscow, 1974, p. 83.

^{b/} Million metric tons.

^{c/} Mine output, metal content.

^{d/} Concentrates, 60% tungsten trioxide (WO₃) basis.

^{e/} Refined.

^{f/} 1,000 flasks (76 lbs. each).

Table 2

USSR: Exports and Imports of Minerals and Metals
Selected Years

	1,000 metric tons						
	1950	1955	1960	1965	1970	1973	1974
<u>EXPORTS</u>							
Iron ore	3,200	8,800	15,200	24,100	36,100	41,400	43,300
Manganese ore	277	852	973	1,020	1,200	1,300	1,500
Ferromanganese	15	26	51	67	119	135	118
Chrome ore	96	158	427	748	1,200	1,200	1,100
Ferrochrome	-	-	22	25	45	46	46
Aluminum, primary	12	42	68	229	369	518	529
Aluminum, rolled	1	6	9	42	131	114	116
Copper	27	37	64	93	123	238	248
Lead	7	26	70	103	92	97	96
Zinc	8	36	90	133	95	146	115
Antimony	-	1.6	2.5	2.7	0.9	-	-
<u>IMPORTS</u>							
Copper	6	44	106	1	1	6	5
Lead	-	18	40	48	39	59	77
Zinc	25	47	61	59	53	45	49
Tin	5	17	18	6	8	4	5
Fluorspar	2	75	75	116	145	391	487
Bauxite	-	-	-	481	1,500	1,500	1,600
Alumina	-	-	-	-	518	902	886

Coking Coal

The USSR reportedly produced 141 million tons of coking coal in 1973 (see Table 1). Of this total, an estimated 18 million tons consisted of byproducts of the coal preparation process ("middlings") not suitable for manufacture of coke. Of the remaining 123 million tons, an estimated 9 million tons were exported to Communist and non-Communist countries, and 114 million tons were used domestically to produce 81 million tons of coke.

The USSR has substantial reserves of coking coal in the Donets, Kuznets, Pechora, Karaganda, and Southern Yakutsk coal basins. In view of growing domestic and foreign demand, output probably will grow at a rate of about 2% per year, or to a level of about 200 million tons in 1990.

Iron Ore

The USSR has the largest iron ore reserves in the world. According to a United Nations survey in 1970, Soviet reserves of exploitable ore amount to 111 billion tons and account for 44% of the world total. The major producing area is the Krivoy Rog Basin in the Ukraine, but the Kursk Magnetic Anomaly, located between Orel and Kharkov, probably is the world's richest deposit and will eventually rival or surpass production at Krivoy Rog. Other important

deposits are found in Kazakhstan, the Kola Peninsula, the Urals, West and East Siberia, Yakutiya, and the Far East.

As the world's largest producer of iron ore, the USSR not only meets its own needs but more than half those of the Communist countries of Eastern Europe. Small but gradually increasing exports have gone to non-Communist countries. In 1974 the USSR shipped nearly 6 million tons to Austria, the United Kingdom, West Germany, Italy and Japan.

The USSR has become concerned, however, about the financial burden involved in development and expansion of its iron ore base. Capital expenditures have increased markedly in the past decade or more, not only to open new mines but to construct beneficiation facilities to upgrade ore which has been declining in average quality.

Although the USSR may gradually increase exports of iron ore to non-Communist countries as production capacity is expanded at Krivoy Rog and Kursk, it seems less interested in self-financed construction of export capacity than in arranging participation of foreign firms in ventures to build such capacity. Substantial increases in Soviet exports of iron ore to non-Communist countries in the future will probably depend, in large part, upon the extent to which this type of arrangement is made. Finland

is already helping to develop a Soviet deposit in Karelia in return for future deliveries of iron ore. Other possible schemes of this type involve United Kingdom aid in developing iron ore mines on the Kola Peninsula and Japanese aid in developing mines in Yakutiya.

The recent deal with West German firms for construction of a large direct reduction plant near Kursk represents another type of arrangement for foreign participation in the exploitation of Soviet iron ore resources. The USSR has agreed to pay on a cash basis as construction of the plant proceeds, but according to terms of the preliminary agreement upon completion of the project in the late 1970s, it will be able to earn foreign exchange by shipping metallized pellets to West Germany.

Manganese

The USSR is the only major steel-producing country of the world which is self-sufficient in manganese. Soviet reserves of manganese, which are estimated at more than two billion tons, are exceeded only by those of South Africa. Soviet reserves are located principally in the Ukraine and the Georgian SSR. Other deposits are located in Kazakhstan, the Urals, West and East Siberia, and the Far East. The quality of Soviet ore, with a manganese

content of roughly 25%, is lower than that of other major producing countries and the USSR currently has to beneficiate all manganese ore.

The USSR is the world's largest producer of manganese ore and has a substantial surplus for export. Exports have averaged more than 1.2 million tons annually during the past decade and reached a peak level of 1.5 million tons in 1974. Over two-thirds of the exports normally go to other Communist countries.

