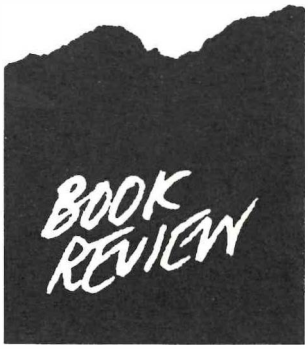

Natural resources in the USSR

By Claes G Alvstam, Zygmunt Berman, and Peter de Souza

Soviet Natural Resources in the World Economy. Ed by Robert G Jensen, Theodore Shabad and Arthur W Wright.
The University of Chicago Press, Chicago and London 1983, 700 pp.

This huge volume is the result of a research project, started in the mid 70s, supported by the American National Science Foundation and the Association of American Geographers. It is one of the most complete and detailed studies of the importance of Soviet natural resources in the world economy, that has ever been published, and it will for a long time remain the standard work within its field. Twenty-seven distinguished experts, mainly geographers, have made 31 different contributions, covering regional as well as sectoral aspects of the problem. All important natural resources, including minerals, forest products and sources of energy are treated and no efforts have been spared in order to present the current status of the Soviet natural resource situation so many-sided as possible. Several empirical facts have probably not been published earlier in the Western world.

Here it is not a possible task to evaluate all parts of this impressive work. We have therefore chosen to concentrate our comments to a few chapters, firstly those discussing the future role of Siberia in the Soviet resource system, and secondly the chapters dealing with the iron ore and energy sectors.

Among the highlights of this volume are the two contributions by **V L Mote**. Their extent, substance and systematic approach not only give the expert or layman a valuable widening of his general knowledge in the field, but will also have a lasting effect on the research methodology of the scientific community.

The first article, on the environmental constraints to the economic development of Siberia (Chapter 3), discusses the implications of two dozen "interrelated environmental constraints", covering the essential climatological, geological and human-induced aspects. The overview is based primarily on Soviet sources, which Mote describes as being extensive and of a high quality. The article is summed up with a tabulation of environmental constraints related to Siberian growth centers.

Two minor complementary or negative remarks can be made here:

- First, it might have been important for the discussion to emphasize the interactive effects of different constraints. The table on page 59 gives a list of the constraints, but not of their specific impact on different projects or growth centers. Mote describes, however, how this should be done in his earlier book "Gateway to Siberian Resources", written with Theodore Shabad.

- The other aspect is related to the description of the official attitude when it comes to issues like protection of the environment. Extensive legislation, officially pronounced policies and budgetary allowances are prerequisites which have an impact on the area of environmental control and on the implementation of protective measures. However, there is a substantial gap between centrally pronounced ambitions and local initiatives and interests. The priority given to environmental policy is also lower than those given to several other sectors in the society.

The article on the Baikal-Amur Mainline (the BAM) and its implications for the Pacific Basin (Chapter 7) continues a discussion started by the author in the book referred to above. The emphasis in this article is on the description of different resources in the zone of influence of the BAM. The regionally based specification of this resource base and the discussion of the possibilities of future development projects does not stand back in importance.

There are two aspects of this article that might be commented. The first, and most controversial one, is the emphasis placed on the military importance of the BAM project. Here it is stated, that the only reason for the renewed planning of

the project in the 60s was condition. References are made to emigrés to the West, earlier participating in the planning process.

The other item relates to the discussion on the so called Territorial Production Complexes (TPC). The fundamental problem when describing the TPC approach in theory and practice is that there exists a substantial amount of differing views as to the definition of a TPC. The map on page 57 marks 19 TPC projects in Siberia, while in the BAM-article it is stated that at least half a dozen are proposed for this region. Officially, in the Five-Year plan, only a limited number are mentioned by name. There are reasons to believe that the goal-programming approach in its TPC form is projected in relation to different vested interests. Therefore 19, or any other figure, is not wrong but it is incomplete, because the choice should include a discussion of these interests in order to understand the complexity of the problem.