The USSR's plans for its manganese industry are revealed, in part, by its solicitation in April 1975 of bids from foreign firms for construction of a ferromanganese plant with an annual capacity of one million metric tons. The Soviets have sought a completion date of 1980 for the plant with provisions for payment in the form of products from the plant. A venture of this type might limit or even reduce Soviet exports of manganese ore in the future, but non-Communist countries, now receiving relatively small amounts of Soviet ore, could receive substantial amounts of manganese in its more highly processed ferroalloy form.

Chrome

The USSR has claimed that its reserves of chrome ore are the largest in the world. Precise information is not

available to support this claim, but there is evidence that Soviet reserves, in any case, are very large. The USSR has maintained high levels of production for many years which have enabled it to meet domestic needs and to rank as the world's largest exporter of chrome ore. Reports concerning construction of new facilities and plans to increase output substantially also suggest a level of reserves high enough to justify new investment.

Most of the Soviet reserves of chrome ore are located in Kazakhstan. Additional reserves are in the Ukraine, the Urals, Azerbaijan, and the Far East. The Donskoye group of deposits near Khrom-Tau in Kazakhstan have the higher grade metallurgical ores.

Soviet exports of chrome ore, mainly to non-Communist countries, have ranged between 1.0 and 1.2 million tons since 1967. Some uncertainty about future Soviet exports of chrome ore has been engendered, however, by recent efforts of the USSR to interest Western firms in projects for the construction of ferrochrome plants. Soviet proposals that repayment be in the form of deliveries of ferrochrome may indicate that the USSR intends to reduce and possibly phase out exports of ore. A switch to the more highly processed export -- which is being made by other countries with resources of chrome ore -- would

probably be particularly advantageous to the USSR with its sources of cheap energy. The amount of chromium equivalent in Soviet exports -- whether of ore, ferrochrome, or a combination of the two -- may not be seriously affected, however, and may increase if plans for increasing the output of ore are carried out.

Nickel and Cobalt

Soviet reserves of nickel are roughly equal to those of Canada, but less than those of Cuba and New Caledonia. Most of the Soviet reserves are located in copper-nickel sulfide deposits at Pechenga, Monchegorsk, Noril'sk, and Talnakh in the Soviet North. The remaining deposits consist mainly of laterite ores in the Urals and Kazakhstan and nickel-cobalt arsenides in Tannu-Tuva. Soviet reserves of cobalt are also extensive and are found associated with nickel in the deposits described above.

The USSR is second only to Canada in the production of nickel and nickel products. Production has increased steadily in the past decade, enabling the USSR to meet its growing internal needs and to become an important supplier of nickel to non-Communist countries. The USSR publishes only fragmentary information on its nickel trade but Soviet exports to these countries are estimated to have ranged

from 10,000 to 20,000 tons since 1966. The USSR recently announced that its nickel exports had increased to 52,000 tons in 1974 but gave no details concerning the recipients of these exports.

The USSR has also steadily increased production of cobalt, but there has been no surplus available for export since 1966. Even then, exports, mainly to other Communist countries, were small. Exports during the 1950s and early 1960s were reported to have been about 100 or 200 tons annually.

The USSR is undertaking a major expansion of its nickel-cobalt industry, mainly in the Noril'sk area. Development of new mines has been underway for about a decade and a contract has been signed with Finland for deliveries of equipment for smelting of nickel and copper concentrates. The availability of nickel -- and possibly cobalt -- for export is likely to increase as the Noril'sk projects are completed in the late 1970s and early 1980s. The USSR has also negotiated with foreign firms for participation in a project to develop nickel resources in the southern Urals. Prospects for early action on this project are uncertain.

Vanadium

Information compiled by the US Geological Survey

indicates that Soviet reserves of vanadium, estimated at 8 million short tons of metal content, are the largest in the world. Soviet reserves are found mainly in the form of titaniferous magnetite deposits distributed throughout the country. The major source is the Kachanar deposit in the Urals. Vanadium is also found in Soviet limonite ores. An important source of this ore is the Lisakovsk deposit in Kazakhstan.

Soviet production of vanadium is difficult to estimate but domestic supplies have increased markedly since the late 1960s as operations at the Kachanar deposit have been expanded. Vanadium is recovered in the form of a converter slag containing vanadium oxide. The charge for the converter is high-vanadium pig iron produced from Kachanar ore. The ore charge for the blast furnace was improved considerably by the construction of a facility to pelletize the Kachanar concentrates.

The USSR has reported exports of 35,000-40,000 tons of vanadium slag and one or two thousand tons of ferrovanadium since 1967. Earlier in the 1960s the USSR imported small amounts of vanadium pentoxide from Finland to ease tight domestic supplies.

Soviet production of vanadium will probably increase in the years ahead as exploitation of the Lisakovsk deposit

is stepped up. The complex at Kachanar has reached rated capacity in its present form, but plans have been announced to build a new iron ore mining and concentrating complex nearby. The time table for construction has not been indicated, however. In light of these plans some growth in Soviet exports of vanadium seem possible but the amounts cannot be estimated.

Aluminum

The principal Soviet reserves of bauxite are located in the Urals, Kazakhstan, the Boksitogorsk area near Leningrad, and the Onega area near Archangel. They have been insufficient both in quantity and quality to meet Soviet needs. Efforts to develop alumina production from non-bauxite ores have met with some success. Alunites and nepheline syenites have been processed to yield substantial quantities of alumina but the methods employed have proven costly. At present, no new facilities are being constructed to use these materials even though reserves are extremely large. As a result of the deficiencies in domestic supplies, the USSR currently relies on imports of bauxite and alumina for about 40% of the raw material needs of its aluminum industry.

The USSR ranks second only to the United States in the

production of aluminum and second only to Canada in the export of the metal and its manufactures. Most of the Soviet exports are to other Communist countries.

To meet future raw material needs the USSR plans to increase imports of bauxite and alumina as well as domestic production of bauxite. Guinea and Yugoslavia are expected to provide the largest shares of increased imports but supplies are being obtained from other countries as well. Increases in production of bauxite are expected from established mining centers in Kazakhstan and the Urals and from the newly opened Onega mines near Archangel. New deposits in the Komi ASSR apparently have been found to be suitable for exploitation but development of the mines will probably take several years.

As in the past, a large share of increased aluminum output will probably reach export markets. The USSR has clearly indicated an interest in arranging future deliveries of aluminum to non-Communist countries in payment for help in expanding its aluminum industry. Extensive negotiations have been conducted with US and French firms for aid in constructing large complexes, each to include a one million ton-per-year alumina refinery and a 500,000 ton-per-year aluminum reduction plant. Formal contracts have not yet been signed, however, and probably only one of these major

projects will be undertaken in the current decade. The other and possibly additional projects of the same scale may be undertaken in the 1980s.

Titanium

The USSR claims to have "inexhaustible" reserves of ilmenite which it uses not only for making titanium pigment but sponge (crude metal) as well. The USSR has only limited reserves of rutile, the principal mineral used for making titanium metal in non-Communist countries.

The most important Soviet deposits of ilmenite are located in the Ukraine and Kazakhstan. Titaniferous magnetites -- another source of titanium -- are found in the Urals, Karelia, and the Kola Peninsula. Sand deposits along the Baltic Sea and the Sea of Azov have been investigated for their potential to enlarge reserves of rutile.

The USSR is the world's largest producer of titanium sponge. Production was initiated in the middle 1950s and has increased steadily since then. Substantial quantities have been available for export to non-Communist countries since 1965. Trade information is incomplete, but Soviet exports of titanium sponge are believed to have reached annual levels of about 5,000-7,000 tons in the 1970s.

The USSR probably could increase exports of titanium

in the next 5 or 10 years, but it may regard a major expansion of export capacity as risky in view of uncertainties about demand in industrialized countries. Another possible constraint on the growth of Soviet exports of titanium is the concern in recipient countries, particularly the United States, about becoming heavily dependent on the USSR for the so-called "space age" metal.

Copper

The USSR has large reserves of copper that probably approach the US level of 80 million tons of contained metal. The principal deposits currently being exploited are located in Kazakhstan. Other important deposits are found in the Urals, Central Asia, the Kola Peninsula, and the region near Noril'sk. However, the most notable deposit is the giant Udokan ore body in the Transbaikal region of East Siberia. The Udokan deposit, which the USSR claims to be the largest single copper deposit in the world, reportedly has the potential to yield 400,000 tons of refined copper per year for over 50 years. The quality of the ore is said to be high, averaging 1½% to 2% copper content.

Prior to 1964 the USSR was a net importer of copper. Substantial quantities were exported to other Communist countries in Eastern Europe, but the amounts imported from

non-Communist countries were considerably larger. Steady increases in production in the past decade have strengthened the Soviet copper position. Imports have been very small and, in the past two years, exports were well above 200,000 tons, of which roughly half went to non-Communist countries.

The USSR probably is in a position to promote some further growth in copper exports as operations in existing producing areas are expanded. No dramatic increases seem likely, however, until new deposits are exploited. The USSR has negotiated extensively since 1965 with Western firms concerning participation in a joint venture to develop the Udokan copper deposits. A major deterrent to an agreement has been the huge capital costs entailed in this project -- estimated as high as \$2 billion -- not only for production facilities but transportation and other support facilities. By starting work on the BAM railroad and stepping up prospecting activities at Udokan the USSR has brightened prospects for an agreement with foreign firms but, under the best of circumstances, Udokan is not likely to be in production until the 1980s.