THE SOVIET IRON ORE INDUSTRY

We will now continue to comment chapters 19 and 20, which contain a detailed and very well substantiated description of Soviet iron ore reserves, the location and classification of the deposits, as well as of flow patterns within Soviet ferrous metallurgy. We will make some objections to statements concerning the advantageous location of iron ore reserves in relation to foreign markets, and the assessment of Soviet export potential of iron ore in the short and long run.

Iron ore deposits

Misko and Zumbrunnen show in detail how the conditions for Soviet iron ore development have deteriorated in recent years and how these problems have been reflected in the foreign trade posture. The iron content declined from 45 per cent in 1958 to 35 per cent 1980. It took 1.2 tons of crude iron ore to produce 1 ton of material usable in the iron and steel industry (48 and 40 Mt respectively) in 1950, while the same ratio increased to 2:1 (498 and 245 Mt respectively) in 1980. It might be added that the deputy minister for ferrous metallurgy, Vinogradov, reports that during the years 1981–82 a further deterioration of the geological and technical conditions took place. Iron ore tenor declined by 0.3 per cent annually during 1976–80 and by 0.5 per cent during 1981–82.[1]

There are different opinions concerning the future of Soviet iron ore. One group of geologists asserts that the USSR in the long run has very rich high-grade magnetite supplies at its disposal. The other group, which believes that the economically exploitable reserves will soon be exhausted, may turn out to be more realistic. During the next few years even the up to now disregarded low-grade, high-phosphorous "tobacco" and "brown" ores, difficult to transport by train in open trucks, will have to be used as well[2]. Therefore the statements concerning the big potential for an increased iron ore export volume, made by the authors, are too optimistic.

Location and economic distances

Neither in chapter 19 nor in chapter 20 sufficient attention has been paid to the impact of the iron ore industry on the transport sector. Therefore we are going to penetrate this issue more in detail below.

- *Domestic transport:*

The overwhelming volume of Soviet iron ore is transported by rail. The most striking feature of the ore transports is the increased average length of haul, from 550 km in 1960 to 775 km in 1982. Another important fact to consider is the huge transport performance – 240 Gt kilometres in the early 1980s. This corresponds to 7 per cent of the total performance by rail, but is at the same time more than the total transport performance by all Western European rail companies together in 1982![3]

Another striking feature is the decreasing efficiency of the Soviet railways. A main indicator of efficiency is the average freight turnaround time. This time was prolonged by 22 per cent during the 70s, which corresponds to a loss of transport capacity of around 725 Gt kilometres, or 20 per cent more than the total freight transport performance in 1950.[4] The declining efficiency can be explained by congestion and insufficient technical standard of fixed structures and working equipment.

On the other hand, there are articles in the volume which give a good understanding of the importance of the transport bottlenecks. Particularly we want to point out chapters 12 and 16, written by **Leslie Dienes.** Dienes concludes his findings very accurately in the following sentences:

> "Transport and communication services are provided only when and to the degree absolutely necessary ... Even with a policy of utmost stringency, the transport burden has grown sharply in recent years, taxing the economy to an even larger extent. Matters are destined to get worse in the 1980s and, as in the 1930s, transport is becoming one of the key bottlenecks to growth. Unlike in earlier periods, however, relatively simple, cheap solutions today are not in sight." (p 405).

North, in his article on the impact of recent trends in Soviet foreign trade on regional economic development, concludes correctly that the freight tariffs in the USSR are not necessarily related closely to costs (p 110). Very low prices have been applied to electricity and fuel for the railways, and the Soviet state railways have been debited extremely low capital costs. Zumbrunnen et al assume that the transport costs for ore amount to 0.4 kopecks per ton-kilometre for rail.[5] These figures are probably related to 1970. Since that time the real costs for rail

transport have increased heavily as a consequence of declining efficiency and the fast increases of energy prices etc. The low, not related to costs, tariffs, give an unrealistic picture of the real burden of the transport costs for a low-value commodity like iron ore.