Lead and Zinc

In 1970 the Bureau of Mines estimated Soviet reserves of ore at 17 million tons of contained lead and 22 million

tons of contained zinc. Most of the reserves are found in the form of low-grade, polymetallic lead-zinc deposits. The largest of these deposits are found in eastern Kazakhstan and others of importance are located in the Central Asian republics, the Caucasus, and the Far East. Copper-zinc deposits are found in the Urals and copper-lead deposits in the Georgian SSR.

The USSR ranks second only to the United States in the production of lead and is first in production of zinc metal, although Canada's mine output of zinc is considerably higher. The USSR has been a net exporter of lead and zinc since the 1950s, but export surpluses of these metals have changed little in the past 15 years (see Table 2). Net exports of zinc have been somewhat higher the past few years than those a decade ago but, in the case of lead, net exports reached their lowest level in 1974 since 1956. The USSR is not only an exporter and importer of lead and zinc metals but an importer of small amounts of lead and zinc ores and concentrates, mostly from Iran.

The eastern areas of the country figure prominently in the USSR's plans for further development of its lead and zinc industry. Important mining and concentrating complexes are scheduled for development in the remainder of the current decade to exploit the Azhurnoye polymetallic

deposit in the Buryat ASSR and the Gorev deposit near the Angara River. Large polymetallic deposits are already under development in the Maritime Kray. The eventual scale of operations and the pace of development cannot be estimated at this time.

Tin

The USSR has reserves of tin that are adequate to support a substantial level of production. Output in 1974 was roughly one-third that of Malaysia, the world's largest producer of mined tin. The amounts produced are not adequate for domestic needs, however, and the USSR relies on imports for a share of its needs. Imports during the past decade, 1965-74, averaged 5,600 tons annually.

The principal supplier of tin to the USSR in recent years have been non-Communist countries, mainly Malaysia and Bolivia. Tin is also imported from China but the amounts averaged less than 500 tons annually in the past decade. At one time China was a major supplier of tin to the USSR. Annual deliveries during 1953-61 averaged 17,000 tons. During this same period the USSR also exported tin, most of it in the form of re-exports of Chinese tin. Soviet exports of tin during 1955-61 averaged 11,600 tons annually. The USSR reported small exports of tin for

several more years but none since 1966.

For the immediate future the Soviet tin industry probably will be concerned only with the task of catching up with internal needs. A substantial growth in these needs may also materialize if the Soviets move to accelerate development of their backward canning industry. Most of the Soviet reserves of tin are located in the Far East and Yakutiya. Increases in production in recent years have come principally from mines in the Maritime Kray and Khabarovsk Kray. Further increases are planned for these areas and preparations are being made for off-shore mining of tin in the Vankina Bay of the Laptev Sea and off Cape Billings in the Bering Sea.

Molybdenum

The USSR has large reserves of molybdenum which are widely distributed throughout the country. Most of the reserves are found in deposits of copper-molybdenum and molybdenum-tungsten ores. The principal deposits of copper-molybdenum ores are located in Kazakhstan, Armenia, and Uzbekistan. Two important deposits of molybdenum-tungsten ore are found in Tyrny-Auz in the Caucasus and near Dzhida in East Siberia. A major deposit of molybdenum is located at Sora near Dzerzhinskiy in East Siberia.

The USSR ranks among the world's leading producers of molybdenum but production is not fully adequate for domestic needs. The USSR has signed contracts with Chile for the purchase of several thousand tons of molybdenum concentrates which were scheduled for delivery during 1973-75. A few hundred tons of molybdenum concentrates were imported from China in 1971.

The USSR is not likely to increase production of molybdenum more than moderately in the next few years. Various projects for expansion of production are underway or in the planning stage but substantial returns are not likely until the latter 1970s and early 1980s. Reconstruction of a major complex at the Sora deposit has been started and is expected to double output of the complex by 1980.. An increase in production of about 70% was planned during 1971-75 at Tyrny-Auz but is not likely to be realized for a few more years. The time table for exploitation of new deposits is not known. Geologists indicated a few years ago that a deposit in Chita Oblast was ready for industrial use but the status of construction on mining and concentrating facilities is not known. Plans for exploitation of new copper-molybdenum deposits in Kazakhstan have been announced but target dates were not given. New discoveries have been made at Ankar in Armenia and near

the Sayan Mountains in Krasnoyarsk Kray. The former has been described as one of the major discoveries of recent years. Considerable exploration work probably will be required before development of these deposits can be started.

Tungsten

The USSR has large reserves of tungsten that are on a par with those of Canada, although considerably less than those of China. The ores are found chiefly in the form of scheelite or wolframite in combination with molybdenum, tin, manganese, and other minerals. Important deposits of tungsten associated with molybdenum are found at Tyrny-Auz in the Caucasus and at Dzhida in the Buryat ASSR. Tungsten is found associated with tin in an important deposit in Chukotka in the Magadan Oblast. Other deposits of tungsten occur in Uzbekistan and other parts of Central Asia. A major deposit under development since 1967 is located in the Maritime Kray in the Far East.