There are signs of an increased consciousness of transport costs, e g the sharp increases of the freight tariffs from the USSR to the GDR via Poland[6] and the replacement since 1979 of the Soviet coal exports to the GDR by re-export from Poland in order to avoid coal transport over long distances. This arrangement is not shown in the official statistics, though.[7]

• *Exports to the CMEA countries*

On page 263, **Theodore Shabad** remarks that:

> "Unlike many Soviet natural resources, iron-ore reserves are not handicapped by being located in remote northern and eastern regions. Most of the explored reserves are found in the accessible European part of the USSR, notably in the Krivoi Rog basin of the Ukraine and in the Central Russian region known as the Kursk Magnetic Anomaly."

It is important to keep in mind that the transport distance to the western border of the USSR is actually much shorter for iron ore than for oil and gas. This picture is changed, however, when we consider the economic distance. The pipeline transport costs for oil and gas are much lower than the rail costs for iron ore[8], and, furthermore, the burden of transport costs compared with total costs is heavier for a low-valued commodity like iron ore. Thus, the profitability of exports is often a function of the transport costs.

The biggest buyers of Soviet exported iron ore are the iron and steelmills in Polish and Czech Upper Silesia at a rail distance of 1 300–1 600 km from Krivoi Rog and Kursk. The distance to Eisenhuttenstadt in the GDR is 1 800 km. The transportation takes place on railways which are used for both passenger and goods traffic, and a huge imbalance between east- and westbound traffic occurs. The westbound volumes are ten times the volumes in the opposite direction, which even more increases real transport costs.[9]

A severe disadvantage in the traffic between the USSR and the rest of Europe are the different gauges. North comments on "the enormous amount of work formerly required to transfer railcars between gauges (p 110). As a matter of fact, efficient railcar transfers (e g used in the goods traffic between France and Spain) are only operated in the passenger and container traffic, while the iron ore, as all other bulk commodities, has to be reloaded from broad gauge to normal gauge cars at the border, which is even more laborious.[10] Construction of broad gauge lines in other CMEA countries may be economically justified, when the steel-mills are located close to the Soviet border, e g Galati in Romania and Kosice in Czechoslovakia. The Kosice mill is, however, not well located from the transport point of view.[11] North writes, that "about half of all Soviet exports to Czechoslovakia move along the Kosice line" (p 110). However, as it is not probable that Kosice receives 50 per cent of the total imports from the USSR, surplus volumes, e g iron ore to other steel-mills have to be reloaded in Kosice instead of at the border.

Shabad notes, that "the increasing flow of iron ore and pellets to East Europe has required rail-transport improvements" (p 264). In 1979 "a direct ore-transport line opened between the Kursk Magnetic Anomaly and the new Katowice iron and steel plant in Poland" (p 264). In the return direction the Katowice line carries sulphur and coal, which is reported by North (p 110). The question is which resources have been put into this project in order to obtain this "improvement" and which results have been reached?

The construction of the socalled LHS-railway (Linja Hutniczo–Siarkowa) was motivated by the inefficient and labour-intensive transport system including the border reloadings, particularly during the winter, when the ore arrived in frozen condition. The investment to build this 400 km line amounted to 17 billion zloties or, very roughly, 500 million USD in 1977 prices. This amount corresponds to the total investment fund used by the Polish State Railways for construction of railroads, double-tracks etc, between 1966 and 1975! It was estimated that the iron ore imports from the USSR should increase from 13 Mt in 1979 to 16 Mt 1980 and 21 Mt 1985. The project started 1978, and after an enormous input of capacity and labour force, was the new line opened for "preliminary traffic" as early as 1980.[12] However, the plans concerning an increase of iron ore deliveries from the USSR to Poland, were not fulfilled. In 1983 the Polish imports of iron ore from the USSR amounted to 11 million tons, of which estimately 3.5 million tons by the LHS railway to the Katowice steelmill, whose capacity is 4.5 million tons of crude steel per year.[13]

Several factors indicate that the real freight transport costs via the LHS-railway are much higher than through other lines for bulk transport to Poland. The main reasons are the large write-offs and other capital costs, the low utilization of capacity and the fact that the line is not electrified – which was originally planned.[14] The acute lack of fuel has resulted in increasing efforts to accelerate the electrification program and at the end of 1985 also the secondary line to Dorohusk, 50 km north of the LHS border station Hrubieszow, will be completely electrified. However, the electrification plan up to 1990 does not include the LHS railway.[15] Furthermore, the Soviet border station at the LHS railway, Vladimir Volinski, doesn't have any electrified connection, neither to Zdolbunov or Lvov, nor via Kiev to Kursk.[16]

In the beginning of the 70s, an extension of *normal gauge* connections between Hrubieszow and Silesia was started.[17] After the decision to construct the

LHS railway, that project was interrupted. The LHS crosses the domestic railway network several times, but may not be connected, and its importance for transport of other goods is very limited indeed. Coal and other bulk commodities exported to the USSR through LHS have to be carried by normal gauge cars to the LHS' terminal in Slawkow, where they are reloaded to broad gauge cars.

Another very serious disadvantage of the LHS investment was the postponement of other, very urgent investment needs, e g the improvement of the north-south connections between Upper Silesia and the Baltic seaports.[18] Thus, it remains doubtful whether a traffic improvement implying avoidance of reloading 3.5 Mt of iron ore can justify the construction of a 400 km long railway.

- *Export outside the CMEA*

Sovjet export of iron ore by rail may take the Kosice or LHS railways, but reloading has to be done somwhere anyway. The distance to the closest located steelmills in Austria is 1 600 km, and to other potential buyers in West Europe 2–3 000 km. The long distances, the different gauges, the use of railways which at the same time are utilized for passenger traffic and the huge imbalances between east- and westbound volumes are together a severe disadvantage, that makes Soviet iron ore export to Western Europe almost impossible from an economic point of view. To the FRG, the transport costs alone are higher than the price of Brazilian iron ore cif West German ports.

On the other hand, the distance between Krivoi Rog and the Black Sea is comparatively short. To be able to use this possibility to compete in the world market, the USSR has to improve the infrastructure through constructing a modern port terminal at Nikolayev and a specialized trunk line from the mines. However, it is doubtful whether such resource intensive investments can be justified.[19] Misko and Zumbrunnen believe that iron ore from KMA will be exported in the future. In this case, the rail transport distance will be 900 km, probably too long for making the exports profitable, even by sea.

The declining iron ore export to countries outside CMEA – is barter (trade with iron ore in return for oil) possible?

Since the second half of the 70s, Soviet iron export has stagnated, and deliveries to countries outside CMEA have almost ceased. In the beginning of the 80s, it amounted to less than 1 Mt with Austria as the only customer.

Misko and Zumbrunnen write that "The Soviet Union, perhaps motivated by political considerations, has expressed interest in importing low-grade iron ore from India on a long-term contract". (p 485) Several factors indicate, that the real reason was the difficulties faced by the USSR to deliver agreed quantities to the CMEA. Polish official statistics indicate that India shipped 600 and 300 Kt to Poland, in 1980 and 1981. These deliveries took place within an agreement between Poland and the USSR and not between Poland and India.[20] Such "invisible" deliveries have probably also been made to other CMEA countries.

The possibility to export iron ore from the Soviet Union is also limited by the stagnating production, according to Misko and Zumbrunnen (p 471)

> ". . . apparently due to chronically inadequate investment, some raw-material shortages and declining ore quality. Because of spiraling construction costs, the modest increases in capital spending have yielded increasingly smaller increments to capacity. Presumably, the rapid growth in Soviet military spending has siphoned off the needed investment funds, as well as 'a large share of the economy's best scientific, technical and managerial talent and large amounts of high-quality materials components and equipment'."