The USSR is one of the world's leading producers of tungsten, but its output is not adequate for domestic needs. In recent years -- 1971-74 -- the USSR has imported 5,000 to 7,000 tons of tungsten concentrates annually to make up for deficiencies in domestic supplies. The principal foreign supplier has been China. Concentrates also have

been purchased from non-Communist countries, although some may have been of Chinese origin. China was a major supplier of tungsten during 1958-63 when annual shipments of concentrates averaged about 19,000 tons and ranged from 12,000 to 26,000 tons. China supplied about 5,000 tons annually during 1964-66 but very little during 1967-70.

The USSR has undertaken a variety of projects in recent years to increase production of tungsten. The important Tyrny-Auz combine is being reconstructed and combines are being enlarged in other producing centers in Uzbekistan and the Buryat ASSR. Facilities are being added at copper combines in Kazakhstan and the Far East to process tungsten-bearing materials. The most important new project has been construction of the Vostok-2 combine in the Maritime Kray. Increased output from these projects probably will be needed for domestic consumers for the remainder of the decade.

By the 1980s, the USSR may be able to generate export surpluses of tungsten if promising new deposits prove adequate. Tungsten discoveries in Kazakhstan have been listed among the most important in the USSR in the 1970s. Other important discoveries have been reported in the Far East, including some in areas adjacent to the Vostok-2 combine in the Maritime Kray. Detailed exploration and prospecting have been initiated but several more years may

be required for comprehensive assessments of these deposits -- even before actual development work can be started. There is no basis for estimating potential output from these deposits.

Antimony

Soviet reserves of antimony, although small compared with those of China, probably compare favorably with those of the limited number of other countries with substantial identified resources. The largest reserves in the USSR are located at the Kadamzhay deposit near Frunze in Kirghizia. Also of importance are the Dzhidzhik deposit in Tadzhikistan, the Turgay deposit in Kazakhstan, and the Razdolinsk deposit in Krasnoyarsk Kray in East Siberia.

In the past several years Soviet production of antimony has been roughly adequate for domestic needs. Foreign trade in antimony has been limited. Several hundred tons of antimony were exported during 1971-72 and a few hundred tons were imported from China in 1973 and again in 1974. At one time the USSR relied heavily on China for supplies of antimony. During 1950-58 annual imports from China averaged 5,800 tons. Beginning in 1955 and continuing through 1970 the USSR was also a substantial exporter of antimony. Exports during that period averaged over 2,000 tons annually.

A substantial improvement in the Soviet supply position for antimony is possible if new deposits under development since 1973 live up to their press notices. The Minister of Geology has described the new deposits, which are located near Oymyakon in Yakutiya, as one of the most important ore discoveries in the current plan period. Early in 1974 the USSR announced that work had started on construction of a large mining and concentrating complex in the Oymyakon Rayon.

Mercury

Mercury reserves of the USSR probably are among the largest in the world. Fragmentary evidence compiled by the US Geological Survey indicates Soviet reserves of mercury are roughly on a par with those of Yugoslavia and China and are exceeded only by reserves of Spain. The largest reserves in the USSR are located in Kirghizia. Other important reserves are located in the Ukraine, the Caucasus, Tadzhikistan, and the Chukotsk National Okrug in the Far East.

Soviet production of mercury is exceeded by that of Spain, but the amounts produced in recent years have fallen somewhat short of domestic needs. The USSR imported several thousand flasks of mercury from China during 1971-72. No imports were reported for 1973 and 1974, however.

At one time the USSR was dependent on China for large amounts of mercury. During 1953-65 Soviet imports from China amounted to more than 240,000 flasks and reached a peak annual level of about 40,000 flasks in 1960. The USSR re-exported a large share of the mercury received from China. Soviet exports of mercury over the period 1955-66 amounted to over 110,000 flasks. During 1960-63 Soviet exports reached their highest levels, averaging about 16,000 flasks a year. The principal recipients were the Communist countries of Eastern Europe. Exports dropped off sharply to less than 1,000 flasks in 1966 and no exports have been reported since then.

In the first half of the 1970s the USSR stepped up efforts to increase its production of mercury, probably to make up for reported lags in expansion of the industry in the late 1960s. The country's leading combine, the Khaydarken complex in Kirghizia, has been enlarged. New facilities have been constructed in Tadzhikistan and development of new mines in Azerbaijan, West Siberia, and the Ukraine has been started. Early in 1974 construction was started on a large combine to exploit promising new deposits in Chukotsk. Some returns are being realized from these projects but the full benefits probably will be enjoyed until late in the decade or early in the 1980s.

Fluorspar

The USSR has extensive reserves of fluorspar which occur mainly in the Asian part of the country. In 1972, reserves in the Transbaykal region were announced to be 45 million metric tons. Other areas with important deposits include the Maritime and Khabarovsk Krays in the Far East, Tannu Tuva in East Siberia, and the Central Asian republics. In the European USSR deposits are located in the Ukraine and in Archangel Oblast.

Lagging production of fluorspar in recent years has fallen far short of rapidly growing needs of consumers, principally the steel and aluminum industries. Imports have been increased sharply to cover these needs.

The USSR has taken steps to increase production but the increase in supplies probably will be required for domestic needs. A substantial contribution to domestic supplies is expected from the Yaroslavskiy mining combine in the Maritime Kray. The combine, in which 1.2 billion rubles has been invested, reportedly was nearing completion more than a year ago. It will be able to produce 345,000 tons of ore a year when its rated capacity is attained. Another important addition to supplies of fluorspar may eventually be forthcoming from the Irkutsk Oblast where the USSR plans to construct a mining and concentrating combine to

exploit the Shakhterskoye deposit. In the Ukraine, where needs are high, exploitation of an important deposit of fluorspar has been under consideration for 15 years but no action has been taken because of inability of industry and planning officials to agree on production methods which will optimize recovery rates and minimize environmental damage.

Columbium and Tantalum

Deposits of ores containing columbium and tantalum have been identified in many parts of the USSR. Probably the largest deposit is in the Lovozero Massif on the Kola Peninsula which consists of minerals containing titanium and zirconium. Other deposits occur in the Il'men Mountains of the Urals, Kirghizia, Kazakhstan, the Ukraine, and scattered locations east of the Urals. One such site is in the Chita Oblast where development of a new tantalum mine was started in 1972.

The volume of mine output and metal production is not known, although columbium apparently is in better supply than tantalum. The principal sources of these metals are complex ores which are difficult and costly to process. The low tantalum content of these ores probably explains its scarcity relative to columbium. Soviet foreign trade brochures indicate that columbium metal products are

available for export. Tantalum, in contrast, is in short supply and prices are very high. The USSR has indicated that tantalite has been imported. Data are not available, however, concerning foreign trade transactions involving either columbium or tantalum.

There are no indications that the USSR plans to develop new mines or processing facilities for other than domestic needs for columbium and tantalum materials.

Zirconium

The USSR has large reserves of zirconium which have been estimated by the US Geological Survey to be about 6 million short tons, in terms of zircon equivalent, or about one-sixth of the world total. Deposits of zirconium are found throughout the USSR. The major sources are in the Ukraine, the Urals, Kazakhstan, Tadzhikistan, and Uzbekistan.

Very little information is available concerning the USSR's exploitation of its zirconium resources. Output is apparently adequate to meet domestic needs. According to commercial press reports, the USSR exported zirconium dioxide to non-Communist countries at low prices several years ago. Soviet foreign trade brochures indicate that zirconium metal products have been available for export.

Trade data are not available concerning Soviet exports of zirconium materials, but the amount of such trade has probably been small.

Soviet plans for future exploitation of zirconium resources are not known.

Eastern Europe

Eastern Europe has large reserves of some minerals -- bauxite, copper, lead, zinc, nickel, and coking coal. The distribution of these reserves is extremely uneven, however. Bauxite is in abundant supply only in Hungary and Yugoslavia. These countries meet most of the needs of the other countries of Eastern Europe engaged in the production of aluminum and they also supply substantial amounts of alumina and bauxite to the USSR. Romania has exploitable resources of bauxite, but it relies on imports for part of its needs.

The largest reserves of copper, lead, and zinc are found in Poland and Yugoslavia, although Bulgaria and Romania also have appreciable quantities. Countries with only limited resources -- Hungary, East Germany, and Czechoslovakia -- import most of their copper, mainly from their better endowed neighbors in Eastern Europe and the USSR.

Yugoslavia has rich resources of nickel but they have not been exploited as yet. Albania has some nickel in the form of iron-nickel ores, but its limited exports of this ore to other countries in Eastern Europe help meet only a very small share of their nickel requirements. The USSR and Cuba are the principal sources of nickel for Eastern Europe.

Reserves of coking coal in Eastern Europe are concentrated almost entirely in Poland and Czechoslovakia. These

two countries help to meet the needs of the other countries in Eastern Europe, but the USSR is the area's principal supplier.

Reserves of most other minerals not discussed above are inadequate for the needs of the countries in Eastern Europe. The principal deficiencies are iron and manganese ores. Yugoslavia is the only country in Eastern Europe able to meet nearly all of its requirements for iron ore from domestic output. Imports, mainly from the USSR, provide the major share of the iron and manganese ores for the iron and steel industries of Eastern Europe. Imports also are needed to cover deficiencies in the supplies of tin, titanium, antimony, mercury, zirconium, columbium, tantalum, fluorspar, chrome ore and vanadium.

In succeeding sections information is given concerning the plans of East European countries for exploitation of their resources. Attention is focused only on those minerals and metals for which there is some potential as export commodities. Table 3 provides data concerning trends in production of these commodities.