Soviet military spendings are a burden for the entire economy. Resources for non-military investments are limited and there are also very urgent investment needs in other sectors and branches of the economy. Will, in this context, an extension of the production capacity of iron ore be given priority? The authors think so:

> "The resultant production of pig iron, crude steel and steel products remains a key indicator of a nation's industrial development, prosperity, and position of power." (p 464)

Such a policy may have been valid during earlier decades, but today it is rather the rational *use* of the steel sector that is important.

The "demise of the détente" is also mentioned as a factor restricting an increased iron ore export to the West. According to the authors this export may amount to 5 Mt at the end of the 80s, and they explain that:

> "Détente's demise could dictate this low level of East–West ore trade regardless of unforeseen Soviet efforts to produce ore surpluses. US–USSR ore trade is likely to be trivial to non-existent through the eighties" (p 485) (. . .)
>
> "This rather pessimistic assessment should be tempered by a number of more optimistic possibilities. First Krivoi Rog will long remain a key factor in Soviet export performance, with vast reserves, a well developed modern infrastructure, and a convenient location for either rail or water transit to current and potential markets in East and West Europe, the United States, and the Middle East . . . In the second half of the decade if the Soviets were forced to start importing oil, a barter trade of enriched iron ore concentrate (suitable for direct-reduction steel-furnaces) in return for oil could become evident (p 485).

In our view it is hardly probable, that détente's demise will have any influence on the exports of iron ore from the USSR to the West. The authors argue that the possibility of barter trade gives good opportunities to expand iron ore exports. However, the authors don't make any estimates of what volumes of oil, that could be replaced by iron ore exports, nor any calculations are to demonstrate the resources needed to extend the production capacity of DR-pellets per ton of imported oil, e g:

- import of Western technology (see p 476 f)
- expansion of the production capacity of crude ores. During 1976–1980, the production of crude ore increased by 50 Mt, while the production of marketable ores only increased by 10 Mt. During 1981–82 the production of crude ores increased by another 10 Mt, while the production of marketable ores declined by 0.3 Mt.
- improvement of the transport infrastructure.

Furthermore an investigation of the suitability of the priority given to an extension of pellet production for export to Western countries and the question of the profitability of such an export would have been valuable.[22]

What role can the USSR play in the international iron-ore market?

World trade in iron ore after the Second World War has been characterized by an increasing production of high-quality ores in new countries, continuously declining mining costs, decreasing real prices,[23] and declining sea transport costs in comparison with rail transport.[24] It should be added, that the big open cast mines are markedly capital-intensive, which means that the relatively lower wages in the USSR is not any considerable cost advantage . All these factors work against the possibilities of competitive Soviet iron ore exports. As real price increases are not likely to take place, neither in the short nor in the long run, the Soviet Union won't be able to make use even of a general increase in world demand for any considerable or lasting increase of its iron ore exports to non-CMEA countries.

Soviet iron ore exports to the CMEA countries in the long run

In his book "World Steel" (1975) Kenneth Warren shows that "the Soviet resolution to produce its own iron ore, whatever the cost, is an outstanding example of the role of the political factor in mineral supply pattern; its trading relations with its European statellites are an extension of this".[25] The reversal of the ore flows after the Second World War was a result of political circumstances. The aim was to make the steelmills in the East European countries dependent on Soviet iron ore. During the first post-war years, this export was also profitable for the USSR, as it provided opportunities to finance imports of industrial goods.