Table 3

Eastern Europe: Production of Minerals and Metals
Selected Years

	<u>1,000 metric tons</u>						
	<u>1950</u>	<u>1955</u>	<u>1960</u>	<u>1965</u>	<u>1970</u>	<u>1973</u>	<u>1974</u>
<u>COKING COAL</u>							
Czechoslovakia	8,000	10,000	13,400	15,800	17,200	18,200	N.A.
Poland	11,000	14,000	17,100	22,200	29,500	35,100	N.A.
<u>CHROME ORE</u>							
Albania	52	122	289	312	466	550	644
<u>ALUMINUM</u>							
Czechoslovakia	-	25	26	26	31	48	50
East Germany	-	25	35	45	55	60	60
Hungary	17	37	50	58	66	68	69
Poland	-	20	26	47	99	102	102
Romania	-	-	-	-	107	141	187
Yugoslavia	2	12	25	39	48	91	147
<u>BAUXITE</u>							
Hungary	578	1,241	1,190	1,477	2,022	2,600	2,751
Yugoslavia	206	791	1,025	1,574	2,098	2,167	2,370
<u>COPPER</u>							
Poland	11	16	22	37	72	156	195
Yugoslavia	15	25	35	56	89	138	150
<u>LEAD</u>							
Bulgaria	3	5	40	93	99	105	107
Poland	22	34	40	41	55	68	72
Yugoslavia	57	76	89	102	97	98	114
<u>ZINC</u>							
Bulgaria	-	1	17	66	76	82	83
Poland	114	156	176	190	209	235	233
Yugoslavia	12	14	36	46	65	55	86

Coking Coal

The only significant producers of coking coal in Eastern Europe are Poland and Czechoslovakia, which together possess 99% of the estimated reserves of coking coal in the area. Poland reportedly produced 35 million tons in 1973 (see Table 3), of which 8 to 10 million tons were exported, chiefly to non-Communist countries. Poland has substantial reserves of coal suitable for production of metallurgical coke in the Upper Silesian basin, although reserves of the best grade (Type 35, or ortho-coking coal) are scarce. Output and exports probably will expand substantially during the next decade or two, although probably not as rapidly as in the past 5 to 10 years (6% per year).

Czechoslovakia produced 18 million tons of coking coal in 1973, of which up to 3 million tons were exported, mainly to other countries in Eastern Europe. Czechoslovakia's Ostrava-Karvina basin contains greater quantities of high-grade coking coal than does the upper Silesian basin in Poland. Output probably will expand slowly in the next 15 to 20 years.

Aluminum

All of the countries of Eastern Europe, with the exception of Albania and Bulgaria, are producers of aluminum. At present, Romania is the largest producer. Although it

plans to increase production, Romania will probably be surpassed in the near future by Yugoslavia which has ambitious plans for development of its aluminum industry.

Countries in Eastern Europe with only limited or no domestic production of aluminum -- East Germany, Czechoslovakia, and Bulgaria -- rely on the USSR for a substantial share of their needs. Only small amounts of aluminum have been obtained from non-Communist countries in recent years. In fact, during 1971-73, Eastern Europe enjoyed a small export surplus -- about 50,000 to 60,000 tons annually -- in trade in unwrought aluminum with non-Communist countries. Eastern Europe's plans for expansion, as discussed below, will probably make possible a further increase in exports of aluminum to non-Communist countries, although not by dramatic amounts.

Romania has made steady progress in expanding production of aluminum since it first started operations in 1966. Production of aluminum in 1974 of 187,000 tons was large enough to cover domestic needs and provide a surplus for export to non-Communist countries estimated at over 40,000 tons. Romania plans to increase its production of aluminum to 250,000 to 260,000 tons by 1980, but allowing for increased domestic needs, the additional amounts available for export would not be very large.

Yugoslavia, with its extensive resources of bauxite, is undertaking a major expansion of both its raw materials base and its facilities for the production of aluminum and aluminum products. A tentative goal of 370,000 to 400,000 tons has been set for the production of aluminum by 1980. Over the longer term Yugoslavia has indicated it is planning an even larger output of 500,000 to 600,000 tons annually. In view of the fits and starts which have characterized previous efforts to develop the Yugoslav aluminum industry, delays of several years seem likely in reaching the production goal for 1980. Yugoslavia is undertaking the development of its raw material base not only for domestic needs but to permit an expansion in exports of bauxite and alumina. Long term commitments have been made for deliveries of these aluminous raw materials to the USSR.