Today, when the easibly accessible high-quality supplies are exhausted, the lack of Western currency is the main reason for the CMEA-countries to continue their imports of iron ore from the USSR – 40 Mt annually, including pellets, corresponding to 16 per cent of the total Soviet production. During the 60s and 70s the USSR demanded the participation of these countries in the expansion of the Soviet mining and enrichment capacity, to provide them with incremental deliveries. Since the beginning of the 80s, however, such claims – in the form of supplies of equipment, fixed assets and labour inputs – are made in return for *all* deliveries.[26] These demands of production factors which are the most scarce for the East European economies as well, are e g to be found in the recent agreement between the USSR and Poland concerning iron ore deliveries between 1986 and 1992.[27]

Since the beginning of the 80s, the rate of investment in CMEA has declined, and capital investments in the low-productivity Soviet iron ore mines are therewith an increasing drawback for the national economies. The USSR also makes attempts to limit oil- and gas exports to the CMEA in order to be able to deliver the surplus to West Europe. Thus, in our opinion the main question is not the size of the iron ore volumes the USSR can "offer for export to hard currency markets" (see p 485), but rather the lack of profitability of this export. In this respect the situation is different from the oil and gas export.

A replacement of e g 50 per cent of the imports of Soviet iron ore to Poland by ore from non-CMEA countries, corresponds in an additional payment in hard currency, very roughly, to 100 M USD, while a decrease of the imports of oil from the USSR by the same ratio, would debit the Polish trade balance by at least 1 500 M USD. The difference is about the same in Czechoslovakia, while it is even larger in the GDR.

No figures have been published concerning the iron ore volumes to be delivered from the USSR to Poland between 1986 and 1992 according to the 1984 agreement. It is probable, that even the very severe conditions in the USSR-Polish agreement will be less painful than direct imports from non-CMEA countries because of the lack of Western currency.

Summarily, we reject the statements by Misko and Zumbrunnen, that the iron ore deposits of the USSR are within economic rail and water-shipping distance of all Europe, and their suggestion concerning barter trade of enriched iron ore in return for oil, if the USSR were forced to start importing oil. Despite the enormous iron ore supplies within the USSR her exports to countries outside the CMEA have never exceeded 1–2 per cent of the world iron ore trade excluding CMEA. For the reasons mentioned above, we don't believe, that the USSR will play any role in the international iron ore market in the future.

Despite these critical comments of limited parts of the anthology, it is quite clear, that Professor Shabad and his colleagues have succeeded in writing one of the most complete books ever published

on Soviet natural resources in the international context. We are quite impressed by the result and congratulate the authors to what will remain the standard reference work within its field for many years ahead.

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Notes:

[1] Vinogradov, R S, *Reshenya XXVI S'yezda KPSS – V zhizn,* Gorny Zhurnal 1/1983, p 3; see also Sidorova, G Zh 5/1982, p 12 and Narodnoye Khozyaistvo SSSR 1982, p 145.

[2] Grigoryev, V, quoted by Przeglad Techniczny, Warszawa 21/1983, p 34f.

[3] Nar Khoz 1972, p 434, and 1982, p 298; Annual Bulletin of Transport Statistics for Europe.

[4] Mitaishvili, Voprosy Ekonomiki 3/1982. The average turnaround time is the number of days a freight car requires to travel from one loading to the next; the shorter the time, the more trips per year the car can make.

[5] In 1972, the average freight transport costs by rail amounted to 0.2526 kopecks per t/km, and by road to 5.351 kopecks (Nar Khoz 1972, p 431). The estimates, that transport costs by road amounted to 0.8 kop (p 493) are therefore probably highly underestimated.

[6] Tymoszuk, J, Eksploatacja Kolei, Warszawa 3/1981 p 96 and 2/1983, p 45.

[7] According to Polish foreign trade statistics, Poland exported 9.5 Mt of coal to the USSR in 1979. Thereof, roughly 6.5 Mt were shipped to the USSR and 3 Mt to the GDR. During 1980–81, third of Poland's coal export to the USSR was re-exported to the GDR (Zycie Gospodarcze, Warszawa 50/1981, p 11). After 1981, figures on the re-exported volumes have not been published.