Hungary plans only a modest increase in production of aluminum to 96,000 tons by 1985, but production of alumina is being increased for export to the USSR in exchange for imports of aluminum. Deliveries of aluminum from the USSR amounted to 112,000 tons in 1973 and 96,000 tons in 1974 and are scheduled to reach 165,000 tons by 1980. A similar arrangement has been made with Poland but on a smaller scale. Hungary plans to use the imported metal along with its own in the manufacture of plate, sheet, rods, bars,

tubes, and other aluminum products. Its target for 1985 for these products is 250,000 to 300,000 tons. Much of the output is earmarked for domestic use and shipment to other Communist countries, but deliveries to non-Communist countries also play a part in the Hungarian export program. Hungary announced in June 1975 that its exports of aluminum and aluminum products to capitalist countries in 1974 had earned \$71.5 million in foreign exchange, or nearly double the amount it had anticipated.

Copper

Poland is the leading producer of copper in Eastern Europe. It has increased output substantially since 1970 and plans even more impressive increases in the next 5 to 7 years to an annual output of 500,000 and possibly 600,000 tons. A \$240 million loan from a consortium headed by the London-based affiliate of the Chase Manhattan Bank will be used to construct mining and metallurgical facilities which will raise annual output of copper to 415,000 tons. The scheduled data for completion of this major project is late 1977. A large share of the output from these facilities will be earmarked for export to hard currency countries to earn foreign exchange for repayment of the loan.

Poland's trade in copper since 1970 is shown below in thousands of metric tons:

	<u>Exports</u>	<u>Imports</u>
1970	18	22
1971	29	34
1972	50	32
1973	40	24
1974	58	10

Yugoslavia ranks second to Poland among copper producers in Eastern Europe. By 1980 it plans to increase output to about 200,000 tons. Allowing for increased domestic needs, the projected increase in output is not likely to alter Yugoslavia's trade balance for copper appreciably. The trend in trade since 1970 is given below in thousands of metric tons:

	<u>Exports</u>	<u>Imports</u>
1970	71	51
1971	104	58
1972	135	59
1973	117	73
1974	97	not available

Lead and Zinc

No major shift in Eastern Europe's trading patterns for lead and zinc seems likely in the near future. At present, most of the foreign trade in lead and zinc is conducted

within the East European area or with the USSR. The limited amounts of lead and zinc traded with non-Communist countries represent only a small share of world trade in the two metals. Exports exceed imports by a slight margin in the case of lead and by somewhat larger amounts in the case of zinc. The combined export surpluses of the two metals in trade with non-Communist countries is estimated at less than 50,000 tons.

The major producers of lead and zinc in Eastern Europe -- Poland, Yugoslavia, and Bulgaria -- are engaged in programs for orderly expansion of production during the remainder of the 1970s. The programs seem geared mainly to domestic needs and commitments to other Communist countries, making unlikely anything more than modest increases in exports to non-Communist countries.

Nickel

Yugoslavia has extensive reserves of nickel-bearing ores in sulfide and lateritic deposits. A reliable estimate of the full extent of reserves is not available, but Yugoslavia is undertaking to develop one group of three lateric nickel deposits said to contain more than 38 million tons of reserves. A mining and ferronickel complex is to be built at Rzanovo in Macedonia with a scheduled completion date in 1979. A financing package amounting to \$187 million has

been arranged by an international banking consortium including the Export-Import Bank, commercial banks, Yugoslav banks, and the Polish government. Planned annual output is 64,000 tons of ferronickel, about 90% of which will be exported. Poland is to receive 5,000 tons annually for 15 years. Yugoslavia has indicated it is seeking to market most of the output in non-Communist countries.

Chrome Ore

Albania is the only important producer of chrome ore in Eastern Europe. Nearly all of its output is exported, mostly to other Communist countries. Albania plans to make greater domestic use of its chrome ore in the near future, however. Operations are scheduled to begin in 1975 at Albania's first steelmaking plant and construction was started late in 1974 on a ferrochrome plant. Until some years from now when these facilities are in full operation, Albanian chrome ore is likely to be available for export. Even then, Albania may be able to continue its exports of chrome ore, and possibly ferrochrome, but its plans are not known.

Antimony

Yugoslavia is a relatively small producer of antimony compared with the world's four leading producers -- South Africa, Bolivia, China, and the USSR. However, it ranks

among some half dozen secondary producers contributing important amounts to world supplies. Production in Yugoslavia reached a peak level of 2,768 tons in 1965, declined to 1,755 tons in 1967, and subsequently increased to 2,349 tons in 1974. Plans for the future are not clear. Proven reserves available for exploitation apparently are limited, but resources, according to some Yugoslav geologists, are adequate to support a substantial level of output if the necessary geological investigations and prospecting are carried out to identify new deposits.

Most of Yugoslavia's output of antimony is exported. For many years the United States was the principal customer, but the USSR is now the principal recipient of Yugoslav antimony. Production and exports are shown below in metric tons:

	<u>Production</u>	<u>Exports</u>
1950	1,815	not available
1955	1,605	1,318
1960	2,410	2,001
1965	2,768	2,297
1970	1,967	1,259
1973	1,999	1,113
1974	2,349	not available