[8] "Rail transport is more expensive than pipeline transport for oil in ratios ranging from 4:1 to 8:1 over major Soviet routes" (North, p 110). These figures give a view of the differences between rail and pipeline transport per ton km. As the experts to the CMEA take place by large-scale transports amount to 8:1.

[9] See North, p 105. Transport imbalances do also take place in the CMEA countries. The import volume by train from the USSR through the biggest Polish border station for freight transport, Medyka, is 15 times higher than the exports (Tejchmanowa, Handel Zagraniczny, 11/1979, p 51).

[10] The re-loading of iron ores and other bulk goods takes place through emptying of the bottom of the broad-gauge cars into normal-gauges ones. Up to 70 per cent of the volumes fall outside the cars during this process and have to be re-loaded manually (See Salata, *Without re-loading from Krivoy Rog to Kraków,* Przekrój 16/1976, Warszawa).

[11] The iron ore is transported 1 300 km to Kosice, the coking cole comes from Ostrava 325 kilometres away, while the steamcoal from the USSR is delivered from Kuzneck, 3 000 km eastwards!

[12] See Godlewski, R, Eksploatacja Kolei 10/1978, p 334 ff, Domański, M, EK 1/1980, p 8 ff; *Rocznik Statystyczny Transportu* 1971, p 29 and 1976, p 31.

[13] May Rocznik Statystyczny, 1984, p 233, Warszawa.

[14] The electrification of the LHS was originally to be completed in 1981–82 (see Godlewski, op cit).

[15] See Godlewski, R, EK 8/1983, p 205, map of the electrification programme up to 1990.

[16] See Nikolskiy, I V, *Geografia transporta SSSR,* Moskva 1978, p 122, map 17.

[17] Zajfryd, M (former Minister of Communications in Poland), Przeglad Komunikacyjny 12/1973, p 4.

[18] *Report from a Polish parliamentary committee,* Przeglad Komunikacyjny, 4/1981, p 147.

[19] Cf the text by Dienes:

> "All signs indicate that in the years ahead, the speed of new transport construction will not match that required by the economy for coal and gas . . . The rudimentary development of product pipelines *is* and will continue to be a serious problem, aggravating the burden of railways . . . The transport bottleneck will thus play a key role in the coming energy crunch." (p 405 and 401).

[20] See *Technika i Gospodarka Morska,* Warszawa, 7/1981, p 423. In the Soviet foreign trade statistics, re-exports are included in the total exports (Vnyeshnyaya Torgovlya SSSR, 1982, p 277).

[21] Vinogradov, V S, op cit.

[22] The investments in the Soviet iron ore mining increased from 630 Mt SUR annually during 1971–75 to 780 in 1976–82, while the ore production increased by 38 and 3 Mt respectively; see Sidorova, Gorny Zhurnal, 5/1982 and Nar Khoz 1982, p 341.

[23] The export prices of Swedish low-phosphorous piece ore declined from 211 SEK per ton in 1955 to 74 SEK in 1980 (measured by 1976 prices) according to Statens Industriverk, PM 1981:8, Stockholm.

[24] Cartwright, Journal of the Iron and Steel Institute, June 1969, quoted by Warren, 1975, p 31; Statens Industriverk, op cit, p 28.

[25] Warren, cop cit, p 25.

[26] In a paper presented by Soviet specialists to the XXII Economic Conference of the CMEA in Bucuresti in September 1982, it is said that

> "the possibility of solving the energy and raw material problems of the CMEA countries through increased imports from the Soviet Union are exhausted . . . This implies that future deliveries to a certain CMEA country, even at an *unaltered* (our underlining) level is dependent on the participation of this country in Soviet investments in extracting industries or in branches of industry, which serve the mining sector." (quoted by Danielewski, Zycie Gospodarcze 45/1982).

[27] Fronczak, K, Zycie Gospodarcze 21/1984, p 10. ■